

Trends in innovation management research in India – an analysis of publications for the period 1991–2013

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With increasing recognition of the importance of technological innovations in economic development, scholarship on innovation management – seeking to understand the context, process and management of technological innovations, as distinct from their purely scientific, engineering and technical aspects – has been steadily rising as well. This field of research has been instrumental in discovering important concepts that have subsequently informed innovation management in industry, public R&D and academia. In the past two decades, India has also significantly advanced the pace of technological innovations, as evident from patents filed out of the country. However, there is little understanding of whether research on innovation management in the country has also witnessed a similar trend. The present article seeks to address this gap. We looked at the abstracts and keywords of 58 articles related to technology and innovations in India published in 21 journals during the period 1991–2013. We conclude that the trend is not very encouraging. We discuss its implications and offer suggestions for future research.

Keywords: Bibliometric analysis, economic development, innovation management, publication trends.

ECONOMIC growth can be understood as a process of evolution in which technological advancement plays an important role¹. While this importance of technological innovations for economic development has been studied, researchers have also noted its impact on industries and firms. In line with these developments, scholarship to understand the context, process and management of technological innovations, as distinct from their purely scientific, engineering and technical aspects, has also been rising at least since the middle of the last century. Part of this body of literature has focused on understanding the macro-context of technological innovations, namely policy and economics. The focus of this line of research has been to understand the efficacy of policies and legislations in encouraging technological innovations, and the link between these innovations and national economic development.

Another important stream of research has taken a more micro-view. It has sought to understand the management of technological innovations – organizational strategy, design, team work and innovator motivations – that facilitate or hinder technological innovations by industries, firms and lately, by universities and academia. As a result of this line of research, we are better placed today

to suggest steps for organizations to become more innovative and to make their innovation processes better.

There are several examples that can be cited to stress this point. Some of the earliest scholarly books in this stream introduced important constructs such as mechanistic and organic organizational structures that have continued to be relevant in the research on the management of innovation². In subsequent decades, significant conceptual developments have taken place to further our understanding of the management of technological innovations. These include, among many others, constructs such as boundary spanning external communication³, architectural innovations⁴, absorptive capacity⁵, user-defined innovations⁶, disruptive innovations⁷, open innovation⁸ and organizational ambidexterity⁹. The pace of work in both the macro- and micro-research streams is evident from the increasing number of journals dedicated exclusively to them. These include *Research Policy*, *Journal of Product Innovation and Management*, *Technovation* and *R&D Management*. Besides, several journals in economics, policy studies and general management also publish research from these streams.

In this article, we discuss trends in India on the scholarship to understand the management of innovations. Understanding trends in scholarship in a field of research is intrinsically interesting. Bibliometric and scientometric studies, for example, are dedicated to unearthing patterns in the progression of a field of study. They help us spot

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gaps in the attention of researchers, and also to connect scholarship with wider institutional contexts in which they are embedded. Indeed, there are already several reports on research trends in specific subjects in management research, including technological innovations^{10,11}.

However, to our knowledge, there is as yet no research on such trends specific to India. Therefore, in this article, we report trends in research on technological innovations in India. In the following sections, we first discuss our methodology, and then report our findings, before discussing them in the macro-context for innovation in India. We conclude with our thoughts on the implications of these trends on scholarship in the field of research on innovation management in India.

Methodology

We undertook a review of the literature drawing substantially on the methodology suggested by Transfield *et al.*¹². It is acknowledged that journal articles are likely to have the greatest impact in a field^{10–13}. It has also been argued that reputed journals often tend to influence the frontiers of conceptual and empirical work by suggesting potential lines of research within their own fields¹⁴. Therefore, we limited our review to double-blind reviewed articles published in top journals in the fields of general management and innovation.

Data collection

The journals were chosen from general management, strategy, entrepreneurship and innovation categories as listed by Harzing journal quality index¹⁵. We cross-verified these journal rankings with the SCImago rankings as well. Following Nag *et al.*¹¹, we did not consider *Harvard Business Review*, since it has primarily a managerial audience. The journals we considered are classified under three categories as suggested below.

(i) General management: *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *Strategic Management Journal*, *Management Science*, *Journal of Management*, *Journal of International Business Studies*, *Journal of Management Studies*, *Academy of Management Perspectives*, *British Journal of Management*, *Organization Science*, *Strategic Organization* and *Long Range Planning*.

(ii) Entrepreneurship: *Journal of Business Venturing*, *Entrepreneurship Theory and Practice*, *Small Business Economics* and *Strategic Entrepreneurship Journal*.

(iii) Innovation: *Research Policy*, *Journal of Product Innovation Management*, *R&D Management* and *Technovation*.

This wide array of journals helps in bringing out broader discussion elements that are not covered if we

focus on one category of journals^{10,11,14}. The time period of our literature review is 1991–2013. The year 1991 was chosen as a cut-off year as it coincided with the government policies of liberalization and economic reforms in India. Following prior approaches to identifying relevant articles in literature reviews^{10,16}, we performed searches on each of the journals and retained 58 articles that contained the word ‘innovation’ and/or any of the phrases ‘R&D’, ‘technology’, ‘creativity’ along with the ‘India’ in their abstracts.

Data analysis

We adopted a two-tier analysis scheme for systematic evaluation. At the macro level, we identified the trends of publication in India. We also looked at the category of journals into which the articles get published. At the micro level, we wanted to study the key themes stressed by the articles. For this, we analysed the entire set of keywords, classifying them into appropriate categories. The coding scheme is provided in Appendix 1. The three main classification categories were macro-perspectives, technical or operational aspects, and organizational or management aspects. The categorization into operational and organizational aspects was done according to Krishnan and Ulrich¹⁷. We then performed subsequent analysis based on the counts of keywords coming under each of these categories. Since the count of keywords is nominal data, we performed chi-square tests to analyse whether each of the categories was substantially different. The results from this two-tier analysis scheme are detailed in the next section.

Results

Macro-level analysis

At the macro-level analysis, we focused on the general publication trends in India. In Figure 1, we present publication trend on innovation management in India, superimposing it on the number of patents granted. We made two key observations from this trend. First, a marked increase in the number of publications was observed post 2000 in comparison to the last decade of the earlier millennium. However, this increase is not statistically significant ($\chi^2 = 2.07$, $P > 0.05$). Second, we noted that the rate of increase in the number of patents granted was much higher than the rate of increase in the number of publications.

Another macro-level observation that we made was that majority of the publications were restricted to innovation-based journals as shown in Figure 2. The classification of articles in the three categories of journal was done according to the Harzing journal guide¹⁵. Over 80% of the publications figured in innovation-related journals,

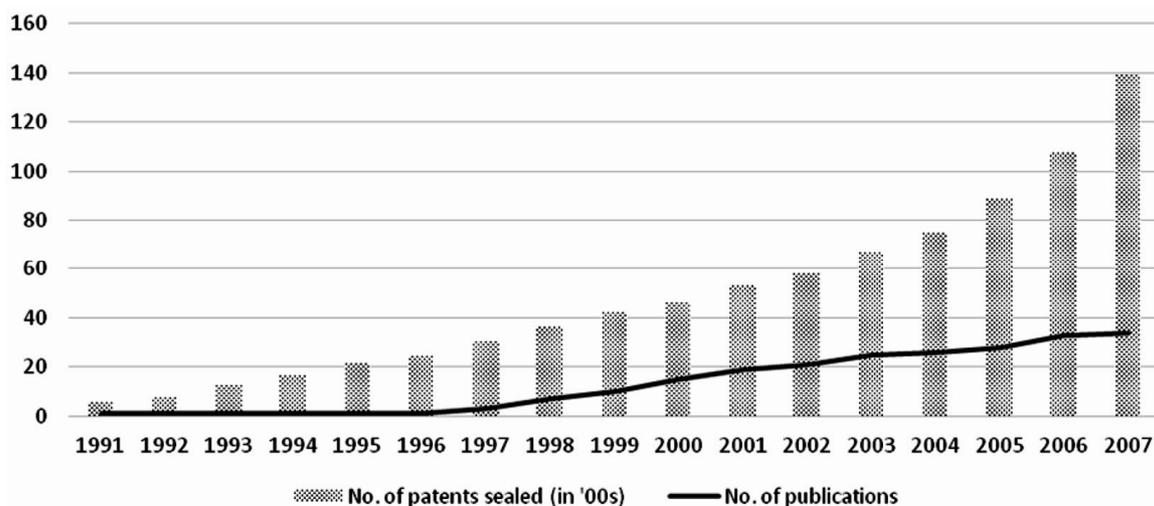


Figure 1. Year-wise cumulative trend of publications and patents granted in India. (Number of patents sourced from Indiatat website at <http://www.indiatat.com/table/industries/18/patents/204/9151/data.aspx>, accessed on 1 August 2014.)

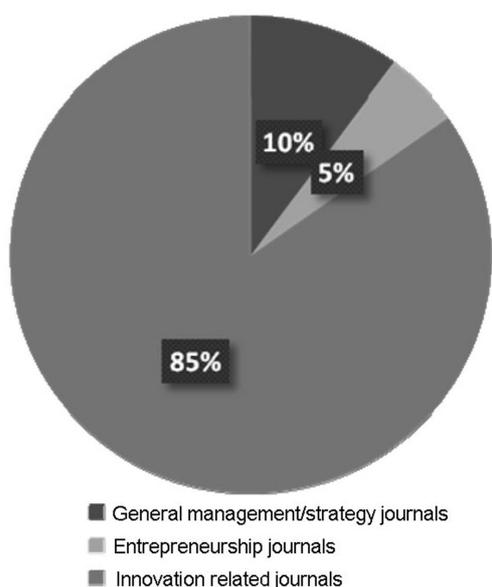


Figure 2. Percentage of publications in different categories of journals.

with the remaining quarter being distributed between general management and entrepreneurship journals. We found statistical support for this argument as the chi-square value indicates that there is significant difference ($\chi^2 = 70.40, P < 0.05$) between the number of publications in each of the three categories of journals.

Micro-level analysis

At the micro level, we wanted to study the key themes and industrial sectors that are focused upon by the journal articles. As already mentioned, we performed a coding of keywords according to the coding scheme provided in

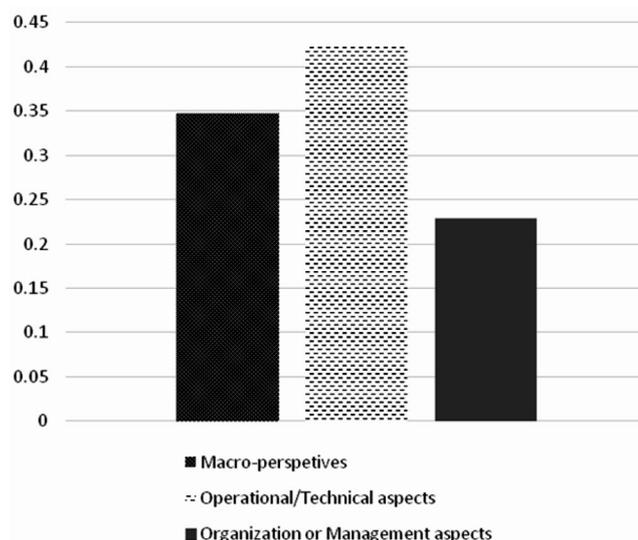


Figure 3. Trends of key themes focused upon by publications from India.

Appendix 1. For the three major classes of keywords, namely macro-perspectives, operational/technical aspects and organization/management aspects, variation across India is as shown in Figure 3. From this figure, we note that operational/technical aspects of innovation appear to be dominant, followed by macro-perspectives. Organization/management aspects seem to be a distant third. These differences are statistically significant ($\chi^2 = 6.83, P < 0.05$).

The second part of the micro-level analysis was to identify the main industrial sectors that are focused upon by the journal articles. There were 11 main industrial sectors that were featured in the publications as shown in Table 1. We classified these sectors into three broad categories, namely, high technology industry, manufacturing industry and services industry. The graphical representation

of the number of publications falling into these broad categories is shown in Figure 4. We did not find any significant difference among the three categories of industries ($\chi^2 = 1.19, P > 0.05$).

Implications for studies of innovation management in emerging Asian economies

In this section, we discuss the trends noticed in our empirical investigation and offer our views on their implications. We also discuss, where relevant, possible linkages with macro-environments that helped us make sense of the trends.

Macro-level analysis

We had made three key observations with regard to our macro-level analysis. First, we noted that at the macro

Table 1. Number of keywords on each of the industrial sector in publications based on India

Industry	No. of times keyword is used
Technology sector	
Electronics industry	5
High technology industry	3
Biotechnology	4
Nanotechnology	4
Energy industry	3
Manufacturing sector	
Chemicals industry	1
Manufacturing industry	5
Automobile industry	3
Pharmaceutical industry	4
Services sector	
Service industry	0
Software/Information technology	15

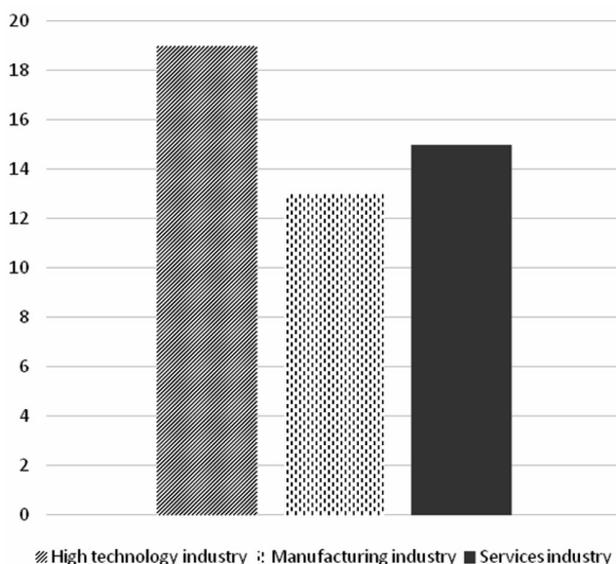


Figure 4. Industry sector focus in India.

level, one clearly discernible pattern was the marked increase in the number of publications observed since the beginning of the new millennium (Figure 1, line graph). This finding is interesting in so far as this time period is a decade since India liberalized its economy. What our analysis suggests is that economic liberalization might have had little to do with increasing the publication count immediately. Rather, there appears to be only a gradual increase in publication counts in the two decades since then. Our conjecture is that the subsequent growth of Indian multinational companies, foreign multinationals setting up operations and innovation centres in India, and the dotcom boom since the 1990s coupled with the growth of Indian software companies might have triggered research interest on the management of innovation in India.

Our second main observation from the macro-level analysis is the relationship between the growth of science and technology and innovation management research in India. One indication of this is the growth in Ph Ds in India. Considering the growth in the number of Ph Ds during the period 1998–2006, India is at fourth position with a 8.5% rise¹⁸. Buttressing this trend is our observation that the rate of increase in the number of patents is much higher than the rate of increase in the number of publications (Figure 1, bar graph). Thus, the rapid growth of the field of science and technology does not appear to be reflected in corresponding interest in research on innovation management.

Our third observation from the macro-level analysis concerns the spread of subjects in the scholarship on innovation management. We found that most of the publications are from innovation management-related journals. This is not surprising and is along expected lines. General management and entrepreneurship-related journals, after all, would be expected to publish articles on a variety of management subjects, and would not be restricted to innovation management only.

However, we made two observations in this connection. First, general management journals, appealing to a large pool of scholars, tend to have higher citation counts, and hence higher impact factor. This implies that even if they tend to publish lesser number of articles in a particular field (say innovation management), whatever they do publish has the potential to be widely read and referred to by scholars in that field. Thus, research on innovation management reported in general management journals may have a greater probability of setting directions for future research in the field.

Secondly, general management journals, because of their very nature, expect contributions on strategic, organizational and behavioural aspects of innovation management. At least some of these would be concerned with the introduction or testing of new concepts in innovation management. As mentioned earlier in the introduction section, important concepts that have become

fundamental to research on innovation management were reported in general management journals. Therefore, if we assume that the size of research reported in general management journals is an indication of conceptual development in the field, we see that India is still far behind developed countries in this regard. Given the size and population of India, it is certainly nowhere near its potential. This should be a cause for serious introspection among the faculty of business schools where much of the research on innovation management is carried out across the world.

Micro-level analysis

We had made two key observations with regard to micro-level analysis. First, there appears to be a much lesser stress on innovation management-related research in India. This observation may be connected with our discussion in the preceding sub-section with regard to the poor publications count in the country. Coupled with this point, we feel that it is a matter of concern that research in India is not only less in quantity, but also less focused on innovation management. It might mean that scholars are losing out on important possibilities of discovery on how innovation is managed in Indian companies. As such, the research on innovation management in India may, therefore, offer little by way of guidance to industry, public R&D institutions and universities as they seek to enhance the innovation efforts in the country.

Second, we observed (Figure 4) that hi-tech industries appear to be more researched than services and manufacturing. This seems to be encouraging in so far as India aspires to be a hi-tech innovation hub in the coming years. Consistent with the software sector boom, which has been primarily driven by IT services rather than product innovation, we find that this sector has seen more publications than manufacturing. Nevertheless, we also note that the inter-sectorial differences in innovation management research are not statistically significant.

Limitations of the study and suggestions for future work

We recognize several avenues to take this exploratory study forward in future. Our data was dependent on the journals we selected. While we did try to ensure that this selection process was not arbitrary, we do recognize that important bodies of work might have been left out since our selection methodology was inherently biased towards journals that are popular among Western scholars. We certainly recognize that we left out journals that are more national in nature.

Another potential problem was that we depended on keywords reported by authors of the articles. While we did refer back to the articles' abstracts to cross check on

our interpretation of the keywords, we recognize the need to go through the articles themselves to ensure that our interpretations of the keywords were indeed correct.

Going further, it is important to design studies that connect these trends more specifically with institutional environments. While we did recognize this possibility in places (for example, in connecting with macro-economic trends related to the dotcom boom), there is scope to study these relationships further. Connected to this is the question of institutional affiliation of researchers and its impact on the subject of research. For example, it might be interesting to study the role of researcher networks in order to understand their impact on which topics are selected for study. Our database did not permit this line of study, but reference to databases with more detailed bibliometric information might afford such opportunities.

Summary and conclusion

We undertook this study to take stock of the state-of-the-art in innovation management research in India. To our knowledge, this kind of a study has not been undertaken earlier. The subject was intrinsically interesting, in so far as scholarship to understand innovation management has the potential to discover and unearth novel methods, processes and ideas in the management of innovations. With competition increasingly dependent on technological and product innovations, it is imperative that better ways of managing innovations are discovered.

We note that during the 1980s and later, Japanese management practices became the subject of numerous investigations. Important scholarly works, that were deeply rooted in the practices of Japanese companies were introduced and continue to hold scholarly interest. Prominent examples include the works of Nonaka and Takeuchi¹⁹ and Ouchi²⁰. The central ideas in these works have enriched management practices and scholarly work on innovation management throughout the world in subsequent decades. We feel that there are potential benefits from studying the field of scientific and industrial research in India as well. Ideas such as frugal innovations, reverse innovations and grassroots innovations are already in the public domain from the work of practitioners and consultants.

However, our study suggested that scholarship in India seems to lag far behind its potential when it comes to research on innovation management. Not only is the number of publications less, but the attention of scholars appears to be more on policy-related issues rather than management and organizational issues.

We conclude by saying that management scholars in India should take a more active interest in the field of innovation management studies. Conversely, scientists and engineers in government, public sector, and corporate

R&D organizations, as well university faculty and researchers should actively seek out partnerships with management faculty in business schools to study and document scientific and R&D activities in their organizations.

Appendix 1. Coding scheme adopted for keyword analysis

Broad category	Example of keywords classified under the category
Macro-perspectives	Economic development, economic reform, international trade, government policy, law, industrial policy.
Operations/technical aspects	Technological innovations, R&D, intellectual property, patents, technology transfer, product development.
Organizational/management aspects	Strategic planning, organizational performance, business networks, creative ability, innovation management, organizational behaviour, project management.

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