



REVISITING CUSTOMER INVOLVED VALUE CHAINS UNDER THE CONCEPTUAL LIGHT OF INDUSTRY 5.0

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Industry 5.0, Advanced Personalization, Customer Involvement, Product Development, Value Chain.



ABSTRACT

Industry 5.0 is upon us and with the mass personalization concept, it seems that customer value chain involvement (CVCI) will be the gravitational center for implementation process. Drawing from the axiomatic premises of Industry 5.0, this paper accentuates the role of CVCI in the coming era. In the light of industry 5.0 principles, the present article particularly focuses on the need for human touch factor in product development and mass personalization concepts and proposes a value creation model to be an initial guideline for practitioners and to foster ideas pertinent to the fifth industrial revolution.

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1. INTRODUCTION

Due to ever-changing and fast-growing consumer needs and customer demands, we will probably not encounter a halt in technological advancements or AI developments. The fourth industrial revolution caused these advancements and developments to skyrocket and provided significant production, logistics, quality management costs savings to the organizations that opt for adopting such mechanisms (Nahavandi, 2019). However, Ozdemir and Hekim (2018) argue that societal effects of Industry 4.0 have been understudied and the mainstream of ideas and visions have been mainly based on technological advancements of the fourth industrial revolution. Buhr (2015) also asks how the society will benefit from these innovations as a whole because industry 4.0 fundamentally ignores the human costs and labour problems in the first place, for

the sake of attaining ultimate efficiency and optimization levels (Nahavandi, 2019).

Industry 5.0 can be a remedy for such probable ramifications of the fourth industrial revolution. In contrast to what Industry 4.0 imposes, AI is meant to work with humans, not replacing them. Fifth Industrial Revolution will be combining humans and machines to increase creativity and efficiency (Nahavandi, 2019). Industry 5.0 denotes engaging people in manufacturing processes while conserving automation to promote continuous improvement, value-adding activities and avoid waste (Mekkunnel, 2019).

The term was coined in an article published by Michael Rada in 2015 (Martynov et al., 2019). "...focused on combining human beings' creativity and craftsmanship with the speed, productivity and consistency of robots" is the definition of industry 5.0 given by the European

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Economic and Social Committee (EESC, 2018). The government of Japan also addresses the issue of industry 4.0 by introducing the term society 5.0 which intrinsically asserts that advanced technologies such as IoT or AI are for the benefit and convenience of each person and society in its entirety (Skobelev and Borovik, 2017).

In line with these assertions that underline the prominence of people and societies, another perspective that prioritizes the 5th industrial revolution before its predecessors is the intense competition and customer demand which renders mass production insignificant and need for adaptation to the specific needs of each customer salient (Mekkunnel, 2019). The fifth industrial revolution will focus on the personalised demands of customers by embracing modern manufacturing techniques. However, there will be substantially more human touch in the advanced manufacturing processes to satisfy and meet ever-changing market demands providing more flexible solutions (Javaid and Haleem, 2020).

Many companies are looking for new ways out of declining profits and shrinking markets. Conventional business models are increasingly replaced by open business models which ultimately seek to integrate consumers into organizations' value chains (Kortmann and Piller, 2016). Particularly in product development processes, the open business concept promises a notable potential, considering the product failure rates (Leahy, 2013). One of the key aspects of open business model is the involvement of customers in value chains. It essentially refers to exposing customers to the value-adding activities and interacting with players, products, processes and components of the chain instead of passive participation like a spectator in a product expo (Mascarenhas et al., 2004). It has been reported that embracing such open business models can be rewarding in terms of sustainable growth and profitability. According to Alexander and Nicholls (2006), consumer involvement may induce loyalty, awareness, and positive word-of-mouth which eventually would build up to enhanced competitive advantage and improved profitability. Moreover, involved consumers can develop a more enduring relationship with the brand or organization owing to their engagement with the products or services (Leong et al., 2019).

Co-creation or open business models have been adopted for decades. For example, in 1995, Volkswagen announced "Polo Harlequin" model that featured different colored parts which were determined by customers (Mascarenhas et al., 2004). However, the advent of advanced technologies and user-friendly communication platforms have utterly reshaped the way consumers participate in product design and development procedures. BMW's co-creation labs (Kortmann and Piller, 2016) or DHL's innovation

centers (Fournier, 2019) can be examples of such customer involvement models.

In today's fast-paced markets, understanding customer needs and values has become a fundamental necessity for successfully defining, designing and introducing new products or services (Donaldson et al., 2004). In line with this objective, firms constantly pursue new paths to foster value both for consumers and themselves (Voss and Kock, 2013). Donaldson et al. (2004) propound that organizations strive for such effective tools to capture and analyze the customer value perceptions. Fearn et al. (2012) argue that integrating shared value is the key ingredient in value chain approach. They posit that this coalescence has a potential not only in exploiting opportunities but also in resource usage efficiency.

Following the preceding line of reasoning, we believe that the 5th industrial revolution can expedite the awaited perspective alteration to realise the mentioned multifarious goals. In this context, the current paper explores the personalization aspect of industry 5.0 and immediately after examines consumer involvement concept within value chains. In the penultimate section, critical perspective change of the 5th industrial revolution is discussed through the lens of consumer involvement notion. This article is concluded with a model proposal and suggestions about future research frontiers.

2. THE PROMINENCE OF PERSONALIZATION IN INDUSTRY 5.0 ERA

Humans are the key players when it comes to innovation and personalization, which is what industry 4.0 mainly lacks (Doyle-Kent and Kopacek, 2019). Industry 4.0 primarily focuses on customisation through automated manufacturing systems such as Internet of Things (IoT) or cyber-physical systems (Lu and Xu, 2018). The extreme pursuit of profitability has led to systems where the human touch is diminished every single day.

That being said, time incessantly brings out new notions, and ever-changing mechanisms of societies shift the paradigms that are once considered immutable. Today, mass customization capabilities that have been fuelled by the technologies of industry 4.0 are becoming insufficient in addressing highly customized requirements of customers (Østergaard, 2018). Customers want product/service bundles and experiences that are shaped and personalized for them (Mascarenhas et al. 2004). They want to feel special. For example, today configuring and purchasing a car online is definitely nothing like buying a car in the 20th century. People want to stand out, be seen as unique, and depict themselves through their purchasing choices. This is where Industry 5.0 comes in, bringing the

desired human touched personalization to products and services (Østergaard, 2018).

The fundamental rationale behind Industry 5.0 is that it sets about increasing collaboration between humans and manufacturing systems to meet the personalized demands of customers (Javaid and Haleem, 2020). Industry 5.0 is becoming an increasingly popular notion owing to the rapid elevation in individualized requirements of end-users. This mass personalization has led to the integration of artificial intelligence into human life for boosted human capabilities (Martynov et al., 2019).

The fifth industrial revolution is meant to provide better synchronization amongst human and machine workers to attain effective and faster outputs. An important notion is that collaborative robots (cobots) replace traditional robotic workers to work in harmony with human employees. Robots provide the necessary hard work for preparation of the product and scrupulously meeting specification requirements, enabling humans to add the finishing touches to the product (Doyle-Kent and Kopacek, 2019) and giving them a certain kind of “design freedom” in which products can be more individual-focused while preserving the efficacy of digitalized automation systems. In addition, owing to improved flexibility of human - cyberphysical systems, customer demands can be met and even exceeded (Lu, 2017; Ozdemir and Hekim, 2018). Boston Consulting Group also reports that companies that combine flexibility, adaptability, and comprehensive experience of humans with the technology have their cash flow and enterprise value boosted faster than other firms (BCG, 2020).

Indeed, consumer attitudes and purchase behaviours are changing. Products with distinctive human imprint and craftsmanship are becoming more attractive (Østergaard, 2018). Consumers don't mind if technology is being used during production. What they desire is the personal mark of human crafters and designers who produce something special and unique for them (Ozkeser, 2018). There are even firms reserving more space for human craftsmanship (Atwell, 2017). According to Paschek et al. (2019), such unique demands will be rising in the future, on account of the feeling of luxury, bringing forth a new kind of personalization that businesses must handle.

In this new era of B2C business models, what will be the role of end-users? How will they add value and impact the value chain? It is a question to be asked if we are to examine Industry 5.0 healthily in the light of mass personalization since industry 5.0 places humans at the center of value chains and claiming the mass personalization as a tool to improve the overall value.

3. CONSUMER INVOLVEMENT IN THE VALUE CHAINS

Today, consumers are actively taking part in the production processes of the products they purchase. They can design their own personal computers, shoes or even motorcycles (Humphreys and Grayson, 2008). Examples of consumer involvement started decades ago. The famous “Harlequin” campaign of Volkswagen started in 1995 is one of the said involvements wherein customers were able to actively participate in designing process (Mascarenhas et al., 2004). Moreover, involvement is not limited to B2C business models. For instance, Qualcomm adopts an open innovation process where their products are co-created with their customers such as Samsung or Apple (Kortmann and Piller, 2016)

Peter and Olson (1987) describe involvement as the degree of personal pertinence that consumers feel for a certain activity or a process and achieving consequences and obtaining value from them. Consumer involvement is based on human learning theory to understand the expectations and goals of consumers, and segmenting them as per the level of involvement. Today, it is known as consumer involvement theory (Lesschaeve and Bruwer, 2010).

Involving customers in the manufacturing process has been remunerative for companies and it has been being used for some time. But more importantly, customer involvement yields competitive advantage and sustainable profitability (Alexander and Nicholls, 2006). It also leads to other achievements such as improved delivery service, inventory reductions or improved quality (Sahay, 2003). But from the perspectives of customers, successful involvement can produce significant advantages such as improved loyalty or positive word-of-mouth communications (Yeung et al., 2002), granting firms opportunities to establish strategic alliances. With such relationships, customers are more likely to engage with the firm and extend their interest beyond their routine transactions, consequently providing more value which otherwise unattainable (Leong et al., 2019). To our understanding from the literature, these alliances formed through involvement generate substantial impetus for two major processes of the businesses; value-adding and product development (Figure 1), which will be explicated in the remainder of the paper.

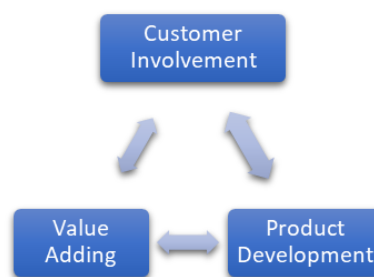


Figure 1. Interrelation of Involvement
Source: Authors

According to a definition, value is the comparison of benefits and acquisition costs (Walters and Lancaster, 2000) happening during a transaction. But more essentially and pertaining to the context of this paper, value is an experience flowing from sources to different recipients, creating the value chain (Feller et al., 2006). People, processes or products that add value to a service or product form a value chain. In these value chains, the value of the customer should be recognized, prioritised and enhanced (Prahalad and Ramaswamy, 2003) at every step of the value chain, in order to achieve customer satisfaction and retention (Mascarenhas et al., 2004).

Value chain approach is primarily contingent upon open communication, trust, pursuit of understanding customer perceptions and ultimately attaining amplified value at every level of value chains (Fearne et al., 2012). To achieve these goals, firms need to adopt customer-centric perspective in which customers are regarded as the first link of the value chain (Walters and Lancaster, 2000). Consumers are recently after more personal experience, excitement and engagement (Mascarenhas et al., 2004). Hence, value chain understanding will provide not only better decision-making through logical resource allotment for specific customer segments but also mutual benefits from the creation and realisation of *value-adding* along the chain (Fearne et al., 2012).

An important aspect of value chain is outsourcing certain processes to customers, highlighting the exchange value perspective. A fitting example of this perspective is what IKEA does by selling unassembled furniture with decreased costs as a result of customer involvement in the value chain process (Humphreys and Grayson, 2008). In this particular example, the labour cost of assembly is basically transferred to customers, but through this procedure their benefit/cost (value) perceptions are manipulated, granting the firm a possible long-term oriented value chain. Such a co-creation mindset also brings us to the second key process in the consumer involvement framework; new *product development* (NPD).

NPD is a vital source of competitive advantage (Lin et al., 2013). Firms that properly analyse and fulfill consumer needs can achieve major market success through NPD (Lesschaeve and Bruwer, 2010). While NPD is an integral part of production function of the organizations, customer involvement has positioned it right on the cross-roads of multiple functions such as marketing or supply chain management. Today, many companies systematically integrate their customers into their product development processes using advanced tools at their disposal (Xie and Jia, 2016) to benefit from their ideas and also to improve value chain efficiency.

Involving customers to the value chain as a “product development player” has two rudimentary benefits for the organization. First, involving customers in product development processes may provide notable insights (key design features or previously unidentified customer requirements) to company from consumer’s perspective (Leahy, 2013). Moreover, it reduces product failures by ascertaining that the product being co-developed is needed and deemed useful by customers (Lesschaeve and Bruwer, 2010). Secondly, bringing customers closer to the firm, in other words, connecting producers to consumers can significantly ameliorate the links in the value chains and augment the total value added to the system (Holweg and Pil, 2001).

Products, existing or newly developed, can only generate value if they meet customer needs and desires, provided that benefit/cost ratio is within reasonable limits (Mascarenhas et al., 2004). Companies are in intense competition to answer those needs. Using advanced communication tools to co-create value will undoubtedly remain a substantial instrument for creating competitive advantage. But how should the consumers and customers be regarded in the era of Industry 5.0 wherein value-adding capability of personalization is deemed cardinal and people are considered intrinsic source of value? What will be their role in the value chains and product development processes?

4. ROLE OF CONSUMERS IN THE ERA OF INDUSTRY 5.0

A firm can involve customers for their insights but may fall short of shaping their products or services accordingly. On the other hand, personalization might be implemented for customer segments as per their purchase behaviours or other big data, without involving them. But today, customer involvement and personalization, the two key aspects of this study, although seemingly distinct concepts, are in fact intertwined in many business models and functions (Blasco-Arcas et al., 2014). In this penultimate section of the paper, we will first discuss how and in what form these two essential concepts of industry 5.0 will bring change into our way of thinking and doing business. Secondly, we will explore the indications of this change for practitioners in terms of two involvement aspects that this study primarily aims to elucidate; value-adding and product development, through the lens of industry 5.0 precepts.

4.1 Social Responsibility and Needs

Throughout history, facts about the market affected the business models, revealing new ideas (Baden-Fuller and Morgan, 2010) and sometimes inducing drastic changes termed as revolution in the process. Similar to the 4th industrial revolution, all previous industrial revolutions were born out of facts such as productivity or efficiency (Preuveeneers and Ilie-Zudor, 2017). The industry 4.0

concept is essentially intended to automate most of the processes, if not all, and produce large chunks of products with extreme efficiency to maximize profits.

Particularly normative dimensions of Industry 4.0 such as being socially responsible or ethical have been understudied and their impacts on society are still partly unbeknownst to us owing to its relatively recent appearance. Whereas some contend that highly interconnected AI will be a trigger for a dystopic future, others are concerned about the gradual reduction of the human workforce due to the fact that cyber-physical systems are replacing them (Ozdemir and Hekim, 2018). These concerns ineluctably have brought forth terms such as Society 5.0 or Industry 5.0 which emphasize that advanced technologies such as IoT or AI are for the benefit of societies (Skobelev and Borovik, 2017).

Industry 5.0 diverges from its previous counterparts by focusing on the human factor, not technology or company based prospects (Mekkkunnel, 2019). What has intrinsically driven this particular change both in academia and practice? Kotler and Armstrong (2014) state how business models evolved into more socially and environmentally responsible systems that adopt different concepts throughout the years. We also concur with this opinion and propose that needs of individuals/society and social responsibility concerns have impelled this brand new industrial revolution in congruence with the arguments presented in sections two and three (Figure 2).

Succinctly, it would be safe to say that concerns about industry 4.0 will palliate as more people start to express themselves to the full extent. What's more, the rising demand for unique and personalized products will render human creativity more valuable than ever before (Mekkkunnel, 2019). The change will be in the direction of consumer - producer integration, resulting in redefined value chains (Kortmann and Piller, 2016).

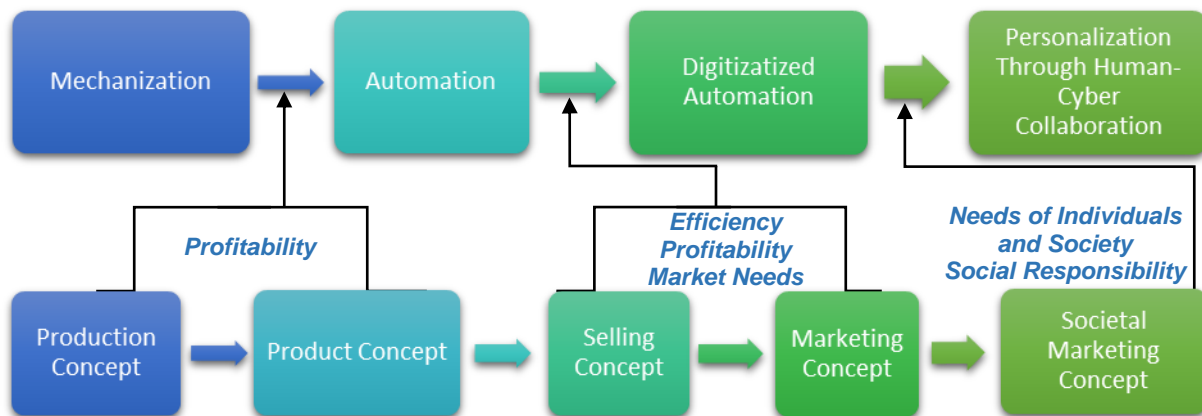


Figure 2. Influence of Market Orientations on Industrial Revolutions
Source: Authors

4.2 From Mass Customization to Mass Personalization through Value Chain Approach (Value-Adding Aspect)

As mentioned, customer involvement has a crucial role in both value-adding and product development activities. Their intertwinement, particularly in the era of industry 5.0, has prominent implications. In this section, we will explicate these implications and how this new era might change our CVCI perspectives.

Firms increasingly adopt the individualization concept within their value chains. Congruently, mass customization model gave rise to fundamental changes in product development processes. The idea of the personalized mass product has been gaining ground in value chain building strategies (Brettel et al., 2014). Mass customization is a business strategy that aims to address individual demands by involving customers in product development processes (Pine, 1993). Industry

5.0 will accelerate this transition in which the demands of every single customer are fulfilled. The transition basically refers to a shift from mass customisation of industry 4.0 to mass personalisation of industry 5.0 (Javaid and Haleem, 2020), for the purpose of bringing the desired human touch factor (Nahavandi, 2019). Human touch here is of paramount importance since the notion of mass personalization constitutes the societal driver behind Industry 5.0 which is based on employing the technology to reinstate the workforce to the industry and answering the growing demand for human design and craftsmanship for personalized needs (Mekkkunnel, 2019). In other words, it is about proclaiming that technology is not for technology, but for humans.

These arguments bring us the first implication; mass customization is gradually being replaced by mass personalization with an increased human touch. Manufacturing lines will be employed with high-speed cobots and humans with critical and flexible thinking to

produce exceptional and unique items for customers, inflating the relative value for them (Doyle-Kent and Kopacek, 2019). Since value management is about the need for novelty and innovation (Ozkaser, 2018) and personalization denotes the feeling of high quality and relevant / unique experiences for customers, strategically involving customers in firms' value chain can yield long-term loyalty (Haleem and Javaid, 2019) as well as purchase intention and consumer satisfaction (Kamali and Loker, 2002). Contingent on the complexity of the product, by wisely designating the key points in the value chain where customers can add more value and sort of value-adding activities to which customer are expected to attribute their knowledge or expertise, firms can expand the total value added by customers considerably (Kortmann and Piller, 2016)

Finally, it can be propounded that firms wielding industry 5.0 perspective may deepen the connection with their customers through "the personalization" feature. Even more, firms can deploy the CVCI strategy that Mascarenhas et al. (2004) set forth to intensify the aforementioned link by socially involving customers for magnified trust and confidence.

4.3 Personalization through Involvement within Product Development Framework (Product Development Aspect)

Being innovative in the progression of product development demands hard work and dedication from most of the stakeholders, if not all. But it is indubitably not impossible. Because there are examples demonstrating the participative innovation being converted into profits. For instance, Dell's business model comprises unrivaled value chains where customers are spryly involved in personalization of their computer configurations (Teece, 2010). Microsoft incorporates their customers' insights and recommendations into their testing processes before finalizing the products or Harley-Davidson holds close-knit relationships with their current and potential customers to discuss new designs and models (Mascarenhas et al., 2004).

Adopting such business models will probably continue to bring success owing to enhanced links in value chains and a greater understanding of customers (Kortmann and Piller, 2016). Moreover, implementing successful personalization strategies by responding directly to customer needs, firms can mitigate product failure risks which have been a critical setback for their development strategies and cycles. The rate of product failure is around 40 percent depending on the type of industry (Castellion and Markham, 2013). On many occasions, failures occur because in the early product development processes, valuable customer insights are not acquired and analysed to meet the needs and contextual requirements of customers (Lesschaeve and Bruwer, 2010). That being said, involving educated consumers

in the product design process and addressing directly consumer needs can lead to sustainable success in the market (Leahy, 2013).

However, it is imperative to comprehend that next industrial revolution is not about a fundamental change in how we conduct or perceive current businesses. 5th industrial revolution is rather a shift of perspectives towards a more humane approach to current business environments wherein it is predicted that personalization will be all-time high in demand (Paschek et al., 2019). We will hear more of concepts such as build-to-order (Holweg and Pil, 2001) or assemble-to-order systems (Song and Zipkin, 2003), end-to-end engineering (Paschek et al., 2019) or open innovation (Chesbrough, 2003).

In line with the preceding arguments, the issue of personalization brings us the second implication; the impact of personalization during the product development on value creation processes. More inputs obtained from the customers and integrated into product development procedures can yield more significantly satisfying returns. In line with this inference, Kortmann and Piller (2016) exemplify "servitizing manufacturer" model which highlights the quality of service provided by the manufacturer during interactions with the customer (both before and after sale). Thereby furthering the inference that; not just during the sale, but customers' contribution to value creation processes or the product itself should be deemed omnitemporal. Another vital aspect of the tapestry is the type and characteristics of personalization aimed at product development. Kim and Mauborgne (2000) provide a convenient illustration named utility levers. The concept attests to customer's benefit expectations (remember from benefit/cost ratio) for a new product or service in terms of economic use of money, time, energy, environment friendliness, safety, etc. According to Mascarenhas et al. (2004), customers in a CVCI can disclose information about their levers. Hence, firms that successfully integrate these levers into their manufacturing processes will also attain the capability to design unique and personalized products.

To illustrate the idea, assume that m number of customers providing personal insights about product i being converted into value by relevant company employees (c_{mi}) and also the regular value produced by production or supply chain crew (p_i). Consequently, the firm will have their total generated value swollen exponentially, as a result of direct customer – producer (or engineer, designer, etc.) collaboration which we term as "advanced personalization", depicted as;

$(p_i \times c_{mi})$: value generated as a result of advanced personalization for i^{th} product.

But on the other hand, firm can gather crucial information about its product i through indirect

communication channels such as user forums or social media. We term this process as “analysed total secondary customer inputs” (c_i). Consequently, we can delineate the total value generated for product i (V_i) as;

$$V_i = c_i + \sum_{k=1}^m (p_i \times c_{ki}) \quad (1)$$

p_i : value added by producer for i^{th} product, c_{ki} : value added by k^{th} customer for i^{th} product, i : i^{th} product, k : k^{th} customer

The foundational rationale behind this mindset is actually empowering the production processes and producers in particular, by engaging customers through advanced technologies without omitting the human factor. Accenture (2019) expounds this mindset in figure 3 in which consumers are engaged in every level of the process to empower the designers, engineers and others. Consequently, the company will be able to increase the total value drastically with hyper-compressed processes whereby development cycles are reduced to days from months.

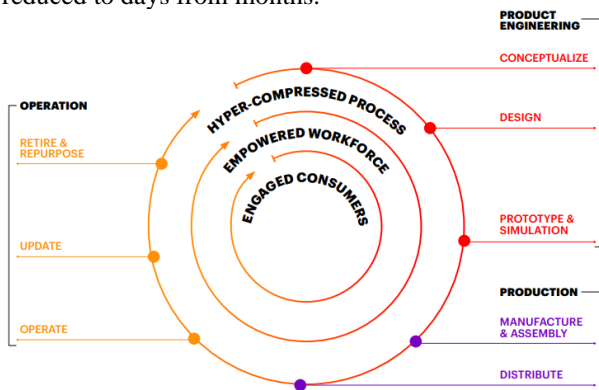


Figure 3. Empowering Employees with Engaged Consumers
Source: Accenture, 2019

By working closely with customers, firms can significantly increase customer satisfaction and customer loyalty (Kortmann and Piller, 2016). Therefore, the human aspect (both customers and employees) in the entire process which 5th industrial revolution is fundamentally based on will continue to gain ground and be the center of gravity for operations.

5. CONCLUSION AND FINAL REMARKS

Social ramifications stemming from the extensive automation idea of industry 4.0 are not thoroughly studied (Ozdemir and Hekim, 2018). Particularly, the human factor is overlooked in business models, raising concerns both at individual and societal levels. Due to growing concerns, society 5.0 and industry 5.0 concepts were introduced to attract attention to the collaboration of humans and cyber-physical systems to empower the process without omitting the human factor. In this paper, we attempted to underline this empowerment in accordance with the customer chain value involvement (CVCI) perspective.

Our deductions from the CVCI and Industry 5.0 perspectives lead to two fundamental implications. First, mass customization concept is transforming into mass personalization accentuating increased human touch in the entire process due to the elevated awareness of customers. Customers are becoming more informed, perceptive and demanding. They desire more than a simple transaction that meets their expectations. They pursue unique experiences and engagements that would add meaning to their lives. In order to respond to such a sophisticated demand, managements need to be extraordinarily customer-centric and should reconsider their business models and CVCI strategies (Mascarenhas et al., 2004) and exploit this opportunity to enhance value-adding activities. On the other hand, the second implication postulate that producer – customer engagement and interaction during product development can exponentially increase value creation and empower the production process. The contribution customers provide should not be constrained to a single process or period but be considered timeless, leading to advanced personalization that industry 5.0 predicts. Furthermore, if analysed and integrated correctly, inputs from secondary communication channels such as forums or new media may also add significant value to the product and the firm. These inputs may be directly about a product or not, but intrinsically consist of individual or societal needs and concerns. In the light of the implications, we provide a value creation model that can be considered as a guideline for future studies (Figure 4).

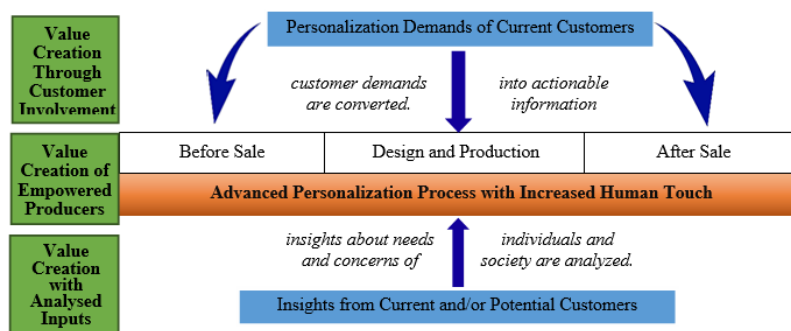


Figure 4. Value Creation Model in Industry 5.0 Framework
Source: Authors

A prominent aspect of Industry 5.0 is to create a personalised experience to address personalised demands through human workforce by boosting their capabilities. As a result, a unique product can be produced with minimum effort and maximum efficiency (Javaid and Haleem, 2020). Industry 5.0 accentuates a lucid perspective alteration from mass automation to the augmented collaboration of human workers and cyber-physical systems for attaining advanced and unique personalisation which will also be intensified in the coming years (Paschek et al., 2019). It carries customer – producer engagement idea to the next level, and into every stage of production chain (Mekkunnel, 2019).

Fearne et al. (2012) argues that value chain thinking cannot succeed unless key points for customer integration and value creation are elucidated. The assertion is also supported by Kortmann and Piller (2016) who underline the prominence of determining these key points in the value chain where customers can add more value and sort of value-adding activities to which customers are expected to contribute for obtaining extended total value. Hence, the model we propose and tenets of industry 5.0 can be regarded as inceptive guidelines by practitioners for reaching this objective.

As for future studies, we opine that open business models examined and instantiated by Kortmann and Piller (2016) constitute pivotal and robust starting points. According to them, open business models will be increasingly adopted, with more customers integrated into value chains. Likewise, open innovation can also be

a prominent approach to industry 5.0, because it not only defines how firms implement innovation activities (Chesbrough, 2003) but also enhances value creation and innovation performance (Pilav-Velić and Marjanovic, 2016).

On the other hand, consumers' resistance to novelty products and services poses a significant risk that organizations should take into consideration. Heiskanen et al. (2007) proffer that integrating consumers at earlier stages of the innovation cycle may be a remedy for mitigating or removing these risks. By involving consumers in the value chain and designing products and services using advanced technologies and information platforms of the fourth industrial revolution can be an ultimate solution for alleviating such risks and thereby lowering the number of product failures sharply.

Lastly, the role of 5th industrial revolution in sustainability and other disparate environmental issues are currently inchoate even though it is partly discussed by Javaid and Haleem (2020) and Paschek et al. (2019). How human-technology cooperation can affect our environment is evidently a sensitive subject. Thus, further discussions and examinations of the issue might improve our understanding and chances of industry 5.0 adoption.

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References:

- Accenture, (2019). Accenture Industry X0, Retrieved from https://www.accenture.com/_acnmedia/PDF-63/Accenture-Industry-X0-POV-RGB.pdf.
- Alexander, A., & Nicholls, A. (2006). Rediscovering consumer-producer involvement. *European Journal of Marketing*, 40(11/12), 1236-1253.
- Atwell, C. (2017). Yes, Industry 5.0 is Already on the Horizon, Retrieved from <https://www.machinedesign.com/industrial-automation/yes-industry-50-already-horizon>
- Baden-Fuller, C., & Morgan, M. S. (2010). *Business models as models. Long range planning*, 43(2-3), 156-171.
- BCG, (2020). The Bionic Company, Retrieved from <https://www.bcg.com/capabilities/digital-technology-data/bionic-company>.
- Blasco-Arcas, L., Hernandez-Ortega, B. I., & Jimenez-Martinez, J. (2014). Collaborating online: the roles of interactivity and personalization. *The Service Industries Journal*, 34(8), 677-698.
- Brettel, M., Friederichsen, N., Keller, M., & Rosenberg, M. (2014). How virtualization, decentralization and network building change the manufacturing landscape: An Industry 4.0 Perspective. *International journal of mechanical, industrial science and engineering*, 8(1), 37-44.
- Buhr, D. (2015). *Social innovation policy for Industry 4.0*. Friedrich-Ebert-Stiftung, Division for Social and Economic Policies.
- Castellion, G., & Markham, S. K. (2013). Perspective: New Product Failure Rates: Influence of Argumentum ad Populum and Self-Interest. *Journal of Product Innovation Management*, 30(5), 976-979.
- Chesbrough, H. W. (2003). The era of open innovation. *MIT Sloan Management Review*, 44 (3), 35-38.
- Donaldson, K. M., Ishii, K., & Sheppard, S. D. (2004). Customer value chain analysis. *In International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. 46962, 993-1001.

- Doyle-Kent, M., & Kopacek, P. (2019). Industry 5.0: Is the Manufacturing Industry on the Cusp of a New Revolution?. In *Proceedings of the International Symposium for Production Research*. 432-441. Springer, Cham.
- EESC, (2018). Industry 5.0, Retrieved from <https://www.eesc.europa.eu/en/agenda/our-events/events/industry-50>
- Fearne, A., Martinez, M. G., & Dent, B. (2012). Dimensions of sustainable value chains: implications for value chain analysis. *Supply Chain Management: An International Journal*, 17(6), 575-581
- Feller, A., Shunk, D., & Callarman, T. (2006). Value chains versus supply chains. *BP trends*, 1, 1-7.
- Fournier, A. (2019). Customer Co-Creation Examples: 10 Companies Doing It Right. Retrieved from <https://www.braineet.com/blog/co-creation-examples/>
- Haleem, A., & Javaid, M. (2019). Industry 5.0 and its applications in orthopaedics. *Journal of Clinical Orthopaedics and Trauma*, 10(4), 807-808.
- Heiskanen, E., Hyvönen, K., Niva, M., Pantzar, M., Timonen, P., & Varjonen, J. (2007). User involvement in radical innovation: are consumers conservative? *European Journal of Innovation Management*, 10(4), 489-509.
- Holweg, M., & Pil, F. K. (2001). Successful build-to-order strategies start with the customer. *MIT Sloan Management Review*, 43(1), 74.
- Humphreys, A., & Grayson, K. (2008). The intersecting roles of consumer and producer: A critical perspective on co-production, co-creation and prosumption. *Sociology compass*, 2(3), 963-980.
- Javaid, M., & Haleem, A. (2020). Critical components of Industry 5.0 towards a successful adoption in the field of manufacturing. *Journal of Industrial Integration and Management*, 5(3), 327-348.
- Kamali, N., & Loker, S. (2002). Mass customization: On-line consumer involvement in product design. *Journal of Computer-Mediated Communication*, 7(4), JCMC741. Retrieved from <https://academic.oup.com/jcmc/article/7/4/JCMC741/4584248?login=true>
- Kim, W. C., & Mauborgne, R. (2000). Knowing a winning business idea when you see one. *Harvard business review*, 78(5), 129-138.
- Kortmann, S., & Piller, F. (2016). Open business models and closed-loop value chains: Redefining the firm-consumer relationship. *California Management Review*, 58(3), 88-108.
- Kotler, P., & Armstrong, G. (2014). *Principles of Marketing*, Global Edition, 15e, Pearson Education Limited, Harlow.
- Leahy, J. (2013). Targeted consumer involvement: An integral part of successful new product development. *Research-Technology Management*, 56(4), 52-58.
- Leong, M. K., Osman, S., Laily, P., & Sabri, M. F. (2019). Enhancing consumer online engagement through consumer involvement: A case of airline and hospitality services in Malaysia. *Management Science Letters*, 9, 795-808.
- Lesschaeve, I., & Bruwer, J. (2010). The importance of consumer involvement and implications for new product development. In *Consumer-driven innovation in food and personal care products*. 386-423. Woodhead Publishing.
- Lin, M. J. J., Tu, Y. C., Chen, D. C., & Huang, C. H. (2013). Customer participation and new product development outcomes: The moderating role of product innovativeness. *Journal of Management & Organization*, 19, 314-337.
- Martynov, V. V., Shavaleeva, D. N., & Zaytseva, A. A. (2019). Information Technology as the Basis for Transformation into a Digital Society and Industry 5.0. In *2019 International Conference Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS)*, 539-543. IEEE.
- Mascarenhas, O. A., Kesavan, R., & Bernacchi, M. (2004). Customer value-chain involvement for co-creating customer delight. *Journal of Consumer Marketing*. 21(7), 486 – 496.
- Mekkunel, F. (2019). Industry 5.0: man-machine revolution (Doctoral dissertation), TU Wien, Vienna.
- Nahavandi, S. (2019). Industry 5.0—A human-centric solution. *Sustainability*, 11(16), 4371.
- Østergaard, E. H. (2018). Welcome to industry 5.0. Retrieved from <https://isajobs.isa.org/intech/20180403/>
- Ozdemir, V., & Hekim, N. (2018). Birth of industry 5.0: Making sense of big data with artificial intelligence, “the internet of things” and next-generation technology policy. *Omics: A Journal of Integrative Biology*, 22(1), 65-76.
- Ozkeser, B. (2018). Lean innovation approach in Industry 5.0. *The Eurasia Proceedings of Science, Technology, Engineering & Mathematics*, 2, 422-428.
- Paschek, D., Mocan, A., & Draghici, A. (2019). Industry 5.0-The expected impact of next Industrial Revolution. In *Thriving on Future Education, Industry, Business, and Society, Proceedings of the MakeLearn and TIIM International Conference*, Piran, Slovenia. 15-17.
- Peter, J. P. & Olson, J. C. (1987). *Consumer Behavior*, Marketing Strategy Perspectives, IL, Irwin.
- Pilav-Velić, A., & Marjanovic, O. 2016. Integrating open innovation and business process innovation: Insights from a large-scale study on a transition economy. *Information & Management*. 53(3). 398-408.

- Pine, B. J. III. (1993). *Mass customization: The new frontier in business competition*. Boston: Harvard Business School Press.
- Prahalad, C. K. & Ramaswamy, V. (2003), The new frontier of experience innovation, *MIT Sloan Management Review*, 44(4), 12-19.
- Preuveneers, D., & Ilie-Zudor, E. (2017). The intelligent industry of the future: A survey on emerging trends, research challenges and opportunities in Industry 4.0. *Journal of Ambient Intelligence and Smart Environments*, 9(3), 287-298.
- Sahay, B. S. (2003), Supply chain collaboration: the key to value creation, *Work Study*, 52(2), 76-83.
- Skobelev, P. O., & Borovik, S. Y. (2017). On the way from Industry 4.0 to Industry 5.0: From digital manufacturing to digital society. *Industry 4.0*, 2(6), 307-311.
- Song J. S. & Zipkin, P. (2003). Supply chain operations: Assemble-to-order systems. *Handbooks in Operations Research and Management Science*, 11, 561–596.
- Teece, D. J. (2010). Business models, business strategy and innovation. *Long range planning*, 43(2-3), 172-194.
- Voss, M., & Kock, A. (2013). Impact of relationship value on project portfolio success—Investigating the moderating effects of portfolio characteristics and external turbulence. *International Journal of Project Management*, 31(6), 847-861.
- Walters, D., & Lancaster, G. (2000), Implementing value strategy through the value chain, *Management Decision*, 38(3), 160-178.
- Xie, X., & Jia, Y. (2016). Consumer involvement in new product development: A case study from the online virtual community. *Psychology & Marketing*, 33(12), 1187-1194.
- Yeung, M., Ging, L., & Ennew, C. (2002), Customer satisfaction and profitability: a reappraisal of the nature of the relationship. *Journal of Targeting, Measurement and Analysis for Marketing*, 11(1) 24-33.

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