Edith Cowan University

Research Online

Research outputs 2014 to 2021

12-1-2019

Mapping product and service innovation: A bibliometric analysis and a typology

Anton Klarin
Edith Cowan University

Follow this and additional works at: https://ro.ecu.edu.au/ecuworkspost2013

 Part of the Business Commons

10.1016/j.techfore.2019.119776
This is an Author's Accepted Manuscript of: Klarin, A. (2019). Mapping product and service innovation: A bibliometric analysis and a typology. *Technological Forecasting and Social Change, 149*, Article 119776. Available here
© 2019. This manuscript version is made Available under the CC-BY-NC-ND 4.0 license
http://creativecommons.org/licenses/by-nc-nd/4.0/
This Journal Article is posted at Research Online.
https://ro.ecu.edu.au/ecuworkspost2013/7197

© 2019. This manuscript version is made available under the CC-BY-NC-ND 4.0 license
http://creativecommons.org/licenses/by-nc-nd/4.0/

Title: **Mapping product and service innovation: A bibliometric analysis and a typology**

Running title: **Product and service innovation typology**

by

Dr. Anton Klarin

School of Business and Law, Edith Cowan University, 270 Joondalup Drive, Joondalup, Western Australia, 6027, Australia

Email: a.klarin@ecu.edu.au

Accepted at *Technological Forecasting and Social Change,* October 2019.

Abstract: Research conducted in the innovation field lags behind organizations' general technological development and innovativeness. Literature that previously depicted innovation types in developed markets is markedly different from progressively publicized emerging market innovation types. While capital-abundant firms tend to engage in respective pioneering and incremental innovation loops, resource-constrained firms and firms in emerging countries may partially free-ride on existing products and services through innovations such as copycat and frugal. To date, there have been no attempts to holistically consolidate product and service innovation types into one overarching typology. Using novel methods of text mining and co-citation analysis, this study systematically maps three decades of product and service innovation scholarship to provide a typology of eight major product and service innovation types. This is further supported by case study analysis to demonstrate how these innovation types fit into the cost vs market novelty matrix. This study is unique in its methodological proposition to systematically review the innovation scholarship of more than 1,400 articles through comprehensive, quantified, and objective methods that offer transparent and reproducible results. The study provides some clarity regarding the classifications and characteristics of the innovation typology.

Keywords: Science mapping; disruptive innovation; radical innovation; frugal innovation; imitative innovation; low cost innovation.

Introduction

Technology has never been more influential than it is today. In 2012, the top five publicly traded companies by market capitalization were three natural resource companies (ExxonMobil, PetroChina, and Shell), one financial corporation (Industrial and Commercial Bank of China), and one tech company (Apple) (Financial Times, 2012). Just five years later, in 2017, the top five public companies by market capitalization were Apple, Alphabet, Microsoft, Amazon, and Facebook, all of which are tech companies (PricewaterhouseCoopers, 2017). Technology is driven by a relentless stream of innovation. However, academic literature on innovation is inconsistent on fundamentals such as basic definitions and characteristics of types of innovation. Product innovation is often typified by either 'radical' technological change—that is, dramatic breaks from the past—or 'incremental' improvements to current products and processes (Crossan and Apaydin, 2010; Damanpour, 1991; Dewar and Dutton, 1986; Garcia and Calantone, 2002; Helfat and Quinn, 2006). This paper argues that this simplistic view of innovation is obsolescent and needs to be updated for clarity. The main aim of this paper is to consolidate several mainstream types of product and service innovations, thus proposing a typology of product and service innovations.

The escalation of interest in innovation research coupled with the creative ingenuity of industrial innovations has given rise to a number of types and divisions of innovation. Interest in firms' innovativeness can be traced back to the late 1970s and early 1980s, when the first comparisons of radical and incremental innovations were conducted (Dewar and Dutton, 1986). Since then, few other typologies, including the notions of disruptive innovation (Christensen, 1997), and value innovation (Kim & Mauborgne, 1997), have received scholarly attention. In past decades, similar to the rise of emerging economies, the literature on innovation followed the trend by depicting innovation catch-up by emerging market firms

(EMFs) (Chuang, 2014; Luo et al., 2011; Mathews, 2006), innovation for base-of-the-pyramid (BoP) markets (Agnihotri, 2015; Hang et al., 2010; Prahalad, 2010; Reinhardt et al., 2018; Zeschky et al., 2014), the role of state support in EMs (Fu et al., 2011; Lall, 2006; Nelson and Nelson, 2002), and the rise of EMFs in the technological race (Altenburg et al., 2008; Govindarajan and Ramamurti, 2011).

Many tags and labels for innovation types often overlap; for example, radical innovation is referred to as breakthrough, revolutionary, and discontinuous, among other tags (Ahuja and Lampert, 2001; Hill and Rothaermel, 2003; Leifer et al., 2001; Veryzer Jr, 1998). Further, research in this field is progressively dynamic and continuously updated. This paper aims to provide an exhaustive and definitive guide to the main product and service innovation types for people who aim to understand or research innovation. It may serve as a prompt in bringing together research on firm-level innovation and the need to standardize certain definitions and inclusions of various types of innovation. For example, the term 'disruptive innovation' is broadly used to mean anything and everything that disrupts the current market, which is just one trait of the originally devised interpretation offered by Christensen (1997). We believe that disruptive innovation is more specific than any product or service that disrupts the markets. Thus, this paper will provide a comprehensive review and outline the attributes of the main types of innovation across the business and engineering disciplines. Consistency in construct identification, definitions, and systematization provides a framework for analysis, facilitates the efficient development of the field, and is needed for applicability to practical real-world conditions (Wacker, 1998).

This study is based on the latest advancements in science mapping to provide the most comprehensive and systematic review of innovation to date. While a traditional narrative review may base its findings on 50–200 studies, this study uses the entire Web of Science (WoS) database, which has synthesized 1,445 articles on innovation since 1980 (WoS

database indexes documents since 1980). The results are robust and reproducible, which infers the reliability of the offered typology. The study also uses multiple case study analysis to support the findings of the scientometric grouping.

The aim of this paper is to identify how organizations are able to differentiate their products and services from competitors through innovation. Thus, this paper is primarily concerned with product and service innovation types. Organizational, marketing, and process innovations are outside the scope of this research because they are related to organizational and competitive dynamics rather than the differentiation of products and services. For example, this study does not typify open innovation paradigms against traditional closed innovation paradigms, which are considered organizational processes rather than product or service innovations. The adopted definition of product and service innovation relates to providing goods or services that create economic value and are diffused to other parties beyond the discoverers.

The inevitable expansion of research into innovation leads to an increasing number of labels and concepts, which can result in mislabeling and confusion (Christensen et al., 2015). This study heeds the call to clarify the notion of innovation (Baregheh et al., 2009; Gault, 2018) and product innovativeness (Danneels and Kleinschmidt, 2001; Story et al., 2015) to guide practitioners and policymakers, thereby reinforcing the bridge between academia and industry and enabling the collaboration of researchers to holistically move research forward. Although the literature increasingly offers detailed investigations of various types of innovation separately (e.g., studies that investigate disruptive innovation only, or the comparison between radical and incremental innovation), this study shows that the characteristic features of product and service innovation types should be investigated side by side to derive a holistic understanding of the complete typology of various product and service innovations and their features.

Typologies of product and service innovation

Radical vs incremental innovation

One of the earliest attempts to solidify knowledge on innovations and create a systematic approach for identifying innovations can be attributed to Freeman and Perez (1988), who subdivided innovations into four categories and called it the 'taxonomy of innovations'. First, *incremental innovations* are continuous improvements or small-scale developments that do not create dramatic effects on their own, but that improve long-term productivity. Second, *radical innovations* are discontinuous events that are usually the result of deliberate research in centers and institutions like universities. They create some changes but are small and localized on a large scale. Third, *changes in technology systems* is a mixture of incremental and radical innovations in technology that have large-scale effects on several industries. Fourth, *changes in the techno-economic paradigm* are significant changes in technology systems that affect the whole economy. The effects not only create new products, services, systems, and industries, but they also affect all other existing processes and industries within the economy. This study looks at the product or localized innovation which is divided into two types: incremental vs radical.

While the definition of *radical innovation* as presented by Freeman and Perez (1988) is self-explanatory, to identify the types correctly, we will agglomerate the definition to other possible tags as presented in the literature. Radical innovations are large-scale technological developments that create significant or revolutionary changes in their environments. Ahuja and Lampert (2001) and Leifer, O'Connor, and Rice (2001) identified radical innovation as breakthrough or new-to-the-world or industry. This type of innovative products or services are often referred to as path-breaking, first-mover, pioneering, or lead innovations (Ali, 1994; Anderson and Semadeni, 2010; Chandy and Tellis, 2000; Coccia, 2012; Hill and Rothaermel,

2003). Examples include the development of the steam engine, autonomous or self-driving vehicles, virtual reality, and other large-scale innovations.

Although most of the literature concerns radical or revolutionary technological breakthroughs, *incremental innovation* may sometimes be referred to as marginal or continuous (Bessant et al., 1994; Fagerberg, 2004), and it cannot be underestimated. It is believed that the cumulative effect of incremental innovations is just as great, if not greater, and that to ignore these would lead to a biased view of long-run economic and social change (Lundvall, 1992). At present, there is neither a concrete definition for radical or incremental innovation nor a measure of the radicalness of innovations; one person might consider an innovation radical, while another may refer to it as incremental (Garcia and Calantone, 2002). For example, one person might consider self-driving cars an evolutionary progress–that is, incremental innovations of vehicle automation that comprises various sensors and a series of computer algorithms—while another might consider driverless cars a radical innovation that will transform current mobility behaviors.

In general terms, a synthesized interpretation of incremental innovations would include improvements to existing technologies in existing environments that do not create macro discontinuities as in radical innovations. Examples include continuous updates of smartphone technologies, improvements in fuel efficiencies and performance of cars, and CPU processing speed evolution.

Imitative innovation

An abundance of competition complemented by the availability of knowledge and technology has created niches and environments in which firms are forced to play catch-up through various means. The simplest and most common form of technological advancement that uses existing technologies via free-riding is imitative or copycat innovations (Currie et al., 1999).

Imitative product or me-too innovations can be defined as products and services derived by copying processes and aspects of those processes from existing developments to create a similar or identical product or service (Lukas and Ferrell, 2000). Luo, Sun, and Wang (2011) identified that copycat-type innovators range from the pure imitative/duplicative stage to the creative/innovative imitation stage. Common characteristics of such innovators include reverse engineering and absorptive capacity (Cohen & Levinthal, 1990; Keller, 1996), a tendency to originate from countries with low intellectual property protection institutions (Chittor, Sarkar, Ray, & Aulakh, 2008; Luo et al., 2011), and entrepreneurial mobility (Trimi & Berbegal-Mirabent, 2012). Successful imitation or imovation (Shenkar, 2010) requires risk-adjusted, cost-effective operations. For this, a supportive environment, continuous assessments, and research into competitors (both large and small) are prerequisites (Shenkar, 2010). This type of innovation is often associated with late-movers, free-riders, and leapfrogging (Cui & Lui, 2005; Schnaars, 1994). China with its *shanzhai* culture has a reputation for being a copycat nation and is becoming an increasingly formidable competitor by producing products and services that were initially imitations of existing products and services. Recognized imitations include Baidu as Google of China, Alibaba as eBay, Alipay as PayPal, WeChat as WhatsApp, and DiDi Chuxing as Uber.

Copying and imitation is not only attributed to collectivist ideologies; leading individualist countries have piggybacked on the progress of predecessors. The United States (US) initially built its economy by copying and then improving on and innovating technologies developed in Britain and Germany up to World War II (Abramovitz, 1986; Patel and Pavitt, 1998). The Germans learned from the British, and the British learned from the Dutch during and after the industrial revolution (Becker et al., 2011; Freeman, 2002). One may suggest that imitation is often at the heart of innovation (Tarde, 1903). Where there is invention, there is imitation that leads to innovation (Djellal and Gallouj, 2017; Kinnunen, 1996).

Disruptive vs sustaining innovation

The fourth innovation typology is the most widely discussed after radical vs incremental typologies (see the results section). More recently, the creation of a new market through the introduction of a new kind of product or service was called *disruptive innovation*. The core characteristics of disruptive innovation include lower performance, lower gross margins, smaller target markets, simpler products, and services that may not appear as attractive as existing solutions (Christensen, 1997; Christensen and Overdorf, 2000). These products create new markets and value networks, disrupt existing markets and value networks, and may also displace earlier technologies (Christensen, 1997; Christensen et al., 2015). Recently, revolutionary changes in technologies and markets were wrongly labelled as high-end disruptions, although Christensen (2006) did not acknowledge the division into low-end vs high-end disruption.

Disruptive innovation examples can be attributed to Japanese cars and motorcycles entering the US market post-World War II that were lighter, cheaper to produce due to lean manufacturing, more fuel-efficient, and easier to maintain compared with their US counterparts. The vehicles managed to conquer mainstream markets through first disruption and then the gradual displacement of leadership of the US brands (Hart and Christensen, 2002). More recent examples of disruptive innovation include two-in-one personal computers (PCs), otherwise known as tablets. The demand for smaller, lighter, and simpler products that do not require peripherals except for a touchscreen paved the way for tablet PCs. The market for laptops is increasingly being disrupted by hybrid two-in-one PCs with detachable, foldable, or otherwise flexible keyboards. The performance of tablets such as the Microsoft Surface can easily rival a full laptop or desktop computer. There are many examples for disruptive innovation; however, it is important not to confuse any and every product that disrupts the market as a disruptive innovation. The characteristics mentioned above were

originally devised by Christensen (1997) and should remain as such to create certainty and clarity in innovation research.

As identified by Christensen (1997), *sustaining innovations* are derived by listening to lead customers through evolutionary processes. Briefly, sustaining innovation improves existing products. It does not create new markets or value markets, but develops existing ones with better value, allowing companies to compete against each other's sustaining improvements (Bower and Christensen, 1995). Examples of continuing sustaining innovation are gradual improvements in combustion engine performance, enlargements of lithium battery capacities, and continuous upgrades of flat-screen technologies. Although some people might refer to Tesla vehicles as disruptive innovations, the brand is in fact an example of sustaining innovations because it offers top-of-the-range vehicles with dramatically improved electric engine technologies that target markets with sizeable pockets. The vehicles do not disrupt mainstream markets and are targeted to the high end of the market.

Frugal innovation

Low-cost innovations abound, and the literature is rapidly emerging, similar to the rise of the countries associated with these types of innovation. Low-cost innovation centers around the concept of frugality. Thus, extending the discussion on tapping into non-consumers, *frugal innovation* offers products and services targeted to the bottom of the economic pyramid, which is the largest but poorest socioeconomic group. In global terms, it amounts to around four billion people who live on less than US$2.50 a day (Prahalad, 2010). Other characteristics of frugal innovation include reengineering existing off-the-shelf products and services and offering a good-enough no-frills product that can satisfy underserved markets through affordability (Zeschky et al., 2011). The final major characteristic of this innovation is development under resource constraints—for example, an underfunded subsidiary or a local firm with low capital (Jaroslwaski and Saberwal, 2013). An example of this innovation

is a chain of small maternity hospitals in India called LifeSpring Hospitals. This for-profit outfit offers normal deliveries attended by private doctors for just US$40 in its general ward, and caesarean sections for about one-fifth of the price charged at larger hospitals. The hospitals reduce costs by having no canteens and outsourcing laboratory tests and pharmacy services. The prices attract large numbers of customers, with the hospitals performing around 25 procedures a week compared with six in other private hospitals. Doctors perform four times the number of operations and purportedly gain improvements due to high volumes and specialization (Pietrasik, 2009).

Previous studies showed fundamental inconsistencies in characteristics of frugal innovation. Thus, Zeschky, Winterhalter, and Gassmann (2011) combined the features of good-enough innovation with frugal innovation; however, at a later stage, Zeschky, Winterhalter, and Gassmann (2014) identified frugal as having different features compared with good-enough and cost innovations. Banerjee (2013, pp. 292–294) offered eight core features of frugal innovations: "ruggedization, affordability, simplification, adaptation, reliance on local materials and manufacturing, renewability, user-centric design, and portability." The core features include local sourcing of materials and equipment; however, some examples provided in the study include the use of products, materials, and equipment from overseas to develop frugal products and services. Further, frugal innovation in the study can be reversed, which is called Gandhian or *jugaad*. Indeed, further studies, including Radjou, Prabhu, and Ahuja (2012), Rao (2013), and Reinhardt, Gurtner, and Griffin (2018), use frugal and *jugaad* innovation interchangeably. As demonstrated further in the paper, *jugaad* has specific characteristics that differentiate it from frugal innovation. Other labels for this type of innovation include BoP (Prahalad, 2010) and inclusive (Foster and Heeks, 2013), which are similar to catalytic innovation (Christensen et al., 2006; Mohan and Potnis, 2010).

Value innovation

Combining the concept of targeting cost vs differentiation, the architects of *value innovation* or *blue ocean strategy*, Kim and Mauborgne (1997), drew on generic strategic competitive theories and emphasized the importance of finding niches in markets to offer such services. Rather than exploiting the resource-based view to the company and its offerings, firms should identify the most promising possibilities for growth and concentrate on gaps in the market—that is, out-competencing rather than out-performing competitors (Matthyssens et al., 2006). The importance of niche concentration through combined differentiation and cost-leadership cannot be underestimated in today's environment (Dillon et al., 2005). Value innovation is sometimes referred to as *strategic* or *strategy* innovation (Matthyssens et al., 2006), with *good-enough* features (Kim & Mauborgne, 1997; Zeschky et al., 2011). When discussing strategy in disruptive innovation competency-building, good-enough features are a prerequisite in creating value. Their overriding objective is to make a product that is not necessarily the best, but one that is good enough in performance and superior in price (Bower and Christensen, 1995; Christensen, 1997; Markides, 2006). Services offered by low-cost carriers can be attributed to the blue ocean–value innovation strategy. When Ryanair offered low airfares that generated increased passenger volumes while maintaining a focus on cost-containment and operational efficiency, it became the largest European airline according to the number of passengers flown (Powley, 2018). Ryanair reversed the notion that air travel is a luxury service at a high price, and it turned some non-consumers into consumers by making it cheaper to travel.

Reverse innovation

Having covered the imperatives of frugality and serving the underserved, innovation is not a one-way, top-down stream. Low-cost innovations often find appeal in developed countries for the cost–value proposition. Given the rapid growth and technological progress of

emerging markets, it is no wonder that the share of emerging market innovation globally is forecast to increase from 17 percent to 40 percent in the next decade (Mahajan, 2014). Emerging market giants such as Huawei, Alibaba, TSMC, Lenovo, Infosys, and Tata, among other latecomers, have introduced products that may rival products not only in their respective countries but also in the developed world. Govindarajan and Ramamurti (2011) identified reverse innovation as being first adopted in the developing world and then 'trickling up' to the developed world. When Haier, a Chinese household goods manufacturer, linked with German Liebherr in a joint venture for the Chinese market, it was able to increase the quality and performance of its refrigerators. Soon after the joint venture, the company started an aggressive expansion in China. When the Chinese market became saturated, Haier saw a niche in the US market for mini fridges and wine coolers. The company, from the eastern Chinese city of Qingdao, has established itself as a global consumer brand and become a serious competitor for Western companies, even in their home markets (Wagner, 2014). Reverse innovation does not only originate from EMFs, but may be established by multinational enterprise subsidiaries in the developed world. This is the case with Vscan by General Electric (GE), a portable ultrasound device that was developed in China and is now a global success (The Economist, 2012).

Jugaad innovation

In Hindi, *jugaad* is a hack, workaround or simple innovative solution. This type of innovation is inclusive and tends to orient itself for social needs (Radjou et al., 2012). Compared with frugal, it is not scalable or sustainable in the business sense (Agnihotri, 2015; Shepherd et al., 2017). The main distinguishing feature of this type of innovation is that it is a simple workaround for a problem under conditions of extreme resource constraints; hence, it is technically non-commercializable on a large scale (Shepherd, Parida, & Wincent, 2017). Some such innovations or hacks may be illegal, such as stealing electricity, or they may

involve corruption (avoiding excessive bureaucracy through 'greasing the wheels') or break ethical standards (Agnihotri, 2015; Banerjee, 2013). *Jugaads* may also be dangerous (e.g., homemade transport vehicles). *Jugaad* tends to be associated with *bricolage* (Baker and Nelson, 2005)—that is, doing what has to be done with the resources available at a given moment—and it is not the overall 'optimal' utilization solution (Banerjee, 2013). Despite the traditional Hindi label used for this type of innovation, *jugaad* is omnipresent throughout the world. A well-known example of this type of innovation is a lightbulb that is made of a plastic bottle filled with water and some bleach, which was invented by Alfredo Moser, a Brazilian mechanic, and has provided light to millions of people who lack electricity throughout the world (Kuruvilla, 2013). Other labels for this type of homemade solution include *gambiarra* in Brazil, *zizhu chuangxin* in China, *jua kali* in Kenya, and *systeme D* in France (Radjou et al., 2012, p. 5).

While some of the proposed product and service innovation types, including disruptive, frugal, and value innovations, may also refer to business model innovations, as mentioned earlier, this study examines these types of innovation from the perspective of the value added as an end product or service.

In summary, the studies proposed in this section are compiled and reviewed in a traditional narrative fashion and pertain to authors either proposing or characterizing the types of innovations. In contrast, the use of bibliometrics in management studies is gaining increasing popularity due to the rigorous and reliable nature of presenting information derived from large data samples (Zupic and Čater, 2015). However, there is no comprehensive research on innovation typology using this progressively germane methodology.

Methods: Bibliometric exploration validated by case study analysis

We undertook a two-stage process to ensure a rigorous theory consolidation study. First, we conducted a systematic review of all available articles on innovation typologies available through the WoS database to create the typology of product/service innovations. Second, we conducted multiple case study analysis to validate the findings of the systematic review.

Systematic review

A scoping analysis of review studies identified 14 types of review research methodologies (Grant and Booth, 2009). Overlaps of review types make it difficult to distinguish between each type due to frequent inconsistencies and commonalities. Nevertheless, Grant and Booth (2009) highlighted that the clear and structured methodology of systematic-type reviews means that they are prime candidates for input for information science professionals. In contrast, traditional 'narrative' literature reviews that rely on singular descriptive accounts of the contributions made by writers in the field, which are often selected for inclusion based on the implicit biases of the researcher, often lack rigor and thoroughness (Tranfield, Denyer, & Smart, 2003, p. 208). Indeed, systematic reviews are rare but are of immense importance in the field of management and social sciences in general because of the high fragmentation in the fields (Reinhardt et al., 2018). This is especially true in the discussion of innovation types to deliver output that is not only of high academic quality, but that also has the practitioner community in mind. A clearer classification of the various innovation types according to the characteristics proposed will potentially assist practitioners to derive informed implications for strategy and operations, and will contribute to a clearer understanding of this topic.

Co-citation analysis of a particular area of research has proven to be an effective tool in structuring intellectual foundations across disciplines (Randhawa et al., 2016; Zupic and Čater, 2015). Co-citation analysis involves measuring the affinity and proximity of relationships between topics, researchers, and communities. Previous co-citation analysis on

innovation research carried out by Rossetto et al. (2018) demonstrated archetypal results of a bibliometric co-citation analysis including top outlets, papers, and authors. We go further by analyzing the area through unstructured ontological discovery using advanced methods of text mining (Randhawa et al., 2016; van Eck and Waltman, 2010). This allowed us to synthesize detailed conceptual insights by shifting the level of analysis using the basic co-citation analysis combined with the content of articles to provide a systematic, unbiased, and content-driven review of the literature. Content analysis occurs when terms are taken from the contexts within which they appear, thus allowing us to bootstrap an expanded list of related terms that signify a concept from the search data. This research used VOSviewer as a narrative inquiry tool to enable identification of the most frequently used concepts and the relationship between these terms. This approach systematically reveals key concepts within the *innovations* paradigm by using terms from available text (thematic analysis) and examining how they are interconnected depending on the frequency and co-occurrence of these terms in specific contexts (semantic analysis). This allows a rigorous approach in mapping the scholarship and practitioner-oriented literature. It was found that the key article topics are usually in the form of noun phrases (Justeson and Katz, 1995; van Eck and Waltman, 2014). Thus, VOSviewer uses an algorithm to track noun phrases and create networks that are divided into clusters according to co-occurrence based on the text data.

This study used a bibliometric quantitative analysis of the literature obtained from the WoS database using the VOSviewer science mapping system (van Eck and Waltman, 2010). The use of VOSviewer as a bibliometric tool to systematically analyze the literature offers a number of advantages, including a comprehensive literature analysis allowing us to carry out unprecedented scope investigations (Markoulli et al., 2017), a number of tools for extracting reliable data from a series of units of analysis (Cobo et al., 2011), and a transparent set of results offered with a reproducible rigorous process.

We applied Tranfield et al.'s (2003) three-stage systematic review procedure of planning, conducting, and reporting. At the planning stage, we clearly identified the need for the review to offer a systemic framework for the classification of product and service innovation types in the literature and for practitioners. As recommended by other systematic reviews of this nature, we identified the inclusion criteria and the key data source. We chose peer-reviewed journals, which tend to be more rigorous in the findings and have the highest impact on the field (Podsakoff et al., 2005). The chosen data source was the Institute for Scientific Information's Web of Knowledge Core Collection database, which is considered one of the most comprehensive databases of high-level peer-reviewed articles. At the time of the research, all available articles from 1980 (the starting year of indexing in WoS) to 13 August 2018 were collected. The most important part of the research involved classifying the various tags and names of the innovation types into several main product/service innovation types. We relied on the extensive literature review together with the case study analysis (see case study analysis section) to classify the innovations into groups. Further, we collected data using Boolean logic for each tag in the database to conduct a comparative analysis using VOSviewer. Following the data collection, we compared each of the selected and compiled innovation types with each other to identify whether the overlaps among the selected groups warranted classification of similar types into one of the groups.

The second stage included the collection, processing, and analysis of the data. Journal article titles, abstracts, and keywords were searched using Boolean logic to include each of the compiled innovation types in the English language. The results were refined by the 'management' WoS category, which incidentally includes articles in the management, marketing, other business, and engineering management disciplines. Further, the results were filtered by published 'article' document type, excluding conference proceedings and other materials that may overlap with the article results, to obtain the most reliable and rigorous

research output. The results were transferred to the VOSviewer bibliometric mapping software to create a network visualization of the most common terms used in the topics selected. The typical minimum number of occurrences of each chosen term was set at 10 to qualify for the network bibliometric mapping because it is a reliable placement of term relations in the map. This ensures the removal of misspelled and non-meaningful noun phrases (Markoulli et al., 2017; van Eck and Waltman, 2014), and it assists in finding commonalities among innovation types to merge or differentiate them. When there were fewer than 50 articles in the results of the innovation types, the minimum number of articles in which the term occurred was set between three and seven, which is above the minimum requirement of one (Klarin, 2019; Sinkovics, 2016). The results were entered into a document that was created manually and uploaded to VOSviewer to transform British English spelling into US spelling (e.g., *organisation* into *organization*), to abbreviate some terms pertaining to business and innovation (e.g., *new product development* into *npd* and *small and medium enterprises* into *sme*), and to exclude academic research methodology terms (e.g., *research limitations implication* and *longitudinal case study*). We reviewed each innovation type as proposed by the review of the literature backed up by the bibliographic analysis of the types of innovation using VOSviewer. Table 1 amalgamates the results of the searches for each of the selected innovation types.

< Insert Table 1 here >

During the third stage, after the results were collected from WoS and analyzed through VOSviewer term collection and mapping, they were compared with each other using semantic analysis of common terms among the innovation types. The types were grouped together (as per previous literature convergence of the types presented in the theoretical section of the paper)—for example, the radical innovation group included discontinuous, lead, and pioneering, whereas incremental was converged with marginal and sustaining. The

algorithmic analysis carried out by VOSviewer confirmed the groupings by demonstrating similar results for the innovation types grouped together (e.g., incremental innovation had similar noun results as sustaining, as seen in Table 3). In cases of doubt, the authors analyzed highly cited articles pertaining to a queried innovation type and compared characteristics to ensure correct groupings of the innovation types. The findings are reported in the results section.

Case study analysis

To ensure reliability and external validity of the systematic review, we carried out multiple case studies to compare the typology offered by the semantic analysis with the findings of the case study analysis. Prior to the scientometric analysis, over the course of five years, from 2013 to 2018, we collected 124 cases, mainly from secondary sources, as well as interview data from small (four) and large (three) firms in the pharmaceutical industry in an emerging economy. The aim of the case study analysis was to identify the innovation types depicted in the literature to create a typology of innovation types. The theoretical section is largely based on the results shaped by the case study analysis of the innovation types extracted from the literature and the case study analysis. We used a scoping review to include all available cases from reputable sources—mainly journal articles and practitioner-oriented sources—that pertained to either of the product/service innovation types. Divergent location, size, and the scope of activity contexts within which these cases pertain to ensure strengthened validity and generalizability of the findings (Eisenhardt, 1989; Yin, 2013). The secondary research case studies included organizations from around the world of all sizes and from all sectors. The primary data were extracted from seven firms via in-depth semi-structured interviews, and the cases pertained to the pharmaceutical industry, where four cases were in retail and wholesale operations, and three cases were large organizations involved in a full-scale value network, from substance manufacturing and information systems to retail operations. The

primary data also included company documents such as brochures, observation notes, reports, and documents provided by company officials during the interviews. Given that the pharmaceutical industry is heavily innovation-dependent, strategic, and capital-intensive, it is an important research context, especially in a developing country, where smaller firms are under pressure to innovate and compete for survival in imperfect institutional environments and with cost constraints. The primary data collection served as an exploratory tool to determine whether practitioners are aware of and in need of a clearer classification of innovation types to better inform themselves and their stakeholders.

Following the comparison and eventual grouping stage, we plotted the cases and respective innovation types against a 3 × 3 matrix of cost vs market novelty, which was inspired by Ansoff's (1957, 1965) matrices of markets vs products. Notably, there are previous instances of plotting innovation types against the matrices (Banerjee, 2013; De Waal, 2016; Zeschky et al., 2014). The matrix aims to provide a general graphic representation of how innovations and perceptions of case innovations relate to the two most important variables—the cost of innovation and the market novelty of innovation. The grouping was consolidated by extracting characteristics generated by the semantic bibliometric analysis in the first part of the review, followed by a careful investigation of key articles for each innovation type generated by the bibliometric analysis, combined with an iterative analysis of the key characteristics of each innovation type in the available literature.

The semantic analysis carried out using VOSviewer confirmed the major types of innovation—namely, radical, incremental, imitative, disruptive, frugal, and value. Reverse and *jugaad* innovations were scant in the algorithmic results because the innovation types were being published outside highly cited journal outputs. Thus, a decision was made to keep the case study analysis results in the paper to ensure clarity in the low-cost innovation

typology. Low-cost innovation, especially *jugaad* and reverse, as well as the characteristics pertaining to each, are largely based on the results of the literature and case studies collected.

Results

Semantic analysis

The bibliometric analysis of each of the depicted innovation types led to both expected and unexpected results compared with those offered in previous innovation typologies. We used a three-stage procedure to group similar innovation types. The first stage involved searching the entire WoS database for product and service innovation types using Boolean logic. This returned 1,445 articles in the English language in the management category, which includes management, marketing, engineering, and other business and social science articles. Using the default of at least 10 occurrences, VOSviewer identified 944 terms, which were classified into five clusters that exhibit major overlaps, as evident in the highly mixed structure of the clusters (see Figure 1). We searched for innovation types within these terms and identified several product/service innovation types that appear prominently among the results. These include radical, incremental, imitative, value, reverse, and disruptive (see Table 2). Surprisingly, there were no results for frugal, *jugaad* or other low-cost innovations. This may be due to the lack of high scholarly output in regard to these innovation types. While Google Scholar and Scopus may have a plethora of outputs on these types, a brief analysis shows that much of the work on low-cost innovations from emerging countries is available in low-impact journals, books, book chapters, and other less methodologically rigorous outlets. This area is potentially worth exploring, because the prominence of emerging markets and the innovations they offer cannot be ignored.

< Insert Figure 1 here >

< Insert Table 2 here >

We further identified innovation types that have overlaps in the previous literature, as well as which types are to be considered unique. The literature suggested that disruptive, *jugaad*, and reverse innovation have certain significant features that differentiate these types from others. The unique features of disruptive innovation, at least in theory (Christensen, 2006, 1997), include the creation of new or relatively undeveloped markets and value networks, as well as disruption and, at times, displacement of previous products and services. Typical examples used by Christensen, the conceptualizer of the type, are Honda motorbikes and Toyota vehicles taking on US incumbents in the 1960s on US soil (Hart and Christensen, 2002). *Jugaad* innovation is often used interchangeably with Frugal, BoP, cost, inclusive, and other types. However, recent studies differentiate this type of innovation because of its key feature of non-commercial application, which is non-scalable and unsustainable (Agnihotri, 2015; Radjou et al., 2012; Shepherd et al., 2017). Finally, we identified that reverse innovation deserves a spot of its own in relation to low-cost innovations that are developed in emerging markets and find their way to industrialized markets. A common example used is GE's Bangalore-developed portable, durable, rechargeable and low-cost electrocardiogram (ECG) MAC 400 device, which had a price of US$550 compared with traditional US$10,000 machines. MAC 400 and 800 do not rely on India's inconsistent electrical grid, and their portability means that they can reach consumers in rural areas of India. The device eventually found its way to other emerging countries and the developed world (Rao, 2008). The five other types (radical, incremental, frugal, imitative, and value) were grouped under common characteristics with a number of other tags that characterize these innovations.

The third stage of the analysis involved comparing the overlapping types through the network maps created by VOSviewer. We also extracted the most commonly cited keywords from each innovation type and identified similarities in the datasets of keywords among the innovation types. The oldest and most consolidated typology of innovation pertains to radical

vs incremental innovation types, which was conceptualized in the 1970s and 1980s (Ettlie et al., 1984). Radical innovation was compared with new-to-the-world, first-mover, path-breaking, breakthrough, lead, discontinuous, and pioneering. Incremental was grouped with marginal and sustaining. Imitative was compared with me-too, copycat and free-rider innovations. Blue ocean, strategic, strategy, and good-enough innovations were identified as value innovations. Finally, frugal was also referred to as inclusive, catalytic, and BoP. The overlapping common key terms are provided in Table 3.

< Insert Table 3 here >

Case study support

Case study analysis was used to compare and finalize the findings of the systematic review through an iterative process of plotting cases against the levels of costs involved in the development process vs the levels of market novelty that these innovations propose. During the analysis of the cases, it became clear that the nature of radical-type innovations falls into high cost–high market novelty criteria. This is the case with breakthrough medicines produced by Big Pharma companies, which purportedly spend in excess of US$5 billion for each blockbuster drug (Herper, 2013). The research and development costs of rolling out such innovations requires the newest technologies, state-of-the-art laboratories, information systems, highly skilled personnel, and other related costs, which are compensated by the market novelty and premium market segments. Incremental innovations also involve high levels of capital investments to continuously update and improve product and service offerings for the masses of early adopters and most developed country markets. Thus, the costs in maintenance and continuous development fall below those of lead innovation outputs, and it becomes less of a market novelty than the lead innovation. Although there are bound to be outliers that would fit radical and incremental innovations into the medium- or even low-cost/market novelty, these tend to be rare and negligible (Ali, 1994).

Disruptive innovations tend to create new markets and value networks; thus, market novelty is at the highest considering the cost, which is lower compared with that of sustaining (incremental) and radical innovations. It is about fully targeting those overlooked segments and gaining a foothold by delivering more suitable functionality at a lower price (Christensen et al., 2015).

Having covered the two prominent typologies of radical vs incremental and disruptive vs sustaining (which incidentally is incremental) that are prominent in the developed country context, we turn to low-cost innovation types that tend to overlap dramatically between each other, as seen in Figure 2. Value innovation offers products and services that have no direct competitors by strategically aligning differentiation and low cost, thereby creating a leap in value for both the buyers and the company (Kim & Mauborgne, 1997, 2005). A frequently used example of this is the Accor chain of hotels, which realized that a large segment of customers yearned for a good night's sleep for an affordable price. The hotel chain removed the bells and whistles, such as costly restaurants, appealing lounges, and 24-hour reception, and rooms were made smaller and stripped to the bare necessities (e.g., no stationery, desks, or décor) (Kim & Mauborgne, 2005). The concept of frugality has gained immense popularity among the features of low-cost innovations. Indeed, frugal can be defined as simple or plain, and costing little. Thus, academics often use frugal, value, cost, and *jugaad* interchangeably. However, the semantic analysis supported by the case studies and previous literature suggests that the key features of frugal innovation include scarce resources, attention to customers' immediate needs (core features and often localized applications), and, almost always, an attractive price that suits constrained underserved markets. As a result of cost-cutting, frugal innovation fits within the low–medium cost of development and overlaps with copycat, reverse, and value innovations (see Figure 2). The market novelty of such products may vary from low (e.g., the Jaipur artificial prosthetic foot, which was created

using rubber, wood and tire cords for under US$45 (Arshad et al., 2018)) to high (e.g., Narayana Health in Bangalore, which offered heart bypass surgeries for US$1,500 by introducing just-in-time, an 'assembly line' medical staff rotation combined with cost cutting in all aspects of operations) (Khanna, 2014).

There are major overlaps between frugal and reverse innovations in terms of cost and market novelty. The frugal products and services that expand from BoP to developed countries, or the top of the pyramid, are considered reverse innovations. In 2002, GE's China subsidiary developed a portable ultrasound scanner that was 15 percent of the price of traditional scanners, which created a global market for portable ultrasound machines (Govindarajan and Ramamurti, 2011).

Imitative innovations tend to use institutional voids to avoid expensive legal actions to piggyback on existing products (at least in the beginning) and adapt them to local markets at lower costs. Tencent's first product, OICQ (renamed to QQ), was a reverse-engineered imitation of the US-based ICQ. It had localized features such as software skins, people's images, and emoticons, which gained traction and allowed the company to propel itself to its current highs.

Finally, *jugaad* creations are socially oriented, non-commercializable, and hence non-scalable innovations that provide an answer for financially disadvantaged people. These innovations include refrigerators made of clay, hammocks in overcrowded trains, plastic water bottles used as plumbing and drainage systems, and other examples that are known as hacks in other countries.

Figure 2 presents the innovations and their cost and market novelty positioning, and Table 4 provides the 13 key characteristics through which the case study analysis was carried out.

< Insert Figure 2 here >

< Insert Table 4 here >

As seen in Table 4, there are numerous overlaps between the innovation types. However, there are certain distinguishable features among them that allow differentiation among the types of product and service outputs. For example, frugal innovation bears a resemblance to disruptive innovation, except for a number of fine differences. The first is the resource constraints of enterprises that engage in such innovations. Christensen and Overdorf (2000) stated that firms mainly create substructures responsible for disruptive innovation, thus implying the ability to cross-subsidize to derive disruptive technologies, while frugal innovators are resource-constrained involuntarily. The second difference relates to offering products and services to underserved markets, less disruption of existing markets, and in particular, no displacement of earlier technologies. The aim of frugal innovators is simply to offer products and services to low-end markets. The third difference relates to offerings to much larger underserved markets in contrast to disruptive innovation, which creates a 'smaller market' initially. Products and services in frugal innovation may not necessarily be of lower performance or be less attractive, as in characteristics of disruptive innovation. In summary, the eight major innovation types are systematized according to the key features of each innovation type in Table 5.

< Insert Table 5 here >

Discussion and conclusion

Innovation literature is abundant and derives from a variety of researchers from different backgrounds. The lack of communication and accord between the fields creates opacities in regard to explaining simple concepts and relationships among the types (Fagerberg, 2004). This paper offers some groundwork in defining and characterizing common innovation types that a scholar or practitioner may find useful in understanding product innovation types. While this makes it easier to designate any product or service innovation into any of the

proposed types, there are possibilities that a particular innovation may fall under two or more labels depending on the interpretation of the inquirer. Although various tags and labels were not mentioned in the innovation types discussed or listed in this paper, this study portrays the general division in innovation types across various streams of literature. It offers general instructions regarding the commonly used innovation types across the business literature, and it provides some clarity and order in this field.

This paper contributes to the literature by identifying a plethora of labels and constructs in a comprehensive and easy-to-understand manner, with each innovation type given specific characteristics that make it easy to differentiate between the main types of innovations. Researchers tend to explore either the typologies of developed market innovation, a single type of innovation, or types of low-cost innovation. Surprisingly, the literature fails to comprehensively illustrate various types of innovation holistically for both industrialized and emerging countries. The task of highlighting all innovativeness, including product, process, and business-model innovation types, from around the world is a vast area worthy of a textbook. We have not attempted to typify how organizations innovate, for example, through open innovation processes; instead, we have limited our research to the typology of outcomes in the products and services offered. Thus, this paper demonstrates solely the typology of product and service innovation to illustrate the variety of ways in which organizations deliver their products and services. This review makes an important contribution that creates clarity and appeals to researchers to solidify the combined knowledge and delineations of each type of product innovation to create consistency across the academic disciplines. Consistency in defining the constructs and avoidance of wrongful identification of innovations (see discussion of frugal innovation in the theoretical section) will help to facilitate further knowledge and an understanding of the immensely important subject of innovation.

For practitioners, identifying and understanding each innovation type is important because of the corresponding strategies that should be implemented when faced with competitive threats or forging strategic paths. The case study interviews of the pharmaceutical firms revealed that organizations interchangeably use innovation types to mean various product and service offerings. For example, on a number of occasions, the first author recorded a new drug offering being called a breakthrough, disruptive, or even incremental product innovation from different respondents when referring to the same medication. Thus, depending on the type of innovation, a firm must forge strategic responses according to whether they are the developer of or responder to the innovation. As Christensen et al. (2015, p. 44) noted, "if we get sloppy with our labels or fail to integrate insights from subsequent research and experience into the original theory, then managers may end up using the wrong tools for their context, reducing their chances of success. Over time, the theory's usefulness will be undermined." To fully realize the benefits of the theoretical underpinnings, it is necessary to apply the theory correctly. Thus, a thorough understanding and consistency is of utmost importance. As such, competitors' strategies and outputs require different strategic responses depending on the type of innovation they use. Is the smaller competitor a mere value innovator that sticks to its niche, or is it a potential disruptive innovator that poses the threat of displacement of an incumbent's competitive position?

As previously mentioned, there is a vast array of possibilities relating to how organizations develop their innovative competences. Similarly, there is fluidity and overlap in the types of innovation created by firms. Products and services are derived from a combination of organizational strategies and techniques. Thus, some innovations may fall under two or more types of innovations listed in this paper. Nonetheless, the characteristics of each type should be differentiated to instruct and study innovations more effectively, as there is increasing significance for technological development.

References

Abramovitz, M., 1986. Catching up, forging ahead, and falling behind. J. Econ. Hist. 46, 385–406.

Agnihotri, A., 2015. Low-cost innovation in emerging markets. J. Strateg. Mark. 23, 399–411. https://doi.org/10.1080/0965254X.2014.970215

Ahuja, G., Lampert, C.M., 2001. Entrepreneurship in the large corporation: A longitudinal study of how established firms create breakthrough inventions. Strateg. Manag. J. 22, 521–543. https://doi.org/10.1002/smj.176

Ali, A., 1994. Pioneering versus incremental innovation: Review and research propositions. J. Prod. Innov. Manag. 11, 46–61. https://doi.org/10.1016/0737-6782(94)90118-X

Altenburg, T., Schmitz, H., Stamm, A., 2008. Breakthrough? China's and India's transition from production to innovation. World Dev. 36, 325–344. https://doi.org/10.1016/j.worlddev.2007.06.011

Anderson, B.S., Semadeni, M., 2010. The follower's dilemma: Innovation and imitation in the professional services industry. Acad. Manag. J. 53, 1175–1193.

Ansoff, H.I., 1965. Corporate strategy. McGraw-Hill, New York.

Ansoff, H.I., 1957. Strategies for diversification. Harv. Bus. Rev. 35, 113–124.

Arshad, H., Radi, M., Radi, D., 2018. Patterns of frugal innovation in healthcare. Technol. Innov. Manag. Rev. 8, 28–38.

Baker, T., Nelson, R.E., 2005. Creating something from nothing: Resource construction through entrepreneurial bricolage. Adm. Sci. Q. 50, 329–366. https://doi.org/10.2189/asqu.2005.50.3.329

Banerjee, P.M., 2013. The "frugal" in frugal innovation, in: Brem, A., Viardot, É. (Eds.), Evolution of Innovation Management: Trends in an International Context. Palgrave Macmillan UK, London, pp. 290–310. https://doi.org/10.1057/9781137299994_13

Baregheh, A., Rowley, J., Sambrook, S., 2009. Towards a multidisciplinary definition of innovation. Manag. Decis. 47, 1323–1339. https://doi.org/10.1108/00251740910984578

Becker, S.O., Hornung, E., Woessmann, L., 2011. Education and catch-up in the industrial revolution. Am. Econ. J. Macroecon. 3, 92–126. https://doi.org/10.1257/mac.3.3.92

Bessant, J., Caffyn, S., Gilbert, J., Harding, R., Webb, S., 1994. Rediscovering continuous improvement. Technovation 14, 17–29. https://doi.org/10.1016/0166-4972(94)90067-1

Bower, J.L., Christensen, C.M., 1995. Disruptive technologies: Catching the wave. Harv. Bus. Rev. 73, 43–53. https://doi.org/10.1016/0024-6301(95)91075-1

Chandy, R.K., Tellis, G.J., 2000. The incumbent's curse? Incumbency, size, and radical product innovation. J. Mark. 64, 1–17. https://doi.org/10.1509/jmkg.64.3.1.18033

Christensen, C.M., 2006. The ongoing process of building a theory of disruption. J. Prod. Innov. Manag. 23, 39–55. https://doi.org/10.1111/j.1540-5885.2005.00180.x

Christensen, C.M., 1997. The Innovator's Dilemma. Harvard Business School Press, Boston.

Christensen, C.M., Baumann, H., Ruggles, R., Sadtler, T.M., 2006. Disruptive innovation for social change. Harv. Bus. Rev. 84, 94–101.

Christensen, C.M., Overdorf, M., 2000. Meeting the challenge of disruptive change. Harv. Bus. Rev. 78, 66–76.

Christensen, C.M., Raynor, M., McDonald, R., 2015. What is disruptive innovation? Harvard Buisness Rev. 93, 44–53.

Chuang, Y., 2014. Learning and international knowledge transfer in latecomer firms: The case of Taiwan's flat panel industry. IEEE Trans. Eng. Manag. 61, 261–274.

Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E., Herrera, F., 2011. Science mapping software tools: Review, analysis, and cooperative study among tools. J. Am. Soc. Inf. Sci. Technol. 62, 1382–1402. https://doi.org/10.1002/asi

Coccia, M., 2012. Driving forces of technological change in medicine: Radical innovations induced by side effects and their impact on society and healthcare. Technol. Soc. 34, 271–283. https://doi.org/10.1016/j.techsoc.2012.06.002

Crossan, M.M., Apaydin, M., 2010. A multi-dimensional framework of organizational innovation: A systematic review of the literature. J. Manag. Stud. 47, 1154–1191. https://doi.org/10.1111/j.1467-6486.2009.00880.x

Currie, D., Levine, P., Pearlman, J., Chui, M., 1999. Phases of imitation and innovation in a North-South endogenous growth model. Oxf. Econ. Pap. 51, 60–88. https://doi.org/10.1093/oep/51.1.60

Damanpour, F., 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. Acad. Manag. J. 34, 555–590.

Danneels, E., Kleinschmidt, E.J., 2001. Product innovativeness from the firm's perspective: Its dimensions and their relation with project selection and performance. J. Prod. Innov. Manag. 18, 357–373.

De Waal, G.A., 2016. An extended conceptual framework for product-market innovation. Int. J. Innov. Manag. 20, 1640008. https://doi.org/10.1142/S1363919616400089

Dewar, R.D., Dutton, J.E., 1986. The adoption of radical and incremental innovations: An empirical analysis. Manage. Sci. 32, 1422–1433.

Dillon, T.A., Lee, R.K., Matheson, D., 2005. Value innovation: Passport to wealth creation. Res. Manag. 48, 22–36. https://doi.org/213803004

Djellal, F., Gallouj, F., 2017. The laws of imitation and invention: Gabriel Tarde and the evolutionary economics of innovation. Rev. Econ. 68, 643–671.

Eisenhardt, K.M., 1989. Building theories from case study research. Acad. Manag. Rev. 14, 532–550. https://doi.org/10.2307/258557

Ettlie, J.E., Bridges, W.P., O'Keefe, R.D., 1984. Organization strategy and structural differences for radical versus incremental innovation. Manage. Sci. 30, 682–695.

Fagerberg, J., 2004. Innovation: A guide to the literature, in: Proceedings of the First Globelics Academy, Ph.D. School on National Systems of Innovation and Economic Development. Georgia Institute of Technology, Lisbon, pp. 1–22.

Financial Times, 2012. FT global 500 December 2012 [WWW Document]. FT Glob. 500. URL https://im.ft-static.com/content/images/2a53e388-569a-11e2-aa70-00144feab49a.pdf (accessed 1.9.18).

Foster, C., Heeks, R., 2013. Conceptualising inclusive innovation: Modifying systems of innovation frameworks to understand diffusion of new technology to low-income consumers. Eur. J. Dev. Res. 25, 333–355. https://doi.org/10.1057/ejdr.2013.7

Freeman, C., 2002. Continental, national and sub-national innovation systems - Complementarity and economic growth. Res. Policy 31, 191–211. https://doi.org/10.1016/S0048-7333(01)00136-6

Freeman, C., Perez, C., 1988. Structural crises of adjustment, business cycles and investment behaviour, in: Dosi et al (Ed.), Technical Change and Economic Theory. Pinter Publishers, London, pp. 38–66.

Fu, X., Pietrobelli, C., Soete, L., 2011. The role of foreign technology and indigenous innovation in the emerging economies: Technological change and catching-up. World Dev. 39, 1204–1212. https://doi.org/10.1016/j.worlddev.2010.05.009

Garcia, R., Calantone, R., 2002. A critical look at technological innovation typology and innovativeness: A literature review. J. Prod. Innov. Manag. 19, 110–132. https://doi.org/10.1016/S0737-6782(01)00132-1

Gault, F., 2018. Defining and measuring innovation in all sectors of the economy. Res. Policy 47, 617–622. https://doi.org/10.1016/j.respol.2018.01.007

Govindarajan, V., Ramamurti, R., 2011. Reverse innovation, emerging markets, and global strategy. Glob. Strateg. J. 1, 191–205. https://doi.org/10.1111/j.2042-5805.2011.00023.x

Grant, M.J., Booth, A., 2009. A typology of reviews: An analysis of 14 review types and associated methodologies. Health Info. Libr. J. 26, 91–108. https://doi.org/10.1111/j.1471-1842.2009.00848.x

Hang, C.C., Chen, J., Subramian, A.M., 2010. Developing disruptive products for emerging economies: Lessons from Asian cases. Res. Technol. Manag. 53, 21–26.

Hart, S.L., Christensen, C.M., 2002. The great leap: Driving innovation from the base of the pyramid. MIT Sloan Manag. Rev. 44, 51–56.

Helfat, C.E., Quinn, B., 2006. Reviewed work: Open innovation: The new imperative for creating and profiting from technology. Acad. Manag. Perspect. 20, 86–88.

Herper, M., 2013. The cost of creating a new drug now $5 billion, pushing Big Pharma to change [WWW Document]. Forbes. URL https://www.forbes.com/sites/matthewherper/2013/08/11/how-the-staggering-cost-of-inventing-new-drugs-is-shaping-the-future-of-medicine/#594d631513c3 (accessed 5.8.18).

Hill, C.W.L., Rothaermel, F.T., 2003. The performance of incumbent firms in the face of radical technological innovation. Acad. Manag. Rev. 28, 257–274.

Jaroslwaski, S., Saberwal, G., 2013. Case studies of innovative medical device companies from India: Barriers and enablers to development. BMC Health Serv. Res. 13, 199.

Justeson, J.S., Katz, S.M., 1995. Technical terminology: Some linguistic properties and an

algorithm for identification in text. Nat. Lang. Eng. 1, 9–27. https://doi.org/10.1017/S1351324900000048

Khanna, T., 2014. Contextual intelligence. Harv. Bus. Rev.

Kim, W.C., Mauborgne, R., 2005. Blue ocean strategy. Calif. Manage. Rev. 47, 105–121. https://doi.org/10.4018/jabim.2010010104

Kim, W.C., Mauborgne, R., 1997. Value innovation: The strategic logic of high growth. Harv. Bus. Rev. 75, 102–112. https://doi.org/Article

Kinnunen, J., 1996. Innovation Diffusion Research. Acta Sociol. 39, 431–442. https://doi.org/https://doi.org/10.1177/000169939603900404

Klarin, A., 2019. The decade-long cryptocurrencies and the blockchain rollercoaster: Mapping the intellectual structure and charting future directions. Res. Int. Bus. Financ. 51, 101067. https://doi.org/10.1016/j.ribaf.2019.101067

Kuruvilla, C., 2013. Brazilian mechanic creates light bulb using water, bleach, and a bottle [WWW Document]. NY Dly. News. URL http://www.nydailynews.com/news/world/brazilian-mechanic-creates-light-bulb-water-bleach-bottle-article-1.1427011 (accessed 1.4.18).

Lall, S., 2006. Some insights to reinvent industrial strategy in developing countries. Int. J. Technol. Manag. 36, 16–20. https://doi.org/10.1504/IJTM.2006.009981

Leifer, R., Colarelli O'Connor, G., Rice, M., 2001. Implementing radical innovation in mature firms: The role of hubs. Acad. Manag. Exec. 15, 102–113. https://doi.org/10.5465/AME.2001.5229646

Lukas, B.A., Ferrell, O.C., 2000. The effect of market orientation on product innovation. J. Acad. Mark. Sci. 28, 239–247.

Lundvall, B.-Å., 1992. National Systems of Innovation: Towards a theory of innovation and interactive learning. Pinter Publishers, London. https://doi.org/10.1080/08109029308629360

Luo, Y., Sun, J., Wang, S.L., 2011. Emerging economy copycats: Capability, environment, and strategy. Acad. Manag. Perspect. 25, 37–56. https://doi.org/10.5465/AMP.2011.61020801

Mahajan, N., 2014. 17 percent of global innovation is coming from emerging markets [WWW Document]. Forbes India. URL http://www.forbesindia.com/article/ckgsb/17-percent-of-global-innovation-is-coming-from-emerging-markets/37566/1 (accessed 1.5.18).

Markides, C., 2006. Disruptive innovation: In need of better theory. J. Prod. Innov. Manag. 23, 19–25. https://doi.org/10.1111/j.1540-5885.2005.00177.x

Markoulli, M.P., Lee, C.I.S.G., Byington, E., Felps, W.A., 2017. Mapping Human Resource Management: Reviewing the field and charting future directions. Hum. Resour. Manag. Rev. 27, 367–396. https://doi.org/10.1016/j.hrmr.2016.10.001

Mathews, J.A., 2006. Catch-up strategies and the latecomer effect in industrial development. New Polit. Econ. 11, 313–335. https://doi.org/10.1080/13563460600840142

Matthyssens, P., Vandenbempt, K., Berghman, L., 2006. Value innovation in business

markets: Breaking the industry recipe. Ind. Mark. Manag. 35, 751–761. https://doi.org/10.1016/j.indmarman.2005.05.013

Mohan, L., Potnis, D., 2010. Catalytic innovation in microfinance for inclusive growth: Insights from SKS microfinance. J. Asia-Pacific Bus. 11, 218–239. https://doi.org/10.1080/10599231.2010.500574

Nelson, R.R., Nelson, K., 2002. Technology, institutions, and innovation systems. Res. Policy 31, 265–272.

Patel, P., Pavitt, K., 1998. National systems of innovation under strain: The internationalization of corporate R&D. Sci. Policy Res. Unit 19, 1–25.

Pietrasik, T., 2009. Lessons from a frugal innovator: The rich world's bloated health-care systems can learn from India's entrepreneurs [WWW Document]. Econ. URL http://www.economist.com/node/13496367 (accessed 1.3.18).

Podsakoff, P.M., Mackenzie, S.B., Bachrach, D.G., Podsakoff, N.P., 2005. The influence of management journals in the 1980s and 1990s. Strateg. Manag. J. 26, 473–488. https://doi.org/10.1002/smj.454

Powley, T., 2018. Ryanair seeks UK operating permit in Brexit move [WWW Document]. Financ. Times. URL https://www.ft.com/content/2cf795d0-efdd-11e7-b220-857e26d1aca4 (accessed 1.27.18).

Prahalad, C.K., 2010. The fortune at the bottom of the pyramid: Eradicating poverty through profits. Wharton School Pub, New Jersey.

PricewaterhouseCoopers, 2017. Global top 100 companies by market capitalisation, An IPO Centre publication.

Radjou, N., Prabhu, J., Ahuja, S., 2012. Jugaad innovation: Think frugal, be flexible, generate breaktrhough growth. Jossey Bass, San Francisco.

Randhawa, K., Wilden, R., Hohberger, J., 2016. A bibliometric review of open innovation: Setting a research agenda. J. Prod. Innov. Manag. 33, 750–772. https://doi.org/10.1111/jpim.12312

Rao, B.C., 2013. How disruptive is frugal? Technol. Soc. 35, 65–73. https://doi.org/10.1016/j.techsoc.2013.03.003

Rao, C., 2008. Science and technology policies: The case of India. Technol. Soc. 30, 242–247.

Reinhardt, R., Gurtner, S., Griffin, A., 2018. Towards an adaptive framework of low-end innovation capability – A systematic review and multiple case study analysis. Long Range Plann. https://doi.org/10.1016/j.lrp.2018.01.004

Rossetto, D.E., Bernardes, R.C., Borini, F.M., Gattaz, C.C., 2018. Structure and evolution of innovation research in the last 60 years: review and future trends in the field of business through the citations and co-citations analysis. Scientometrics 115, 1329–1363. https://doi.org/10.1007/s11192-018-2709-7

Shepherd, D.A., Parida, V., Wincent, J., 2017. The surprising duality of Jugaad: Low firm growth and high inclusive growth. J. Manag. Stud. https://doi.org/10.1111/joms.12309

Sinkovics, N., 2016. Enhancing the foundations for theorising through bibliometric mapping.

Int. Mark. Rev. 33, 327–350. https://doi.org/10.1108/EL-01-2017-0019

Story, V.M., Boso, N., Cadogan, J.W., 2015. The form of relationship between firm-level product innovativeness and new product performance in developed and emerging markets. J. Prod. Innov. Manag. 32, 45–64. https://doi.org/10.1111/jpim.12180

Tarde, G. De, 1903. The Laws of Imitation. Henry Holt & Company, Clouchester.

The Economist, 2012. Asian innovation: Frugal ideas are spreading from East to West [WWW Document]. Econ. URL http://www.economist.com/node/21551028 (accessed 1.5.18).

Tranfield, D., Denyer, D., Smart, P., 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. Br. J. Manag. 14, 207–222. https://doi.org/10.1111/1467-8551.00375

van Eck, N.J., Waltman, L., 2014. Visualizing bibliometric networks, in: Ding, Y., Rousseu, R., Wolfram, D. (Eds.), Measuring Scholarly Impact. Springer, Cham, pp. 285–320.

van Eck, N.J., Waltman, L., 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics 84, 523–538. https://doi.org/10.1007/s11192-009-0146-3

Veryzer Jr, R.W., 1998. Discontinuous innovation and the new product development process. J. Prod. Innov. Manag. 15, 304–321.

Wacker, J., 1998. A definition of theory: Research guidelines for different theory-building research methods in operations management. J. Oper. Manag. 16, 361–385. https://doi.org/10.1016/S0272-6963(98)00019-9

Wagner, W., 2014. Brand expansion: China's race to conquer world markets [WWW Document]. Spiegel Online. URL http://www.spiegel.de/international/business/chinese-brands-expanding-into-world-markets-a-942094.html (accessed 1.5.18).

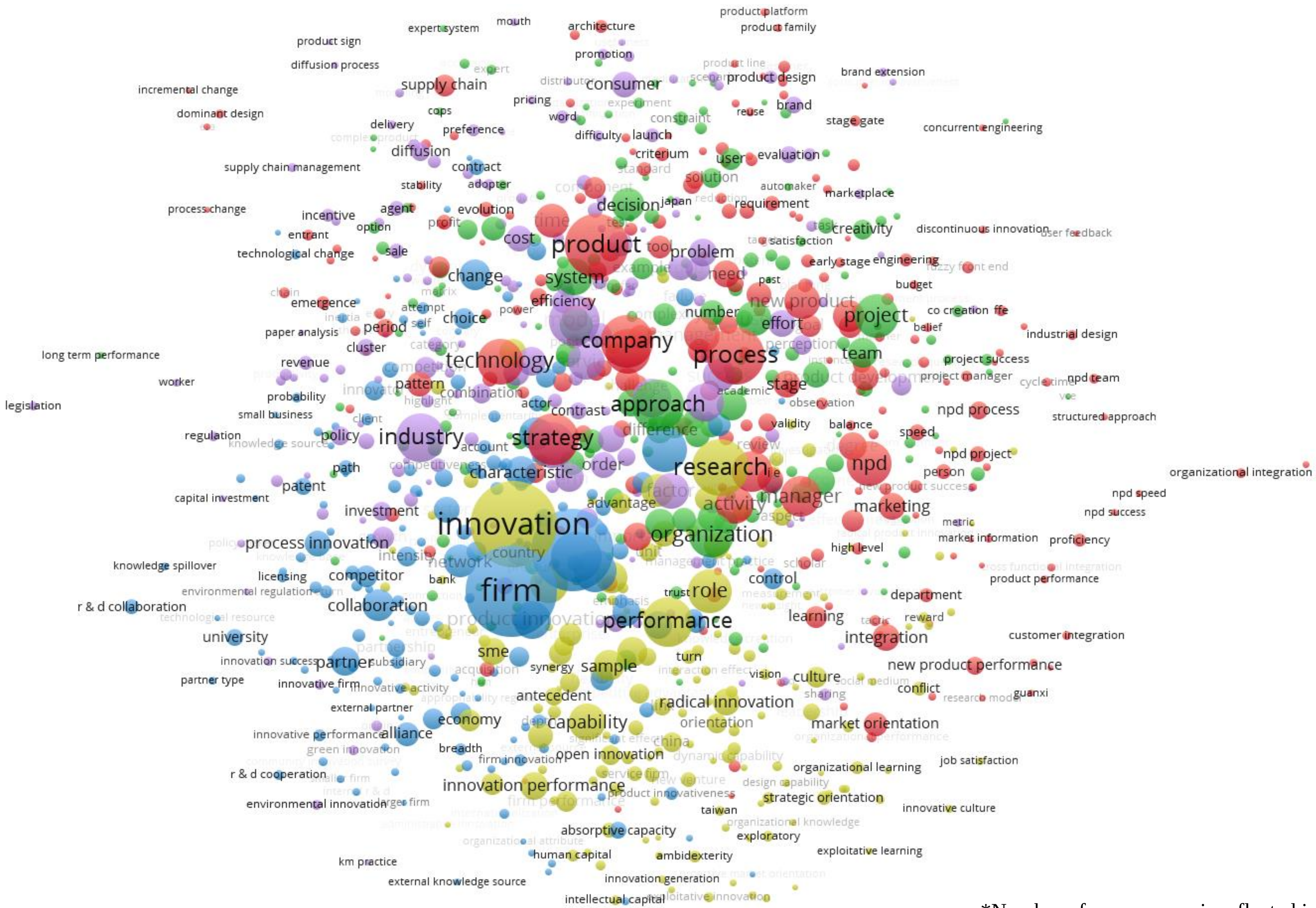
Yin, R.K., 2013. Validity and generalization in future case study evaluations. Evaluation 19, 321–332.

Zeschky, M., Widenmayer, B., Gassmann, O., 2011. Frugal innovation in emerging markets. Res. Manag. 54, 38–45. https://doi.org/10.5437/08956308X5404007

Zeschky, M., Winterhalter, S., Gassmann, O., 2014. From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness. Res. Manag. 57, 20–27. https://doi.org/10.5437/08956308X5704235

Zupic, I., Čater, T., 2015. Bibliometric methods in management and organization. Organ. Res. Methods 18, 429–472. https://doi.org/10.1177/1094428114562629

Figure 1. Product and service innovation types map



*Number of occurrences is reflected in the circle size

Figure 2. Product and service innovation typology matrix

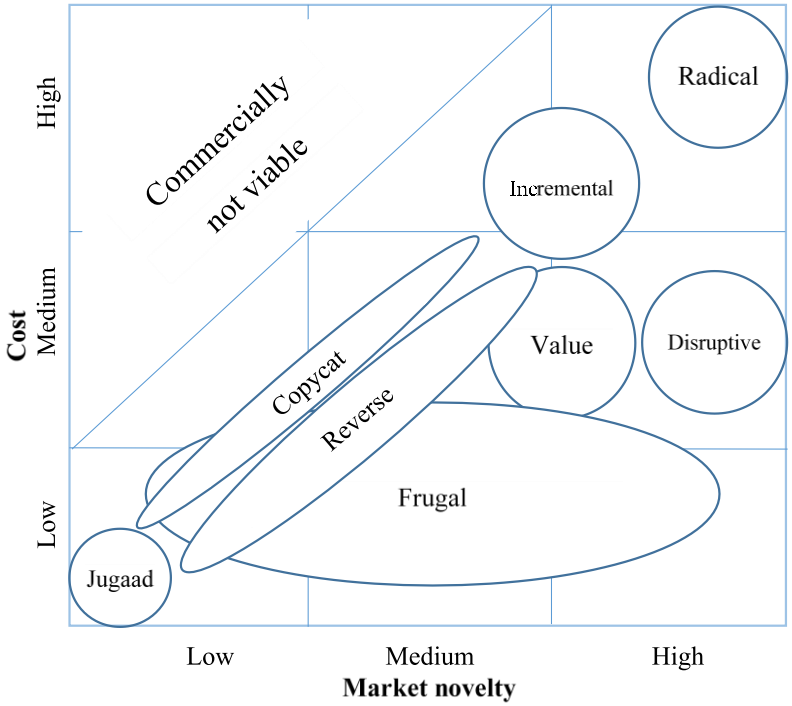


Table 1. Article search results for each of the innovation types

Type	WoS Boolean search terms	WoS Core Collection	Management	Article results	Results in English
Radical	radical innovat*	5,216	1,388	1,066	**1,052**
New-to-the world	"new to the world" or "new-to-the-world" innovat*	53	27	22	**22**
Revolutionary	revolution* innovat*	5,309	473	280	**268**
Breakthrough	breakthrough innovat*	2,676	474	285	**282**
First-mover	"first-mov*" or "first mov*" or "firstmov*" innovat*	1,967	247	197	**196**
Path-breaking	"path break*" or "path-break*" or pathbreak* innovat*	566	31	24	**24**
Lead	“lead* innovat*” or “lead innovat*”	322	87	48	**47**
Discontinuous	discontin* innovat*	1,797	540	446	**446**
Pioneer	pioneer* innovat*	2,761	322	227	**222**
Incremental	increment* innovat*	3,630	917	731	**716**
Marginal	margin* innovat*	4,315	435	335	**329**
Sustaining	“sustaining innovat*”	7,364	1,290	816	**804**
Disruptive	disrupt* innovat*	4,120	662	469	**465**
Copycat	copycat innovat*	37	12	8	**8**
Me-too	“me-too” or “me too” innovat*	301	24	16	**15**
Imitative	imitat* innovat*	2,194	593	417	**409**
Free-riding	"free-rid*" or "free rid*" innovat*	3,659	225	185	**184**
Frugal	frugal* innovat*	203	50	34	**33**
Inclusive	inclusive innovate*	1,872	172	108	**105**
Catalytic	catalytic innovat*	4,930	258	180	**173**
BoP	"bop" or "bottom-of-the-pyramid" or "bottom-of-pyramid" or "bottom of the pyramid" or "bottom of pyramid" innovat*	3,747	156	197	**101**
Value	“value innovat*”	263	97	40	**37**
Good enough	"good enough" innovat*	103	18	15	**15**
Strategic	"strat* innovat*"	637	297	166	**156**
Blue ocean	“blue ocean” innovat*	73	24	12	**11**
Reverse	"reverse innovat*"	123	45	35	**34**
Jugaad	jugaad innovat*	33	10	6	**6**

Table 2. Product and service innovation types in WoS database

Terms identified	Occurrences	Average publication year	Average citations	Average normalized citations
Radical innovation	174	2012.35	35.11	1.35
Incremental innovation	87	2010.62	48.34	1.50
Imitation	21	2010.57	51.29	1.30
Value innovation	20	2009.8	55.4	1.56
Reverse innovation	17	2015.47	12.18	1.13
Disruption	16	2011.25	16.25	0.64
Disruptive innovation	11	2008.36	33.82	0.69
Breakthrough innovation	24	2010.5	85.87	1.62
Exploitative innovation	24	2015.04	13.46	1.15
Discontinuous innovation	18	2003.28	98.33	1.21
Exploratory innovation	14	2016.64	5.5	0.64
Radical innovation project	14	2006.71	89.36	1.05
Radical product innovation	13	2012.62	13.08	1.13

Table 3. Top common terms among the clustered innovation types

Radical/new-to-the-world/first-mover/path-breaking/breakthrough/ lead/ discontinuous/pioneering	**Incremental/ marginal/ sustaining**	**Imitative/ me-too/ copycat/ free-rider**	**Frugal/ inclusive/ catalytic/ BoP/**	**Value/ blue ocean/strategic/ strategy/good enough**
Resource; customer; innovativeness; organization; new product; influence; creation; ability; risk; R & D; new technology; radical innovation; manager; china; innovativeness; importance	Process; development; technology; product; incremental innovation; project; market; manager; activity; practice; value; new product; new product development; success; R & D; product innovation; network; investment; creation; benefit; difference; quality; integration; technological innovation; insight; experience; innovation performance; competitive advantage; brand; innovativeness; continuous improvement; firm performance; new technology; value creation; margin; continuity; improvement; large firm	Imitation; China; value; increase; dynamic capability; imitator; practice; partner; patent; project; example	Pyramid; market; India; country; opportunity; value; condition; poverty; service; solution; lack; replication; challenge; institutional void; poverty alleviation; jugaad; problem; reverse innovation; bop	Value; approach; market; strategy; competitive advantage; opportunity; type; competitor; BOS; idea; blue ocean; pricing strategy; solution

Table 4. Product/service innovation types, characteristics, and overlaps

	Radical (17)*	Incremental (25)	Imitative (8)	Disruptive (14)	Value (16)	Frugal (18)	Reverse (17)	Jugaad (9)
Patentable	✓	✓	±	✓	✓	✓	✓	
Scalable	✓	✓		✓	✓	✓	✓	
Commercializable	✓	✓	✓	✓	✓	✓	✓	
Existing markets	✓	✓	±			±	±	
New markets	✓		±	✓	✓	✓	✓	✓
Under served markets due to cost			✓	±	✓	✓	✓	✓
Largely developed on existing products/services		✓	✓	✓	✓	✓	✓	±
High technological novelty	✓	✓		✓				
New uses	✓			✓		±		✓
BoP to ToP markets				±			✓	
Market positioning by choice	✓	✓		±	✓		±	
Use of institutional voids			✓		±	✓	±	✓
A degree of product localization			✓			±		✓

*Numbers in brackets refer to the number of cases including the case studies

'±' refers to the characteristic flexibility in regards to the innovation type, e.g. some copycat products may be patentable but not always.

Table 5. A typology of product and service innovation

	Radical	Incremental	Disruptive	Imitative	Value	Frugal	Reverse	Jugaad
Characteristics	• New or revolutionary; • Large-scale; • Create discontinuous shifts in the markets; • Can be a significant improvement to existing	• Evolutionary continuous improvements; • Not discontinuous; profit-seeking; • Top end of the market	• Simpler solutions; • Smaller target markets; • Creation of new markets & value networks; • Disruption of existing markets & value networks; • *Displacement of earlier technologies	• Reverse engineering of existing products and services; • Similar end products or services	• Niche innovators; Mostly in low-end of the market; • Turn non-consumers into consumers	• Serving the bottom of the pyramid; • Off-the-shelf products; • Built on resource constraints; • Scalable; • Sustainable	• Frugal and value + expands to developed countries	• Non-commercializable • non-scalable; • non-sustainable; • fixes to make life easier; • Mostly everyday hacks
Product and/or service examples	Penicillin; Steam engine; Nuclear energy; Artificial organs	Mobile phones; Education techniques; Electronic storage	Blockchain technologies; Tablet PCs; Online music streaming services; Some 3D-printing projects	Pharmaceutical generic drugs; Luxury fashion brand imitations	Low-cost airlines; Supermarkets that open smaller marts	P2P lending in India; High volumes surgical procedures	Smartphone-based blood-cell counter; Portable ECG machines	Bleach filled bottles to substitute lightbulbs; Peer-to-peer sharing
Commercial examples	Tesla electric cars + energy; Apple iPhone; Philips Hue products	Apple iPhone upgrades; Intel CPUs; Microsoft Windows; Dyson vacuums	Aldi; Netflix; Wikipedia; Spotify	Some South Korean and Chinese manufacturers began as imitators	TSMC; Ryanair; Tata Nano;	LifeSpring Hospitals; GE ECG portable machines	Haier white goods; Mahindra tractors; GE Vscan	N/A as it is non-commercializable in the strict definition
Representative articles and books	Dewar and Dutton, (1986); Hill and Rothaermel (2003); Leifer et al., (2001); Ettlie, Bridges, and O'Keefe (1984)	Ali (1994); Garcia and Calantone (2002); Lundvall (1992); Christensen (1997)	Christensen (1997); Christensen and Overdorf (2000); Christensen, Raynor and McDonald (2015)	Kim (1997); Schnaars (1994); Shenkar (2010)	Anderson et al. (2006); Dillon et al. (2005); Kim and Mauborgne (1997)	Banerjee (2013); Radjou and Prabhu (2013); Rao (2013)	Govindarajan and Ramamurti (2011); Zeschky, et al. (2014); von Zedtwitz, Corsi, and Frega (2015)	Agnihotri (2015); Banerjee (2013); Radjou et al., (2012); Shepherd et al. (2017)
Also referred to as	New-to-the-world/ first-mover/ path-breaking/ breakthrough/ lead/ discontinuous/ pioneering	Marginal/ sustaining	N/A	Me-too/ copycat/ free-rider	Blue ocean/ strategic/ strategy/good enough	Inclusive/ catalytic/ Base of the pyramid (BoP)	N/A	Hack