Research Paper
Impact Factor: 6.462
Peer Reviewed & Indexed Journal
www.ijmsrr.com

IJMSRR
E- ISSN - 2349-6746
ISSN -2349-6738

INNOVATION AND EMPLOYMENT: IMPLICATIONS FOR INDIA

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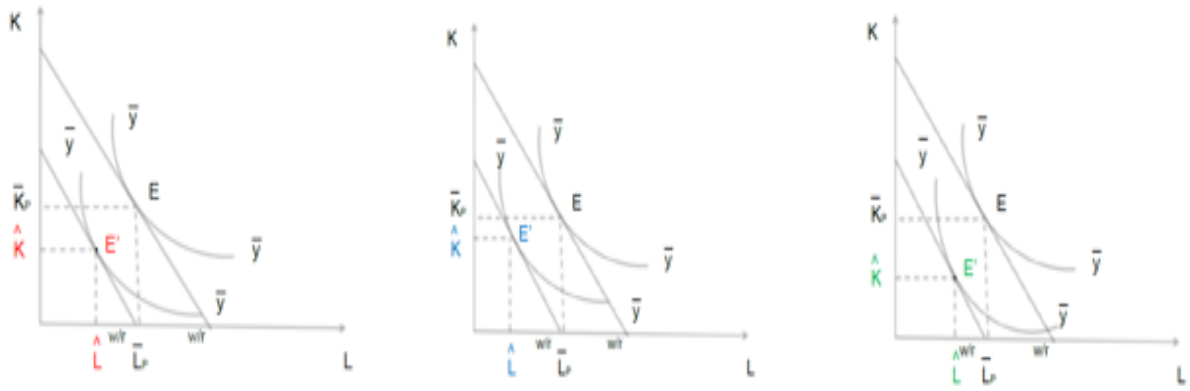
Abstract
Innovation is an integral component for the long term sustainable growth for any economy, as suggested by various growth models as well as supported by empirical studies. This paper explores the contemporary issues in the relationship between innovation and employment. Going by the literature developed hitherto regarding the same, this paper analyses the various compensation mechanisms for employment generation from innovation, their implications and hindrances in the case of India. It is observed that in the absence of planned government intervention, neo liberal policies are unlikely to yield positive returns, but on the other hand, policies promoting the development of the high technology sector combined with import substitution policies for capital intensive goods, as well as, policies promoting entrepreneurship can be highly beneficial to curb the effects of creative destruction.

Keywords: Innovation, Employment, Compensation Mechanisms, Entrepreneurship, Distribution.

Introduction
Innovation is a key driver of economic growth and development. It creates new products and services, improves productivity and efficiency, and drives structural transformation. However, the relationship between innovation and employment is complex and can be both positive and negative. In this research paper, we will review the literature on the relationship between innovation and employment and suggest policy interventions, as per the implications for India according to existing literature, to maximize the positive effects of innovation on employment. In order to do so, the central idea around which the employment effects of innovation effects are analyzed is via six central compensation mechanisms of innovation, which in principal suggest that even though innovation is not explicitly employment friendly, it implicitly generates employment through the aforementioned compensation mechanisms.

Figure 1: From left to right – Neutral Technological Change, Labour-saving Technological Change and Capital-saving Technological Change



As can be seen from the above figure, whether an innovation is neutral, labour-saving or capital-saving, the net direct impact of it will always be negative, hence the need to study the compensation mechanisms of innovation.

It is followed by a discussion on how entrepreneurship can be a tool for employment generation, since innovation directly implies change, and entrepreneurs are referred to those who seek opportunities for profit making, they are likely to invest in the production and research for new products and services, thereby having the potential to play a key role in structural transformation and employment generation via product innovation and as well as better absorption of technology. "Entrepreneurs in developing countries have a much greater propensity for innovation than is often recognized in the literature or by policy-makers."[Naudé, 2013].

Research Methodology

The idea presented in this paper is built upon existing literature on innovation studies, innovation-employment relationship, innovation and distribution dynamics as well as entrepreneurship-development relationship.

Literature Review

Vivarelli, 2014 - An extensive study regarding the relationship between innovation and employment has been done in this paper, which analyses the impact of innovation on employment theoretically and empirically based on the Theory of Compensation - the six compensation mechanisms of innovation, their respective hindrances and criticisms, and the empirical validation of the compensation mechanisms. The paper further analyses them in case of developing countries separately.

Pianca and Tancioni, 2008

"This paper investigates the dynamics of wages and profits and the influence innovation strategies have on them. The relationships between innovation, productivity, and distribution are modeled and estimated by employing panel data techniques". Their findings conclude that: there exists a positive and significant relationship between the intensity of innovation expenditure on turnover and wage growth, and a negative and insignificant relationship with profit growth; Wages increase faster in the sectors and countries where innovation expenditures are higher (and have no effect on profits; The general diffusion of innovation and new processes increase profits and may lead to slower wage dynamics through adverse labor market effect; The success of new product sales accelerates the growth of Schumpeterian profits, with no effects on wages.

Naudé, 2013: The paper studies the relationship between entrepreneurship and development and covers a range of topics including "(i) recent theoretical developments at the intersection of entrepreneurship and development studies; (ii) empirical findings on the connection between entrepreneurship and development; and (iii) innovative policy recommendations for promoting entrepreneurship in developing countries, including the promotion of female entrepreneurship."

Innovation and Employment: Theory and Empirical Findings

The most comprehensive theory as of now, dealing with the dynamics of innovation and employment is that of the Theory of Compensation. It is the union of all existing theoretical possibilities of the channels between innovation and employment. As per this theory there are six different mechanisms driven by innovation itself that creates employment. All of them have been met with criticisms regarding their limitation on a theoretical level.

The six compensation mechanisms and their criticisms are as follows

1. **The compensation mechanism "via additional employment in the capital goods sector":**
   The same process innovations that displace workers in the user industries create new jobs in the capital sectors where the new machines are produced. Given that it is likely that the production of a machine must employ fewer persons than it replaces, as only then can it be profitable, and that labor-saving technologies spread around in the capital goods sector, as well; so this compensation is an endless story which can only be partial.
2. **The compensation mechanism "via decrease in prices":**
   Innovations themselves lead to a decrease in the unit costs of production and—in a competitive market—this effect is translated into decreasing prices; in turn, decreasing prices stimulate a new demand for products and so additional production and employment. However, the very first effect of labor-saving process innovation is a decrease in the aggregate demand due to the cessation of the demand previously associated with the dismissed workers. So, the mechanism "via decrease in prices" deals with a decreased demand and has to more than counterbalance the initial decrease in the aggregate purchasing power.
   If an oligopolistic regime is dominant, the whole compensation is strongly weakened since cost savings are not necessarily and entirely translated into decreasing prices.
3. **The compensation mechanism "via new investments":**
   In a world where the competitive convergence is not instantaneous, during the gap between the decrease in costs—due to technical progress—and the consequent fall in prices, innovative entrepreneurs may accumulate extra profits. These profits are invested, which leads to new productions and new jobs. The economic agents' expectations can delay the translation of additional profits into "effective demand". Moreover, the intrinsic nature of the new investments does matter: if these are capital-intensive, compensation can only be partial.
4. **The compensation mechanism "via decrease in wages"**
   As with other forms of unemployment, the direct effect of labor-saving technologies may be compensated within the labor market through a proper price adjustment. In a neoclassical framework—with free competition and full substitutability between labor and capital—a decrease in wages leads to an increase in the demand for labor.
   On the one hand, a decrease in wages can induce firms to hire additional workers, but—on the other hand—the decreased aggregate demand lowers the employers' expectations and so they tend to hire fewer workers. There is inherent plausibility in the Hicks inducement theory, biasing the long term direction of technical change in a labor-saving direction. Attempts to generate a reversal of this trend by temporary small reductions in the relative price of labor are extremely unlikely to be effective.
5. **The compensation mechanism "via increase in incomes"**
   In a Fordist mode of production, unions take part in the distribution of the fruits of technical progress. Thus, it has to be taken into account that a portion of the cost savings due to technical change can be translated into higher incomes and hence higher consumption. This increase in demand leads to an increase in employment, which may compensate the initial job losses due to process innovations.
   The distribution of income follows different rules and the labor market is competitive once again. On the whole, this compensation mechanism has been strongly weakened in the new institutional context.
6. **The compensation mechanism "via new products"(Product Innovation)**
   Entirely new branches of production, creating new fields of labor, are also formed, as the direct result either of machinery or of the general industrial changes brought about by it.

In different historical periods and different institutional frameworks, the relative balance between the labor-saving effect of process innovations and the labor-intensive impact of product innovations can vary considerably. Moreover, product and process innovations often come together, since the latter can be a necessary complement of the former. Therefore, the final impact in terms of employment turns out to be an open empirical matter.

Since relative to developed countries, developing countries lack the capabilities for innovation owing to lower R&D expenditures and an endogenous innovation environment. Hence, most of technological progress is in the form of Embodied Technological Change, implying dependence on imports and innovation in the form of process innovation, which are mostly not employment friendly.

In such a scenario three of the compensation mechanisms are hindered:

1. Hindrance to Price Compensation Mechanism: low degree of competition of the local goods and labour markets.
2. Hindrance to income compensation mechanisms: By a tendency to invest abroad and to spend additional income in luxury goods imported by richer countries.
3. Hindrance to Product Innovation (absorptive capacity): Only those DCs that enjoy a sufficient level of endogenous R&D and innovation capabilities would be able to fully develop the growth and employment potentialities of the new technologies, with particular reference to the labor-friendly product innovations. This is not the case for many low-income countries where the lack of absorptive capacity by domestic firms severely limits the implementation of the new technologies developed abroad, either through import or through spillovers from FDI inflows.

Empirical studies pertaining to employment effects of innovation have found an all pervasive positive impact of product innovations on employment irrespective of the nature of innovation. Further, there is also the evidence in favor of the skill-biased nature of new technologies that is large, robust, and proven across different OECD countries, different economic sectors, and different types of innovation. Implying that even process innovations can be labour friendly. Empirical findings of impact of innovation on wages also show a positive relationship on a microeconomic level. Considering these three points together, it implies that, empirically, even though the job destroying effect of innovation cannot be mitigated completely, policies promoting development of high technology sector and skill transfer together can be highly beneficial for offsetting the effects of innovation.

Entrepreneurship, Innovation and Employment

There are three broad definitions of an entrepreneur, discussed in Naudé, 2013 which are as follows:

1. **Behavioral definition**: It defines an entrepreneur as someone who is in search of an opportunity for profit making, indulged in innovation hence spending on R&D, and has an appetite for risk.
2. **Occupational definition**: Self-employed, who chooses entrepreneurship over wage employment.
3. Synthesis definition: "the resource, process and state of being through and in which individuals utilize positive opportunities in the market by creating and growing new business firms."

Entrepreneurs can be seen as agents of structural change, which is of great macroeconomic importance for a developing country. As enablers of structural change, entrepreneurship can also fill the deficiency of skilled labour, in case they can come up with business ideas, products or services aimed at raising the skills of those displaced by process innovation. Existing literature suggests ways to maximize development impacts on entrepreneurship, by way of promoting innovative entrepreneurship. Given the various challenges of doing the same in a developing country, entrepreneurship still comes out as a

legitimate policy initiative as far as job creation via structural change and new products in concerned. Other than that entrepreneurship can also lead to the development of the manufacturing sector in India which has largely been stagnant relative to services. Entrepreneurship is also a viable option for resource mobilization in India, which in the past has either been carried out by the government, or by big domestic corporates, both of which have failed in doing so.

This however does not imply complete dependence on entrepreneurship for driving employment, as there are limitations to it too, such as evidence showing an inverted U shaped relation between entrepreneurship and national happiness. Hence such policies must be complementary to other policies such as development of PSUs and investment in agricultural research by government, which are unlikely to be done by an entrepreneur.

Conclusion

There shall always be some amount of unemployment associated with innovation, implying a safety net for those affected. Safety nets can be in the form of social security, or even competition laws protecting industries from creative destruction, but in a planned manner.

Product expansion is at the heart of the positive impact of innovation on employment. In case of India, one possible way to do so is the development of the high-technology sector, combined with import substitution policies, which would also provide profit opportunities for potential entrepreneurs. This is a viable option in today's date since India does have a sizable skilled workforce which can be mobilized for R&D expenditures. Development of the high technology sector will also better India's position in the global supply chain, thereby necessarily having a positive employment impact due to market expansion.

Absorptive capacity is still a vital issue in India, especially with respect to the expansion of manufacturing sector. The government till now has mostly focused on higher education expenditure to counter this problem. However, what is required is a more holistic approach to raise the overall skill level of the country. In order to do so, primary and secondary education should be of national focus.

Increasing the share of educated/skilled workforce requires expansion of education, which is a relatively labour intensive sector, hence generating employment. However this mechanism can fail if most of the quality education is concentrated in the private sector, which will likely employ a lower number of educators as compared to the public sector, and considering the profit motive nature it would also imply that education would be inaccessible to economically weaker learners to a large extent relative to the public sector. Therefore, public sector education expansion, both secondary and tertiary, would give a push to structural transformation, diffusion of technology and generate employment.

A separate study would be required to estimate the employment effects of such a move, however, learning from China's example, which spent more than a decade investing in the core sectors of education and health; it indeed reaped some significant economic and employment benefits, given its large population and history of underdevelopment. This is a long term policy, the benefits of which wouldn't be immediate, but necessary, if not sufficient. This will further enhance the efficacy of tertiary education, and give a push to the manufacturing sector, constrained by shortage of skilled workforce and low productivity.

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