

HOW CAN INDIA BECOME A NATION OF INNOVATORS?

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ABSTRACT

This paper attempts to study the context of Innovation in India and stresses that to make India a country of innovators, it is first imperative to make innovation an inclusive concept. Studying the socio- economic landscape of India, it makes the case for ‘frugal innovation’ as a method to encourage country wide innovation, especially in circumstances of certain resource constraints – be they financial or material in nature. Further, it discusses how frugality in innovation can allow India to become a lead market in the sector, and thus reap the benefits of an increased competitive advantage over other emerging economies.

The paper then shifts its focus to the challenges faced by innovators in India, and based on them, provides a number of suggestions to overcome them. It proposes a multipronged approach to unleash India’s innovative potential, which is primarily centred on improving levels of competition through commercializing knowledge, eliminating non - essential regulations and improving funding options for innovative activities. Here it provides solutions to commercialize innovation and thus make it a real driver of economic growth. Later, it shifts our study to the support systems associated with encouraging innovation, i.e, the institutions which affect not the process of innovation, but rather the inherent capability of it. Hence we stress on the need for social capital or human development to fully realise the innovative potential of India.

This paper aims to propose remedies to make innovation a national agenda, supported by a strong symbiotic relationship between the government, the corporate sector and the academic system, to address key social issues while also supporting a burgeoning entrepreneurial sector.

Keywords: frugal innovation, inclusive innovation, lead markets, social capital

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INTRODUCTION

Innovation, as an approach to development, is progressively becoming the real driver for change in the world, as it intervenes across sectors, providing accessible solutions to ever evolving consumer needs. Around the world, countries have already demonstrated the role of innovative solutions in catalysing national growth rates while improving standards of living. For instance, since the 1980s, South Korea has vastly improved its economic status by promoting an inward transfer of foreign technology while developing its domestic capacity to innovate through reverse engineering and foreign licensing—followed by significant investments in R&D (Kumar 2003). This paper provides suggestions for a similar innovation-driven path in India, which will allow it to maintain a balance between economic development and social well-being.

THE INNOVATION CONTEXT

Making the case for frugal innovation

India is steadily becoming a top global innovator for high technology products and services. With all the right ingredients - the massive population strength, history of innovation, significant support and infrastructure, it possesses the ability to innovate in a way that will disrupt the status quo and create breakthrough solutions. However, the country is still underperforming relative to its innovation potential— with direct implications on long-term industrial competitiveness and economic growth.

Despite pockets of innovative activities in both the formal and informal sectors, innovation remains concentrated in a small segment of the economy. With about 25 percent of its population living below the national poverty line, India is largely a subsistence economy, with significant spatial variance across and within states (Dutz 2007).

Roughly 80 percent of the workforce is employed in the informal sector, which is often characterized by low-productivity and low-skill activities. Though India has the benefit of a younger population — more than half of the country's population is under 25 years old— only 17 percent of people in their mid-20s and older have a secondary education. While their youth is an advantage, their inexperience combined with a risk averse, imitation prone mentality is a major disadvantage. Moreover, another critical input to encourage innovation, domestic R&D spending, has never exceeded 1 percent of India's GDP (Ministry of Statistics 2012).

Historically, the trajectory of Indian innovation has predominantly reflected the priorities of the developed world, with technologies traditionally being developed by well-educated engineers, in multinational firms, funded by large R&D budgets (Radjou, Prabhu and Ahuja, 2012). The socio economic landscape of India (and the myriad of problems associated with it) necessitates the call for a new model of innovation, one in which new applications and processes can induce the production of better goods and services, with the same or fewer inputs—to meet the needs of all sections of Indian society. To harness its innovation potential, an approach that can prove invaluable for India in the present hyper-competitive market setup is that of Frugal Innovation.

Simula et al. (2017) define frugal innovation “*as a product, service or a solution that emerges despite financial, human, technological and other resource constraints, and where the final outcome is less pricey... and which meets the needs of those customers who otherwise remain un-served*”. Here, Mitticool, a clay fridge developed by a potter with limited access to electricity, or Tata Swach, a water purifier targeted at rural areas with poor facilities for running water, are both prime examples of how frugal innovations are meeting ‘unserved’ local needs. In a narrow sense, frugal innovation could be defined as the stripping of attributes of technologically sophisticated products and services to make them cheaper without losing technical functionalities, and therewith making them affordable for low income customers, either in low, middle or high-income countries. However, many scholars have stressed that frugality goes beyond costs reduction. According to Bhatti, it mainly relates to the challenges faced by innovators in environments where frugal innovations are meant to be designed:

- 1) Resource constraints – material and financial, but also knowledge and human resources;
- 2) Institutional voids - lack of services, formal rules, laws, and constitutions;
- 3) Specific needs of population at the bottom of the pyramid.

A careful study of the environment suitable for frugal innovation expresses similitude to the environment in which Indian innovations already stem from. Take for example, the aforementioned ‘Mitticool’, developed by Mansukh Prajapati, who used his traditional knowledge of pottery to transform it from an artisanal craft to an industrial process. After an earthquake struck Gujarat and destroyed his earthen pots¹, Prajapati developed a clay fridge using the principle of ‘cooling by evaporation’, which owing to its value sensitive pricing, has now evolved into a leading earthen cookware company in India.

¹ Earthen pots are utensils traditionally used for cooling in rural India.

Here the resource constraints, in this case the restricted supply of electricity, when combined with the specific needs of the fellow community members for a low cost cooling device, and a lack of supporting institutions and R&D facilities, created the demand for an ingenious product that could be produced using readily available materials (clay) and did ‘more with less’; driving environmental and socio-economic stability while ensuring financial stability of the business itself.

Thus, frugal innovations can address social challenges and simultaneously create profit for businesses by developing new (frugal) products and services to low-income markets. This paradigm shift has also attracted criticism to the fact that targeting the poor as a primary consumer might lure them into ‘wasting away’ the little resources at their disposal, on goods and services that might prove unnecessary for their own welfare. The basic idea, however, remains justifiably positive in that it can *potentially* make significant contributions in raising standards of living for millions, as proven by examples such as iodized salt or mobile payment services (Dutz, 2007).

Frugal innovation can be interpreted as a context sensitive solution to a problem, one which allows adversity to become inspiration for further innovations. It is already inherent in the Indian society through the system of ‘Jugaad’, a word which itself has connotations to improvise, hack, make do, and mend. However, it is important to note that the association of frugal innovation with the term ‘Jugaad’ can at times, be limiting. While Jugaad is simply an ideation of an individual and can be seen as a short term fix, frugal innovation attempts to go beyond the negative aspects of ‘making do’ and instead, implies resourcefulness in a cycle of processes that is sustainable in the long run. Hence, frugal innovation, anchored in the mind-set of Jugaad, is still oriented towards ‘more from less’ products as opposed to ‘short-cuts’, which it achieves by means of efficiency and creativity in structured innovation processes and not momentary fixes.

Further, it should be pointed out that while frugal or ‘good enough’ innovations are perfectly appropriate for the resource constrained India of today- that is not to say that Indians deserve only ‘good enough’ products and not highly advanced innovations. As the country develops, it is natural for citizens to expect superior products, which in turn will be supplied by more advanced production processes. Thus, while ability to innovate develops over time and regions, to make India a country of innovators and solve specific problems of the greater population *at present*, it is crucial to focus on frugal innovation.

Frugal innovation to make India a global innovator

In recent years, India has been attracting several multinational companies with its opportunities for frugal innovation. It already hosts 750 R&D subsidiaries of companies employing over 400,000 professionals and is thus becoming a serious player in the innovation space (Kumar and Puranam, 2012). The promises of India’s rapid growth and the ever relevant need of MNCs to provide ‘frugal’ services to meet international competition, creates the potential for India to be a ‘lead market’ in the frugal innovation sector.

The Lead Market Theory: India’s Potential as a Lead Market for Frugal Innovations

Historically, the global innovation diffusion process usually starts out in a particular area or country.² Here the countries which are first to invent or adopt a globally successful innovation have been called ‘lead markets’, while those that acquire the innovation later through global diffusion are called ‘lag markets’ (Beise and Gemunden, 2004). For instance, Germany can be seen as a lead market for renewable energies and advanced automobiles, while the USA would lead in information technologies and e-commerce.

² Global innovation Diffusion: The system through which an idea or product gains momentum and spreads through a specific population or social system.

According to the lead market theory developed by Beise et al (2004) lead markets are usually characterized by high per capita income, customer sophistication and high quality infrastructure. These assumptions regarding the characteristics of lead market economies imply that a) lead markets by default exist in highly industrialized or economically developed nations which can finance the development of advanced technologies, and b) the presence of highly sophisticated customers is an important prerequisite for lead market potential owing to its positive effect in inducing innovative activity and signalling quality to consumers elsewhere (Ghoshal and Barlett, 1990).

Recent studies, however, indicate an increasing trend in globalization of market-driven innovations in countries like China or India, which, contrary to lead market theory, can primarily be attributed to factors such as access to cheap and skilled manpower only (Asakawa and Som, 2008). Furthermore, research also suggests that firms are increasingly using fast-growing emerging economies as lead markets for innovating specific products, services, and technologies (Tiwari and Herstatt, 2012). India has specifically emerged as a source for cost effective and ‘disruptive innovations’, with price-sensitive consumers inducing firms to apply ‘frugal engineering’ for creating affordable products and services without compromising excessively on quality. Characterized by low costs and ‘good enough’ quality in a volume-driven market, resource constraints motivate entrepreneurs to think of out-of-the box solutions which can overcome limitations imposed by the infrastructural and business environment. There are several instances of successful affordability-driven Indian innovations that have gone on to succeed globally, e.g. a baby-warmer called “Lullaby” developed by GE, which is now reportedly sold in 62 nations or small-sized tractors developed by India’s Mahindra & Mahindra now sold in the USA (Tiwari and Herstatt, 2012). Such innovations have been defined as being “frugal” for focusing on the elementary, core-functionality and renouncing the integration of unnecessary features.

Termed as ‘indovations’ by the business press, they come from a series of potentially game-changing frugal innovations which suggests a lead market role for India (Lamont, 2010).

The trickle down effects of India becoming a lead market are several, and are rooted in the competitive advantage to be enjoyed by India for the new products innovated. Global interdependence, complemented by intense competition and a need for path breaking technological advances has resulted in the ‘globalization of innovation’, with firms increasingly seeking to tap global knowledge resources in order to shorten development cycles, reduce costs or simply to design products for local markets with differing consumer tastes.

With frugal innovation at the crux of Indian innovation, these features can act as ‘market pull’ factors for global firms looking to establish R&D units outside the home country which can potentially enable access to open innovation networks and help upgrade R&D capabilities by creating cross-border nodes between regional/national systems of innovations. In turn, the firms can use the large markets faced with certain material and infrastructural deficiencies as ideal experiment grounds to develop accessible, disruptive products which can generate large volumes of demand.

As market conditions everywhere become increasingly volatile due to the information boom and social media, while resource constraints (given the exigencies of climate change and the Age of Scarcity) become a norm for emerging and developed nations both, people have to go beyond an R&D intensive paradigm to include innovations in processes and organisational models. Here, frugal innovation can help access the huge reserves of latent innovative capabilities present in the Indian population. Since problems with developing new products and services are often centred on finding resources - material or financial - the low cost, constrained approach of frugality can be the perfect solution.

DEVELOPING THE INNOVATION ECOSYSTEM: MAKING INDIA INNOVATE

This section suggests a two pronged strategy to create an enabling environment for Indian innovation. First, there is a need to improve the innovative climate in India by recognizing that competition is vital to unleash innovation. Second, we need to develop a support mechanism based on social or human capital formation to unleash the human creativity behind an innovation.

According to the context of frugal innovation defined by Bhatti, it ‘exists’ in environments with limited resources, institutional voids and specific demands. With these constraints, the only way to truly stimulate frugal innovation is to stress on the inherent imaginative capabilities of the people to think inventively and develop ingenious products suited to their needs. On the other hand, suggestions to improve existing institutions might seem contradictory to the climate (the institutional voids) from which frugality stems. However, the key term here is ‘exists’, because given that frugal innovation exists in such environments, in a country like India, it is still possible to enlist the help of formal institutions to *commercialize* relatively successful innovations, without hindering the process of innovation itself. While these institutions are not essential for the process of frugal innovation, it is still important to note their unique position in India. Being moderately developed, they can be built upon to facilitate innovation activities and provide incentives, and thus, to an extent, can encourage them.

- INNOVATIVE CLIMATE:

According to the theory of ‘Creative Destruction’ popularized by Joseph Schumpeter, markets reward powerful creativity with extraordinary returns, and consumer demand gives genuine innovators a significant advantage over the rest of the market (Dutz, 2007). Since the only way to become a market leader and defeat the original innovator is to produce a far superior product, it goes to prove that competition drives the second generation of innovators by ‘destroying’ the original market position to ‘create’ a new generation of products. So, in well-functioning markets, product market competition encourages enterprises to innovate.

In India, actions that can spur competition may consist of conventional recommendations like facilitating easy entry and exit of enterprises by removing legal and administrative bottlenecks, improving regulatory framework and liberalization, or changing FDI restrictions. This paper focuses on financial inclusion, bringing the informal sector to par with the formal sector and commercializing R&D knowledge through private-public collaborations.

1. Financial Inclusion:

Although India has a relatively well developed equity market compared to other emerging economies, access to finance is still a common constraint faced by most small enterprises, start-ups, and grassroots projects. The Third Census of SSI (2001-02) found that only 3.09 percent of all enterprises in the informal sector accessed any credit from a bank or any other formal financial institution. This is despite various mandates to Indian banks to lend to the ‘weaker sections’, with it counting towards the “priority sector” obligation of 40%. To encourage small- scale innovation, it is crucial to first extend to these innovators the umbrella of formal credit sources, which can only be done by working towards financial inclusion.

The Inclusive Development Index (IDI), an index to measure inequality in growth of global economies, recently ranked India 62 out of 74 emerging countries, with regional competitors like Pakistan ranking 15 positions ahead (World Economic Forum, 2018). Given the rising divergence between productivity in agriculture and in knowledge-intensive professional sectors, it is now crucial to focus on informal research and development to encourage innovations that are inclusive in nature.

Unlike developed nations that have the infrastructure to focus on market driven 'cutting edge' technologies, India needs to promote inclusive innovation models aimed at improving the quality of life by opening up sustainable livelihood and productive income-generating opportunities for the poor. For instance, there exists huge untapped potential in R&D for agriculture, a sector that accounts for 18 per cent of India's gross domestic product (GDP) and employs 58.2 per cent of the total workforce (Finance Ministry, 2015). Here, apart from the necessary skill formation, innovation can be encouraged by joint ventures between public research institutes and the private sector, which will shift from resource- and input-based growth to knowledge- and science-based growth. For example, 'Farms and Farmers' (FnF) was started in 2010 by alumni of IIT Kharagpur and IIT Delhi, having vast experience in rural development as well as supply chains, retail and FMCGs. In the Farm Producer Organization, they have collaborated with members of various public agricultural institutions to digitize agriculture and design innovative farming models which can be successfully implemented to boost productivity (Projects: Farm and Farmers, 2014).

Similar developments are needed in fields like preventive medicine, clean water, education, and other public services that can benefit from harnessing collaborative efforts of public and private enterprises. In the long run, enterprises could benefit from the creation of strong global networks to share best practices, provide information on inclusive innovation products, and to attract funding in supporting national and regional inclusive innovation efforts.

2. Funding Innovation:

Other than banks, funding for frugal innovations can also be sourced through institutions like the government, private sector like venture capitalists or the public itself.

- *Government:*

Government funding has played an important role in India's early-stage technology development, but has not achieved the desired scale and quality of R&D investment and commercialization. Although a number of public financing schemes have set up to fund indigenous technologies, they have often been mismanaged, with inappropriate allocation of funds (Dutz 2007). The first step to correcting the mismatch between the need to promote entrepreneurial ventures and the shortage of capital is to assess spending on government programs to improve governance and correct design flaws. It is critical to treat public sector intervention as venture capital competing against private sector investments in R&D effort and accordingly find the competitive advantage of government funding. Hence funding by the government, though limited, can provide an incentive for frugal innovators to overcome tendencies to avoid risk and instead expand production bases.

- *Private Sector:*

Although venture capital and private equity have been expanding in India in recent years, funding of seed and early-stage finance remains a key challenge. Despite significant number of major funds existing in India, there remains a bias toward larger funds, information technology (IT), and proven business models (Dutz 2007). This stems from market failures like information asymmetry which arise from the gap between the information available to inventors and that to the investors. Most investors are poorly equipped to quantify the risks and market uncertainties associated with frugal inventions, and thus prefer to wait for the technology to gain reasonable success before investing (Granqvist 2016).

Here, there is a need for a policy framework that encourages the private sector to undertake riskier initiatives that are also economically beneficial. This should be complemented with financial support where needed, especially in pro-poor funding. Changes in tax, insurance, and pension fund guidelines for the investors could attract early-stage venture capital as well. Further, a 'fund of funds' could be created to attract capital and expertise, thus supporting investment throughout the innovation cycle: from its inception to the later phases of scaling-up potentially successful frugal innovations.

- *Public:*

Crowdfunding is an emerging concept that can allow small businesses to raise capital by pitching their idea to the public through crowdsourcing platforms or social media. Here the lack of a trusted network of partners can actually act as a positive, as the developers need to cast no limitations on who can participate in the funding process, and further, the development process itself. These platforms allow funders to make small initial investments that they can iteratively increase in phases, based on performance of a product, service, or solution, thus reducing risk that is already shared more equitably between funder and grantee. This stands in contrast to more front-loaded funding mechanisms. However, the fact that this is an online process and that it has no credibility backed by legal processes makes it a challenge to develop the mechanism in India. Like in e-commerce, which saw a boost in sales only when the concept of Cash on Delivery was initiated, an offline base can be created to induce larger participation in crowdfunding. Further, to gain the trust of the public, India may also have to bring in requisite laws to support the mechanism and reduce the overall risk associated with it.

3. Knowledge Creation and Commercialization:

Public policy should not just promote competition, but stimulate collaboration as well.

On one hand, private sector involvement in innovation has been minimal: most programs have been operated and managed by government institutions. On the other, public institutions typically suffer from complex structures and often reflect a preference for government ownership and management, rather than leveraging private sector capacity to provide investments, modern management, designs, and operational flexibility.

To encourage country wide innovation, India needs to promote collaboration between its sectors. Take for instance, the example of technology incubators. The shift of government-industry linkages from a linear to an interactive innovation model is visible best in the history of the incubators, which transcending the production and dissemination of research, now increasingly lie behind new frugal products and firms. Technology incubators can be used to promote commercialization, transfer, and diffusion of knowledge, thus fostering links between universities, R&D labs, and industries. For eg, Centre for Innovation Incubation and Entrepreneurship was setup by IIM Ahmedabad in 2002, with support from the Government of India and Gujarat Government. It now operates through an autonomous not-for-profit entity, to foster entrepreneurship through incubation, ecosystem development and academic initiatives.

Further, platforms can be designed to induce collaboration between innovators through global innovation networks, like The Honey Bee Network and SRISTI, the Society for Research and Initiatives for Sustainable Technologies and Institutions. Especially useful for frugal innovation by linking informal and formal science and scientists, they have documented over 10,000 grassroots innovations with a view to patent them as validation of their intellectual and commercial merit.

- SUPPORT MECHANISM:

However, innovation essentially only stems from the *capabilities* of the people to innovate, which are generated from the environments they originate from. It is not possible to alter the innovation climate in India without first improving upon the fundamental support mechanisms in place.

4. Education and skill formation:

To contribute effectively to the innovation economy and capitalize on the trend of globalization, India's workforce must have market-driven skills that are aligned with its country's transformation, albeit incomplete, from an agrarian to a manufacturing/service based economy. However, the skill set required by the informal sector, encompassing both technical and business management skills, is not adequately provided for by most formal training programs for the sector. Further, in the few existing vocational programs, many workers are held back by their lack of basic education, which reduces their ability to absorb the information provided. High illiteracy curbs the productivity potential of the informal and lower-skill sectors. Though 71 percent of Indian workers are employed by the informal sector, the resources devoted to enhancing their skills do not reflect this reality (NSSO, 2012).

- i. Innovative approaches to improve the quality of primary and secondary education:*

Adequate skills need to be imparted at the foundational level, whether through formal or informal educational systems. Schools need to modernize the curriculum and revamp the examination system from a test of memory to a test of analytical skills, thus paving the way for more flexible and responsive teaching.

For instance, in June 2017, the Government of India through NITI Aayog, to “create scientific temper and cultivate the spirit of curiosity and innovation among young minds”, established a network of Atal Tinkering Labs in about a 1000 schools across the country. These open-ended innovation workspaces are equipped with state-of-the art technologies like 3D printers, robotics, Internet of Things, miniaturised electronics etc., which can enable students to learn and solve local community problems using emerging technologies. With platforms to nurture their curiosity, students have started making prototype solutions for projects such as better irrigation management or waste disposal using IOT devices and robotics in their labs. It is of utmost importance for schools to foster a culture of experimentation while also reducing the stigma of failure, a common occurrence in innovation activities. Hence resilience of character needs to be built from an early age to combat the risk averse tendencies of innovators.

ii. Strengthen vocational and enterprise based training:

India’s vocational education and training system needs to be better aligned to market needs to meet the preservice training requirements of enterprises. So far, vocational systems were unsuccessful in preparing graduates to meet market needs, particularly because of a lack of interaction with industry (Froumin, Divakaran, Tan and Savchenko 2007). Aligning these systems with the market requires restructuring through increased private participation; in the management of institutions, curriculum development, upgrading infrastructure and instructor capabilities and system financing.

Froumin et al. (2007) urged that only 16 percent of Indian manufacturing firms offer in-service training, compared with 92 percent in China and 42 percent in the Republic of Korea. The Indian firms that provide training are usually around 23 percent more productive than those who do not.

The government needs to ensure that the benefits of in-service training are widely recognized by enterprises, while simultaneously providing strong financial incentives—such as matching funds—for firms that invest in training.

To prepare for an information and communication technology (ICT) dominated world, digital literacy must be given greater prominence through focused, short-term courses such as training in information technology (IT) literacy.

- *University Innovation Clusters:*

As proposed by the National Innovation Council, university innovation clusters should be set up across the country where innovation can be seeded through Cluster Innovation Centres (CIC) (National Innovation Council, 2011). The CIC will provide a platform for the university and its partners to forge linkages between various stakeholders from industry and academia, initiate and assist innovation activities, encourage innovations in curricula and act as a catalyst and facilitator. An initial pilot with University of Delhi has commenced and is receiving an overwhelming response from the student community.

CONCLUSION

The unique context of Indian innovation, from the wide infrastructure gaps to the human capital deficiencies, in most countries, could prove a hindrance to the process of innovation. In India however, these constraints themselves - through the approach of frugality in innovation - have helped innovation thrive. In recent times, this strength has gained a whole new significance. The pressure for financial austerity and environmental sustainability are increasingly making frugal approaches to innovation attractive to developed economies. Thus, this strength now has particular relevance for the way India positions itself within global innovation networks, and the strategies it adopts for collaboration and engagement with countries around the world. If developed right, frugal innovation has the potential to induce a paradigm shift in the way all products, services and business models are designed. Due to the number of factors that have come together to create an environment that is particularly conducive to frugal innovation in India – like a price-sensitive market, a culture of creative improvisation, an emerging funding system for social innovation, and a government keen to create an ‘inclusive’ model of innovation, to make India a nation of innovators, frugal innovation is the way to go.

However, to commercialize such innovations, there is an urgent need to ameliorate certain pre-existing mechanisms that will allow large scale promotion of such innovations. Public and Private sector partnerships, in funding, collaboration and education, are the key to encouraging frugal innovation.

In conclusion, to the question of ‘How can India become a nation of Innovators’, it is safe to argue that it is *already* one. The fact that India has the creative potential to innovate is indubitable. But for global success, it needs to channel that creative potential through formal sources, orientated towards ingenious yet effective solutions, backed by sound infrastructure.

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