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Effective Implementation Of Industry 4.0 And Its Impact On Marketing Performance

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Abstract

Industry 4.0 (I4.0) is the fourth promising revolution in the history of industrial development and perhaps the most awaited industrial revolution so far. The concrete core of industry 4.0 is the intensive technologies used in manufacturing. These technologies are the internet of things (IoT), artificial intelligence (AI), additive manufacturing and advanced robotics, and many more. The implementation of industry 4.0 gives strength to quality manufacturing and efficiency. The higher performance of the concept of industry 4.0 is making it popular among developed and developing nations. Many quality research is taking place at every level to explore and reveal the interesting findings of industry 4.0 that can affect the industry and the economy. Additionally, industrialists are actively engaged in implementing and making a great success to the industry 4.0. However, there is a need for significant research that can focus on the marketing scope with the implementation of industry 4.0. Therefore, in the current research, the endeavor has been put towards understanding the impact of industry 4.0 on marketing performance. The study incorporates a survey-based analysis to test the hypothesis developed in this context. Multiple linear regression has been applied to bring the findings of the study. Effective implementation of industry 4.0 can lead towards marketing performance if it can enhance product customization and increase customer loyalty. It is the main findings of the study.

Keywords— Customer loyalty; Customization; Industry 4.0; Marketing performance; Smart Manufacturing

Introduction:

Industry 4.0 (I4.0), has become a very popular terminology among industrialists and academicians around the globe. It is because the concept of industry 4.0 is one of the emerging industrial revolutions in recent times (Pereira and Romero, 2017). This industrial revolution has taken a good position among the industrialist, especially in the manufacturing sector. The industry 4.0 have a

different kind of terminologies such as smart manufacturing and digital manufacturing. Before industry 4.0 three industrial revolutions have survived with their pros and cons. The earlier industrial revolution was based on machines, electricity, and information technology (Gilchrist, 2016). The evolution of industry 4.0 took place among German industries in 2011 and later the German government adopted these practices into the mainstream of their national industrial strategic planning (Zheng et al., 2019). After, observing the successful results of industry 4.0 towards smart manufacturing the other nations around the world have also adopted it. The major countries adopting industry4.0 in industrialization are Europe, India, and China (Gilchrist, 2016). The foundations of industry 4.0 are based on advanced technologies largely Internet of Things (IoT), additive manufacturing, advanced robotics, and artificial intelligence and 3D printing technologies, and even many more (Culot et al., 2020). The imperative aim of implementing industry 4.0 is to make the industries effective towards accomplishing the demands of the complex market. Therefore, industry 4.0 mainly focuses on making the industries smarter by implementing the latest digital technologies and advanced networking systems. Industry 4.0 not only makes the industries smart but also helps in making the industries more efficient towards optimum utilization of scarce resources **(**Stock and Seliger, 2016). In today's competitive world, it is very difficult for industries to survive with their existing product and their manufacturing process. There is a major shift has been noticed in the market towards the demand for the products. Therefore, to upgrade the product secondly, to cope up with the changing need of the market both these objectives can be accomplished by implementing the concept of industry 4.0 (Dalenogare et al., 2018). Although, it is a matter of fact that industry 4.0 is still not everyone's cup of tea among the industries. Most of the industries that are adopting these practices are big organizations. Small organizations have yet less adopted the industry4.0 concept. It is because they are mostly not capable to bear the financial burden of installing hi-tech technologies in their industries. But, it is expected that sooner or later to survive in the market there is a need for the adoption of industry 4.0. Overall, the concept of industry 4.0 has numerous advantages such as it helps in strengthening the manufacturing sector further which can boost the economic development of the nation (Sharma and Kushwaha, 2017). Moreover, the concept of industry 4.0 can be a leading strategy towards gaining the competitive advantage of the company.

Industry 4.0 is not only inclined towards the manufacturing firms but it also drives the consumer market and helps in accomplishing the demands. Industry 4.0 helps industries to understand the needs of their valued customers so that industries can respond appropriately by catering to the demand of the industries (Kiraz et al., 2020). Industry 4.0 is featured with various aspects such as efficiency, adaptability, and flexibility that further helps in dealing with the customer's actual need in the competitive market. Based on digital technologies the industry 4.0 takes fasters action to meet the desired demand within the time frame (Lorenz et al., 2018). The marketing efficiency is majorly driven by the technologies used in understanding customer patterns and behavior. These technologies such as big data analysis and real-time monitoring systems for the customers provide several significant information to the industries and marketers (The benefits of the industry 4.0 and how to implement it in your business, 2019). The customer experience can also be improved significantly with the help of using advanced robotics systems whereas, additive manufacturing fulfills the customer demand more closely in a customized manner (Dutzler et al., 2016). In the recent competitive business environment, retaining customers is one of the key agendas for a company that also leads to marketing success. Therefore, with the help of smart manufacturing,

these industries can provide the exact product to their customers with higher satisfaction by using the intelligent system (Brand, 2020). Industry 4.0 provides several benefits to the marketing department such as product design with customer choice, speed, flexibility, timeliness in delivery, and providing customer experience by using customer intelligent systems. The marketers face several challenges specifically towards customer retention which is backed by customer loyalty. But, industry 4.0 leads to higher customization which is one of the key components towards gaining customer loyalty. Further customization and customer loyalty can be leading factors towards the overall marketing performance (Ashraf and Siddiqui, 2020). In this way, the concept of industry4.0 enhances the marketing performance.

There is numerous research available in the field of Industry4.0, but there is hardly any research available connecting industry 4.0 to marketing performance. This is one of the major gaps in the research area of industry 4.0. The significant research questions that have been answered with the help of the present research are:

- RQ-1 Can industry 4.0 effects customization and loyalty?
- RQ- Is customization makes a customer loyal towards a brand.
- RQ2- How industry 4.0 can enhance marketing performance?

To answer the above research questions few objectives have been set these are:

- To study the connection between industry 4.0 and customization and loyalty
- To develop a conceptual model based on the theory.
- To test the hypothesis for understanding the relationships.

To meet the research objective of the present research a model was proposed and further tested. A structured questionnaire based on a set scale has been developed. The data collected with the help of the questionnaire and further tested with multiple linear regression analysis. It is expected that the outcomes of the research can be used by researchers and marketers to utilize it in their upcoming strategies based on industry 4.0.

In the present study after the introduction part, the paper presents the literature review portion, in the next section, the research methodology of the study is narrated, further the analysis and results in part have been covered. In the next section, discussion and conclusion are presented, in the next part managerial and social implications of the study are discussed and the study ended with the final section, which is limitations and future research scope of the study.

Review of Literature:

Several research papers were studied to develop the theoretical foundations and conceptual model of the study. The keywords used for paper selection were 'industry 4.0' 'smart manufacturing' 'industry 4.0 and marketing performance' and 'industry 4.0 and customer'. In context to marketing and industry4.0, there are limited numbers of quality research available. Therefore, a few websites and reports were also incorporated for literature review.

Industry 4.0

The concept of industry 4.0 was firstly introduced in Germany in the year 2011 at the "Hannover Festival". This festival was based on the industrial fair and exhibition with a big crowd. Later, the German government acquired the concept in the mainstream of their nation's industrial strategic mission for industrial development (Moller, 2016). The great success of industry 4.0 attracted many

other nations particularly those nations which are developing their manufacturing skills and output. In Asia, mainly China and India have aggressively adopted the concept of industry 4.0 [2]. The main objective of industry 4.0 is to provide rapid growth to industrial development. On the other hand, the main notion of industry 4.0 also makes industries capable of sustainability (Tiwari and Khan, 2020). These are the strong reasons that why the terminology "industry 4.0" is a trending term among academicians, researchers, and industrialists. The revolution industry 4.0 is mainly based on the advanced networking-based technologies collectively known as the internet of things (IoT) (Udan and He, 2017). Industry 4.0 became popular because it is capable to meet the diversified demand of the consumers globally and it enhances the supply chain system efficiency. Industry 4.0 has emerged as a promising revolution that can give a positive impact on industries, consumers, the market, and the overall economy (Lorenz et al., 2018).

Technology and Industry 4.0

The significant feature of industry 4.0 is the development of the smart manufacturing system, digitalization of types of machinery in the facility, optimizing the use of resources, and providing market some unique solutions to cater to and solve the need of the consumers (Dutzler et al., 2016). Industry 4.0 is loaded with advanced technologies such as additive manufacturing, which is also known as 3D printing. The other technologies are based on the internet of things (IoT), super robots, blockchain technologies, artificial intelligence, and many other associated advanced technologies (Culot et al., 2020). These technologies make the industry digital manufacturing units this is why industry 4.0 also connotes the term smart manufacturing. These advance technologies support in smart manufacturing as it brings crucial behavioral data of the consumers and customers to the manufacturing unit. These data help the manufacturing units to design and redesign the product in the most acceptable form to the consumers **(**Rekettye and Rekettye, 2020).The development of the customized products is mainly based on these data collected from the customers with the use of intensive web-based technologies (Dutzler et al., 2016; Barreto et al., 2017). The advanced technologies convert conventional industries into smart industries. Smart manufacturing is also a leading driver towards sustainable development in the industrial development journey. Therefore, the prime intention of the industrialist is to incorporate the concept of industry 4.0 and make the industries economically and technologically viable.

Smart Manufacturing and Digital Manufacturing

Smart manufacturing or digital manufacturing is mostly used in context to industry 4.0. The demand among the consumers has been increased so far that too for quality and tailored products **(**Rekettye and Rekettye, 2020). The conventional manufacturing system is not sufficient enough to produce such products that can cater to specialized demand. In this context, there is an emergence of technology-intensive manufacturing based on advanced networking, artificial intelligence, and several other promising technologies. The use of hi-tech technologies converts these conventional manufacturing into a smart manufacturing system. Digital manufacturing is one of the key systems to meet the exact demand of the customer for example use of a 3D printing system (Culot et al., 2020). The upcoming time is for digital manufacturing or smart manufacturing. Digital manufacturing is beneficial for marketers and industrialists as it helps in real-time monitoring of the product from the manufacturer to the consumer with the help of advanced technologies. Smart manufacturing provides aid to show scientific proofs which also helps in acquiring quality

certifications. Smart manufacturing is more helpful for those industries which are supposed to produce a bulk volume of units such as auto industries, consumer durable industries, etc. (Tao et al., 2019). However, there are several obstacles in adopting digital and smart manufacturing, for example, it requires several changes in existing facility layout of the firm (Riel et al., 2017).

Industry 4.0 and Marketing Performance

Industry 4.0 concept can cater to the demand for the quality product raised by the market. Hence, there is a significant role of industry 4.0 in contributing towards the marketing performance (Rekettye and Rekettye, 2020). The marketing performance is measured by various parameters for example customer retention, customer loyalty, customer satisfaction, sales volume, and the performance of the product in the competitive market. Although these parameters are not complete many factors play a crucial role in marketing performance (Naglic et al., 2020). However, the main pillars of marketing performance depend upon the product and the customer. Industry 4.0 gives extra driving force to the product and power of choice to the customer. Hence, there is a strong and significant correlation between industry 4.0 and marketing performance **(**Rekettye and Rekettye, 2020).

Product Customization and Customer Loyalty by Implementing Industry 4.0

Industry 4.0 is a promising concept towards delivering value to the customers. Among, many marketing advantages customization of products is also one of the key benefits to the customers as well as for the entire market (Fels et al., 2017). Customization refers to the development of the product by the choice of the customers. The customization is well facilitated by industry 4.0 because the intensive technologies used in industry 4.0 give a superpower to the manufacturing industries **(**Rekettye and Rekettye, 2020).For example, with additive manufacturing, it is possible the product can be printed as per the requirement of the customers. There are several examples of customizations of products under the industry 4.0 regime. In today's consumerism world, every customer wants to fulfill demand with the help of customized products. The customer gets extreme satisfaction and delightfulness after receiving the product the way he/she desired. Some evidence shows that customizations lead to customer loyalty (Muller et al., 2018). The marketing performance can also be increased by retention of the customers. Customer retention is also one of the major challenges for marketers. Because of the high level of competition as most consumers switch to another brand or customers become less loyal. However, industry 4.0 helps in customizations of the product that lead to customer loyalty, and further, it connects to marketing performance **(**Rekettye and Rekettye, 2020; Muller et al., 2018).

Research Methodology:

To bring the outcome of the present research significant variables have been explored from a review of the significant literature. Four latent variables have been taken from the study to develop the measurement model and scale. Fig.1 shows the measurement model of the study based on the literature review. All, four latent variables used in the study are the effective implementation of industry 4.0 (EII), product customization (PC), customer loyalty (CL), and marketing performance (MP). Each latent construct was measured by observable variables adopted from the previous studies. Table I shows the observable items of the study with their source. The questionnaire was developed containing 12 items for the study with basic demographical information based entries. The items were measured based on a five-point Likert type scale between 1to5 whereas, 1 is for

strongly disagree and 5 is for strongly agree. The final questionnaire was checked with academic experts before it was administered.

Hypotheses Development:

The following hypotheses have been developed based on the measurement model.

- H1 Effective implementation of industry 4.0 (EII) positively leads to product customization (PC).
- H2 Effective implementation of industry 4.0 (EII) positive impact on customer loyalty (CL).
- H3 Product customization (PC) has a significant relationship with customer loyalty (CL).
- H4 Product customization (PC) has a significant relationship with marketing performance (MP).
- H5 Customer loyalty (CL) has a significant relationship with marketing performance (MP).

Data Collection:

The data collection has taken place on educated consumers especially those who have completed their post-graduate and above. The purposive sampling technique has been applied so that the data can serve the purpose of the study. The data collection was done with the help of google forms. The link of the questionnaire was sent to many academic what's app groups belongs to students of higher studies and faculty members. Finally, 112 samples were received after the filtration as incomplete and vague responses were discarded.

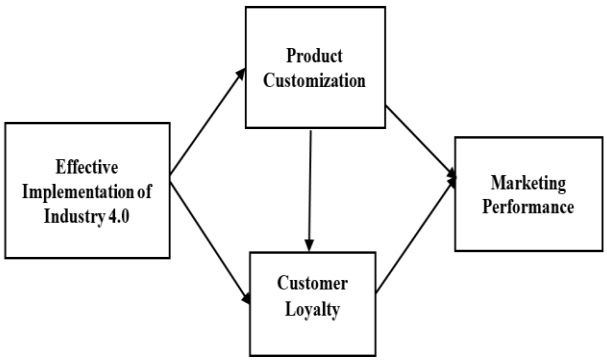

Fig.1 The measurement model

TABLE I. MEASUREMENT SCALE

Latent variable	Observable variable	Source
EII	EII1 Industry 4.0 implementation is relevant for market effectiveness. EII2 Implementation of industry 4.0 is imperative for consumer benefits. EII3 Implementation of industry 4.0 can improve industrial developments.	(Muller et al., 2018)

PC	PC1 If I get the design of a product as per my thinking it makes me happy. PC2 The product designer should consider my engagement in product design. PC3 I cannot complain if the product is as per my choice.	(Turner et al., 2020)
CL	CL1 If the product design is based on my choice I will repurchase it. CL2 If the product is made according to my satisfaction standard, I will not switch to another brand. CL3 If the product is designed according to my needs, I can pay an even higher price.	(Izogo, 2017)
MP	MP1 Industry 4.0 improves product experience. MP2 Industry 4.0 can help in satisfying customer needs. MP3 Industry 4.0 has the potency to enhance sales.	(Das et al., 2019; Saroha and Diwan, 2020; Grønholdt and Martensen,2006)

Data Analysis and Results:

To check the relationship between the variables linear regression analysis was used with help of Statistical Package for the Social Science (SPSS-22). Before, conducting the regression analysis the demographic analysis was performed with a simple percentage method. It was found that 26.78 percent of the respondents were female and 73.21 percent were male respondents. The education of 56.25 percent of respondents was post-graduate, 43.75 percent were with higher educational degrees. The age group of the respondents between 25 years to 35 years found 46.42 percent, between 36 years to 45 years was 30.35 percent, between 46 years to 55 years it was 16.07 percent and above 56 years, it was only found 0.07 percent. In the next step, the scale reliability was checked with the help of Cronbach alpha measure with the help of SPSS. The result of the alpha value found for EII was 0.736, for PC it was 0.690, for CL it was found 0.829 and for MP it was 0.789. The Cronbach's alpha (α) was found satisfactory for all the latent variables used in the study. The Kaiser-Meyer-Olkin (KMO) and Test of Sphercity were performed and the results show that the sample is found adequate (Df= 0.758) and significant. In the next step, the factor analysis was performed to understand the power of the observable variables used in the study. The factor loadings found for all the items are (EII1=0.644, EII= 0.663, EII= 0.871; PC1= 0.738, PC2=0.678, PC3=0.798; CL1= 0.777,

CL2=0.719, CL3=0.748; MP1= 0.713, MP2=0.713, MP3=0.772). The factor loadings in the study for all the items were found >0.5 which is satisfactory.

In the next step, multiple linear regression analysis was performed with the help of SPSS software to test the significance of the relationship established in the model and to test all the five hypotheses in the study. The regression results confirm the relationship between dependent and independent variables. The results of the regression analysis are provided in the Table-2.

Table-2 Path Co-efficient summary

Hypotheses	**Path**	**Beta (β)**	**t-value**	**P-value**	**Result**
H1	EII→PC	0.490	8.269	0.006	Accepted
H2	EII→CL	0.308	0.892	0.612	Not accepted
H3	PC→CL	0.429	13.262	0.000	Accepted
H4	PC→MP	0.244	2.365	0.000	Accepted
H5	CL→MP	0.532	16.212	0.000	Accepted

Note: Significance level P< 0.05, t- value ≥ 1.96

The stepwise regression analysis performed, as there are multiple dependent and independent variables are present in the study. In the first part, the regression analysis of the impact of effective implementation of industry 4.0 (EII) was checked on product customization (PC) and customer loyalty (CL). In this case, the EII is an independent variable whereas PC and CL are the dependent variables. Here, the standardized coefficient for the EII on PC was found positive (β= 0.490) and significant. The t-value (t=8.269) found >1.96 and the p-value (p=0.006) is significant at 95 percent level of confidence. On the other hand, the impact of EII on CL found positive but insignificant as the results (β= 0.308, t=0.892, p= 0.612) are not supporting the relationship. In this way, the H1 is accepted but H2 is not accepted in the study. Further, the impact of PC on CL is also found positive and significant with the results (β= 0.429, t=13.262, p= 0.000) at 95 percent level of confidence. Thus, H3 was accepted based on the results. In the next phase, the two predictors PC and CL were checked with the MP. The results (β= 0.244, t=3.365, p= 0.000) in the case of PC on CL was found positive and significant. Additionally, CL on MP was also found significant and positive where, β= 0.532, t=16.212, p= 0.000 was found in the study. These results favor both the hypotheses H4 and H5 and hence are accepted in the study.

The results found the value of R^2 for all the dependent variables while predicting the outcomes of the study. The R^2 value suggests the predictive power of the dependent variable in explaining the

independent variable. The R^2 value found 0.289 (EII and PC) and 0.190 (EII and CL). Further, the R^2 value found 0.429 (PC and CL). The R^2 value found 0.510 for PC and CL on MP. All these values of R^2 in the study found significant and positive for the relationship shown in the study.

Discussion and Conclusion:

The study found interesting results based on the regression analysis. The implementation of industry 4.0 (EII) is positive and significant in explaining product customization (PC). This represents a simple relationship, which we have seen in the literature that industry 4.0 is a strong predictor that explains or contributes to product customization. It is again confirmed from the study that if industry 4.0 is implemented effectively can lead to product customization and which is favorable for consumers so as for the market. Many consumers desire product customization as it gives more power to consumerism. The R^2 value suggests that approximately 29 percent is the contribution of EII in explain PC, which is a fair value. The results show that EII is positively correlated with customer loyalty (CL) but, found insignificant. It suggests that the factor, effective implementation of industry 4.0 alone is not able to lead the customer loyalty. The R^2 value is also very low it is around 19 percent contributing to explaining customer loyalty. Therefore, we can say that there is a week correlation between EII and CL. The product customization is positively significant with customer loyalty. The results indicate that industry 4.0 cannot directly influence customer loyalty but if it comes via product customization, which makes it significant. The R^2 value found approximately 43 percent, which is a fair value it means that the PC contributes 43 percent in predicting or explaining CL. The previous studies favor the present result that product customization is significant for customer loyalty [30]. Product customization is significant for marketing performance as consumers and customers desire it. Product customization (PC) can enhance the sales volume as it increases the CL also shown in the study. In the same way, CL is also a significant indicator for marketing performance, and hence the relationship found in the study significant. The R^2 value found approximately 51 percent for both the predictors PC and CL in explaining MP. The results show that the PC and CL both are found most strong predictors for marketing performance (MP).

Industry 4.0 is one of the responsible factors in making product customization easier than it was ever before. The results of the study have given some new insights into industry 4.0 and its connections with marketing performance. Product customization on a large scale can be only possible if industry 4.0 is implemented effectively. The research says that product customization is a significant factor in developing consumer loyalty not only in the service sector but also in the general product market **(**Ashraf and Siddiqui, 2020). The interesting concept is seen in the study that industry 4.0 is not leading directly to consumer loyalty it can connect with consumer loyalty only when it goes via product customization. It is because the general customers are not very much keen on understanding what industry 4.0 is but they are more interested to know that it can miraculously lead to aid in product design and redesign what is called a higher level of customization. Moreover, product customization and customer loyalty lead to marketing performance but, again industry 4.0 cannot be directly associated with marketing performance unless it is not doing anything for the market. If the industry 4.0 is making the production, efficient and effective may be in term of volume or it is only benefiting to the industry. In this case, the customer will not be delighted enough and the customer will be neutral towards industry 4.0.

However, this study has shown a new perspective that industry 4.0 is not only for the industrialist but, also very much for the consumers. This study has revealed few marketing factors, which can be affected by effectively implementing in industry 4.0, and this concept is the novel contribution of the present study.

Managerial and Social Implications:

The results of the study can be beneficial for the marketers who can correlate with the results of the study with the production department to enhance the results of the market. Secondly, the marketing strategies and promotion campaign can be improved by incorporating the features of industry 4.0. Society at large can understands with the help of the results that customization is important so that the waste can be avoided. Because the product which is not serving the purpose of the customer goes to waste. Waste reduction in this way can be a step towards sustainability and society is one of the key integral parts of the sustainability measures.

Limitations and Future Research Scope

The present study has also few limitations as other studies have had previously. The important limitation found in the study is the sample size, which is very low. It can create hurdles in generalizing the results to the whole population. The literature is comparatively less in the area of marketing and industry 4.0 although both have strong correlations. These limitations allow the researchers in this field that they can go for further research removing these limitations and modifying the model for new outcomes.

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