Global Scientific JOURNALS

Implementing industry 4.0 in global perspective: A challenge for managing inter-country supply chain.

Maroof Alam Siddiqui
Research Scholar
Karachi University Business School, University of Karachi, Pakistan
Maroofalamsiddiqui@hotmail.com

Dr. Muhammad Asim
Associate professor
Karachi University Business School, University of Karachi, Pakistan

Mr. Salman Mazoor
Karachi University Business School, University of Karachi, Pakistan

Abstract

The concept of mass customization are rapidly taking place of mass production system we call it the third industrial revolution. After the birth of industrial revolution 4.0 the smart factory concept where machines and robots works in highly collaborative environment by the support of Cyber Physical System, Internet of Things, Big data, Integrated Networks and other coming information technologies. The pupose of this paper is to highlight the other challenging factors that may create hassle for organization supply chain management in inter-country perspective. For this instance and to check the significance of the study regression and coorelation analysis was applied. For data collection a survey based questionnaire was shared with industry professionals of Pakistan. The outcome of the study indicates that all independent variables has a significant relationship with dependent variable industry 4.0.

Keywords: *Cyber physical System, Internet of Things, Integrated Networks, Pakistan.*

1. Introduction

1.1 What is industry 4.0?

The code name industry 4.0 is regarded to define the advanced high technological step promoted by German government and then from onwards thedevelopment of systems include cyber physical system and digitalized data processes that utilizes mass number of data to run smart integrated machines in production setups. More commonly industry 4.0 is the sign of emergence and diffusion of new self-operating industrial technologies by embedded sensors, by which the smart product and machines can communicate and interact with each other during production lines by the support of application internet of things (IoT). The receiving and evaluation of digitalized data to justify the quality and cost of production. Machines with more flexibility and autonomy,latest manufacturing idea like 3-D and additive manufacturing. Perhaps many of such technology are available for the time being but for cost minimization their use of industrial use in more commercially viable.(Roger Strange and Antonella Zucchella, 2017).

The starting phase of industry 4.0 is quite interesting and successful in giving multiple business solutions adding interoperabilityenhancement and global value creation improvisation.. Industrial revolution 4.0 the smart factory concept first utilizes by German automobile manufacturing giants such as Volkswagen, Daimler and BMW. Presently China has also introduced the concept of made in China 2025 with the aim to promote and improve the manufacturing sector of china with rapid replacement of outdated technology with latest digitalized technology. (Surajit Bag, Arn esh Telukdarie, J.H.C. Pretorius and Shivam Gupta,, 2018).

Currently the fourth industrial revolution the global industrialized sector of manufacturing and interlinked connections combined through multiple enablers and application of the system like IoT, cyber physical systems and big data. In first industrial boom mostly heavy machine based

setups were formed by earlier industrials, their idea to operate manufacturing units on usually water and steam based energy. In second phase of industrial revolution the concept of bulk production wasinitiated with the support and more focused on electrical energy which is still in application in most parts of the industrialized regions of the world. After second boom the revolution of industry came up with the role of Information technology and electrical power system. Presently the fourth industrial revolution idea is influencing the manufacturing sector based on the short life cycles of products, rapid introduction of new product design and smart features product and especially the mass customization.(Li Da Xua, Eric L. Xub and Ling Lia, 2018).

1.2 Past research background

As the concept of industry 4.0 is not yet too old, still is infancy and mostly applicable in well developed nations the researchers and industrial experts exploration domain is influenced towards the system configurations like Internet related components and application including the Internet of things (IoT), Cyber Physical System (CPS), Big Data, integrated networks etc. for sure the exploration of such application are vital and demanding in industrial point of view as they are the premier element and factors. But as the international business is not only based on such well-established high tech countries the underdeveloped region should also need to be in research domain for the successful implementation and utilization of potential inter regions partners including potential suppliers and developing markets like Asia. Many researched highlighted the integration of networks which is also a hint towards the exploration and expansion of researcher focus towards more available potential interesting filed and geographies. On the other hand the researcher mostly talked about the internal environmental factors of industrial revolution very few highlighted the external factors like political situation, technical infrastructure, the technological grounds of a country, industrialization infrastructure etc.

In order to get further insights about the newly formed industrial revolution and its component researcher should also need to be expand their area of interest towards the stated unexplored area. It will possibly create opportunities for industrial sectors and help to figure out the possible expansions to the new potential markets.

1.3 Industry 4.0 and Pakistan

As the mostly Pakistani thinking about the country economic and political crisis, the other hand a mysterious ship of opportunity is on the door step for the industrial units of the country. The mysterious ship is here relate with the forth industrial revolution commonly known as "Industry 4.0". As the export segment of the country is rely on mostly manufactured products especially the garments goods. Will it the best time to incorporate the smart manufacturing concept in our production systems? Off course the statement can'tanswer the question accurately without any research and past information that need to be evaluate for future decisions and understanding the dynamic of the country.

The smart manufacturing concept is lies with full connected and integrated processes with support of artificial intelligence that transform a system to learn and adapt new ways. The result of automated and less human intervene manufacturing are more productive and accurate. Currently many factories in Pakistan has some sort of automated system that need to be update and streamline the processes and protocols according to the requirement of industry 4.0.

The two Asian countries including Bangladesh and Vietnam has also focusing on industry 4.0 implementation and as a part of their long term policies firm are investing rapidly. Vietnamese organization spending heavily on digitalization and automation for coming five years for greater utilization of their investment by improvising operational efficiency and greater access to customer through integrated networks and advance value chain.

The fourth industrial revolution is no more futuristic itis now rapidly overcoming the previous industrial concept as the technology become part of our regular life, gadgets, machines, electrical vehicles , solar energy etc. many firms in the region including textile sector and automotive manufacturer are using automated system that will be a significant impact to adopt any futuristic system.

1.4 Research Gap

It is noted and observed after reviewing differentresearcharticles about the topic industry 4.0 and all its relate aspect that the academia researchers and industrial expert are only bound towards the technological factors as earlier stated in the paper. Very few researcher had talk about the other potential enablers regarding to this topic.

The main purpose of this paper is to highlight and explore the other unexplored factors related with industry 4.0 efficient implementation, including technical infrastructure, supplier flexibility and capability, production mechanism, technological challenges and barriers, Governmental support and ground realities and the logistical aspect. Based on stated factors this study check the significance of industry 4.0 success rate and implementation in Pakistani industrial leadership and industrial culture.

2.0 Literature review

Industrial revolution consider to be a latest way to organize and implement production setup. By the engagement of advance technology like cloudcomputing, cyber physicalsystem the supply chain become more strengthen and crystalized. But as the new changes occurs the new challenges are inherent with the same. The objective of this study is to highlight the risk associated with industry 4.0 with its shadow on supply chain management. Amendment in the supply chain context with respect to risk and try to find out risk mitigation formulas for professional concepts.(Meike Schröder,Marius Indorf and Wolfgang Kersten, 2014).

The primary concern of all production industries as well as German based firm is to handle rapidpenetration of competitors on quality and manufacturing cost. As the cost of production has become challenging for firms and customer won't put access money outside their buying power. In contrast with the prevailing situation majority of German firm realizes to put their efforts to highly customized goods by integration of their core competencies and joint networks. The integrated network system ensures the crystal and hassle free process among all participating supply chain entities by information sharing between autonomoussystems. The methodology of paper based of eight different research journal within same domain the customized and end to end engineering. Took interviews of different people from different industry and as well as structured interviews of consultants. The finding deflects the strong reason are required for transformation in managerial point of view whether to accept of decline.(Malte Brettel, Niklas Friederichsen, Michael Keller and Marius Rosenberg, 2014).

The implementation of industry 4.0 describe by activities and requirement of man in a production unit. Labor in the area have to face diverse range of job from standardization to evaluation to checking production aims. By the supervision of robust and advance technology it is assured that labor can efficiently adopt the purpose of strategicdecision and multi-level issues

handling techniques. The main idea behind this article is to resolve the technical barriers of labors in effective use of multilayer intelligent user interface. The articles further add the necessary level of qualification for inter-entity supply chain awareness in industrial revolution.(Dominic Gorecky, Mathias Schmitt, Matthias Loskyll and Detlef Zühlke).

Industry 4.0 has been regarded with many namessome call it smart production system, integrated industry, black industry and so on. Presently it is a most highlighted topic in industrial world and in researcher's subjects. How goods develops, produce, distribution and money returns etc. this study conclude the all possible outcomes that are related with logistics aspects. The author tries to match the application models of logistics and conceptual idea of industry 4.0 and its main components within different logistical scenarios. Based on the expert opinions and understandings that asked in the interviews, the result indicates that possibilities in decentralization, self-operations and efficiency in the system will boost. It is further added that because the concept of industry 4.0 is still lacking and not fully implemented as yet the potential of this concept is still have many path which is to be explore. (Erik Hofmann and Marco Rüsch, 2017).

In current situation production equipment's and organization are connected as a collaborative units. This revolution need the capitalization of latest for casting system to transform raw data into reliable information to alarm entities about possible harsh condition and to provide support in informed decisions. The main theme of this articles is to understand the transformation of manufacturing units by big data and the flexibility of to advance informatics tools by enhancing clarity and efficiency in production system.(Jay Lee, Hung-An Kao and Shanhu Yang, 2014)

The concept of industry 4.0 was started by German manufacturers. As the topic is being so much attracted for industries and for academicians, the study brief the upcoming threats and opportunities regarding to industry 4.0.The industrial revolution is nearly related with internet of things (IoT), Cyber physical system (CPS), Information and communication Technology (ICT), Enterprise architecture (EA) and Enterprise integration (EI). The paper explore the issues of integrated operations and provide the systematic framework for integrated operational risk. (Lu, 2017)

The core purpose of the study is to explore the impact of state policies, bureaucracy and political situation on supply chain industries in a potential markets .the author use Bangladesh garments

industry example in the investigation that how external stakeholders influence impact on supply and demand side drivers and limitation to competition. The methodology of this study is based on qualitative finding as well as quantitative approach which gets from Dhaka industrialist and in finding it is clearly indicated that government policies and bureaucratic behavior has significant impact on barriers and supply-demand side drivers. Relaxation in behavior and state policy would result greater completions and balanced in demand –supply drivers. The study is both theoretically and practically applicable because it use both external and internal stakeholder point of view to bring positive change in especially garment sector of Bangladesh. (Nuruzzaman, 2015).

The emergence of industrial growth from the latest organizational age to the technological phase precise Lesly known as industrial revolution 4.0 the higher level of commitments for the vertical, horizontal, point to pint and collaborative/ coordinated system. Forcing implementation Industry 4.0 has a significant impact on mostly all supply chain entities. The methodology of this article is strictly rely on journal articles literature reviews on industry 4.0 and supply chain. In result there has been numerous thing happened only 10 study out of 53 talked about the smart factories, manufacturing, warehousing, logistics etc. Majority of the earlier paper avoid the social implication of supply chain bonding. The strategic decision for industry 4.0 must redesign a flexible system of economic and social basis that can absorb frequent changes in system. The higher roles should support the investment for developing a system that behave and attach with technological shifts and change. To evaluate and control the system manager must work on new models and plan activities for the generation of coordinated path to supervise research and developments. (Surajit Bag, Arn esh Telukdarie, J.H.C. Pretorius and Shivam Gupta,, 2018).

The fantasy of industrial advancement emphasis organization to be innovative and internationalize at the same phase to remain competitive in global markets. By the concept of the domain industry 4.0 in our understanding technological shifts has potentialsenhancing the competition among organization. Presently the latestresearch approach to this domain is to find out possible coverage of adaptation of industry 4.0 in international setups. Through the help of multiple case papers the study gives a qualitative investigation the relationship between industry 4.0 and internationalization of organizations. The study taken 16 Italian organizations analysis which adopted more of the same technologies and figure out the close relationship and has open

opportunities for future investigation on current topic.(Maria Chiarvesio and Rubina Romanello, 2018).

With frequent improvement in industry, technology and its utilities many ideas has proven earlier. Majority of organization and research people are still working on this industrial revolution subject but the findings are yet need to be disclosed and explore further. However the roadmap to implementing industry 4.0 is still blur and in professional world as well as in academia. The study highlights and explore the current manufacturing practices and industry 4.0, the paper also indicate the distance between production setups and industry 4.0 necessary requirements. The most highlighted find is to show how a multi layered framework is design to understand and achieve the requirement of industry 4.0.(Jian Qina, Ying Liua and Roger Grosvenora, 2016).

Production firm are frequently facing threats in regards with industry 4.0 and its components. Building complex scenarios for all manufacturing firms develops uncertainty for organization and technical strategies on this level. In this article the author explores by the help of empirical grounds to assess the implementation of industry 4.0 maturity. The aim of the paper was to extend the advanced technology rely on latest designed models by inducting firms aspects. The study define 9 dimension to assess the industry 4.0 maturity. Product, customer, operator and technology are the basic enabler's. Furthermore the leadership, strategy, governance, culture and people are allocated for putting organizational aspect in to the assessment. The study conclude that the deigned model is transparent and convenient to use in practical manufacturing environment. (Andreas Schumachera, Selim Erolb and Wilfried Sihna, 2016).

The current world challenge is to reach the continuously developing need for capital and consumer goods by ensuring the involvement of human existence in social, environmental and economic dimension. In contrast to handle this issue industry value development should shift toward high sustainability. Presently the phase of value development in highly established countries are better known as industry 4.0 or industrial revolution. The concept provide great immense to the futuristic opportunities to sustainable manufacturing. This paper depicts the reviews about industry 4.0 based on current and past developments and practices.(T. Stock and G. Seliger, 2016).

The word industry 4.0 is linked with fourth industrial revolution. A latest domain enlighten by the Internet of things (IoT), in production setups and environment. The core idea behind the concept is to integrate the worldwide network of machines and system to operate by managing autonomously exchanging information and control each other as a smart industry. For better understanding a machine will know what sort of process is required to produce a specific product and how much flexibility is required to do so etc. By doing this the product is specifically unique of its process through entire production line. To obtain these type of flow a close coordination is required between customer manufacturer and material supplier for when the product required, its quantity, specification and so on. It is necessary to first check the impact of industry 4.0 on supply chain entities.(B. Tjahjono, C.Esplugues, E. Ares and G. Pelaez, 2017).

Continuous advancement in industrialization and processes have gain remarkable improvement in the next generation of latest production technologies. Currently we are on the edge of next industrial revolution the industry 4.0. In 2013 among the 10 future project introduced my German government and industry 4.0 is one of the project as a part of their advance high technology projects. Industry 4.0 is renowned for Germany to be established its leadership role in integrated high tech industry by fully control and applicable aspect of the core concept. China has also put its efforts to become more industrialized by unveiling its 10 years plan made in china 2025. In industry 4.0 and made in china concept multiple implication and application need to be integrated for the greater emergence of the planned program. Such applications and technology originate from different domains and sectors including cyber physical system (CPS), Internet of things (IoT), cloud computing (CC), Industrial Integration (II), Enterprise architecture (EA) industrial information integration and others. At the current stage the lack of potential tools can become a miserable issue in exploration of industry 4.0 and its relevant components. In practical decline method and systemized method are very crucial in realization of industry 4.0 and its practices. The paper tries to relate the industrial revolution state of the art conceptual applications with current industry.(Li Da Xua, Eric L. Xub and Ling Lia, 2018).

The main focus in this study is to evaluate the continuous adoption of advance technological application like internet of things (IoT), big data, Robotic system and flexible production system possible impact on locational and organizational process throughout the global value chain. The approach of this study is review multiple sources in supply chain entities and ensure the potential

impact of technologies with the current practices and technology that how a firm with industry 4.0 lead to organizes customer, suppliers and their internal stakeholders. The result of the study conclude that these potential technology has a considerable impact that how and where the operation of the organizations perform in global value chain. The study also indicates the industrial revolution is still in underdevelopment phase but its impact is commonly seen in corporate competition and strategy. The author also explore the risk associated with this setup the cyber risk and it could be handle through strong regulations. (Roger Strange and Antonella Zucchella, 2017).

The main agenda of this study is to find out the impact of industry 4.0 on manufacturing and services sector in Pakistan. Mainly five elements has been taken for this action namely big data, smart factory, cyber physical system, internet of things and interoperability. To figure out the significant impact of the system textile firms has been taken as manufacturing domain and the logistics providing firms as a service industry. In response to get the result a survey based quantitativeresearch method was applied. The data has been collected from 224 respondents of textile and logistics firms and (PLS-SEM) was applied to evaluate the collected data. The results indicated that implementation of fourth industrial revolution can initiate the betterment in the performance of selected industries in Pakistan by overcoming challenges though automation and strong network integrations. This study is comparatively unique that indicates the role of industry 4.0 on manufacturing's and logistics companies operating in Pakistan and also expand researchers mind towards this big gap for future investigations.(Muhammad Imran , Waseem ul Hameed and Adnan ul Haque, 2018).

Identifying operations requirement and short life cycle design of product forcing new ways or style of manufacturing industries. In last some decades researches and technological advancement increases quite continuously on industrial grounds. Somehow techniques that are utilized in production are still too old and it is also not a focused area on enterprise level. This study indicates and investigate why we need to incorporate the industry 4.0 with our outdated manufacturing setups, there are so many potential challenges arises day by day including shorter product life cycle, rapid changes in customer demands, tech savvy products and features, mass customization etc. the methodology of paper is to identifies and explore new tools with the

support of application and give initial feedback from surveys how to handle the challenges and situations. (Ateeq Khan and Klaus Turowski, 2016)

The main theme of this study is to check the significance of manufacturing techniques and long term plans in industry 4.0 vendor performance measures. Commonly as the manufacturing setup are open system and are dependent of external environmentalplayer'sincluding suppliers and customers. To check the significance of this study a survey based technique used to grab the data from respondents and applied a multi layered regression analysis. Based on the literature the four different strategiesfind out and evaluated as the correspondent to supplier performance checking parameters. The sample of 200 was collected to check the relationship between variables effectively. On behalf of finding it is stated that the performance of supplier under industry4.0 influences positively while some factor like cost didn't seen changes.The industry and country that has been taken is only in the study so it is not applicable for other country and industry. The paper helps and support the supply chain professional to examine the relationship between performance of vendor and supplier under the context of industry 4.0 and creates chances for improvement in process and better controllingmechanism through performance check.(Salam, 2019)

The industrial revolution 4.0 influences the burial of outdated production setups, the idea came up with super autonomous factories having integrated communication networks. To meet the customer unique requirement the setup supported by latest information technologies components. This latest manufacturing setup support by Manufacturing execution system. (Almada-Lobo, 2015).

2.1 Research Hypothesis

H1:   Technical infrastructure impact significantly in implementation of industry 4.0

H2:   Supplier flexibility and capabilities has significant relationship with o industry 4.0

H3:   Production mechanism has significant impact in industry 4.0 implementation

H4:   Technological and environmental challenges has a significant relationship with industry 4.0

H5:   Government or State policy has significant relationship with industry 4.0 implementation

H6:   Logistics framework has a significant relationship with industry 4.0

2.2 Research Model
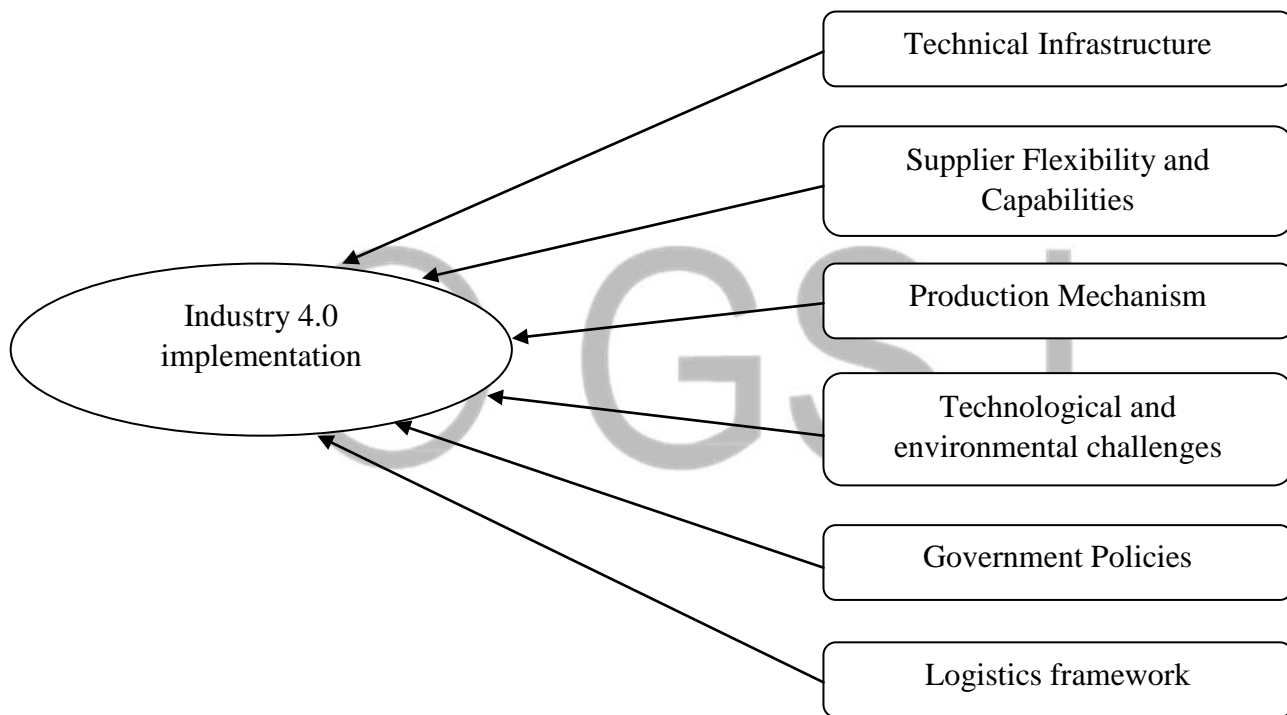
2.3 Theoretical Framework

Technical Infrastructure

Technological infrastructure are the separating wall for a country in global competition. The global competitions does not represent by wage criteria, prices or value of money. Technological leadership depict the real comparative advantage, because it can cope, create or cluster with technology. (Freeman, 2004)

Supplier Capabilities

Adopting rapid technological changes and capabilities to efficiently reply to customer needs. In OEM manufacturing is it really crucial to improvise their setups according to the customer level. (Yen-Tsung Huang and Wenyi Chu, 2010)

Production Mechanism

Not only the transformation of raw material or idea to finished product or services but with the exact need of customer and the way or style how raw material or idea transformed is known as production.(Business Dictionary)

Technological and Environmental challenges

Technology issue arise from the beginning point of implementation, as the tools and practices are new for the user. (Jeffrey T. Penka, 2003). Environmental issues in firms and managerial concepts primarily restricts the external environment threats on the survival of organization. (R.J.Orssatto, 2001)

Government Policies

It is a set of decisions or Future plans that a government expresses and announced through documented procedure. Change or cope a problem or issue that may hinder dramaticsituation for country or any technological opportunity that may give country a potential economic boom usually a part of long term goals.(AnkeHassel, 2015)

Logistics

Logistics management is consider as a science today as the requirement of the customer changes rapidly with fast pace the storage, transportation and sharing of information with right area known as logistics. In other term logistics is organizing, leading and controlling the flow of

goods or raw material from point of origin to point of consumption to meet the requirement. (Julien Bramel and David Simchi-Levi, 1997)

3.0 Methodology

The main objective of the study is to investigate the relationship betweenthe subjected Variables Including industry 4.0 implementation as a dependent variable and Technical infrastructure, supplier capabilities, productionmechanism, technological and environmental challenges, Government policies and Logistics as an Independent variables. A survey oriented approach is applied in this paper to get the primary data from different respondents from different manufacturing firms. It is the systematic collection way of data to understand and predict the attitude of participants of the target audience. The survey based technique is also quite cost cheaper than other techniques, fast and more reliable to gather information from audience of the population.(Salam, 2019) In this study the target audience are the industry professional people who are in the production department and have sound awareness of industry 4.0 and its factors.

3.1 Research Approach

The approach behind this research was quite simple because based on quantitative data the prediction of relationship among variables is quite easy and justifiable as compare to a qualitative technique. The explored result could be better addressed in quantitative approach.

3.2 Sample Size and Collection of Data

As earlier stated that the data has been collected from professional who are from supply chain management field, the participants were asked almost 42 different questions to get the out efficiently and proper analysis. How much the significance of independent variables impact on dependent variables the industry 4.0 implementation.For this instance 150 response were collected from different manufacturing firm'sprofessionals especially the automotive and textile firms of Pakistan. The data collection duration of this study was almost 1 month and closed in Dec 2019, after that a quality check was performed in order to check the accuracy of option feeding of the questionnaire from the respondent or checked any biased response. After quality checking the data further moved to analysis.

3.3 Research Instrument

The instrument that was used to collect the response was Likert scale based questionnaire form having 42 specific question regarding to the subject of the study. The question were adopted from past studies and to check the content of such question APh.D. qualified person checked the content of that research questionnaire. The options of likert scale base option were strongly agree, agree, neutral, disagree and strongly disagree. On the other side of the research data the secondary source was also utilize to build the concept through past studies and researches on the subjected topic, the inclusion of secondary data support the study by recorded and published statement of different researchers in the literature review segment of the study. Secondary source are the justification of reliability and validly of the selectedresearch topic that was further explored in the ongoing studies and researches.

3.4 Ethical Consideration

All ethical norm has been strictly followed in this study, all collected data from the participant from different industrial setups are kept confidential and t in secure custody and only be used for this specific research purpose. The respondent details are also remain highly confidential with this stream of the study.

4.1 Analysis of data

The core focus of this study is higly based on the relationship between Industry 4.0 (the dependent variable) and the technical aspect, supplier capabilities, production aspect, technical and environmental challenges, government policies and logistics taken as independent variables. In order to check the outcome a survey based data collection approach is used and after analysis of specific data it is revealed that there is a relationship exist between the variables that were used in this study. It is revealed that all independent variables has a significant relationship with industry 4.0.

4.2 Descriptive statistics

Statistics								
		TA	SC	PA	TAEC	GP	LA	I4.0
N	Valid	150	150	150	150	150	150	150
	Missing	0	0	0	0	0	0	0
Std. Deviation		.46765	.72153	.46770	.36512	.48659	.59577	.33486

Variance	.219	.521	.219	.133	.237	.355	.112
Skewness	1.093	1.221	1.390	1.465	1.294	1.707	1.032
Std. Error of Skewness	.198	.198	.198	.198	.198	.198	.198
Kurtosis	1.484	.938	3.792	9.013	3.535	2.873	2.564
Std. Error of Kurtosis	.394	.394	.394	.394	.394	.394	.394

4.3 Regression Analysis

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	LA, TAEC, GP, TA, PA, SC[b]	.	Enter

a. Dependent Variable: I4.0

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	T Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.129[a]	.017	-.025	.33898	.017	.401	6	143	.878

a. Predictors: (Constant), LA, TAEC, GP, TA, PA, SC

The R^2 value represent coefficient of determination, proportion of variance for regression model above or beyond the mean model. The R^2 of the study is .017 that mean study independent variable explains 17% variablility of dependent variable.

4.4 ANOVA Analysis

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.276	6	.046	.401	.878[b]
	Residual	16.431	143	.115		
	Total	16.708	149			

a. Dependent Variable: I4.0

b. Predictors: (Constant), LA, TAEC, GP, TA, PA, SC

The study used multiple regression technique to predict CDL from the independent variable i.e. TA, SC, PA, TAEC, GP AND LA. The close F value predict that the null hypothesis is true while P value indicates the strong evidence in favor of null hypothesis.

4.5 Coefficients Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.757	.180		9.735	.000
	TA	-.067	.110	-.093	-.604	.547
	SC	.061	.079	.131	.766	.445
	PA	-.035	.092	-.049	-.381	.704
	TAEC	.067	.103	.073	.650	.517
	GP	-.023	.080	-.033	-.285	.776
	LA	.038	.084	.068	.454	.651

a. Dependent Variable: I4.0

4.6 Relaiability and Validity Test

Scale all variables

Case Processing Summary

		N	%
Cases	Valid	150	100.0
	Excluded[a]	0	.0
	Total	150	100.0

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.935	.933	46

The cronbach's alpha reperesents the relaiability of data collection tool (questionnaire), in this study the model indicate the relaiability of questionnaire is .935 or 93.5% relaiability level.

4.7 Hypothesis Summary

	Hypothesis	p-value	t-value	Emperical conclusion
H1	Technical infrastructure impact significantly in implementation of industry 4.0	.547	-.604	Accepted
H2	Supplier flexibility and capabilities has significant relationship with o industry 4.0	.445	.766	Accepted
H3	Production mechanism has significant impact in industry 4.0 implementation	.704	-.381	Accepted
H4	Technological and environmental challenges has a significant relationship with industry 4.0	.517	.650	Accepted
H5	Government or State policy has significant relationship with industry 4.0 implementation	.776	-.285	Accepted
H6	Logistics framework has a significant relationship with industry 4.0	.651	.454	Accepted

The table of hypothesis summary indicates based on the p and t value respectively the all hypothesis or assumptions in the study has been accepted and has a significant relationship.

4.7 Discussion

The overall analysis report indicates that tha relationship between indpenendent variable i.e. Technical aspect, Supplier capabilities, Production aspect, Technological and environmental challenges, Government policies, logistcial aspect and the dependent variable industry 4.0 respectively. In order to further explore about the study the other available analyzing technique should also be used in future, it would minimizes the ambiguty about the clear path for other researchers and practioners.

5. Conclusion

5.1 Conclusion

As the world is becoming a global village day by day thing and technologies are also upgrading with a sound pace, lets take the example of personal computers, cell phones, online markets etc are the expanding domain of this era. Organization are continuously came up with new idea like touch panel cell phone introduced by Apple inc, and right after that samsung and other cell phone manufacturer follow the same path with their expertise and marketing approach, many organization didn't adopt and abosrb the technological boom and become part of the past like Nokia, siemens etc. currently the concept of mass production is loosing its position by the introduction of concept mass customization as we regularly see in online website portal where a customer can design his/her own product by utilizing the customizing options just like the example of Dell computers, where you can choose your specification on online and placed directly order to the Dell, as the company is dealing with the direct channel of distribution involve no intermediery. The concept of mass customization is still infancy to mostly countries especially the underdeveloped, organziations operting in such countries are not well aware of it or the buying behavior is still on the same level or consumer is not so influencial.

The concept of mast customization is known as industry 4.0 or fourth industrial revolution, its was introduced by German government as part of their strategic plan and other countries are also planning for the transformation of industrial setups as per industrial revolution 4.0. China is also came up with Made in China 2025 plan, the objective is to minimizes the cost of production and

higher level of quality standardization by optimizes the industrial approach. The concpet of industrial revolution is the most famous and exiting domain for researchers and professional field personels as yet because the concept is not fully implemented and organization are still working with the transformation phase. As we know that transformation would also impact on other major area especially the supply chain management of an organization, this paper theme is also relate with the industrial revolution and inter-country supply chain management. The concept has a significant impact on supply chain functions as the technology adoption is rapidly changing the dynamics, manual practices are becoming obsolete, networks and entities are becoming integrated system under one umbrella, all upstream to downstream level become highly informative and works in coordinated systems. With the support of Internet of things (IoT), Cyber Physical System (CPS), the Big data, Autonomous robotic system and integrated networks the fourth industrial revolution is breathing and growing.

Based on this study the implementaion of the fourth industrial revolution is not only depends on the technological factors but other external factor and ground realities of the host country matters in successful transformation of the project. In this study the other factors are streamline with technological factors to check the results through a proper statistical study approach by analyzing the big research gap existed. The result of the study highlighted that other external factors like government policies, production approach, logistical infrastructure, technical grounds etc also has a significant impact on industry 4.0 and its transformation. In earlier said statement world is now a global village, supplier and other stakeholders must integrate in the same platform to get the desired outcome form the latest industrial mechenism. By the use of studied factors in this study it is vaiable for organization to get the thing easy and clear for their plans and can be easily tackle down any issues during transformation period.

5.2 Limitation and Recommendation

This data that has been collected for this study is from Pakistan, professional from different industry including automobile sector and Textile firms are commonly the source of the data behind this research. As it is not possible to cover all possible variables related to the study, so only six significant indepenedent variables and one dependent variable is taken for this study. The other common limitation is the study is only focused on the Pakistan industrial culture and

way of working, government policies etc, and not all industrial sector data analyze in this study so the study is limited to its domain and sample size which is 150 responses.

It is recommended to the research personels and professionals of the industries to further explore the concept of industrial revolution and its impacts on the same ground with large sample size and consider other potential factors that are still in viel and need to be explored for greater outcome efficieny and compatibility check for the transformation. It is also recommended that other fuctions of the organization including finance, Human resources, R&D etc may have also significantly influence by the transformation and the possible impact should need to evalute under some statistical grounds.

References

Almada-Lobo, F. (2015). The Industry 4.0 revolution and the future of Manufacturing Execution Systems (MES). *Journal of Innovation Management* , 16-21.

Andreas Schumachera, Selim Erolb and Wilfried Sihna. (2016). A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises. *Changeable, Agile, Reconfigurable & Virtual Production* , 161-166.

AnkeHassel. (2015). *Public Policy.* Berlin: Elsevier.

Ateeq Khan and Klaus Turowski. (2016). A Survey of Current Challenges in Manufacturing Industry and Preparation for Industry 4.0. *the First International Scientific Conference Intelligent Information Technologies for Industry" (IITI'16* (pp. 15-26). Springer International Publishing Switzerland 2016.

B. Tjahjono, C.Esplugues, E. Ares and G. Pelaez. (2017). What does Industry 4.0 mean to supply chain. *Manufacturing Engineering Society International Conference* (pp. 1175-1182). Vigo: Elsevier.

Business Dictionary. (n.d.). Retrieved January 16, 2020, from businessdictionary.com:
http://www.businessdictionary.com/definition/production.html

Dominic Gorecky, Mathias Schmitt, Matthias Loskyll and Detlef Zühlke. (n.d.). Human-Machine-Interaction in the Industry 4.0 Era. Germany: Innovative Factory Systems, German Research Center for Artificial Intelligence.

Erik Hofmann and Marco Rüsch. (2017). Industry 4.0 and the current status as well as future prospects on logistics. *Computers in Industry* , 23-34.

Freeman, C. (2004). Technological infrastructure and international competitiveness. *Industrial and Corporate Change, Volume 13* , 541-569.

Jay Lee, Hung-An Kao and Shanhu Yang. (2014). Service innovation and smart analytics for Industry 4.0 and big data environment. *Product Services Systems and Value Creation. Proceedings of the 6th CIRP Conference on Industrial Product-Service Systems* (pp. 3-8). Cincinnati: Elsevier.

Jeffrey T. Penka. (2003, Feburary). The Technological Challenges of Digital Reference. *D-Lib Magazine* .

Jian Qina, Ying Liua and Roger Grosvenora. (2016). A Categorical Framework of Manufacturing for Industry 4.0 and Beyond. *Changeable, Agile, Reconfigurable & Virtual Production* , 173-178.

Julien Bramel and David Simchi-Levi. (1997). *The Logic of Logistics:Theory, Algorithms, and Applications for Logistics Management.* Berlin: Springer.

Li Da Xua, Eric L. Xub and Ling Lia. (2018). Industry 4.0: state of the art and future trends. *International Journal of Production Research* , 2941-2962.

Lu, Y. (2017). Industry 4.0: A survey on technologies, applications and open research issues. *Journal of Industrial Information Integration* , 1-10.

Malte Brettel, Niklas Friederichsen, Michael Keller and Marius Rosenberg. (2014). How Virtualization, Decentralization and NetworkBuilding Change the Manufacturing Landscape:An

Industry 4.0 Perspective. *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing EngineeringVol:8, No:1* , 37-44.

Maria Chiarvesio and Rubina Romanello. (2018). Industry 4.0 Technologies and Internationalization: Insights from Italian Companies. *International Business in the Information and Digital Age* , 357-378.

Meike Schröder,Marius Indorf and Wolfgang Kersten. (2014). INDUSTRY 4.0 AND ITS IMPACT ON SUPPLY CHAIN RISK MANAGEMENT. *The 14 International Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION – 2014"* (pp. 35-36). Riga: Transport and Telecommunication Institute, Lomonosova 1, LV-1019, Riga, Latvia.

Muhammad Imran , Waseem ul Hameed and Adnan ul Haque. (2018). Influence of Industry 4.0 on the Production and Service Sectors in Pakistan: Evidence from Textile and Logistics Industries. *Social Sciences* , 246-266.

Nuruzzaman, M. (2015). Improving Competitiveness in Manufacturing-Wholesaling-Retailing Supply Chains. *Sustaining Competitive Advantage Via Business Intelligence, Knowledge Management, and System Dynamics* , 221-457.

R.J.Orssatto. (2001). *International Encyclopedia of the Social & Behavioral Sciences.* ELSVIER.

Roger Strange and Antonella Zucchella. (2017). Industry 4.0, global value chains and international business. *Multinational Business Review* , 174-184.

Salam, M. A. (2019). Analyzing manufacturing strategies and Industry 4.0 supplier performance relationships from a resource-based perspective. *Manufacturing strategies* , 1-20.

Surajit Bag, Arn esh Telukdarie, J.H.C. Pretorius and Shivam Gupta,. (2018). Industry 4.0 and supply chain sustainability: framework and future research directions. *Benchmarking: An International Journal* , 1-42.

T. Stock and G. Seliger. (2016). Opportunities of Sustainable Manufacturing in Industry 4.0. *13th Global Conference on Sustainable Manufacturing - Decoupling Growth from Resource Use* (pp. 536-541). Berlin: Elsevier.

Yen-Tsung Huang and Wenyi Chu. (2010). Enhancement of product development capabilities of OEM suppliers: inter- and intra-organisational learning. *Journal of Business & Industrial Marketing* , 147-158.