INNOVATION AND EMPLOYMENT FOR SKILLED AND UNSKILLED WORKERS IN SMALL AND MEDIUM ENTERPRISES (SMES) IN INDIA

Parneet Kaur

Corresponding Author, Assistant Professor
Punjabi University Patiala, School of Management Studies,
NH 64, Urban Estate Phase II, India

ABSTRACT

This Study analyzes the structural effects of Innovation on the Employment of both skilled and unskilled workers in the case of Small and Medium Enterprises (SMEs) in India. The study is based on different types of Product and Process innovation and its impact on employment. The study further measures how employment dynamics varies for high technology and low technology firms with different kinds of innovations. It is based on a follow-up survey on Innovation by the World Bank. Using logistic regression this paper found that for Product Innovation involving completely new products and designing product with different inputs lead to the hiring of a skilled and unskilled worker. However, Product innovation focused on better quality does lead to the layoff of unskilled workers. For Process Innovation, innovations related to increasing the speed of delivery, decreasing the cost of production and to comply with regulation lead to the hiring of skilled and unskilled workers. Process Innovation reducing waste led to the hiring of unskilled workers. However, innovations leading to increased flexibility and speed of production lead to the layoff of unskilled workers. Technology-wise high technology firms hire for a new function for product Innovation. However, for process innovation high-tech firms hire to increase production, speed for delivery, decreased cost of production, and comply with regulations. Low-tech firms hire to comply with regulations only.

Keywords: Product Innovation, Process Innovation, Employment, Skilled workers, Unskilled workers, High-tech firms, Low-tech firms.

1. INTRODUCTION

Innovation and employment is one of the crucial topics for research all around the world. Innovation and employment growth are interlinked in virtuous or vicious circles that unfold over time (Herstad and Sandven, 2020). Various researchers has studied how innovation of different types i.e. product, process, organizational effect employment growth of firms, as it can lead to job creation as well as job destruction (Freeman et al., 1982; Dosi, 1984; Freeman and Soete, 1994; Evangelista and Vezzani, 2012; Pianta, 2005; Harrison et al., 2014; Vivarelli, 2014; Calvino and Virgillito, 2018; Cirera and Sabetti, 2019; Crespi et al., 2019; Hou et al., 2019; Mairesse and Wu, 2019). The results in these studies suggest that product innovation does not lead to destruction but job creation or job polarisation. The effects of process innovation on employment is not conclusive, evidence at firm level does not suggest significant negative effect on employment but at industry level it shows negative impact on employment. For organisational innovation, it shows positive impact on employment but indirectly. Further the innovation and employment dynamics are different for developed and developing countries like china. The primary concern in these studies is the methodology used to measure the impact of innovation on employment and secondly Product and Process innovation can be of different types, how to measure that particular type of innovation and its

impact on employment? Majority of these studies relies on modelling approach, proposed by Harrison et al. (2014). To untangle the employment-creating versus displacing effect of innovation, a broader classification is made between product and process innovation. In the basic model, two types of products are distinguished: the production of existing products and the production of new products. The change in employment is then decomposed into the part due to the increased efficiency in production of old products (which could be related to process and organizational innovations) and the part due to the introduction of new products (product innovations). This modelling approach suffers from certain drawbacks i.e identification issue, causality and measurement error. As highlighted by Crespi et.al, (2019) Identification estimation can be affected by two different problems: the potential endogeneity of the innovation variables and the measurement error problem generated by using constructed growth rates rather than observed growth rates among the regressors. In context to endogeneity problem, parameters can be estimated consistently only if there is no correlation between the variables representing process and product innovations and the error term. Innovations are the result of investment in research and development which have to be decided by the firms in advance. These decisions depend on firm's productivity, which can be characterized as an unobservable firm`s attributes that are mainly constant over time and, if innovation investments are correlated with firm productivity, innovation outputs will also be. This will lead, in turn, to innovation outputs being endogenous, creating a serious problem of identification. Carlino and Kerr, (2015) has pointed the concern of endogeneity or reverse causality lying in the innovation-employment nexus because of simultaneity between innovation and rising labour input.

Isolating the effect of product and process innovation on a common proxy for employment growth is empirically challenging, as the widely used indication for process innovation i.e. productivity rate and rework rate fail to control product innovation taking place along with process innovation (Zhu et al 2020). Another concern is the lag effect of process innovation on job creation (Lachenmaier and Rottmann, 2011). Other factors that can impact employment growth i.e., when overall employment growth is taken as a proxy for employment there can be omitted variable biased in the study because employees can be hired for increasing demand for old products, expansion of markets and scale by firms and not because of Innovation.

In this context, World Bank data on Innovation provides a unique opportunity to explore and untangle in detail the impact of different kinds of innovation on employment. The data is collected in two phases. It's a unique and elaborated dataset not only for different innovation (Product, Process, organization, etc) but it captures the specific impact of innovation on skilled as well as unskilled labor (if specific hiring is done for Innovation if there is an increase/ decrease/ same employees because of Innovation) and is documented for the first time by the world bank (made available on the portal in 2019). Literature suggests that the Impact of Innovation on employment varies for skilled and unskilled workers (Acemoglu, 1998; Card and DiNardo, 2002). One Innovation may bring compensation for skilled workers and displacements for the unskilled worker or vice versa. For skilled workers, Innovation improves technical efficiency and resource allocation efficiency, saves labor time and demand of skilled labor, or improved efficiency may require labor with better skill (Zhu et al 2020). However, Dutz et al. (2011) found that more unskilled workers are employed due to technological innovation. Skilled biased technological change (SBTC) leads to increasing demand for better-skilled labor.

In this paper we tried to explore in detail how different types of product innovation (completely new, cheaper to produce, same product but with better quality, use a different

combination of inputs, or is innovative because it uses new technology and design) and process innovation (if the improved quality of Product/ service, if increased total production, if increased flexibility of production if increased the speed of delivery, if the decreased cost of production, if reduced waste/ error, and to comply with standards) impact overall employment, skilled employment and unskilled employment. This study further explored employment impact technology-wise as employment patterns can vary for high technology firms and low technology firms for skilled and unskilled workers. This study is based on a follow-up survey of the World Bank on innovation by SMEs in India. The literature on the impact of Innovation on employment provides enough evidence in the case of developed nations but not for developing nations. For developing nations impact of innovation is even more important because of its large unskilled labour and low-end consumers (Haar & Ernst 2016). India is emerging as an important developing nation because of its size and emphasis on innovation.

Considering the limitations of the models used in earlier studies this study is first of its kind by pointing out directly the impact of innovation on employment. This study can tackle three major challenges that are faced to untangle the impact of Innovation on employment. One, Because Innovation can have a different implication for skilled workers and unskilled workers; this study is capturing the effect because of the availability of data specifically collected from the skilled and unskilled worker's point of view. The second concern of the endogeneity of process innovation to the product innovation is taken care of with specific questions framed to capture the impact on employment of product innovation and process innovation separately. A third important aspect is a type of product innovation and process innovation; the survey captured the impact on five types of product innovation and eight types of process innovation which are taken as a proxy for innovation in this study. This study is very unique in itself because of the richness of data.

This paper found that for Product Innovation involving completely new products and designing product with different inputs lead to the hiring of Skilled and Unskilled worker. However, Product innovation focused on better quality does lead to the layoff of unskilled workers. For Process Innovation, innovations related to increasing the speed of delivery, decrease the cost of production, to comply with regulations lead to the hiring of Skilled and Unskilled workers. Innovation reducing waste led to the hiring of unskilled workers. However, innovations leading to increased flexibility and speed of production lead to the layoff of unskilled workers. Technology-wise high technology firms hire for a new function for product Innovation. however, for process innovation high tech firms hire to increase production, speed for delivery, decreased cost of production, and comply with regulations. Low tech firms hire to comply with regulations only. There is no other study available to compare the results at this micro-level but broadly results are consistent with evidence from developed markets i.e., Europe and U.S in context to product innovation and employment generation. In contrast to literature on process innovation our result shows broadly positive impact of process innovation on employment. However, results matches to China which confirms that process innovation leads to a positive effect on employment but not with product innovation as it has been found that it leads to the layoff of workers. The possible reason listed for the same by Zhu, et al. (2020) is first, due to delay in entering the market there is no "market expansion effect". Second, challenge in matching labour skill with upgraded innovation because of the current stage of low-quality innovation.

The study is organized as follows; section 2 discusses the literature review and hypothesis development. Section 3 describes the data and Methodology. Section 4 discusses the Empirical findings and finally, section 5 concludes and discusses the study.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Innovation and employment are interlinked in a complex structure. Innovation can lead to compensation i.e., job creation, or job displacement i.e., job loss in the organization. Job compensation and displacement can further depend on if it's a Product innovation or Process Innovation and if the workers are skilled or unskilled.

Peters et al., 2012 found that two types of push i.e., technology push and demand-pull derives explains the technical change. The technology push concept assumes supply-side-driven research to development and the demand-pull hypothesis assumes market demand as a key determinant of technical change. Piva and Vivarelli, 2007 based on 216 Italian manufacturing firms (1995- 2000) found the role of sales in introducing R&D.

Adner and Levinthal, (2001) presented an alternative to a supply-side explanation for Innovation i.e., demand impact on Innovation. This study presented that how the presence of consumers with different needs and requirements impact firms' innovation choices. Adner and Levinthal, (2001) found that the Innovation life cycle can be explained by three stages i.e., "attribute equalization", where the focus is on the new/ improved function of product at an increased price; the second stage is "market expansion" where the market is expanded for the product but with reduced cost and price and the third stage is "demand maturity" where at the same price, product functions are added. The first stage is more focused on product innovation, the second stage is focused on process innovation and the third stage is focussed equally on product innovation and process innovation.

Different types of innovation introduced in the firm impact employment dynamics of the firm. Harrison et al., (2014) based on few European countries (France, Germany, Spain, and Britain) for the period 1998-2000 found that process innovation improves productivity, hence reduce employment. At the same time, increased demand for old products over compensates the displacement effects.

Based on German manufacturing firms, Lachenmaier and Rottmann, (2011) found a positive effect of innovation on employment. This study is based on twenty years of time series data and concluded that innovation even shows a positive effect on employment with lag and process innovation have higher effects than product innovation. Greenan and Guellec (2000) based on French firms over the period 1986- 90 found that process innovation creates more jobs at the firm level and product innovation creates more jobs at the sector level.

Figure 1: Effect of Product and Process Innovation on Employment
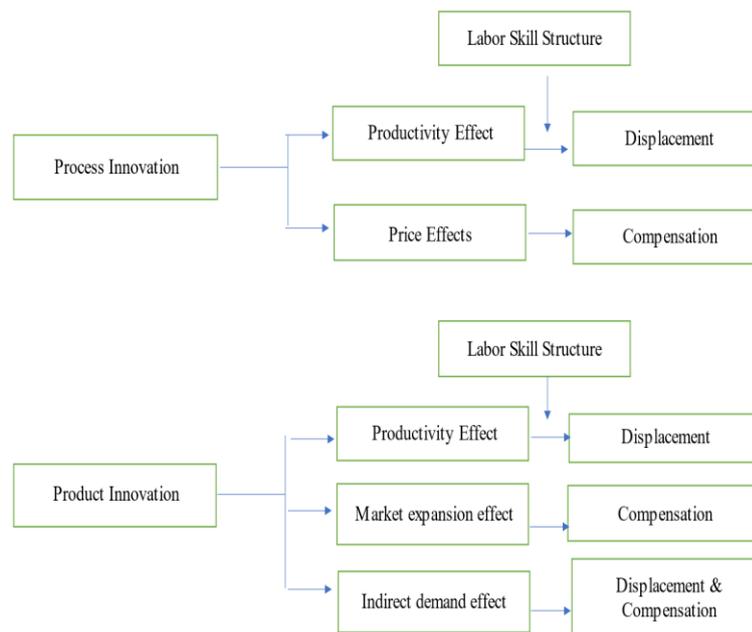
Source: Zhu, et al. (2020)

Zhu, et al. (2020) found that for Developing countries like China, process innovation leads to a positive effect on employment while product innovation leads to the layoff of workers. García et al., (2002) find that the employment compensation effect of the process is more than the displacement effect, both in the short run and long run for Spanish firms. A study based on 16 European countries, Dachs and Peters (2014) found that process innovation leads to higher job losses for foreign-owned firms than domestically owned firms. Product innovation leads to higher job creation for foreign-owned firms and overall lesser net employment growth than in domestically owned firms. Herstad and Sandven (2020) based on a Norwegian community Innovation survey (2008) found that standalone process innovation gives large employment expansions compared the product innovation which has a limited impact on employment beyond sustaining growth at moderate levels.

Based on data from 1995- 2003 for Italian firms Hall et al., (2008) study found no evidence of displacement from Process innovation (job destruction). For Product Innovation, employment growth came equally from product innovation and net contribution from sales growth of old products. The contribution of innovation to productivity growth is null.

H1: Product Innovation and employment

In case of completely new product if introduced to the consumer, studies find that new demand for the new product will lead to an expansion in the market because of demand by regular customers of old product and new customers buying a new product for the first time (Fosfuri and Giarratana, 2009). This leads to more production and more demand for workers. Based on American manufacturing firms, Kekre and Srinivasan, (1990) found that firms offering a broader range of product lines earn high profits with significant market share benefits with no extra cost. With more options of products, firms can capture the market

share of rivals also (García et al., 2002). So more the product, the more the demand, and more is the requirement of manpower (Mahajan et al., 1993). Mitra and Jha, (2015) finds positive impact of product innovation on employment in developed countries. The indirect demand effect of Product innovation increases the demand for the old product (Harrison et al., 2014). New products if offered either can complement or substitute the old product. If a new product complements the old product (refer figure 1) creates market expansion effect and employment compensation for both old and new product. if a new product substitutes an old product, it will create an indirect demand effect (refer to figure 1). Labour for the old product will reduce and labor for the new product will increase i.e., both displacement and compensation of labor can happen. The productivity effect of product innovation creates product displacement as more output can be produced with lesser inputs (Zhu, et al. 2020).

Hence, based on the skill of labor, this study has the following hypothesis for Product Innovation.

H1a: Product Innovation leads to labor compensation (new jobs) for Skilled labor (Market expansion effect)

H1b: Product Innovation leads to labor compensation (new jobs) for unskilled labor (Market Expansion effect)

H1c: Product Innovation leads to displacement (layoffs) of skilled labor (Productivity effect)

H1d: Product Innovation leads to displacement (layoffs) of unskilled Labour (Productivity effect)

H2: Process Innovation and employment

Process Innovation usually helps in improving the process, productivity, efficiency, and reducing wastages, labor hours, cost, redundant activities, etc. Process innovation can lead to an increase in productivity because of which there can be displacement of labor (Harrison et al., 2014). At the same time, process innovation improves productivity, reduce labor requirement and cost. Reduced cost of product leads to more demand by customers, which needs firms to recruit more labor. This is called the price effect of Process innovation leading to labor compensation (Figure 1). Hence, based on the skill of labor, this study has the following hypothesis for process Innovation.

H2a: Process Innovation leads to labor compensation (new jobs) for Skilled labor (Price effect)

H2b: Process Innovation leads to labor compensation (new jobs) for unskilled labor (Price effect)

H2c: Process Innovation leads to displacement (layoffs) of skilled labor (Productivity effect)

H2d: Process Innovation leads to displacement of unskilled (layoffs) Labour (Productivity effect)

H3: Technology firms, Innovation and employment

Innovation can have different impact on employment based on technology level of firms. Merikull (2010) finds that there is strong effect of process innovation on employment in medium and low-tech industries. Bogliacino et al. (2012) have applied empirical analysis on 677 European large publicly traded companies between 1990 and 2008 to find R&D and employment nexus. They concluded that there is not a significant impact in low-tech manufacturing sectors but the effect becomes evident in high-tech manufacturing. Van Roy et al. (2015) using patent data in a sample of European firms for the period 2003–2012, to

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investigate the innovation-employment relation shows a positive effect of patenting activities on employment in high-tech manufacturing sectors. So based on different impact of innovation on employment for high-tech and low-tech firms we proposed following hypothesis.

H3a: Product Innovation leads to compensation of workers in high technology firms (Price effect)

H3b: Product Innovation leads to compensation of workers in Low technology firms (price effect)

H3c: Process Innovation leads to compensation of workers in high technology firms (price effect)

H3d: Process Innovation leads to compensation of workers in Low technology firms (Price effect)

3. DATA AND METHODOLOGY

The study is based on two datasets available on the World bank website. One is Enterprise survey data[1] covering firm-level data of 9281 Indian firms. This survey broadly covers all the aspects of firms related to financial issues, an obstacle to growths, competition, Innovation, and human resource of Small and Medium Enterprises (SMEs) and is based on the period 2013. Follow up survey[2] covers innovation data for the product, process, and organizational innovation. This study is based on is follow-up Innovation survey data of 3488 firms out of 9281 firms (made available on 16th September 2019 by the World Bank) covered in the Enterprise survey, which the World bank collected to improve the measurement of Innovation in emerging markets. Both the datasets are merged based on a common reference id for doing the analysis. The data is cross-sectional and considering the dependent variable as binary, this study uses logit analysis, and analysis is done using STATA software. Following Ayyagari, Demirgüç-Kunt, & Maksimovic (2011), the logit regression equation used are...

Firm Innovation$_{it}$ = α + β_1 Spent on Formal research$_{it}$ + β_2 LOC$_{it}$ + β_3 high competition$_{it}$ + β_4 Size$_{it}$ + β_5 Age$_{it}$ + β_6 International quality standard$_{it}$ + $\mathcal{E}_{it}$ …. (1)

Firm Innovation is either Product Innovation or Process Innovation (Tessa, Jacques, Eleanor, & Nick, 2003). Further, based on equation 1 we developed different equations for Product Innovation and Process Innovation. We used different proxies for product innovation and process innovation.

Firm Innovation$_{it}$ = α + β_1 Spent on Formal research$_{it}$ + β_2 LOC$_{it}$ + β_3 high competition$_{it}$ + β_4 Size$_{it}$ + β_5 Age$_{it}$ + β_6 International quality standard$_{it}$ + β_7X$_{it}$ + β_8 Industry$_{it}$ + β_9 Region$_{it}$ + $\mathcal{E}_{it}$ …. (2)

Using equation 2, for Product innovation dependent variables are…

Dependent Variable: Product Innovation	Model

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New function	1 if completely new function, 0 otherwise	1
Cheaper	1 if cheaper to produce, 0 otherwise	2
Better quality	1 if better quality, 0 otherwise	3
Different Input	1 if using different input, 0 otherwise	4
New techn/design	1 if new technology/ Industrial design, 0 otherwise	5

Using equation 2, for Process Innovation Dependent variable is…

Dependent Variable: Process Innovation		Model
Improved quality	1 if the improved quality of Product/ service, 0 otherwise	1
Increased production	1 if increased total production, 0 otherwise	2
Increased flexibility	1 if increased flexibility of production, 0 otherwise	3
Increased speed	1 if increased the speed of production, 0 otherwise	4
Increased speed Delivery	1 if increased the speed of delivery, 0 otherwise	5
Reduce Cost	1 if the decreased cost of Production, 0 otherwise	6
Reduce waste	1 If reduced waste/ error, 0 otherwise	7
Comply regulation	1 if to comply with standards, 0 otherwise	8

X_{it} is an explanatory variable for Product Innovation equation

Explanatory Variable: Product Innovation	
Hiring for product	1 if specific hiring is done for Product Innovation, 0 otherwise
skilled work Increase	1 if there is an increase in Skilled work, 0 otherwise
skilled work Decrease	1 if skilled worker decreased, 0 otherwise
skilled work same	1 if skilled workers remained the same, 0 otherwise
Unskilled Increase	1 if there is an increase in unskilled work, 0 otherwise
Unskilled Derease	1 if unskilled worker decreased (Prod, 0 otherwise
Unskilled same	1 if unskilled workers remained the same, 0 otherwise

X_{it} is an explanatory variable for Process Innovation equation

Explanatory Variable: Process Innovation	
Hiring for Process	1 if specific hiring is done for Process Innovation, 0 otherwise
Skilled Work increase	1 if there is an increase in Skilled work, 0 otherwise
Skilled Work decrease	1 if skilled worker decreased, 0 otherwise
Skilled Work same	1 if skilled workers remained the same, 0 otherwise
Unskilled Work increase	1 if there is an increase in unskilled work, 0 otherwise
Unskilled Work decrease	1 if unskilled worker decreased, 0 otherwise
Unskilled Work same	1 if unskilled workers remained the same, 0 otherwise

Several competitors are taken as a proxy of competition (Kumar, & Saqib, 1996; Dasgupta & Stiglitz 1980; Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011; Lin, & Lin, 2010). Availability of a line of credit, taken as a proxy of financing (Brancati, 2015; Galende, & de la Fuente, 2003; Kaur et.al., 2021). Following previous studies, we have used the following control variables, i.e., if the firm has spent money on formal research, given time to

employees to do research (Bos-Nehles, & Veenendaal, 2019; Alegre, & Pasamar, 2018), Size (Galende, & de la Fuente, 2003; Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011; Kumar, N., & Saqib, M. 1996; Kaur & Kaur, 2020), and Age (Galende, & de la Fuente, 2003; Kumar, & Saqib, 1996). The study is based on World Bank Survey data 2011-13.

Control Variable	
Age	Age of the company based on year of Incorporation
Size	log of the number of Employees
Spent on Formal Research	1 if spent on formal research, 0 otherwise
LOC	1 if Line of credit/debt is available, 0 otherwise
Log wages	Log of wages
high Comp	1 if the number of competitors are equal to or more than 100, 0 if the number of competitors is less than 100
InterQualCerti	1, if the international quality certificate, 0 otherwise
Tech Dummy	1 if high tech, 0 if low tech (spending on internal R& D and external R& D. taken as a percentage of turnover, more than 5% - high tech, less than 5% low tech)

4. EMPIRICAL RESULTS

Empirical results are subdivided into three parts i.e., Part A, Part B, and Part C. Part A deal with Product Innovation, Part B deals with Process Innovation and Part C shows results for high technology firms and low technology firms.

Table 1 summarises the statistics for Product Innovation. Product innovation is categorized under five main heads; the product has a new function; the new product is cheaper; better quality; or different inputs. Of the total 2275 respondent, 64% confirm that Product innovation they have offered has a completely new function, 30% confirm that product innovation makes the product cheaper to produce or offer, 77% of respondent confirms that it's a better-quality product. of the total respondent, 59.78 % says that innovation uses different inputs. Overall product Innovation is more focused on new functions and better quality of the product.

Part A: Product Innovation

Table 1: Summary statistics for Product Innovation (Dependent variables)

It has completely new functions			
	Freq.	Percent	Cum.
Don't Know	4	0.18	0.18
Yes	1460	64.18	64.35
No	811	35.65	100
Total	2275	100	
It is cheaper to produce or offer			
	Freq.	Percent	Cum.

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Don't Know	14	0.62	0.62
Doesn't apply	5	0.22	0.84
Yes	692	30.42	31.25
No	1564	68.75	100
Total	2275	100	
Is it a better-quality product			
	Freq.	Percent	Cum.
Don't Know	13	0.57	0.57
Doesn't apply	5	0.22	0.79
Yes	1753	77.05	77.85
No	504	22.15	100
Total	2275	100	
Does it use different inputs			
	Freq.	Percent	Cum.
Don't Know	8	0.35	0.35
Doesn't apply	2	0.09	0.44
Yes	1360	59.78	60.22
No	905	39.78	100
Total	2275	100	

Table 2: Summary Statistics for Product Innovation (Explanatory variables)

If Employees were hired specifically for purpose of developing			
	Freq.	Percent	Cum.
Don't know	8	0.35	0.35
Yes	1015	44.62	44.97
No	1252	55.03	100
Total	2275	100	
From the fiscal year 2010-13, because of innovation Skilled workers			
	Freq.	Percent	Cum.
Don't know	4	0.18	0.18
Increased	883	38.81	38.99
Decreased	37	1.63	40.62
Remain the same	1351	59.38	100
Total	2275	100	
From the fiscal year 2010-13, because of innovation Unskilled workers			
	Freq.	Percent	Cum.
Don't know	5	0.22	0.22
Increased	697	30.64	30.86
Decreased	50	2.2	33.05
Remain the same	1523	66.95	100
Total	2275	100	

When asked if firms have specifically hired workers for product innovation, it has been found that 44.62 percent of the respondent (2275) specifically hired for product innovation. For skilled workers 38.81 of 2275 respondent have increased their workforce, only 1.63 percent have decreased their workforce and 59.38 percent have the same workforce. For unskilled workers 30.64 of 2275 respondent have increased their workforce, only 2.2 percent have decreased their workforce and 66.95 percent have the same workforce. From this descriptive analysis, it can be made out that the majority of firms have either hired or kept their workforce the same and very few firms have decreased their workforce in response to Innovation. Table 3 summarizes the control variables used in the study. The average age of firms in the study is 8 years with a minimum age of 8 and maximum age of 74. The study is based on 23 regions and 27 Industries.

Table 3: Summary Statistics of Control variables used in the study

Variable	Obs.	Mean	Std. Dev.	Min	Max
Age	3,439	25.41	13.11	8	74
Log Size	3,490	1.63	0.55	0.47	3.90
spent on Formal Research	3,480	0.43	0.49	0	1
Line of Credit	3,405	0.31	0.46	0	1
log Wage	3,359	6.74	0.76	3.90	9.85
high Comp	2,452	0.51	0.49	0	1
InterQualCerti	3,450	0.50	0.50	0	1
Region (dummy)	3,492	12.79	6.71	1	23
Industry Sector (dummy)	3,492	11.92	8.13	1	27

Table 4: Product Innovation types (five) and if specific hiring is done for Product Innovation

	M1	M2	M3	M4	M5
	New function	Cheaper	Better quality	Different inputs	New technology/Industrial design
Specific hiring of employees	0.547***	-0.18	-0.201	0.324**	0.106
	(0.13)	(0.14)	(0.15)	(0.13)	(0.13)
Age	-0.005	-0.005	-0.005	-0.005	(0.005
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.462*	0.436*	0.429*	0.403*	0.420*
	(0.21)	(0.21)	(0.2)	(0.2)	(0.2)
spent on Formal Research	0.454**	0.446**	0.430**	0.425**	0.425**
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
Line of Credit	0.554***	0.561***	0.605***	0.581***	0.584***
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
log Wage	-0.23	-0.225	-0.207	-0.2	-0.203

	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
high Comp	-0.320*	-0.297*	-0.324*	-0.308*	-0.279*
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
InterQualCerti	-0.044	-0.002	-0.045	-0.033	-0.032
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Constant	-1.275	-1.052	-0.931	-1.347	-1.133
	(0.83)	(0.84)	(0.83)	(0.83)	(0.82)
Industry dummy	Yes	Yes	Yes	Yes	Yes
State Dummy	Yes	Yes	Yes	Yes	Yes
N	1562	1551	1555	1557	1550
Pseudo R^2	0.16	0.16	0.16	0.16	0.16

Overall our result shows that product innovation leads to increase in employment which is in line with existing studies (Mahajan et al., 1993; García et al., 2002; Harrison et al., 2014; Mitra and Jha, 2015; García Cirera and Sabetti, 2019; Crespi et al., 2019; Hou et al., 2019; Mairesse and Wu, 2019). When specifically measuring which type of product innovation leads to employment generation it has been found (Table 4) that there is more probability that firms do specific hiring if they are developing new functions or trying to use different inputs in case of Product innovation. More the firms spend on formal research, having a line of credit and the bigger the size is higher is the probability that workers will be specifically hired for Innovation i.e., new function, cheaper, better quality, use different inputs, and opting for new technology or Industrial design. However, higher competition leads to a lower probability of hiring for Innovation. To take care of industry difference and state difference, industry, and state dummy is taken.

Table 5: Product Innovation types (five) and if there is an increase in skilled workers

	M1	M2	M3	M4	M5
	New function	cheaper	better quality	different inputs	New technology/Industrial design
Skilled worker Increased	**0.503***	**-0.234**	**-0.219**	**0.441***	**0.228**
	(0.13)	**(0.15)**	**(0.15)**	**(0.13)**	**(0.14)**
Age	-0.008	-0.008	-0.008	-0.008	-0.008
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.399	0.363	0.381	0.341	0.383
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
spent on Formal Research	0.817***	0.813***	0.784***	0.796***	0.769***
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Line of Credit	0.392*	0.409*	0.433**	0.424**	0.412**
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
log Wage	-0.191	-0.183	-0.175	-0.159	-0.183

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	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
high Comp	-0.233	-0.21	-0.243	-0.232	-0.212
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
InterQualCerti	0.013	0.039	-0.001	0.015	0.028
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Constant	-1.494	-1.228	-1.133	-1.711*	-1.295
	(0.86)	(0.87)	(0.86)	(0.86)	(0.85)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes
N	1567	1556	1560	1562	1555
Pseudo R^2	0.2	0.2	0.2	0.2	0.2

Exploring the type of innovation and hiring/ increase of workers it has been found (Table 5) that there is more probability of the firms to increase their skilled workers if they are developing new functions or trying to use different inputs in case of Product innovation. Our results support evidence by Crespi et al.,(2019) where it has been found that sales growth of new product is larger for skilled worker than unskilled worker . More the firms spend on formal research and having a line of credit is higher the probability for Innovation i.e., new function, cheaper, better quality, use different inputs, and opting for new technology or Industrial design. To take care of industry difference and state difference, industry and state dummy are taken. R square of model 1 to model 5 is .20. when checked for if there is a decrease/ no change (same) in Skilled workers because of Innovation we did not find a Significant F test for the model due to very few observations in this category.

Table 6: Product Innovation types (five) and if there is an increase in unskilled workers

	M1	M2	M3	M4	M5
	New function	cheaper	better quality	different inputs	New technology/Industrial design
Unskilled workers Increased	**0.419****	**0.011**	**-0.475****	**0.480****	**0.061**
	(0.15)	**(0.16)**	**(0.16)**	**(0.15)**	**(0.15)**
Age	-0.006	-0.005	-0.004	-0.005	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.728**	0.694**	0.685**	0.670**	0.699**
	(0.24)	(0.24)	(0.24)	(0.24)	(0.24)
spent on Formal Research	0.883***	0.887***	0.903***	0.888***	0.881***
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Line of Credit	0.452**	0.466**	0.530**	0.480**	0.476**
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)

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log Wage	-0.485**	-0.478**	-0.446**	-0.464**	-0.474**
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
high Comp	-0.362*	-0.352*	-0.365*	-0.365*	-0.333*
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
InterQualCerti	-0.15	-0.105	-0.187	-0.143	-0.135
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Constant	-0.656	-0.741	-0.286	-0.879	-0.515
	(0.96)	(0.99)	(0.97)	(0.97)	(0.96)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes
N	1567	1556	1560	1562	1555
Pseudo R^2	0.24	0.25	0.25	0.25	0.24

Exploring the type of innovation and hiring/ increase of unskilled workers it has been found (Table 6) that if firms are developing new functions or trying to use different inputs in case of Product innovation there is more probability of increasing their unskilled workers. Dutz et al. (2011) also found that more unskilled workers are employed due to technological innovation. However, unskilled are likely to be reduced in case product innovation leads to better-quality products. More the firms spend on formal research, the larger the size, and having a line of credit is higher the probability that firm will do Innovation i.e., new function, cheaper, better quality, use different inputs, and opting for new technology or Industrial design. To take care of industry difference and state difference, industry and state dummy are taken. R square of model 1 to model 5 is .24 to .25. When checked for if there is a decrease/ no change (same) in skilled workers because of Innovation we did not find a Significant F test for the model due to very few observations in this category.

Part B: Process Innovation

Part B deals with the implication of Process Innovation for Employment of both skilled workers and unskilled workers. Table 7 summarise the statistics for process Innovation of variables used as dependent variables. 79.53 percent of 2,403 respondent said yes to the question that process innovation is introduced to increase the quality of product or service, 65.71 percent responded that firms wanted to increase total production or services, 59.97 percent responded that firms wanted to increase the flexibility of production or services, 64.34 percent firms wanted to increase the speed of production or services, 48.31 percent wanted to increase the speed of delivery to the customers, 45.03 percent wanted to decrease the cost of production or service, 57.39 percent firms wanted to reduce the waste, and 44.53 percent firms wanted to comply with regulations or standards.

When asked if firms have specifically hired workers for process innovation, it has been found that 46.11 percent of the respondent (2403) specifically hired for product innovation compiled in Table 8. For skilled workers 40.74 of 2403 respondent have increased their workforce, only 2.7 percent have decreased their workforce and 56.22 percent have the same workforce. For unskilled workers 30.63 of 2403 respondent have increased their workforce, 5.04 percent have decreased their workforce and 63.8 percent have the same workforce. From this descriptive analysis, it can be made out that the majority of firms have either hired or

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kept their workforce the same and very few firms have decreased their workforce in response to Innovation.

Table 7: Summary statistics for Process Innovation (Dependent variables)

To increase the quality of product or services			
	Freq.	Percent	Cum.
Don't know	7	0.29	0.29
Yes	1,911	79.53	79.82
No	485	20.18	100
Total	2,403	100	
To increase the total production/services			
	Freq.	Percent	Cum.
Don't know	8	0.33	0.33
Yes	1,579	65.71	66.04
No	816	33.96	100
Total	2,403	100	
To increase the flexibility of production/services			
	Freq.	Percent	Cum.
Don't know	9	0.37	0.37
Yes	1,441	59.97	60.34
No	953	39.66	100
Total	2,403	100	
To increase the speed of production/services			
	Freq.	Percent	Cum.
Don't know	13	0.54	0.54
Yes	1,546	64.34	64.88
No	844	35.12	100
Total	2,403	100	
To increase the speed of delivery to the customer			
	Freq.	Percent	Cum.
Don't know	9	0.37	0.37
Yes	1,161	48.31	48.69
No	1,233	51.31	100
Total	2,403	100	
To decrease the cost of production/ services			
	Freq.	Percent	Cum.
Don't know	12	0.5	0.5
Yes	1,082	45.03	45.53
No	1,309	54.47	100
Total	2,403	100	
To reduce waste			
	Freq.	Percent	Cum.
Don't know	15	0.62	0.62
Yes	1,379	57.39	58.01
No	1,009	41.99	100
Total	2,403	100	
To comply with regulations/standards			
	Freq.	Percent	Cum.

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Don't know	18	0.75	0.75
Yes	1,070	44.53	45.28
No	1,315	54.72	100
Total	2,403	100	

Table 8: Summary Statistics for Process Innovation (Explanatory variables)

Employees were hired specifically for purpose of developing			
	Freq.	Percent	Cum.
Don't know	11	0.46	0.46
Yes	1,108	46.11	46.57
No	1,284	53.43	100
Total	2,403	100	
From the fiscal year 2010-13, because of innovation Skilled workers			
	Freq.	Percent	Cum.
Don't know	8	0.33	0.33
Increased	979	40.74	41.07
Decreased	65	2.7	43.78
Remain the same	1,351	56.22	100
Total	2,403	100	
from the fiscal year 2010-13, because of innovation Unskilled workers			
	Freq.	Percent	Cum.
Don't know	13	0.54	0.54
Increased	736	30.63	31.17
Decreased	121	5.04	36.2
Remain the same	1,533	63.8	100
Total	2,403	100	

In the case of Process Innovation it is likely that firms do specific hiring if there is improved quality, increased production, increased speed of delivery, decreased cost of production, less waste, and to comply with regulations compiled in Table 9. Our results are different from existing studies finding negative impact of process innovation on employment. It seems that introduction of new processes driven by cost considerations and which generally tends to displacement (Saviotti and Pyka, 2008), does not hold true in our study. It is inclined more towards compensatory effect which is due to increase sale because of less cost. Result shows that more the firms spend on formal research, having a line of credit and bigger the size is higher the probability that firm will be doing Innovation i.e., improved quality, increased production, increased flexibility, increased speed of production, increased speed of delivery, decreased cost of production, less waste and to comply with regulations. To take care of industry difference and state difference, industry and state dummy are taken. Pseudo R^2 of model 1 to model 8 varies from .14 to .16.

Table 10 compiles the result for if there is process innovation and there is an increase in skilled workers. It is found that firms increasing their speed of delivery (m5), firms wanted to decrease their cost of production (m6), firms wanted to comply with regulations (m8) likely to increases skilled workers in response to process innovation. This kind of result may be due to the reason that the above mentioned types of process innovation may lead to increase in demand for the product which is leading to compensatory effect on labor demand. Pseudo R^2 for model 1 to model 8 was .14 and observations are in the range of 1607- 1611. To take care of industry difference and state difference, industry and state dummy are taken.

When we run the logistic regression for Innovation and skilled worker decrease in response to Process Innovation, no significant results were found so did not keep the results.

Table 11 compiles the result for if there is process innovation and there is an increase in unskilled workers. It is found that firms increasing their speed of delivery (m5), firms wanted to decrease their cost of production (m6), firms wanted to reduce waste (m7), and firms wanted to comply with regulations (m8) have more probability of increasing skilled workers in response to process innovation. Pseudo R^2 for model 1 to model 8 was from .19 to .21, and observations are in the range of 1607- 1611. To take care of industry difference and state difference, industry and state dummy are taken.

Table 12 compiles the result for if there is process innovation and there is a decrease in unskilled workers. It is found that firms increasing flexibility (m3), firms wanted to increase the speed of production (m4) likely to decreases unskilled workers in response to process innovation. Pseudo R^2 for model 1 to model 8 was from .19 to .21, and observations are in the range of 1462- 1465. To take care of industry difference and state difference, industry and state dummy are taken.

Table 9: Process Innovation types (eight) and if specific hiring is done for Process Innovation

	M1	M2	M3	M4	M5	M6	M7	M8
	Improved Quality	Increase Production	Increase flexibility	Increase speed of production	Increase speed of delivery	Decrease cost of Production	Reduce waste	Comply with Regulation
Specific hiring of people	0.373**	0.395**	0.057	0.21	0.599***	0.474***	0.341**	0.729***
	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Age	-0.006	-0.006	-0.006	-0.006	-0.005	-0.006	-0.006	-0.006
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.373	0.407*	0.391*	0.380*	0.390*	0.411*	0.413*	0.356
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
spent on Formal Research	0.631***	0.634***	0.642***	0.642***	0.642***	0.643***	0.613***	0.604***
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Line of Credit	0.304*	0.295*	0.314*	0.312*	0.322*	0.327*	0.317*	0.299*
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
log Wage	-0.092	-0.118	-0.094	-0.092	-0.098	-0.098	-0.104	-0.093
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
high Comp	0.03	0.013	0.033	0.029	0.041	0.041	0.056	0.053
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
InterQualCerti	0.015	0.02	0.017	0.027	0.022	0.035	0.023	0.052
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Constant	-2.240**	-2.093**	-2.031*	-2.163**	-2.329**	-2.259**	-2.254**	-2.363**
	(0.81)	(0.81)	(0.81)	(0.81)	(0.81)	(0.81)	(0.81)	(0.82)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1607	1606	1604	1603	1605	1605	1606	1606
Pseudo R^2	0.15	0.15	0.14	0.14	0.15	0.15	0.15	0.16

Table 10: Process Innovation types (eight) and if there is an increase in skilled workers

	M1	M2	M3	M4	M5	M6	M7	M8
	Improved Quality	Increase Production	Increase flexibility	Increase speed of production	Increase speed of delivery	Decrease cost of Production	Reduce waste	Comply with Regulation
Increase in skilled workers	0.157	0.093	0.035	0.06	0.251*	0.265*	0.198	0.398**
	(0.15)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
Age	-0.013**	-0.013**	-0.013**	-0.013**	-0.013**	-0.013**	-0.013**	-0.013**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.542**	0.556**	0.547**	0.548**	0.550**	0.559**	0.559**	0.533**
	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
spent on Formal Research	0.679***	0.681***	0.676***	0.691***	0.685***	0.686***	0.669***	0.668***
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Line of Credit	0.217	0.227	0.229	0.228	0.231	0.23	0.221	0.209
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
log Wage	-0.1	-0.112	-0.102	-0.107	-0.107	-0.106	-0.106	-0.102
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
high Comp	0.009	0.004	0.004	0.012	0.009	0.012	0.023	0.021
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.13)	(0.13)
InterQualCerti	-0.054	-0.049	-0.048	-0.047	-0.049	-0.045	-0.051	-0.036
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
Constant	-2.408**	-2.303**	-2.318**	-2.318**	-2.428**	-2.430**	-2.450**	-2.488**
	(0.83)	(0.82)	(0.83)	(0.83)	(0.83)	(0.83)	(0.83)	(0.83)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1611	1610	1608	1607	1609	1609	1610	1610
Pseudo R^2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Table 11: Process Innovation types (eight) and if there is an increase in Unskilled workers

	M1	M 2	M 3	M 4	M 5	M 6	M 7	M 8
	Improved Quality	Increase Production	increase flexibility	Increase speed of production	Increase speed of delivery	decrease cost of Production	Reduce waste	comply with Regulation
Increase in unskilled workers	0.127	0.201	-0.072	0.021	0.421**	0.371**	0.341*	0.752***
	(0.16)	(0.14)	(0.14)	(0.14)	(0.14)	(0.13)	(0.14)	(0.14)
Age	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log Size	0.616**	0.631**	0.619**	0.623**	0.621**	0.630**	0.640**	0.596**
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
spent on Formal Research	0.821***	0.826***	0.820***	0.830***	0.836***	0.837***	0.801***	0.819***
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Line of Credit	0.248	0.253	0.254	0.263	0.26	0.26	0.247	0.214
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
log Wage	-0.073	-0.091	-0.078	-0.082	-0.079	-0.072	-0.081	-0.078
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
high Comp	-0.048	-0.055	-0.054	-0.048	-0.054	-0.041	-0.025	-0.025
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
InterQualCerti	-0.22	-0.215	-0.212	-0.212	-0.211	-0.206	-0.211	-0.188
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
Constant	-3.770***	-3.719***	-3.619***	-3.665***	-3.913***	-3.931***	-3.949***	-4.042***
	(0.98)	(0.97)	(0.98)	(0.98)	(0.98)	(0.98)	(0.98)	(0.99)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1611	1610	1608	1607	1609	1609	1610	1610
Pseudo R^2	0.19	0.2	0.19	0.19	0.2	0.2	0.2	0.21

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Table 12: Process Innovation types (eight) and if there is a decrease in Unskilled wMrkers

	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8
	Improved Quality	Increase Production	increase flexibility	Increase speed of production	Increase speed of delivery	decrease cost of Production	Reduce waste	comply with Regulation
decrease in unskilled workers	**0.684**	**0.493**	**1.077*****	**1.108*****	**0.487**	**0.18**	**0.044**	-0.187
	(0.36)	(0.28)	(0.31)	(0.32)	(0.26)	(0.24)	(0.25)	(0.25)
Age	0.002	0.003	0.003	0.003	0.003	0.002	0.002	0.002
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log Size	-0.164	-0.119	-0.099	-0.145	-0.161	-0.145	-0.157	-0.171
	(0.43)	(0.43)	(0.43)	(0.43)	(0.42)	(0.42)	(0.42)	(0.42)
spent on Formal Research	-0.513	-0.486	-0.499	-0.476	-0.487	-0.472	-0.468	-0.448
	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)
Line of Credit	-0.016	-0.064	0.013	-0.073	-0.008	-0.011	0.008	0.003
	(0.29)	(0.30)	(0.30)	(0.30)	(0.29)	(0.29)	(0.29)	(0.29)
log Wage	-0.333	-0.368	-0.362	-0.352	-0.316	-0.333	-0.329	-0.323
	(0.33)	(0.33)	(0.33)	(0.34)	(0.32)	(0.32)	(0.32)	(0.32)
high Comp	0.017	-0.042	-0.038	-0.081	0.021	0	0.003	0.008
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
InterQualCerti	0.513	0.506	0.434	0.526	0.519	0.51	0.497	0.491
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
Constant	-2.334	-1.973	-2.474	-2.574	-2.253	-1.943	-1.906	-1.765
	(1.87)	(1.86)	(1.88)	(1.90)	(1.85)	(1.84)	(1.84)	(1.84)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1465	1464	1462	1462	1463	1463	1464	1464
Pseudo R^2	0.2	0.2	0.21	0.21	0.2	0.19	0.19	0.19

PART C: Technology company and impact of Innovation on Employment

Part c deals with if we classify the companies as High-tech firms and low-tech firms, do we find any change in employment dynamics for companies. Firms are categorized as 1 if high tech, 0 if low tech. Classification is done based on spending on internal R& D and external R& D. taken as a percentage of turnover, more than 5% - categorized as high tech, less than 5% are categorized as low tech.

Table 13 confirms that for high tech firms specific hiring is done only in the case product has a new function. M1 to M5, Pseudo R^2 is in the range of .16 to .19. When checked for low tech firms if specific hiring is done for product innovation or not it is found that there are no significant results. For brevity, we have not included that table in the paper.

Table 14 compiles the results for Process Innovation in the case of hi-tech firms. It has been found that in the case of Process Innovation, companies increasing production (m2), Increase speed of delivery (m5), decrease the cost of production (m6), and comply with regulations (m8) firms in High-tech firms hire workers specifically for Process Innovation. M1 to M8, Pseudo R^2 is in the range of .13 to .15.

Table 15 compiles the results for Process Innovation in the case of Low-tech firms. It has been found that In the case of Process Innovation, to comply with regulations (m8) firms in Low-tech firms hire workers specifically for Process Innovation. M1 to M8, Pseudo R^2 is in the range of .25 to .30.

Our empirical results suggest that product innovation in India does not lead to as such displacement of labour rather it leads to increase in the employment level of firms and this hold true for skilled and unskilled labour. So we accept the hypothesis that product innovation leads to labour compensation effect for skilled and unskilled labour. For process innovation again our results support the hypothesis that process innovation leads to compensation effect for skilled and unskilled labour and we reject the hypothesis that process innovation leads to displacement. In case of high-technology firms innovation shows positive impact and supporting our hypothesis that product and process innovation creates employment in high technology firms. Results are not vocal for having impact of innovation on employment in low technology firms and we reject the hypothesis that product and process innovation creates employment in low technology firms.

Table 13: Product Innovation types (five) and if specific hiring is done for Product Innovation in case of high technology firms

	M 1	M 2	M 3	M 4	M 5
	New function	cheaper	better quality	different inputs	New technology/Industrial design
specific hiring_ High tech firms	1.032***	-0.264	-0.147	0.068	-0.197
	(0.28)	(0.30)	(0.31)	(0.26)	(0.26)
Age	-0.006	-0.004	-0.003	-0.004	-0.004
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log Size	0.472	0.526	0.52	0.516	0.531
	(0.49)	(0.49)	(0.49)	(0.48)	(0.49)
spent on Formal Research	0.485	0.332	0.329	0.324	0.341
	(0.36)	(0.35)	(0.35)	(0.35)	(0.35)
Line of Credit	0.114	0.255	0.255	0.23	0.226
	(0.34)	(0.34)	(0.33)	(0.33)	(0.33)
log Wage	-0.482	-0.527	-0.511	-0.532	-0.512
	(0.37)	(0.36)	(0.36)	(0.36)	(0.36)
high Comp	-0.511	-0.51	-0.536	-0.523	-0.492
	(0.30)	(0.29)	(0.29)	(0.29)	(0.29)
InterQualCerti	0.082	0.108	0.115	0.109	0.08
	(0.29)	(0.28)	(0.28)	(0.28)	(0.28)
Constant	1.634	3.005	2.802	2.776	2.74
	(2.40)	(2.35)	(2.36)	(2.37)	(2.36)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes	Yes	Yes
N	392	391	393	391	387
Pseudo R^2	0.19	0.16	0.16	0.16	0.16

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Table 14: Process Innovation types (eight) and if specific hiring is done for Process Innovation in case of high technology firms

	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8
	Improved Quality	Increase Production	increase flexibility	Increase speed of production	Increase speed of delivery	decrease cost of Production	Reduce waste	comply with Regulation
hc16_Specific hiring_ high-tech firms	0.302	0.550*	0.276	0.338	0.839**	0.572*	0.472	0.824**
	(0.32)	(0.25)	(0.25)	(0.25)	(0.26)	(0.24)	(0.27)	(0.25)
Age	0.007	0.007	0.006	0.007	0.009	0.006	0.008	0.008
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log Size	0.387	0.384	0.408	0.366	0.357	0.398	0.429	0.239
	(0.44)	(0.44)	(0.44)	(0.44)	(0.44)	(0.44)	(0.44)	(0.44)
spent on Formal Research	0.183	0.222	0.18	0.191	0.218	0.213	0.126	0.187
	(0.32)	(0.33)	(0.32)	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)
Line of Credit	-0.267	-0.249	-0.228	-0.234	-0.243	-0.166	-0.256	-0.188
	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)
log Wage	-0.027	-0.046	-0.025	-0.022	-0.046	-0.012	-0.074	0.066
	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)	(0.33)
high Comp	0.138	0.142	0.162	0.147	0.152	0.165	0.18	0.14
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
InterQualCerti	0.482	0.5	0.51	0.512	0.563	0.525	0.513	0.504
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)
Constant	-2.599	-2.684	-2.586	-2.428	-2.408	-2.779	-2.568	-3.508
	(2.14)	(2.15)	(2.14)	(2.12)	(2.13)	(2.14)	(2.13)	(2.20)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	392	392	391	390	391	391	391	391
Pseudo R^2	0.13	0.14	0.13	0.13	0.15	0.14	0.13	0.15

Table 15: Process Innovation types (eight) and if specific hiring is done for Process Innovation in case of low technology firms

	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8
	Improved Quality	Increase Production	increase flexibility	Increase speed of production	Increase speed of delivery	decrease cost of Production	Reduce waste	comply with Regulation
Specific hiring low tech firms	0.582	0.703	0.431	0.662	0.919	0.712	0.725	1.949***
	(0.63)	(0.52)	(0.51)	(0.48)	(0.54)	(0.56)	(0.50)	(0.59)
Age	-0.004	-0.002	-0.002	-0.006	-0.002	-0.002	-0.004	-0.004
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Log Size	1.171	1.284	1.175	1.168	1.072	1.306	1.315	1.153
	(0.67)	(0.67)	(0.67)	(0.67)	(0.67)	(0.67)	(0.67)	(0.67)
spent on Formal Research	1.251	1.246	1.179	1.01	1.143	0.957	0.93	0.893
	(0.73)	(0.73)	(0.73)	(0.71)	(0.71)	(0.71)	(0.71)	(0.74)
Line of Credit	0.405	0.423	0.493	0.467	0.281	0.39	0.403	-0.042
	(0.69)	(0.69)	(0.69)	(0.71)	(0.69)	(0.69)	(0.69)	(0.73)
log Wage	0.121	0.113	0.164	0.247	0.15	0.205	0.087	0.039
	(0.44)	(0.45)	(0.44)	(0.46)	(0.45)	(0.45)	(0.44)	(0.48)
high Comp	0.664	0.649	0.581	0.652	0.678	0.737	0.614	0.84
	(0.55)	(0.55)	(0.55)	(0.55)	(0.55)	(0.56)	(0.55)	(0.59)
InterQualCerti	-0.344	-0.313	-0.353	-0.377	-0.408	-0.409	-0.348	-0.119
	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.54)	(0.55)	(0.57)
Constant	-4.548	-4.83	-4.726	-5.207	-4.144	-4.962	-3.992	-4.12
	(3.42)	(3.45)	(3.48)	(3.53)	(3.42)	(3.49)	(3.43)	(3.58)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	135	135	134	135	135	135	135	135
Pseudo R^2	0.25	0.25	0.24	0.25	0.25	0.25	0.25	0.3

5. DISCUSSIONS/ CONCLUSIONS

Innovation and employment are interlinked but difficult to measure primarily because of three reasons. One, the individual impact of product and process innovation on employment is difficult to assess. Second, Innovation can lead to either increase or a decrease in employment, so it's difficult to assess the impact if data is not classified. Third, the Impact of Innovation on employment varies for skilled and unskilled workers.

This study is based on a follow-up survey of the World Bank on innovation provides new empirical evidence to understand that what type of product and process innovation will lead to increase or decrease in employment of firms. This study is very unique in itself because of the richness of data and further explored employment impact technology-wise as employment patterns can vary for high technology firms and low technology firms for skilled and unskilled workers. Results are compiled in Table 16 and Table 17.

Table 16: Summary of Results for Product Innovation

Product Innovation					
	New function	cheaper	better quality	different inputs	technology/Industrial design
Specific Hiring	**Plus**			**Plus**	
a. Skilled worker					
Increased	**Plus**			**Plus**	
Decreased					
Same	**Minus**			**Minus**	
b. Unskilled worker					
Increase	**Plus**		**Minus**	**Plus**	
Decrease					
Same	**Minus**		**Plus**	**Minus**	
Technology-wise Results					
High Technology	**Plus**				
Low Technology					

Table 17: Summary of Results for Process Innovation

Process Innovation								
	Improved Quality	Increase Production	increase flexibility	Increase speed of production	Increase speed of delivery	decrease cost of Production	Reduce waste	comply with Regulation

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Specific hiring	**Plus**	**Plus**			**Plus**	**Plus**	**Plus**	**Plus**
a. Skilled worker								
Increased					**Plus**	**Plus**		**Plus**
Decreased								
Same					**Minus**			**Minus**
b. Unskilled worker								
Increase					**Plus**	**Plus**	**Plus**	**Plus**
Decrease			**Minus**	**Minus**				
Same					**Minus**	**Minus**	**Minus**	**Minus**
Technology-wise Results								
High Technology		**Plus**			**Plus**	**Plus**		**Plus**
Low Technology								**Plus**

This paper found that for Product Innovation involving completely new products and designing product with different inputs lead to the hiring of Skilled and Unskilled worker. However, Product innovation focused on better quality does lead to the layoff of unskilled workers. For Process Innovation, innovations related to increasing the speed of delivery, decrease the cost of production, to comply with regulations lead to the hiring of Skilled and Unskilled workers. Innovation reducing waste led to the hiring of unskilled workers. However, innovations leading to increased flexibility and speed of production lead to the layoff of unskilled workers. Technology-wise high technology firms hire for a new function for product Innovation. however, for process innovation high tech firms hire to increase production, speed for delivery, decreased cost of production, and comply with regulations. Low tech firms hire to comply with regulations only.

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