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Technology-Driven Shifts in Labor Roles and Profiles: Empirical Insights from India's Emerging Market

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Abstract

In the study of the labor market, how technological advancement affects work is an important matter. The effect of new technology on productivity is much more at the firm level as compared to the national level. This study presents a framework to understand how technology as well as other types of automation affect the demand of labor and interpret changes in employment. Automation enables the replacement of labor in jobs and shifts the tasks of production against labor. It is called as displacement effect. Technology reduces the demand for labor as well as their share in the value-adding products and services. The impact of technology and automation are counter balanced by the development of new tasks wherein the labor has a comparative advantage. The technology changes the task of labor for which workers need to undergo training to handle the machines and computerized equipment. Technology has positive as well as negative impacts on labor tasks and job profiles. Sample of 363 people from different occupational sectors have been surveyed to study the factors that determines the Impact of Technology on Changing Labor Tasks and Job Profile. It is found through the study that there is a significant impact of technology on Changing Labor Tasks and Job Profile.

Keywords: *Automation, labor demand, technology, worker displacement, job tasks, worker employment*

Introduction

Talking about the implications of technology for employment and wages is controversial. Automation signifies the development and adoption of technologies that would enable capital to be replaced for labor in different tasks. The task content of the production is changed by automation for labor by displacement effect as the capital overtakes the work that was performed by the labor previously. The displacement effect means that automation reduces the share of labor in value-adding. A major shift in automation and mechanization has been marked by the advent of the computer in the early years of 1950. In the preceding decades, the introduction of calculators and comptometers introduced the probability of the power of human brains being assisted by machines. But this, possibility has been magnified by computers by hundred times. Till that time, everyone was satisfied with the physical power replaced by machines, and later an era began of mind power replacement with machines. In the next three decades, an impressive and mounting growth of computing power came into the picture. As a result, the applications of

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computers moved from the offices of scientists to cover many other functions and roles in human life. This transformation has been fueled with further acceleration after the introduction of personal computers in 1970 and the introduction of the internet in 1990. It was a very common perception that the advancement of technology would steal jobs and reduce the demand for labor in the market *(Balasubramanian, 2018).*

Industrial Automation is really having a positive or negative effect on the industry as well as on employees. Life in the industry cannot be imaged without technology and automation. Various transformations have occurred in industries to bring improvement in productivity as well as efficiency in everyday activities. Automation of industries is essential to withstand globalization. It would also replace the importance of humans at their workplace. The growth of industries is difficult to imagine without automation and digitalization in this digital world. Tremendous growth can be achieved with the proper combination of automation, technology, and human skills. Automation and technology are important for the improvement of quality, worker efficiency. To avoid risky and dangerous tasks or jobs, it will improve productivity. This would also help the organization to achieve its goals more effectively and quickly. Rather than counting the disadvantages of technology as well as automation, we must improve skills, knowledge along with globalization and competitiveness. Technology and Automation would make a great and positive impact on the industry, employers as well as their employees. But, it all depends on them and their reaction towards this transformation. As automation and technology are created, developed, programmed, observed as well as handled by humans, there is no chance that they can replace humans with machines. The human workforce will always be needed to maintain balance *(Jadhav & Gawande, 2020).*

Industrial Automation has impacted workers as due to automation and technology, workers having low skills are replaced by machines. They have to survive for the employees, and their jobs are getting affected. A large amount of money is invested by the industry in the automation of their business, whereas the adoption of technological instruments by the business has a great influence on its operations, the behavior of human resources, the structure of the organization and the efficiency and effectiveness of the business *(Kumar, 2014).* After the technological advancement, majority of humans are facing tight competition from robots, machines, and artificial intelligence. Humans must identify and understand their skills, strengths, and weaknesses in order to fight in this competition. The competition between technology and humans is constantly growing. It can be said that the jobs that are safe in this competition are those that are non-routine jobs and can be done intellectually or manually. The study shows that the workers who are doing routine jobs at their workplace are more likely to get replaced by machines as compared to those who are doing non-routine jobs *(Peng, Wang& Han, 2018).*

Literature Review

Liu & Grusky (2013) stated that information technology (through software, hardware, and telecommunication devices) is playing an important role but is considered as trouble-making for economic as well as social development. As technology would result in replacing humans from

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their workplace, it is not always been considered a blessing for us. At the same time, technology also has some positive effects, as it sometimes creates job opportunities that would need some different kinds of skills from the workers. The use of technology and computers has changed the organizational structure completely.

Wilburn & Wilburn (2018) explained that the technologies could be used in businesses to save time from picking up an idea and to convert that idea into a product and then delivering that product to the customer. This can be done with fewer workers. Replacing humans with robots and machines can save costs as humans need wages, salaries as well as and other benefits. Automation would create more products in less time and price. As jobs disappear from the market, a new economy is getting developed where employees are getting converted into contract workers.

Cardullo & Ansal (2017) found that the objective of introducing technology in the business is to increase productivity, but it impacts employment as well. The basic outcome of the introduction of automation in the industry is the reduced number of workers at the workplace. It is found that the level of productivity reaches heights through technology. History shows that even after technological advancement, there will be sufficient workers working in the industry. The study did not find any negative impact after the utilization of technology. The outcome of technological advancement is the rise in living standards, productivity, as well as employment. The output and the demand are increased by the technology itself. It is done either by increasing productivity or by using new products.

Frank et al. (2019) revealed that the labor market can get adversely affected by the rapid advancement of technology and artificial intelligence. Artificial intelligence has the capacity to improve and increase the productivity of some workers. At the same time, it can remove some others and can do their work just like humans and can transform some occupations to some level. A rise in automation has occurred in a time of growing economic inequalities, high fear of technological unemployment as well as a revived call for policy efforts to examine the reasons behind technological advancement. Artificial intelligence has the capability to bring changes in the demand of skills, career opportunities, as well as distribution of workers in the industry in developing and developed countries.

Beer & Mulder (2020) stated that the manner in which employers and their employees need to complete their job is totally changed by technology and automation. The evidence shows that an increase has been observed in their mental activity, complexity in their work, particularly while working with the robotic machines and other automated machines. At many times, manual work is reduced to a greater level. With the autonomy, the interruptions between the workload and workflow get increased concurrently. The opportunity for development and the role expectations is dependent upon how the profession and the usage of technology are associated with each other, particularly while working with automated machines.

Chinoracky & Corejova (2019) explained that not just from a global perspective, the unemployment and employment of the labor markets get affected by the digital transformation in

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the industry. Digital transformation is just about the internet but above all about the latest digital technologies as they have become an important part of our lives. Digitalization has become an important part of the society. The job levels that are at high risk due to automation have increased, and it can be confirmed by the trend line having an upward movement. The 4th revolution in industries is marked by the rising breakthrough in various fields that includes robots, the internet of things, artificial intelligence, 3D printing, quantum computing, etc. This advancement of technology also brings some challenges along with it that are faced by society. One of the biggest challenges faced by society is the loss of jobs in the labor market.

Kapeliushnikov (2019) explained about different forecasts given by economists and technologists with reference to the damaging impact of the fourth industrial revolution on employment and its structure. These forecasts predict that due to technological advancement and the fourth industrial revolution, we might face a massive replacement of people. Further, their work will be done by machines and there will be an explosion of unemployment in the market. We can say that technology will reduce the demand of labor in the market. This forecast is just a theoretical possibility and has not been realized practically yet. A strong positive association has been found between employment growth and innovations.

Shippy (2019) revealed that technology is a type of innovation that is quickly transforming and constantly affecting the economy. The primary sector has made a huge contribution during independence, but now it has been replaced by the service and tertiary sectors. The primary sector majorly includes the agriculture sector, and it is undergoing various technological transformations. But, the productivity has not yet increased as per the expected level. The major cause behind this is the uneducated farmers. Consequently, the unskilled laborers faced huge losses in the secondary sector. Advanced technology in various other sectors is saving the cost of labor, and that is called as automation. Automation is a situation when work that was done by a person is later on done by a machine. When any mental of physical work is replaced by a machine, it is called Artificial Intelligence.

Paul & Lal (2021) stated that the employment effect of technological changes depends on several factors such as flexibility of labor market, competition in the product market, kinds of innovations and international trading. At the firm level, the technological transformation can be a driver of growth and employment in the long run depending on the type of technology adoption. It is stated that the skill-biased changes in technology would have less effect not just on the employment of the laborers who are unskilled but also on the overall employment. It is expected that there will be a bad effect on the overall employment due to the mix of skill mismatch and poor capacity of the absorption of the organization, which in return would lead to under usage of labor input, low rate of growth, and poor impact on employment.

Ra et al. (2019) explained the two-fold implication of technology on workforce development. There will be a change in the demand for specialized skills that would lead to the shrinking shelf life of skilled labor. Getting adapted to the disruption from the advancement of technology will need to forget old technology as well as practices and start learning the new technologies.

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Simultaneously, innovative modes of education are offered and delivered by new technologies that have the potential to address rapidly changing demands of skills. A solution to these challenges is offered by the new technologies themselves. To meet these changing demands of skills and to maximize the potential offers of the technology, developing the learning ability in the workforce is important. As the growing advancement of technology is affecting the present as well as the future workforce, learning ability is needed among the employees.

Attulur & Yarimoglu (2020) stated that human life had been transformed by artificial intelligence, robots and machines. Today people are thinking about the impact machines and technology would make on their jobs. This, there is a need to study the impact of technology and how it is going to affect future employment as well as the benefits it would give to humans. This study found that, in case society cut off the jobs due to advanced technology and robots, the social benefits that were being delivered would also get impacted. For the public policies, various questions have been raised due to the emerging technology which is affecting demographic works. As an outcome, there is a requirement to confirm social contracts for the new economy delivering social advantages that are progressing.

Sima, Gheorghe Subic, & Nancu (2020) explained that digitalization and automation are long-term processes of evolution. These are causing significant impact on the economy like transforming occupations and the job profiles, transforming the forms of employment, creating challenges for the social policies, more importantly for platform economy. Due to automation, the creativity in work would reduce and human capital would disappear from the production technology. In some of the areas, the unemployment rate would rise with its negative effect for society. There is a direct proportional relationship between the degree of production automation and the rate of unemployment, i.e. higher the degree of production automation, higher the unemployment rate.

Jain & Ranjan (2020) revealed that the pessimists of the technology believe that the advancement of technology would take away jobs from people. However, it is the suggestion of pessimists of technology that the 'non-routine' jobs will go nowhere and will rush. A panel discussion was conducted with senior leaders of the industry in order to better understand the implications of emerging technologies on future employment. Technologies can take away jobs, but they are proving very useful and efficient in many other departments, where jobs were previously done by humans but with low efficiency.

Naz & Magda (2019) revealed that the fourth industrial revolution would bring many benefits for India like globalization, proper utilization of assets, smooth human and interaction with the robots, effective utilization of energy, independent controlling, more adaptability, etc. The result of technological advancement will be seen in the labor market and their utilization. Losing jobs of unskilled labors, technology as well as automation will compress the occupations and unskilled labor will face unemployment. The fourth industrial revolution will have the upper hand on the competition in the worldwide economy. We must have a pattern of the rapidity with an end goal and achieve the objectives of the organization.

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Mehta & Awasthi (2019) explained that as per the evidence the rate of unemployment has shot off many times and the condition of the educated young generation has become serious. This situation would get worse with the emergence of technology and automation affecting a lot of jobs and workers. This challenge is increasing further due to job loss of labor force and the inability to give them a proper and suitable job. India has various challenges like this, such as worsening conditions of work, the supremacy of educated as well as low-skilled workers, larger informal sector and shortage of training centers for the workers to learn new technologies.,

Yuvaraj & Nadheya (2018) stated that as the employees are getting to learn new technologies, they are found to be satisfied with the emerging technologies and automation. Learning new technology would increase their level of performance. It will make them updated with new technologies and make them professional in their field of work. Employees have a positive attitude towards technology as it restrained their work and has made it easier and take less time to complete the work. As organizations are forcing their employees to learn new technology and adapt it in their work in a limited time period, the employees are feeling stressed and taking more time in adopting the technology.

Vashisht & Dubey (2018) found the impact made by automation and technology by changing the mix of the job as well the demand of skills. The study found that the acquisition done by technology under fourth industrial revolution in economies industrially advanced economies is driven by the analysis of cost benefits of accessible technology and highly skilled labor force.

Ernst, Merola and Samaan (2019) explained the applications based on artificial intelligence while stating that they are the largest and widely ranged technological transformations in the past few decades, which has significantly affected the developing nations. According to the study, re-shoring and automation of work reduced labor costs. The author stated that the movement from the 'automating workforce' to 'automating brain force' along with the technology would increase productivity with more efficiency.

Imran, Maqbool & Shafique (2014) stated that the introduction of advanced technologies has motivated employees in the banking sector. They need more training to learn new skills and knowledge about the technology that is used in their field. The study says that, if employees get motivated with the introduction of new technology, their performance will improve as compared to those who are demotivated towards their work and are not interested in training. A significant impact of the introduction of new technologies has been found in the study upon the performance of the employees.

Rezaei et al. (2014) revealed that the productivity indices of employees have improved, who are using information technology in their work as shown by the outcome of the study. Improvement in the work makes the employee more willing to perform their job and bring improvement in their productivity. Furthermore, information technology as a set of generated ideas is provided by the mechanism of software to organizations as well as to their employees. It plays an important role in the development of human resources. Instruments of information technology serve as a solution for the problems when they are used for human development purpose.

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Dzhioev (2020) stated that an ambiguous effect is made by new technologies on the labor market. Hence, the chance of sustainable development of the modern economy with reference to radical changes of nature and labor content is a controversial topic to discuss. Human labor would be partially replaced by machines and new technologies in the coming decades. According to the experts, physical as well as intellectual jobs would be automated in near future and industrial robots as well as artificial intelligence would be used in industries on a large scale. It would lead to the emergence of new professions like specialists in human interactions and Artificial Intelligence (AI) that would adapt human behavior.

Objectives of Study

1. To know the factors that determines the Impact of Technology on Changing Labor Tasks and Job Profile.
2. To know the overall impact of technology on Changing Labor Tasks and Job Profile.

Research Methodology

Sample of 363 people from different occupational sectors have been surveyed to determine the Impact of Technology on Changing Labor Tasks and Job Profile. The study is empirical in nature and the primary data for the study is collected through random sampling with the help of a structured questionnaire. The data was analyzed with the help of statistical tools like Exploratory Factor Analysis and Multiple Regression Analysis.

Findings of Study

Table 1 is showing general profile of the respondents in which it is found that in total 363 respondents 57.6% are males and 42.4% are females. Among them 39.3% are from the age group 30-36 years, 32.8% from 36-42 years of age group and rest 28.9% are above 42 years of age group. 28.4% of the respondents are working in automobile company, 26.7% are from IT sector, and 27.5% associated with manufacturing company and rest 17.3% are from other occupational sectors. 27.3% of the respondents are skilled, 38.8% are semi skilled and rests 33.9% are unskilled with latest technologies.

Table 1: General Profile

Variables	Respondents	%age
Gender		
Males	209	57.6
Females	154	42.4
Total	**363**	**100**
Age Profile		
30-36 yrs	139	39.3
36-42 yrs	119	32.8
Above 42 yrs	105	28.9
Total	**363**	**100**
Occupational Sector		

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Automobile Company	103	28.4
IT Sector	97	26.7
Manufacturing Company	100	27.5
Others	63	17.3
Total	**363**	**100**
Skills		
Skilled	99	27.3
Semi-Skilled	141	38.8
Unskilled	123	33.9
Total	**363**	**100**

Exploratory Factor Analysis

'KMO and Bartlett's Test' was applied in which KMO value found is .897, as shown in Table 2. It is more than the 0.6, which confirms the validity of the factor analysis.

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.897
Bartlett's Test of Sphericity	Approx. Chi-Square	5251.744
	df	171
	Sig.	.000

It is found from Table 3 that the 4 factors explain 72% of the total variance. The 1st factor explains 25.442% of the variance followed by the 2nd factor with 18.964%, 3rd factor having 15.379% of variance and 4th factor explains 12.946% of variance.

Table 3: Total Variance Explained

Component	Initial Eigen Values			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.019	42.204	42.204	4.834	**25.442**	25.442
2	2.159	11.362	53.566	3.603	**18.964**	44.407
3	1.931	10.164	63.730	2.922	**15.379**	59.786
4	1.710	9.002	72.732	2.460	**12.946**	**72.732**
5	.815	4.288	77.020			
6	.713	3.754	80.774			
7	.553	2.910	83.684			
8	.441	2.319	86.003			
9	.427	2.246	88.248			
10	.382	2.011	90.259			
11	.353	1.857	92.116			
12	.321	1.688	93.804			
13	.255	1.345	95.149			
14	.213	1.123	96.271			

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15	.194	1.021	97.293			
16	.175	.919	98.212			
17	.131	.690	98.902			
18	.128	.673	99.575			
19	.081	.425	100.000			

Development of Factors

Digital Transformation is the factor that includes the variables like Manual work gets reduced due to digital transformation; Society is facing challenges of loss of jobs in the labor market; Massive replacement of labor by machines, Unskilled laborers are facing job loss; Demand for specialized skills is leading to decrease in shelf life of skilled labor; and Development of learning ability in the workforce gets increased. The second factor namely Automation consists of variables such as Automation had decreased the demand of labor; Automation is enabling the replacement of labor in jobs; Automation is shifting the tasks of production against labor; Automation had increased the demand of labor training to handle the machines; and computerized equipment and Workers having low skills are replaced by machines. Technological Advancements is the third factor including the variables like Adoption of technological instruments has changed job profiles; Humans are facing tight competition from robots, machines, and artificial intelligence; Labors need to improve their skills, strengths, and weaknesses to fight this competition; and Workers who are doing routine jobs are getting replaced by machines. Fourth and the last factor is named as Artificial Intelligence that includes the variables like AI is working like humans and are transforming labor tasks; AI is causing high fear of technological unemployment; AI has increased labor's mental activity, complexity while working machine; and AI had replaced the importance of humans at their workplace.

Construct- wise Reliability of All Factors

The factor reliability of Digital Transformation is 0.958, Automation has 0.896 reliability; Technological Transformation has 0.863 and Artificial Intelligence has 0.733 factor reliability, as shown in Table 4.

Table 4: Rotated Component Matrix[a]

S. No.	Impact of Technology on Changing Labor Tasks and Job Profile	Factor Loading	Factor Reliability
	Digital Transformation	.877	**.958**
1.	Manual work gets reduced due to digital transformation	.871	
2.	Society is facing challenges of loss of jobs in the labor market	.862	
3.	Massive replacement of labor by machines	.837	
4.	Unskilled laborers are facing job loss	.824	
5.	Demand for specialized skills is leading to decrease in shelf life of skilled labor	.816	
6.	Development of learning ability in the workforce gets increased	.877	
	Automation		**.896**

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1.	Automation has decreased the demand of labor	.840	
2.	Automation is enabling the replacement of labor in jobs	.789	
3.	Automation is shifting the tasks of production against labor	.784	
4.	Automation has increased the demand of labor training to handle the machines and computerized equipment	.781	
5.	Workers having low skills are replaced by machines	.777	
	Technological Advancements		**.863**
1.	Adoption of technological instruments has changed job profiles	.843	
2.	Humans are facing tight competition from robots, machines, and artificial intelligence	.807	
3.	Labors need to improve their skills, strengths, and weaknesses to fight this competition	.775	
4.	Workers who are doing routine jobs are getting replaced by machines	.759	
	Artificial Intelligence (AI)		**.733**
1.	AI is working like humans and are transforming labor tasks	.789	
2.	AI is causing high fear of technological unemployment	.758	
3.	AI has increased labor's mental activity, complexity while working on machines	.744	
4.	AI had replaced the importance of humans at their workplace	.738	

It is clear from Table 5 that there are 19 items including all the variables related to personal factors and total reliability found is 0.913**.**

Table 5: Reliability Statistics

Cronbach"s Alpha	N of Items
.913	19

Multiple Regression Analysis

The Value of 'adjusted R- square' is found to be 0.818, as reflected from Table 6, which means that the model explains around 82% of the variation.

Table 6: Model Summary

Model	R	R- Square	Adjusted R -Square	Std. Error of Estimate
1	.906[a]	.820	.818	.32889
Predictors: (Constant), Digital Transformation, Automation, Technological Advancements and Artificial intelligence				

Table 7 shows the values of ANOVA, which is significant (sig. value below 0.05). It shows that the impact of independent variables is significant on dependent variable. The value in the significance column is 0.000, which means that one or more variables are significant on dependent variable.

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Table 7: ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	176.383	4	44.096	407.662	.000[b]
	Residual	38.724	358	.108		
	Total	215.107	362			
DV: Overall impact of technology on Changing Labor Tasks and Job Profile						
Predictors: (Constant), Digital Transformation, Automation, Technological Advancements and Artificial Intelligence						

Table 8 and Figure 1 show the coefficients of the model. Table 8 depicts that all the factors namely Digital Transformation, Automation, Technological Advancements and Artificial Intelligence are showing significant impact on dependent variable 'Overall impact of technology on Changing Labor Tasks and Job Profile,' as the value in the significant column for all the factors is below 0.05.

Table 8: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.950	.017		228.848	.000
Digital Transformation	.666	.017	.864	38.511	.000
Automation	.151	.017	.196	8.732	.000
Technological Advancement	.124	.017	.161	7.183	.000
Artificial Intelligence	.077	.017	.100	4.439	.000
DV: Overall impact of technology on Changing Labor Tasks and Job Profile					

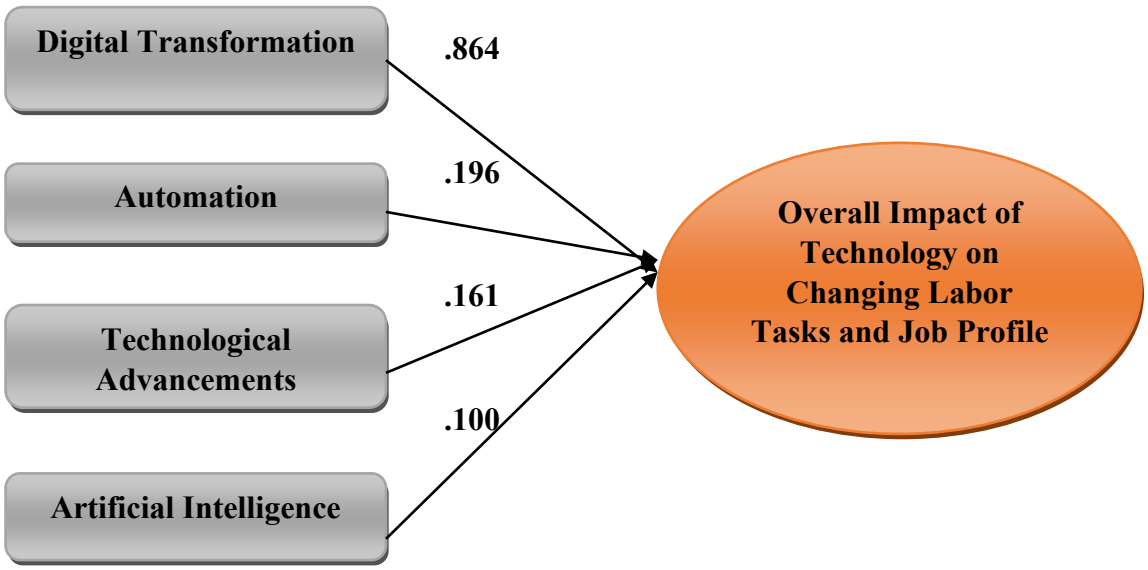

Figure 1: Overall Impact of Technology on Changing Labor Tasks and Job Profile

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Conclusion

The adoption of new technological breakthroughs, sometimes stated as the fourth industrial revolution, would be affecting labor market and income inequality. At the same time, this will bring social transformations. However, the nature and the effect of these transformations would remain unknown. Reduction in the uncertainty of national, local, as well as global effects by future researches and discussions would give a contribution in better preparations for the nations to face these challenges. Such studies could help in finding out the link between the technological revolutions and other major global trends. It would include the demographical changes like aging and migrations, changes in the climate and the need for the transformation in the society through the introduction of new technologies and automating the industries.

The study concludes that Digital Transformation, Automation, Technological Advancements and Artificial Intelligence are the factors that determine the Impact of Technology on Changing Labor Tasks and Job Profile. It is also found through the study that there is a significant impact of technology on Changing Labor Tasks and Job Profile.

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