

Firm Size, R&D and Innovation: Evidence from India

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Abstract

This study examines research and development (R&D) activities of SMEs and large firms. Using the World Bank Enterprise Survey, we find that the percentage of medium-sized firms investing in R&D activities is higher than that of small and large-size firms. Further, we explore the productivity of R&D in terms of introduction of a new product or process into the market. We find that the percentage of firms that introduced a new product or process does not vary in terms of firm size.

Keywords:

SMEs; Research and Development (R&D); Innovation

1. Introduction

Small and medium enterprises (SMEs) are considered as one of the drivers of economic growth (Acs and Armington 2006; Baumol 2002). According to a recent study from the Organisation for Economic Co-operation and Development (OECD, 2018), the micro firms accounts for 75-90% of the total enterprises. In addition, 45% and 33% of total employment and GDP rely on MSMEs respectively (OECD, 2016). In India, based on the recent information, SME sector contribute 29% and 32% to the GDP and gross value added (GVA) respectively (GOI, 2019). It is also interesting to note that the growth of employment in the manufacturing and service sectors are 18% and 34% respectively (GOI, 2014).

Since SMEs are vital to the growth and development

of the Indian economy, it is important that they should be competitive in both domestic and global markets. A principal determinant of SMEs' competitiveness is innovation (Marshall and Parra, 2019). In a developing economies like India, it is necessary that the government should take active involvement in fostering SMEs. As a result, in 2006, the Micro, Small and Medium Enterprises Development (MSMED) Act 2006 is passed for the developments of the SMEs and which intended to improve their competitiveness. Since the enactment of the MSME Act, many other programmes were introduced to with the purpose of fostering the development of MSMEs-the Manufacturing Competitiveness Programme, the Micro & Small Enterprises - Cluster Development Programme, the Credit Link Capital Subsidy Scheme for Technology Upgradation are notable policy measures.

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In this regard, the objective of the current study is to compare the R&D investment between SMEs and large firms. Since the Government of India introduced several policies to boost SMEs in the economy, it is important to investigate whether small firms are able to catch-up with larger firms in their innovation activities. This analysis is extended to map the industries in which SMEs invest actively in R&D. Further, we explore the link between R&D activities and productivity of research efforts. To be precise, we investigate whether the R&D spending firms were able to generate new products or new process into the market (Ugur et al., 2020). The introduction of a new product is regarded as an outcome of innovation (Gault, 2010). Since innovation is one of the key drivers of economic growth and development (Schumpeter, 1934), it is vital to examine the success of investment in innovation activities. To achieve our objective, we rely on a unique firm level survey data on Indian firms obtained from the World Bank Enterprise Survey (WBES). We find that the medium-sized firms are more R&D intensive compared to the small and large-sized firms. However, our research productivity analysis indicates that there is no significant difference between the performance of medium and large-sized firms.

The remainder of the paper is organized as follows. Section 2 describes the data employed in the study. Section 3 examines the size distribution of R&D investing firms. Section 4 investigates the productivity of R&D investing firms. Finally, section 5 concludes the study.

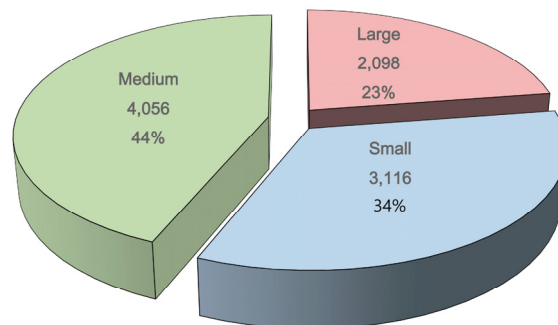
2. Data and variables

For the empirical purpose, the data is sourced from the World Bank Enterprise Survey (WBES). The WBES carries out a survey on non-agricultural firms on an irregular interval. WBES data is obtained from 135 countries and uses a standardized

questionnaire, uniform sampling methodology for easy comparison across countries. Since 2010, the WBES survey includes a module on the innovation activities of the sample firms in conformity with the Oslo Manual definition of innovation outcomes. In the case of India, the recent survey was conducted in 2014 and we use the same in our analysis. The survey covers 9270 firms which belong to the manufacturing and service sectors.

To get an overview of the distribution of firm size in the sample, Figure 1 depicts the number and percentage of small, medium and large firms in the data. We follow the World Bank classification of firm size based on the number of employees. We consider small-sized firms are those enterprises with number of employees less than or equal to 19. Enterprises with the number of employees between 20 and 99 are considered as medium-sized firms while large firms are those with more than or equal to 100 workers. From the firm size distribution, we observe that our data is predominantly dominated by medium-sized firms (44%), followed by small (34%) and large-size firms (23%).

Figure 1. Size-distribution of sample firms

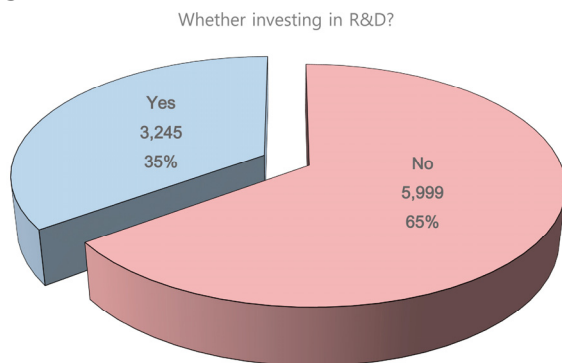


Source: Authors' calculation using World Bank Enterprise Survey.

To capture whether the firm is investing in R&D activities, we rely on survey question “During the last three years, did this establishment spend on formal research and development activities, either in-house or contracted with other companies?” The firms that report yes are considered as R&D investing

firms and firms those which report no are treated as non-R&D firms. To get a glimpse of firms investing in innovation activities, Figure 2 illustrates the number of firms that invest in research and developments (R&D). It indicates that a more than one third of the sample firm report engaging in R&D activities. The statistics show that 35% of firms conduct innovation activities.

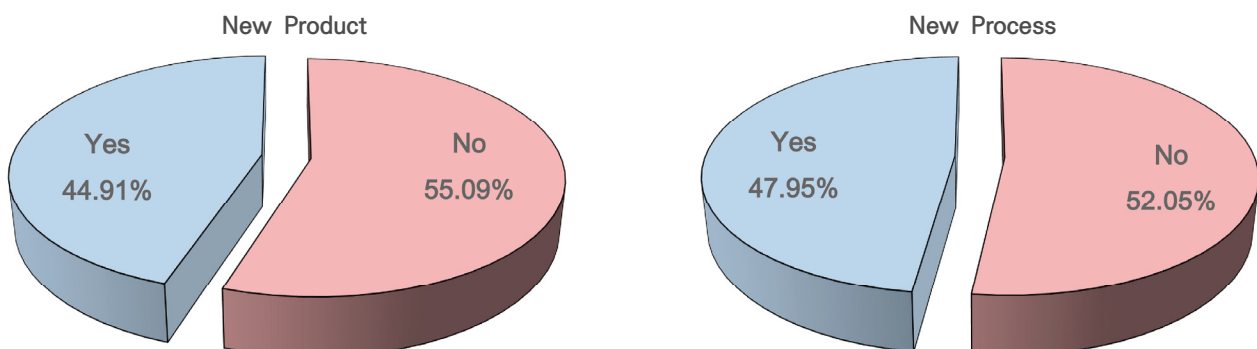
Figure 2. R&D and non-R&D firms



Source: Authors' calculation using World Bank Enterprise Survey.

In order to account the R&D productivity of the firms, we examine whether a firm has introduced a new product or a new process in the market (Castellacci, 2015). To capture the introduction of new product, we use the survey question “*Were any of the new or significantly improved products or services also new for the establishment's main market?*” whereas the survey question “*During the last three years, has this establishment introduced any new or significantly improved methods of manufacturing products or offering services?*”

Figure 3. Firms introduced new product and new process



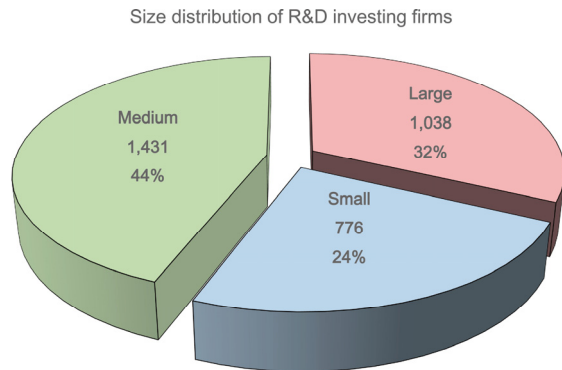
Source: Authors' calculation using World Bank Enterprise Survey

(Chundakkadan and Sasidharan, 2019). Figure 3 show the percentage of firms introduced new product and new process into the market. It shows that 44.91% of firms in our sample have introduced new product whereas the percentage of firms introduced new process is registered as 47.95.

3. Size and R&D investments

We begin our empirical analysis by examining the size distribution of R&D firms. Figure 4 presents the number and percentage of R&D firms which belong to each size classification. The figure shows that 24% of R&D firms belong to smaller firms while large firms accounts for 32%. It is also interesting to know that the majority of R&D firms in our sample are medium-sized firms (44%). This result indicates that the R&D investment is not uniformly distributed across firm size; rather, there is a clear disparity between the three groups in R&D spending. This result is not surprising since small firms given the human and financial constraints may not be in a position to devote more resources for R&D. This finding is also in line with Cohen and Klepper (1996) argument that due the smaller scale in production, small firm may find it difficult to appropriate returns from R&D which may limit their ability to invest in R&D activities.

Figure 4. R&D investment and size distribution



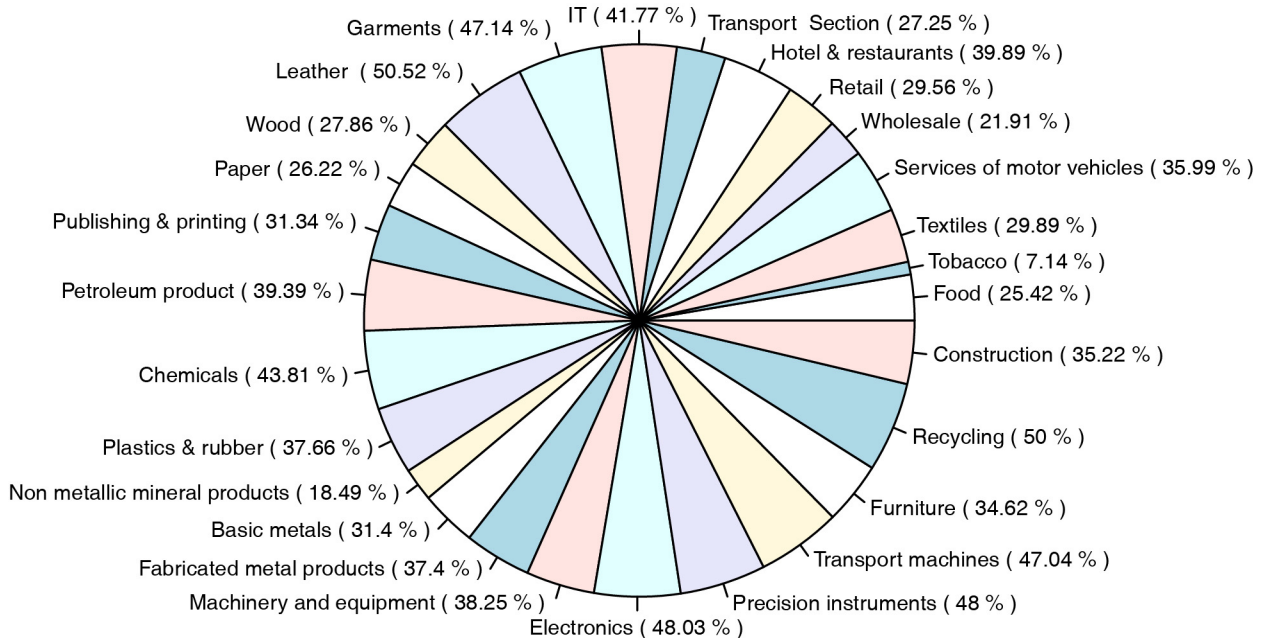
Source: Authors' calculation using World Bank Enterprise Survey.

Further, we extend our analysis to investigate the industry-wise distribution of R&D firms. We plot the percentage of R&D firms in each industry in Figure 5. This figure helps to understand the percentage of R&D firm in each industry. We observe the highest share of R&D firms in the leather industry (50.52%). In the manufacturing sector, other industries that account for a higher share of R&D

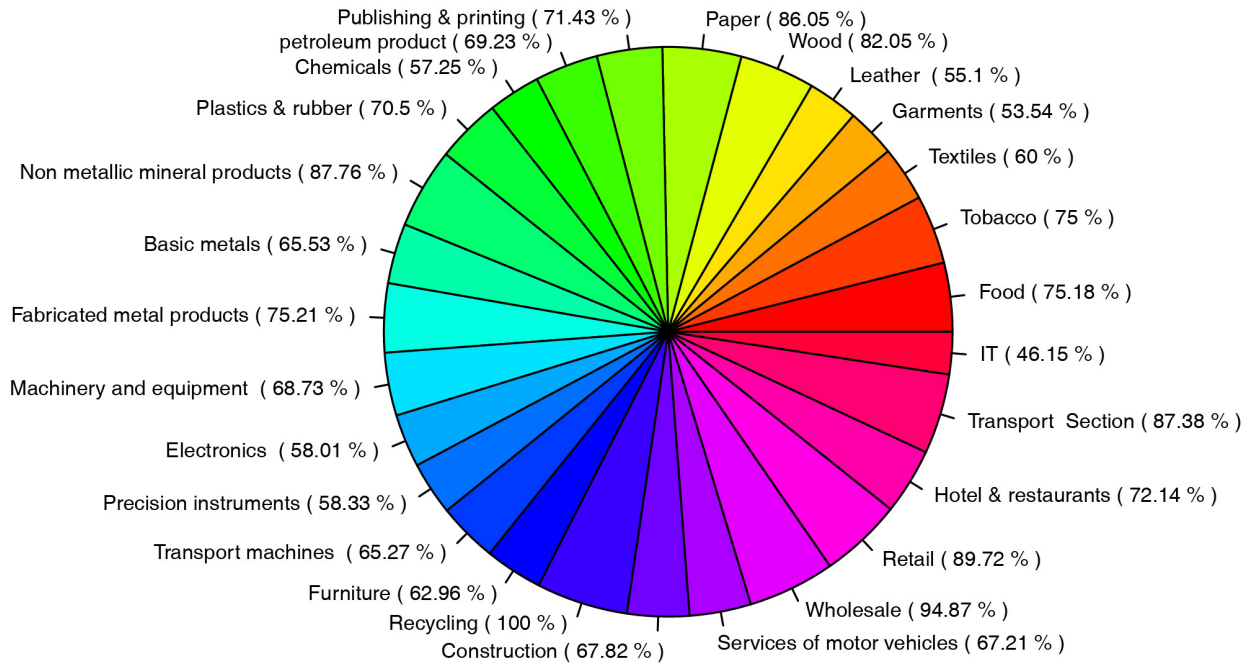
firms are recycling (50%), electronics (48.03%), precision instruments (48%), garments (47.14%), transport machines (47.08%), Chemicals (43%). In the service sector, the highest share of R&D firms belongs to information technology (IT) (41.77) and hotel & restaurant (39.89) industries. One can also infer that manufacturing sectors are more engaged in R&D activities than the service sectors.

The above analysis helped to understand the industry-wise distribution of R&D firms. However, since the aim of our study is to understand the same from the viewpoint of SMEs, we proceed to examine the participation of SMEs in R&D activities. We plot the industry-wise distribution of R&D spending SMEs in Figure 6. It shows that the majority of innovative activities is carried out by SMEs in most of the industries. The large firms have the upper hand only in the IT industry. In the manufacturing sector, SMEs are dominant in recycling, wood, and paper industries.

Figure 5. Industry distribution of R&D firms



Source: Authors' calculation using World Bank Enterprise Survey.

Figure 6. Industry distribution of R&D investing SMEs

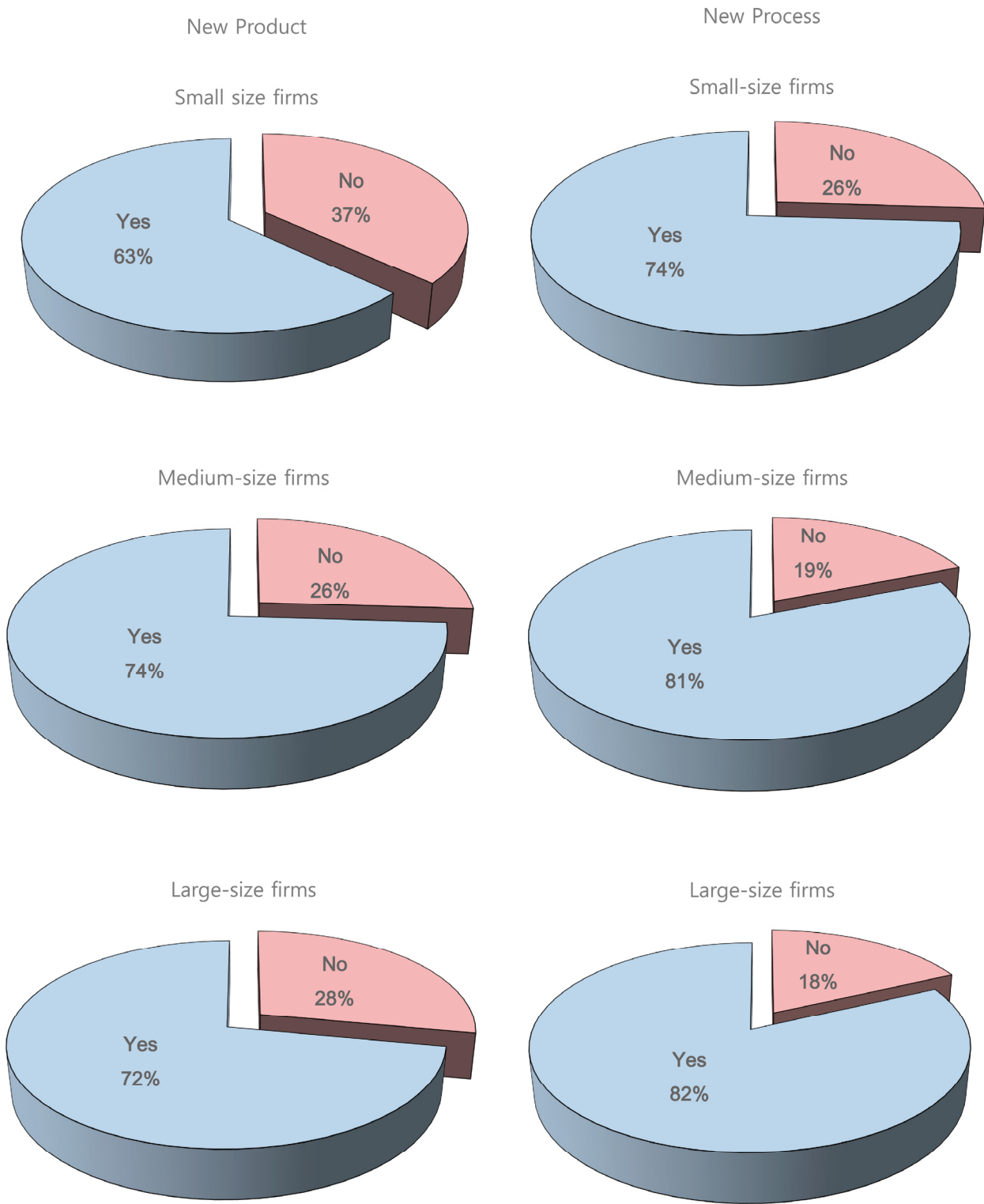
Source: Authors' calculation using World Bank Enterprise Survey.

4. R&D Productivity

So far, we analysed the R&D spending of the Indian firms. However, one of the pertinent questions is whether these firms are successful in the innovation outcomes. To evaluate the performance of R&D spending of firms, we examine how many firms introduced new product and process into the market. In Figure 7, the left side shows the percentage of R&D investing firms introduced a new product into the market whereas the right side shows the percentage of R&D firms introduced new process into the market. It shows that 63% of small R&D investing firms have introduced a new product into the market while 74% and 72% of medium and large firm introduced a new product into the market respectively. In the case of the new process, 74%, 81% and 82% of R&D investing small, medium and large firms respectively find success in their

investment. It is also interesting to observe that even though the percentage of large firms investing in R&D is relatively lower than medium-size firms, their R&D productivity indicators are similar to medium-sized firms.

Figure 7. R&D productivity



Source: Authors' calculation using World Bank Enterprise Survey.

4. Conclusion

This paper explores the role of SMEs in innovation activities in India. We begin our study by investigating the R&D investment of SMEs and large firms. For the purpose, we use recently available World Bank Enterprise Survey data for India. We further extend our analysis to explore how productive R&D spending firms are in terms of introducing a new product or process into the market. In order to capture the R&D investment and introduction of new product & process, we rely on the survey questions. Our finding suggests medium-sized firms are investing more in R&D activities, followed by large firms. We also observe that the percentage of the firms which introduced new products and processes into the market is almost similar between SMEs and large firms.

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