

Technology Intensity and Employment in the Indian Economy

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Abstract

The paper investigates impact of technology on employment in key sectors of the Indian economy in the context of changes in globalisation pattern. The analysis encompasses services and manufacturing sectors. The services sectors include firms engaged in financial and non-financial segments, while manufacturing sector consists of firms engaged in production of consumer goods. The findings suggest that indicators that have affected employment in manufacturing sector are: size of operations, import of capital goods (a proxy of intensity of technology used), and expenditure on welfare and training of workforce, while in financial services sector profitability, expenditure on ICT (a proxy of intensity of technology used), and expenditure on welfare and training of workforce have positively and significantly affected employment. Whereas in non-financial sector firms, import of capital goods and expenditure on training and welfare of workforce significantly influenced employment. The distinguishing finding is that association between employment creation and age of firms is negative in financial services sector, while age of firm is immaterial in manufacturing and non-financial sectors. The common factor is the expenditure on welfare and training of workforce which has positively and significantly influenced employment in both the sectors. The study uses Prowess database for the period of 2011-12 to 2015-16.

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1. INTRODUCTION

Changing technologies and shifting globalization patterns bring manufacturing-led development strategies into questions. Technologies such as IOT (internet of things), advanced robotics and 3-D printing are shifting what makes locations attractive for production and threaten significant disruptions in employment particularly for low-skilled labour. These trends raise fears that manufacturing will no longer offer an accessible pathway for countries to develop, and even if feasible, that it would no longer provide the same dual benefits of productivity gains and job creation for the unskilled. This scenario makes it useful to assess what impact technologies are in fact having on employment in the Indian context.

New technologies are adopted on account of numerous benefits. These vary from emergence of new products; ability of technologies to modify existing products; enabling to serve end-users more effectively; expand market reach; better management and utilization of human and physical resources; and effective information management. Provision of any-where, any-time, and any-one of new technologies is another feature that increases its acceptability. As far as domain of new technologies is concerned, they could be applied in all types of economic and social activities. However, a discredit attached with adoption of new technologies is that benefits of new technologies are at the cost of employment. This disrepute is more relevant if technology is aimed at existing products and existing markets. To some extent this may be true if the technology is adopted for managerial functions and improvements in production processes rather than any direct benefits to the end-users. But such initiatives do provide indirect benefits to users such as cost reduction, better services, and better quality of products.

New technologies could also generate employment if technological change is likely to result in creation of new markets. Emergence of mobile telephony in recent times is a case in point. New technologies could also create employment if they offer improvement in services. The emergence of internet enabled information processing activities in services sector is another example. The internet enabled services such as financial transactions in the banking sector may be considered as the realization of any-where, any-time, and any-one aspect of new technology. And such technologies not only provide better services but also create employment in services sector. In view of these recent technological developments it may not be so appropriate therefore to label technological development as employment reducing.

The stage of economic development is another factor that guides the impact of technological development on employment in the economy. In the developed world where the scope of market expandability is somewhat limited, adoption of new technologies may lead to reduction in jobs whereas that may not be the case in the context of developing countries that are overshadowed by unserved markets. Availability of cheap labour also provides an option for firms in developing countries to adopt technologies that helps firms to expand market rather than to focus on cost saving technologies. The recent development in communication technologies has enabled banking and insurance sectors to reach remote areas in the country, leading to creation of new employment opportunities.

Employment generation has been a highly debated issue in the Indian context for the last several years. The proponents of new technologies have been arguing that Indian economy has witnessed a surge in employment due to recent path breaking initiatives of the government. 'Digital India' movement, among several such initiatives is expected to result in employment creation through the use of digital technologies in manufacturing as well as services sectors. However, there are many who argue that in fact there has been loss of employment. Although the government is yet to release all official data on employment, privately maintained databases such as 'Prowess' show that the average annual growth of employment in consumer goods manufacturing, financial and non-financial services have witnessed a growth of 2.50, 18.45, and 1.12 percent respectively.

In view of the divergent opinions on what affected employment in recent years, the study aims at identifying the factors that influenced employment in the Indian economy. The specific research questions of the study are:

- (i) How technological intensity in different sectors is affecting employment in Indian firms, and
- (ii) The role of sector-specificity in creation/reduction of employment due to adoption of advanced technologies.

The remainder of the paper is as follows. The review of literature is presented in Section 2 while Section 3 formulates the hypotheses. Section 4 describes methodology and data whereas results are presented and discussed in Section 5. Finally, Section 6 summarises the findings of the study.

2. REVIEW OF LITERATURE

The employment effect of technological change depends upon a range of factors, such as labour market flexibility, product market competition, types of innovation, and international trade. The technological change at the firm level may be a driver of growth and employment in the long run. It depends upon the type of new technology adopted. The product-oriented technology adoption is usually expected to have a positive effect on employment while process oriented technology adoption is expected to have adverse employment effects. The adoption of technology by firms could be skill biased (Cirillo, 2014; Harrison *et al.*, 2014; Ugur and Mitra, 2017). The recent technological development is marked with advancement in Information and Communication Technologies (ICTs). Hence the recent studies on technological development focus on ICTs. A large number of recent other studies indicate positive association between ICT investments and firms performance (Brynjolfsson and Hitt, 2003; Lal and Paul, 2008; Oliner and Sichel, 2000). However, Gordon (2016) provides a more sceptical perspective on the contribution of ICT to US economic growth in recent years, arguing that the main effects were all focused during the period 1996–2004. Castro and Lima (2017) in their study of Portuguese firms argue that efficient human capital reduces the hazard of job separation in more technology-intensive firms.

Existing literature provides evidence that technological intensity demands more on firm-specific human capital mostly in the form of ‘on-the-job training’ (Greenhalgh and Mavrotas, 1996; Bartel and Sicherman, 1998). A study by Acemoglu (1997) shows that firms’ profitability by adopting a new technology is associated with higher desired levels of workers’ training. Mincer (1989) also finds that workers receive more on-the-job specific training in firms experiencing more technological change. The author concludes that the more intensive the use of technology is, smaller the hazard of job separation.

It is contended that skill biased technological change would have a reducing effect not only on the employment of unskilled labour but also on the level of overall employment. The adverse effect on overall employment is expected to result from a mixture of skill mismatch and weak absorption capacity of the firms that in turn might lead to underutilization of the labour input, lower growth rates, and adverse effects on employment. Even if overall job destruction is avoided, the rate of job creation may be too small to absorb the increase in the

supply of labour. The technology adoption is associated with increase in productivity of firms, enabling them to capture new markets or increase their market shares. Consequently, innovative firms may create employment but their job creation may be at the expense of output and employment losses in non-innovative counterparts. Hence the effect of technology adoption on employment at the sector or industry level may be negative or smaller than the effect at the firm level.

A study by Schiopu (2015) investigates the effects of skill biased technical change in the frontier economies on the evolution of output, the quantity and quality of human capital in the adopting countries. The study connects the direction of technology adoption to a sequential process of skill accumulation, where the returns of advanced human capital depend on the quality of basic education. It is found that moderate skill bias produces convergence in output per capita, while strong skill bias generates two convergence clubs among adopting countries. In the latter case, a further increase in skill bias leads to a larger disparity in output between the clubs. Furthermore, the countries in the low income club converge to a new steady-state characterized by a higher quantity and lower quality of skilled labour.

Many previous studies highlight the adoption of technology by the Indian MSMEs. They found evidence of various factors influenced by attitude of firm managers towards activities, such as augmentation of size of operations, market share, skill intensity, experience, and infrastructure (Lal, 1999; Kannabiran and Dharmalingam, 2012). On the other hand, credit constraint, lack of awareness, lack of human capital, isolation from technology hubs, and associated risk and uncertainty could be substantial hurdles in technology adoption in Indian MSMEs. There is evidence that higher cost on modern technology may force the marginal and financially unsound micro-entrepreneurs in rural areas to stay with traditional and obsolete technology (Tripathi et al., 2013).

Some authors (Fuentelsaz et al., 2012; Carr, 2003) assert that adoption of new technology in the financial sector firms offer benefits in terms of enhanced cost efficiencies, increased value to customers, and better product quality. The authors also highlight that as availability increases, their costs decrease. Thus, ICT adoption by firms is a strategic necessity that could lead to profitability increases by focussing on risk reduction. A study by Rajesh (2012) on sericulture in South India found that the size of operations does play a critical role in modern technology adoption resulting in economies of scale. In another study by Hazarika et al.

(2016) using micro firm-level data of weaving technologies in the handloom micro-enterprises in the rural areas of Assam, India reveals positive significance of credit inclusion, availability of family labour, and social network on adoption and extent of deployment of weaving technologies. They also found that presence of proper market linkages also plays crucial role in adoption and use of such technologies in the rural areas.

Babalola et al. (2015) in their study on evaluation of factors that influence technological innovation in small and medium enterprises in Nigerian industrial estates found that internal factors such as firm size, turnover, age, ownership, and expenditure on innovation activities were not significantly associated with innovation output i.e., they are not the factors promoting innovation levels. The quality of human resources and interactions with suppliers act as external factors and made significant impact on innovation. Habiyaemye (2013) in the study of 340 manufacturing firms in Botswana, dominated by diamonds exporting firms, analyses the effects of imported capital goods on firm productivity growth and skill development. It was found that imported machines and equipment increase manufacturing productivity after 1-2 years following the investment. Additionally, foreign-owned firms were found to enjoy more productivity growth than their domestic counterparts.

3. HYPOTHESES:

Ever since the emergence of ICTs, there has been serious debate in academia as well as among policy makers about impact of new technologies dominated by ICTs, on employment. One of the most cited document is by Freeman and Soete (1994). It is also regarded as one of the most controversial books of recent times. It presents a scenario for sustainable development and focuses on many dos and don'ts. There is no uniform policy to be followed for employment creation. The book emphasizes that the new technologies may create unemployment if not adopted along with economy-specific strategies. There are other studies (Schiopu, 2015 and Lal, 1999) that argue in favour of skill biased technological change suggesting that adoption of new technologies may create employment for skilled activities and might result in unemployment for unskilled workforce. The authors also argue that the adoption of new technologies need not necessarily create unemployment at the firms or industry level. Given this kind of association between employment and adoption of new technologies, main objectives of the study are:

- (i) To examine the impact of technology adoption by firms on employment;
- (ii) To investigate the factors that affect employment in firms;
- (iii) To examine the role of sector-specificity in employment creation; and
- (iv) To identify the association between international trade and employment.

Several other factors such as size and age of firm, profitability, investment on welfare and re-skilling of workforce, and expenditure on ICTs have also been included in the analysis. Based on the sector-specific characteristics and existing literature, the following hypotheses are formulated.

The findings about age of firm in creating employment are mixed. A study by Adelino *et al.* (2017) finds that ‘startups’ are more poised to create employment. The findings are based on Quarterly Workforce Indicators (QWI) data published by the Longitudinal Employer-Household Dynamics (LEHD) program of the U.S. Census Bureau. The authors argue that startups are much more responsive to changing local economic conditions while Babalola *et al.* (2015) finds that age of firms is immaterial in employment generation. Another study by Halabisky (2006) also concludes that the bulk of net job creation comes from very young firms, while the older firms shed the most jobs in Canadian industry 1993 to 2003. In view of the fact that new technologies are predominantly led by ICTs, newer firms may be better poised to adopt them more easily compared to older firms that have to first dismantle old technologies before adopting the new ones. Hence it is hypothesized that age of firms might emerge as an important determinant in employment generation. Therefore the first hypothesis of the study is:

H1: Newer firms are likely to adopt more advanced technologies resulting in higher employment creation

The earlier empirical findings related to adoption of new technologies and employment generation are mixed. It also depends on purpose of the adoption of technologies. For instance, the adoption of advanced technologies in production processes might offer other benefits but at the cost of employment. On the other hand, if new technologies are adopted for better marketing and improved delivery of services, it might result in employment generation in the manufacturing sector. In the services sector on the other hand, would definitely contribute in employment generation in the Indian context as there is a large

unserved market particularly in banking and insurance sectors. Therefore, the second hypothesis is:

H2: Adoption of more advanced technologies is expected to result in creation of employment in Indian economy.

The size of firms and profitability are expected to influence technological development at the firm level. Size of operations provides the required financial base to acquire new technologies and also ensures the capacity utilisation of new technologies while profitability is usually motive of the firms. Hence these factors govern the adoption of new technologies. The literature is full of studies (Acemoglu, 1997; Kannabiran and Dharmalingam, 2012 and others) that find evidence to show that size of operations influence the adoption of new technologies which in turn may lead to higher employment in the Indian context. It is thus hypothesised that:

H3: Size of operations is expected to influence the employment in firms

Several studies argue that re-skilling of workers is a prerequisite for successful adoption of technologies and to produce appropriate benefits thereof. Acemoglu (1997) shows that firms' profitability from adopting a new technology is usually associated with higher desired levels of workers' training. Mincer (1989) also finds that workers receive more on-the-job specific training in firms experiencing more technological change. Since the technological development in recent times is regarded as skill-biased (Castro and Lima, 2017; Brynjolfsson and Hitt, 2003; Schiopu, 2015), re-skilling takes a pivotal position in deriving potential benefits of new technologies. The professional satisfaction of the workforce is of utmost importance to reap the benefits of new technologies and welfare initiatives such as recreational facilities in the firm premises contribute to a great extent. The professionally satisfied employees are expected to work with higher efficiency leading to improvement in the firms' performance. Better performing firms may expand their market share leading to job creation. In view of the existing empirical evidence and benefits of investment on re-skilling of workers, it is hypothesised that firms investing more on such activities are likely to create more employment. Hence the fourth hypothesis is:

H4: Re-creational and re-skilling facilities at the firm level are expected to contribute positively in employment creation

4. DATA and METHODOLOGY

The study analyses manufacturing as well as services sector firms. The manufacturing sector consists of all the firms engaged in production of consumer goods while services sector encompasses financial as well as non-financial sector firms. Further non-financial sector consists of communication services, information technology, business services and consultancy, health, education, online market places, and tourism. The data used in the study come from Prowess database. The sample consists of five year data, i.e. 2011-12 to 2015-16. The variables used in the study are: age of firms, expenditure on import of capital goods, expenditure on ICT, size of operation, profitability of firm, and expenditure on welfare and training of workforce. The technology variable has been proxied by import of capital goods in consumer goods manufacturing and non-financial sectors while investment on ICT has been used as a proxy in financial sector firms. The size of employment is a computed variable. Prowess database provides profit after tax per thousand employees (A) and also profit after tax (B). Then size of employment is computed as B/A which gives the total employment in thousands.

As far as the analytical technique is concerned, Generalized Estimating Equations (GEE) has been preferred over other panel data analysis techniques. GEE is an extension of generalized linear models (GLM) in that the system allows adjusting for correlation between observations. A major strength of GEE is that it does not require the correct specification of the multivariate distribution but only of the mean structure. It fits an equal-correlation population-averaged model that is equal to the Random-Effects (RE) model for linear regression. STATA software fits general linear models and allows to specify the within-group correlation structure for the panels. The strong assumption of independence of X_i and ϵ_i in the RE model is often implausible in empirical research using observational data. This assumption is relaxed in the Fixed-Effects (FE) model, allowing the distribution of ϵ_i to depend on X_i .

In the linear GEE and RE models, the estimator of β has the same structural form as the GLS estimator. The methods of estimation of the variance $V_i = V_i(\alpha)$ are of course different. In the GEE method, V_i is specified through a working correlation whose parameters are estimated by the method of moments. The true variance is not known, but even though it may be misspecified, the asymptotic variance of the GEE estimator of β can be made robust to this

misspecification by using the empirical variance estimator (Gardiner et. al., 2009). However, some loss of efficiency could result if the assumed working correlation is far from the true correlation. In practice, infeasible estimates of α could result if the data do not support the correlation structure. Recent evidence has shown that, for GEE estimates to converge properly, the estimates of α need to be within the ranges of feasible values. Only in this case the GEE ensure consistent estimation of effects of covariates on the marginal expectation of outcome. In view of the above properties of GEE, it is considered that GEE is more efficient than other RE and FE models.

5. STATISTICAL ANALYSIS

As indicated earlier, consumer goods sector firms, financial sector, and firms engaged in non-financial sectors are included in the analysis. All the variables used in the analysis are normalized before parameter estimation by using standard normalization technique. The analyses of all the three groups of firms is done separately. The results of consumer goods manufacturing firms are presented in Table 1. It is worth mentioning that the sector has witnessed a positive growth rate of employment during the study period. The average annual growth rate has been 2.50 percent.

Table 1: Analysis of Consumer Goods Manufacturing Firms

Dependent Variable: Size of Employment			
Independent Variables	Coeff.	Z-Value	Description of variables
AGE	-1.7119	-0.18	Age of firm
IMP_CAP	0.8655	2.44**	Import of capital goods expenditure
ICT_EXP	4.5835	0.92	ICT expenditure
SALES	0.0086	2.18**	Sales turnover
TRAIN_EXP	4.3498	1.92*	Staff welfare and training expenditure
Wald Chi-Sqr: 645.24; Prob.> Chi2: 00.00			

Note: **→ Significant at 5 %; *→ at 10 % level; Financial figures are in Rs. Million

In view of the main objective of the paper, variability in employment has been explained in terms of age of firms, expenditure on import of capital goods, expenditure on ICTs, size of operation, and expenditure on welfare and training of workforce. The expenditure on import of capital goods has been proxied as the intensity of technology used. The overall model specification is significant at the highest level (1 %). It can be seen from the table that age of

firm has no impact on employment creation suggesting that newness of firms or having existed for a longer period is not an advantage in employment creation. On the other hand, adoption of technologies and sales turnover have significantly (at 5 % level) affected the employment creation in consumer goods manufacturing sector firms.

The emergence of size of operation as a significant variable suggests that the larger firms invested more on new technologies to remain competitive in the domestic market. Such firms might have adopted more advanced technologies to expand in the domestic as well international market. Impact of expandability in international markets could not be analysed due to lack of data. The expandability in the domestic market due to adoption of new technologies might have enabled firms to create more employment. The significance of sales turnover in creating employment is to some extent obvious in this sector. The firms with smaller size of operation may not be able to afford new technologies. Under-utilization of capacities of such technologies also might have discouraged smaller firms in importing such technologies resulting in less or no employment creation.

The results show that expenditure on welfare and skill upgradation of workforce positively and significantly influenced the employment creation. Welfare measures include the equity participation of workers in performance of firms. By doing so, workers may be doing their best to contribute in better performance. Equity participation might be giving a sense of ownership. Improved skills of workforce coupled with sense of ownership might be resulting in market expansion which in turn is expected to contribute in employment creation. Perhaps for the first time, an empirical analysis finds an evidence to suggest that welfare measures and skill upgradation activities contribute in performance of firms. It may be inferred from the findings that firms that focussed on such measures resulted in more employment creation.

The results presented in Table 1 also indicate that the elasticity of employment with respect to expenditure on training and welfare of workforce is the highest among significant variables. It shows that an additional one percent investment on training and welfare of workforce is expected to increase the employment by 4.35 % while the employment with respect to size of operation is almost inelastic.

Table 2 presents the analysis of financial sector firms. The sector also witnessed the average annual growth of employment at 18.45 percent during the study period. The group is

dominated by banking and insurance sector firms. The technological upgradation in these sectors is by and large dominated by information and communication technologies. Such firms do not employ much imported capital goods. Hence use of advanced technologies has been proxied by investment on ICTs by firms in this sector. The parameter estimates are presented in Table 2.

Table 2: Analysis of Services Sector (Financial) Firms

Dependent Variable: Size of Employment			
Independent Variables	Coeff.	Z-Value	Description of variables
AGE	-14.83868	-6.86***	Age of firm
PAT	1.32572	16.70***	Profit after tax
ICT_EXP	43.34491	13.21***	ICT expenditure
TRAIN_EXP	8.42205	2.85***	Staff welfare and training expenditure
Wald Chi-Sqr: 645.24; Prob.> Chi2: 00.00			

Note: ***→ Significant at 1 % level; Financial figures are in Rs. Million

It can be seen from the table that the variables that influenced the employment generation are: age of firms, profit after tax, intensity of technology adopted, and expenditure on welfare and training to workforce. All the explanatory variables are significant at the highest level, i.e. 1 %. Interestingly, age of firm has emerged as negatively associated with employment creation suggesting that newer firms have been able to create more employment than the older ones. This may be due to the fact that it is easy for newer firms to start with state-of-the-art technologies while older firms would need to dismantle the existing technology and then adopt new technology. This might not be economically viable and hence older firms did not adopt latest technologies leading to less or no employment creation. It is worth mentioning that new network technologies coupled with high speed communication technologies enable firms to expand their market. Such technologies also help firms in serving the existing customer base more effectively and efficiently.

The sales turnover was not reported by most of the firms hence could not be used as an explanatory variable. The results presented in Table 2 show that profitability has positively and significantly influenced the employment creation. The higher profit making firms might be in a virtuous circle, i.e. higher profit enabled firms to invest more in new technologies and that in turn resulted in more profits. The finding is on expected lines.

As stated earlier, expenditure on ICT has been used as a proxy of technological intensity for this segment of firms. Such firms are engaged in developing new products which are driven by the recent government policies. Of course, new banking and insurance products reflect firm policies as well. Firms need effective network and communication technologies for successful delivery of such products to existing and potentially new customers. Therefore, expenditure on ICTs has been proxied as intensity of adoption of new technologies. The results show that the firms that adopted more advanced ICTs could generate more employment compared to others. Once existing customer base or new customers are convinced with new products, more workers are needed to implement such products leading to higher employment. This may not be the case with firms who did not have up-to-date technologies to reach the customers.

Like the consumer goods manufacturing firms, expenditure on welfare and training of workforce significantly and positively influenced the employment creation. Similar argument could be extended to justify the association between job creation and expenditure on such activities. Higher level of satisfaction of workers generates more willingness to work for the firm. This is a kind of virtuous circle for firms. On the other hand if employees are not happy, they prefer to leave the firms resulting in reduction in employment. One may infer that results are very obvious.

The results presented in Table 2 also indicate that the elasticity of employment with respect to expenditure on ICTs is the highest. The sensitivity analysis suggests that an additional one percent investment on ICTs is expected to increase the employment by 43.34 % while the elasticity of employment with respect to profitability is the lowest (1.33 %).

Finally non-financial services sector firms were analysed and results are presented in Table 3. The employment in this sector has recorded the average annual growth rate of 1.12 percent. The results are to some extent similar to that of consumer goods manufacturing sector.

Table 3: Analysis of Services Sector (Non-financial) Firms

Dependent Variable: Size of Employment			
Independent Variables	Coeff.	Z-Value	Description of variables
AGE	138.4903	0.41	Age of firm
IMP_CAP	0.7264	1.85*	Import of capital goods expenditure
TRAIN_EXP	19.0644	13.56***	Staff welfare and training expenditure
Wald Chi-Sqr: 198.70; Prob.> Chi2: 00.00			

Note: ***→ Significant at 1 %; *→ at 10 % level; Financial figures are in Rs. Million

The results presented in Table 3 show that the import of capital goods and expenditure on welfare and training of workforce are the only two factors that affected employment creation. Sales turnover could not be used in the model specification due to lack of data. Surprisingly, age of firms has not emerged as a significant determinant of employment creation. Given the type of firms³ in the group, age was expected to influence the employment creation. Findings of the study suggest that firms dealing with Information Technology Enabled Services (ITES) have equal opportunity to expand their markets resulting in employment creation. The existence of older firms such as Tata Consultancy Services, Infosys, Mahindra Tech, and other large firms could not create any barrier for newer firms to emerge and expand their markets.

The emergence of expenditure on import of capital goods as one of the factors that influenced the employment creation is according to our expectation. Like consumer goods manufacturing firms, this variable has been used as a proxy of intensity of technology used in this segment of firms as well. It is important to make a distinction between expenditure of ICTs and import of capital goods used by ITES providing firms. Information technology services providing firms import a lot of products such as routers, data storage devices, high-end servers, and other equipment that are needed in providing IT related services and by and large high technology products are imported and are categorised as capital goods. Whereas expenditure on ICTs is the purchase of hardware and software products that are available locally. The firms equipped with more recent communication and networking technologies are in a better position to serve the existing customer base as well as in expansion of markets. The emergence of import of capital goods as a significant determinant of employment creation is a case in point.

³ This group of firms is dominated by communication services and information technology services.

Like in the other two category of firms, expenditure on welfare and skill upgradation positively and significantly influenced the employment generation in this sector also. The association is significant at the highest level, i.e. 1 %. The findings suggest that re-skilling of workforce is very useful not only in retaining but also preparing them for new technological challenges. The workers equipped with new knowledge are competent to use new technologies more efficiently. This helps in expansion of customer base of firms resulting in creation of employment.

The sensitivity analysis of coefficients of independent variables suggests that the elasticity of employment with respect to expenditure on training and welfare of workforce is the highest. The results show that an additional one percent investment on training and welfare of workforce is expected to increase the employment by 19.06 % while the elasticity of employment with respect to import of capital goods is the lowest (0.73 %).

6. SUMMARY and CONCLUSIONS

The study analyses impact of intensity of technology used on employment in the Indian economy during 2011-12 to 2015-16. Data for the study come from Prowess database. Manufacturing and services sectors have been included in the analysis. The consumer goods manufacturing firms represent the manufacturing sector while financial and non-financial sector firms are included in the services sector. Non-financial sector encompasses firms that are engaged in communication services, information technology, business services and consultancy, health, education, online market places, and tourism. The expenditure on import of capital goods has been used as technology intensity in manufacturing and non-financial services sectors suggesting that embodied technology has been considered in the study. On the other hand, expenditure of ICTs is considered as a proxy of technological intensity in financial sector firms. This is because ICTs are the major technology that are used by financial sector firms to retain/expand market share.

The common factor that has emerged a significant determinant in all the sectors is the expenditure on welfare and re-skilling of workforce. The welfare measures include equity participation of workforce, meeting educational expenditures of wards of employees and other business incentives. Re-skilling of workers is very crucial for successful adoption of new technologies. The firms, depending on their size of operation and market orientation,

provide in-house training or send their technical team to learn from supplier of embodied technology. The recreational activities could also be considered another factor that contributes to professional satisfaction. Re-skilling of workforce coupled with financial incentives and recreational facilities provide enough incentives to workforce to use their full potential for betterment of the firm. And this helps firms in maintaining/expanding market share resulting in creation of more employment.

Intensity of technology used at the firm level has also emerged as a significant factor in influencing employment creation. It was not possible to include export orientation of firms due to lack of data hence expandability of market is limited to domestic market only. The findings suggest that by adopting up-to-date technologies, firms could expand their market leading to higher employment. The study negates the notion that newer technologies are adopted at the cost of employment. It may not be generalized as potential for market expandability plays an important role in employment generation.

The other factors that have influenced the employment creation are: size of operation, age of firms, and profitability. The age of firms has emerged as a significant determinant of employment with negative sign in financial services sector firms. It may be inferred from this finding that newer firms are able to create more employment compared to older ones. One of the possible explanation could be that newer firms start with the latest technologies while older firms need to dismantle the old technologies and then adopt new technologies which may not be economically viable for older firms. Consequently older firms are unable to expand their markets leading to stagnation of employment.

The profitability may be seen as a substitute of size of operation. Profitability was used as an explanatory variable in financial services sector firms due to lack of data on sales turnover. In fact this was the problem in non-financial services sector firms as well. The size of operation is extremely important for acquisition and adoption of any new technologies. It is the size of operation that provides the financial base for such activities. In that sense, the finding is very obvious.

The sensitivity analyses suggests that investment on training and welfare of workforce has highest elasticity with respect to employment creation in manufacturing and non-financial services sector firms. This is followed by investment on import of capital goods in the above

sectors while in case of financial services sector firms, investment on ICTs takes the pivotal position in terms of elasticity with respect to employment.

The findings of study suggest that taking care of the workforce is the crux for firms to remain competitive in the market. Re-skilling and professional satisfaction are equally important for expansion of firms leading to more employment in the Indian context where there is huge potential of market expansion. The study concludes that the adoption of new technologies need not necessarily lead to employment reduction rather employment could be created with the adoption of new technologies coupled with appropriate strategies for the firms.

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