Connectivity as a Future of Customer Experience Management in Automotive Industry in Industrial Revolution 4.0

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Abstract

Revolution has a meaning as a rapid phase change, concerning the basis of life. Industry is one of the activities that are part of the history of human life, which signifies the development of the times. In the development of industry, revolution sometimes becomes inevitable. The fourth industrial revolution or Industry 4.0 is a new era that provides a leap, which prioritizes automation, connectivity, personalization and globalization on a large scale. The automotive industry has also undergone a business transformation, one of which is the Customer Experience Management (CEM) aspect, which is useful for managing a series of interactions between customers and service providers. Connectivity comes as a solution with a technology based on the CEM concept that connects, integrates, and exchanges information and data of a vehicle with the owner's daily life personally, through a system. The advantages of Connectivity are safety, traffic management, maintenance and entertainment for customers. But there are things that are of concern to Connectivity, namely data security and privacy, investment and capital infrastructure, then the product cycle between vehicle technology and communication tools. So that qualified regulations and standards are needed to regulate Connectivity.

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Keywords
Customer Experience Management, Connectivity, Industry 4.0, Automotive

1. Introduction
Revolution has a meaning as a rapid phase change, concerning the basis of life, which is associated with social and cultural aspects, both planned and not. Human life cannot be separated from events related to the revolution. Both the revolution internally or personally, as well as widely in national, sectoral, and global life. Industry is one of the activities that are part of the history of human life, which signifies the development of the times. This activity or activity has a fundamental meaning processing an object into another object that has added value, through certain efforts and skills. Industry plays an important function on the economy because it plays a role in meeting human needs. In the development of industry, revolution sometimes becomes inevitable. History records the occurrence of revolutionary periods in the industrial world. Beginning in the late 18th century, the first industrial revolution emerged in the era of the steam engine. The second revolution took place at the turn of the 20th century, with the advent of electricity and mass production of machines. The third revolution began in the early 1970s, through the process of computing and automation. Now in the 2010s, a major industrial transformation emerged, to welcome a new industrial revolution. The fourth industrial revolution is a new era that provides leaps, both quantitatively and qualitatively in the life of organizations, companies and globally. This new stage of the industry is committed to prioritizing automation, connectivity, personalization and globalization on a large scale. So, the impact today, we can see that there is a link between IoT (Internet of Things) and the world of Big Data with the industrial world (Timoth et al. 2019). The automotive industry has also observed this technology-based transformation - just like any other industry. Make various car manufacturers try to collect data more broadly to understand customer behavior and desires and brand preferences. Because basically Industry 4.0 is based on digitalization, reducing the complexity of the process, waiting time, and unlimited access. The reality of the automotive industry in the era of Industry 4.0, can be summarized into a term called "ACES" which stands for Autonomous vehicles, connectivity, electrification, & shared mobility, or which means translation of vehicle automation, connectivity, electivity (cars that use electricity), and shared mobility. These things are the focus of drivers of vehicle manufacturers to change their industrial processes. One of the things related to customer experience, especially in the automotive business, is how to read what customers really want in service both when purchasing and after purchasing. It is probable that the next generation of customers, who are accustomed to instant digital experiences, will potentially choose not to buy a vehicle at all if it requires services that require a lot of time and are not comfortable with service. This clearly encourages the need for action by the automotive industry to implement integrated and controlled Connectivity or Services. This paper will present an overview related to the application of Connectivity as a Customer Experience Management activity in the Industrial 4.0 era.

1. Literature Review
Customer Experience Management (CEM) is a process mechanism to manage in a strategic manner (Reza et al. 2014) a series of 2-way interactions between customers and service providers (products or services) (Maria et al. 2010). CEM itself is a holistic approach and involves many parties. In CEM, the main focus is on the pattern and sustainability of relationships to customers. The overall goal of this management strategy is to achieve long-term customer loyalty and maintain the company's future growth. To observe CEM, a framework is needed from the point of view of customers and service providers, and describe it in a 3-dimensional space, namely the Physical, Digital, and social dimensions, as illustrated in Figure 1. Dimensions are characterized by digital density from low to high, complexity physical from low to high and social presence from low to high.

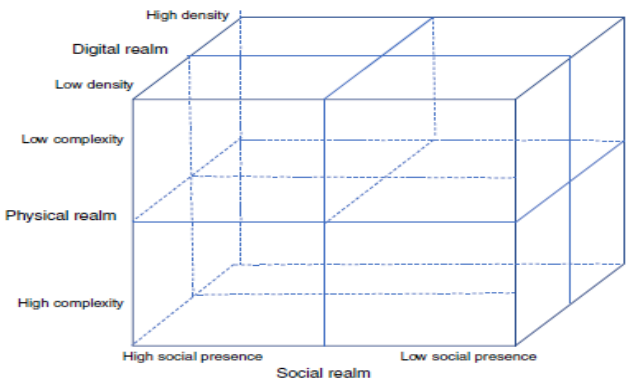

Figure 1. Depiction of customer experience in 3 dimensions

Until finally the world underwent an Industrial Revolution 4.0 that was unprecedented in scale, complexity, and speed. Customers can experience and enjoy entertainment, learning, recreation, shopping, and working in a digital environment that also has a high social dimension. So that in the Industrial era 4.0 customers are able to make better decisions, such as for example customers can manage travel agendas by knowing and buying train tickets in real time, booking lodging, knowing the weather forecast when traveling, tourist destination locations along the way, to find out about traffic jams or obstacles on the way in real time. While the automotive industry still uses traditional methods such as periodic service, checking manually and directly, delivering the car to the garage, and so forth. All this in terms of, customers who have limited information, can only accept. It is this factor that makes customers leave vehicle ownership and switch to lease for a moment or use Ride Hailing or Sharing Mobility.

Connectivity is a technology based on the concept of Customer Experience Management that connects, integrates, and exchanges the information and data of a vehicle with the owner's daily life personally, through a system. (Lars et al. 2019) Connectivity opens up opportunities for manufacturers to keep in touch with customers, even after vehicle surrender, to learn everything about their vehicle repair services and needs, and, in the event of a change of owner, can also be a way to get acquainted with new customers, used vehicle buyers.
Actually, the term Connectivity, has existed since 1996, when General Motors was working with a company called Motorola Automotive, to create a feature where the vehicle can be connected to a system called OnStar, which is useful for asking for help when there is an emergency. The OnStar system is connected to the GPS location system and cellular systems installed in the vehicle. This feature continues to grow until now (René et al. 2021).

In theory Connectivity is very closely related to the relationship between a vehicle and a vehicle or even another system, such as Car2Car (C2C) - a form of communication between cars to other cars or Vehicle-2-Vehicle (V2V) - The relationship of cars to other types of vehicles (motorcycles, trucks, buses, etc.), Vehicle-2-Infrastructure (V2I) - the relationship of vehicles to infrastructure or the surrounding environment such as traffic lights, signs, and Vehicle-2-Backend (V2B) - the relationship of vehicles with the Telematics Service Provider network (TSP) a vehicle for sharing data on vehicle conditions, and this connection often involves connecting to the Internet. (Tomás et al. 2020) The scope of implementation of Connectivity is explained in Figure 2. The use of this connectivity is very personal with each user. For example, as shown in the picture, suppose the vehicle user uses insurance, so if something happens, the connection is directly connected to the registered insurance company.

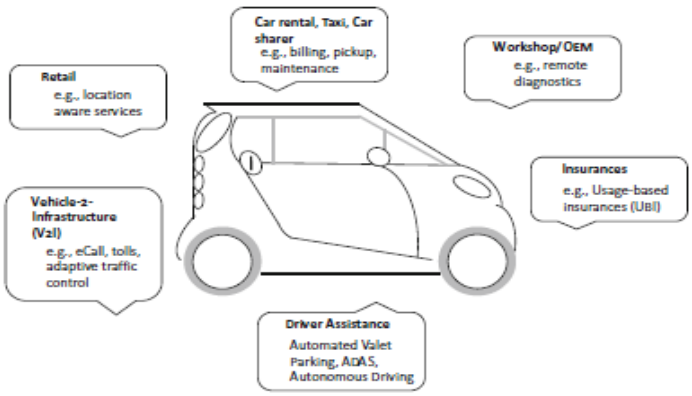

Figure 2. Application area connectivity in a vehicle

Before doing further analysis, there are several advantages of this Connectivity (Patrizioet al. 2020).

1. Increase the driver's morning safety level and the environment. Vehicles that are directly connected will provide language warnings to the surrounding and related companies. In addition, Connectivity is also a preventive method that prevents accidents caused by how to drive. On the other hand, it also helps anticipate damage to vehicles that can cause accidents.
2. As a way of managing traffic extensively. The vehicle position indicator helps the traffic officer monitor if a traffic jam occurs.

3. Assist service to customers and vehicle maintenance. Car manufacturers can monitor the condition of vehicles in real time and can provide information to customers if things go wrong. In addition, it can provide information on refueling points until lodging when customers travel far out of town.
4. Means of entertainment for customers. Through an entertainment system with an attractive UI, customers can enjoy music, television broadcasts in real time, news, bulletins, movies, the latest messages, information about the surrounding environment, or the latest entertainment, as well as equipped with cellular connections can be entertainment on the go.

On the other hand, there are negative impacts of this Connectivity, including:

1. Cyber Security, when cars become more connected, they will become a paradise for hackers. Hackers can take over vehicles and the data in it to commit crimes or sell privacy data to other parties. Even researchers have shown how they can control cars, forcing them to brake, speed up or steer. This becomes an unrest if there are no regulations that guarantee and regulate this technology.
2. Requires complex capital, investment or infrastructure across vehicle manufacturers, governments, cellular access providers, and other parties that need to collaborate, and cover all cities in a country to support this system.
3. There are differences in product cycles between vehicles and smartphone technology. Sometimes the system update or smartphone technology is faster than the technology implemented on a mass vehicle.

3. Methodology

This study was conducted by applying a research approach based on qualitative data. Research data was collected from various sources, including materials from various companies available on the internet, articles, journals, websites, and media releases. For literature review using the SCOPUS index, Google Scholar, ResearchGate relating to the concept of Customer Experience Management (CEM) and the Connectivity system. Then the next process is to carry out further analysis of the information that has been collected. This process aims to obtain relevant and relevant information and explore further the link between the information that has been collected. The methodology used can be explained in the following stages:

1. Phase 1: The initial planning phase, which is in the form of determining the types and documents required and their data availability.
2. Phase 2: Data collection phase, including document collection and development and implementing a scheme for document management
3. Phase 3: The document review phase to test its authenticity, credibility, and to avoid biased documents.
4. Phase 4: The document testing phase of the problem raised
5. Phase 5: The reflection and refinement phase. by compiling, identifying related documents, reviewing sources, and exploring content in documents against concepts or theories.
6. Phase 6: The finalization phase of the analysis, this phase is the final phase of the writing preparation, containing the final analysis of the results and conclusions.

4. Results and Discussion.

To construct a Connectivity system, a framework is needed to measure the levels of Connectivity's relationship with Customer Experience, so the extent to which the driver controls how the car moves and what the customer experiences. McKinsey tried to develop a framework related to Connectivity, as in Figure 3. There are 5 levels or levels of customer experience with Connectivity. Starting from the base to the complex level. The first level is the general level, where customers can monitor hardware and vehicle usage on a daily basis. The second level is Individual Connectivity. Customers use personal profiles to access digital services through digital ecosystems and platforms. The third level, Preference-based personalization, all passengers enjoy personalized control through their own infotainment content and targeted contextual advertising. The fourth level is Multimodal live dialogue, all passengers interact directly with the vehicle and receive proactive recommendations on services and functions (Bertoncello et al. 2018).

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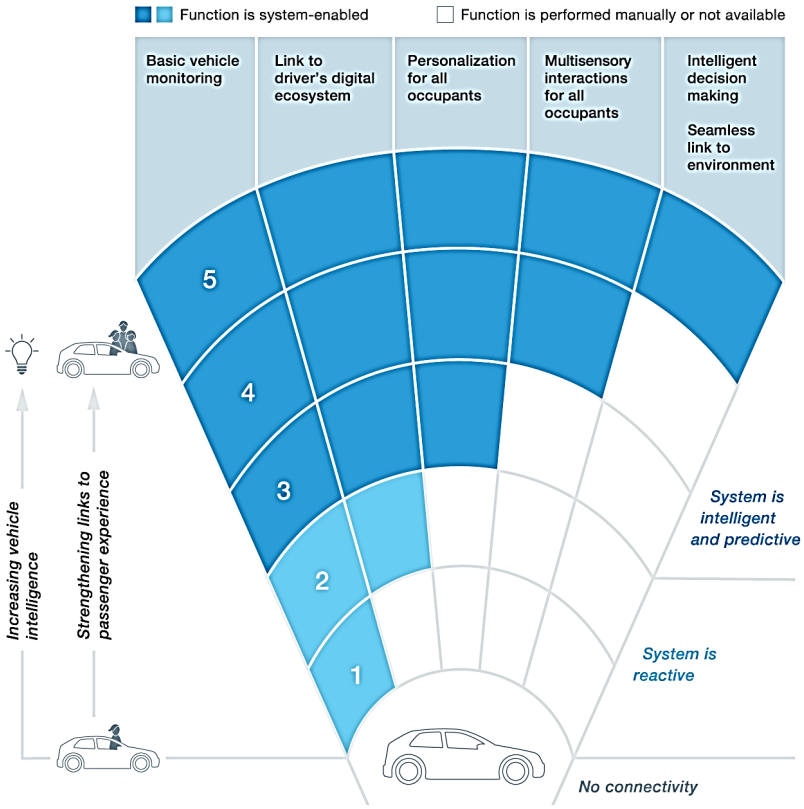

Figure 3. Car Customer Experience (C3X) Framework

The mechanism of using Connectivity can be explained into the following architectural schemes, as in Figure 4. Inside the vehicle there are several Connectivity modules that interact with the outside world, such as V2X / DSRC: Vehicle-to-X (V2X), is a vehicle module with DSRC technology (Dedicated short-range communications - short-range wireless communication channels designed for automotive use, using the 5.9 GHz band (Meihui et al. 2020) to connect other vehicles and infrastructure / the surrounding environment; TCU (Telematics Control Module) or modem that is integrated with the vehicle, useful to provide Cellular connection; Infotainment is a hibuuran system provided in a car with a User Interface (UI) and radio / entertainment / media function, which gives the driver the ability to connect via Wi-Fi or Bluetooth. For wireless connectivity, there are 5 main important wireless connections that can be used in connected cars namely DSRC, Wi-Fi, Cellular Networks, Bluetooth, and Near Field Communication (NFC) (Dakroub et al. 2016).

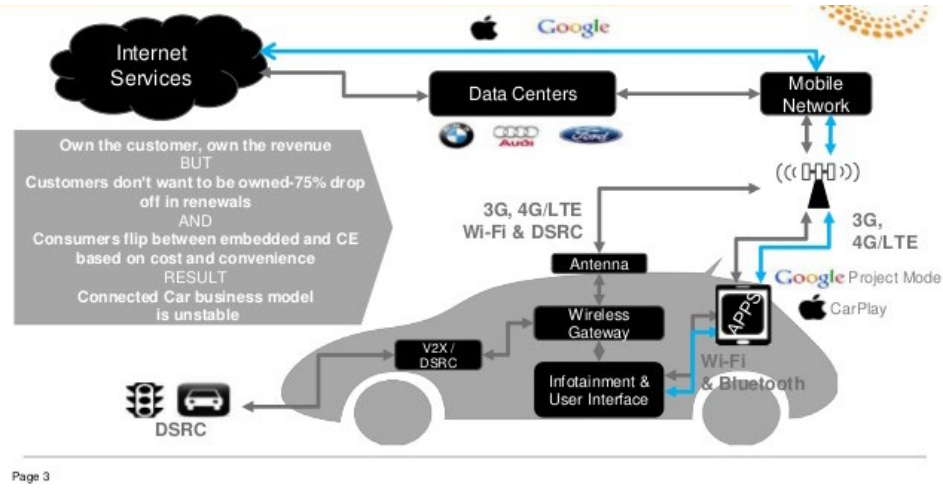

Figure 4. Connectivity scheme in the car (Visteon Corporation, 2015)

Furthermore, through the system architecture. Data is collected by sensors using DSRC technology which is managed by a system embedded in the Controller Area Network (CAN), or the meaning is a system that allows a number of control units in one vehicle to exchange information with each other in one main connecting line (Bates, 2008), to save data. These data actually come from all Electronic Control Units / ECUs in a vehicle, such as the Transmission ECU, Suspension ECU, Engine ECU, Body ECU (Kingston, 2018), and others. All data such as driving behavior, speed limits, braking systems and other traffic information are controlled by the CAN network. The collected data will then be sent to cloud computing using a wireless system such as a cellular network or Wi-Fi connection. DSRC can alert drivers to traffic, accident avoidance, car maintenance and more using infotainment to enable drivers to take action. The data in the cloud computing platform will be used by vehicle or insurance companies to analyze driving behavior to make an analysis of the improvements that must be provided. From the image above we can see that real-time data such as daily use, mileage and speed are transmitted to the cloud computing platform so that vehicle manufacturers can make driver-related analyzes such as driving style, incidents and make reports on the data collected (Jsman and Mastan, 2017). Until finally the use of Connectivity is very useful as a form of service personalization, increases safety, and makes life easier. More than a quarter have prioritized the application of Connectivity over other features such as fuel efficiency or engine power. However, there are several factors that must be considered by users, producers, governments and other parties who participate in the system. First, customers are concerned about digital security and data privacy where vehicle hacking concerns are. On average, up to 37% of respondents feel held back from using Connectivity when it comes to privacy and potential hacking (McKinsey, 2014). Figure 5.

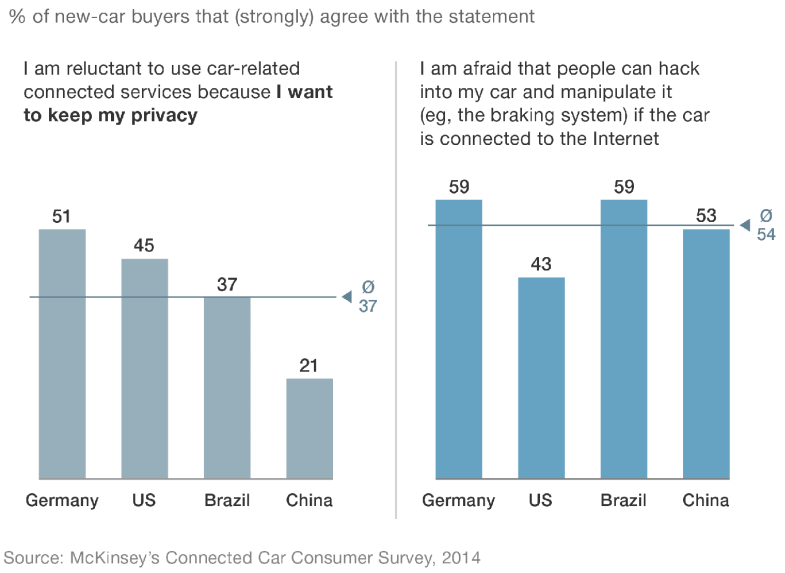

Figure 5. Survey of car buyer concerns about data privacy and possible staging due to Connectivity

5. Conclusion

In accordance with the meaning of the Revolution and Industry. There was a rapid change faced by the Industrial World in the world, until the fourth industrial revolution which was a new era that provided a leap both quantitatively and qualitatively in the life of organizations, companies and globally. This new stage of the industry is committed to prioritizing automation, connectivity, personalization and globalization on a large scale. The automotive industry has also observed this technology-based transformation - just like any other industry.

One of the important things faced by the automotive industry in the Industrial Revolution 4.0, which is related to managing customer experience, by answering questions, how to read what customers really want in service both when purchasing and after purchasing. Theoretically known as Customer Experience Management (CEM). This theory is a mechanism for managing the strategic sequence of 2-way interactions between customers and service providers (products or services). CEM itself is a holistic approach and involves many parties. Observing the current condition of the automotive industry that still uses traditional methods such as periodic service, checking manually and directly, delivering cars to a garage, etc., then the absence of realtime driving support, are the reasons that pose challenges for the automotive industry in industry 4.0.

Until finally the focus of customer experience management for the automotive industry is on a technology called

Connectivity. This term means a technology based on the concept of Customer Experience Management that connects, integrates, and exchanges information and data of a vehicle with the daily lives of their owners personally, through a system. This technology integrates modules on vehicles with various devices that connect vehicles with infrastructure, cloud computing, the Internet, etc.

So that the position, activity, condition of the vehicle and the driver can be monitored and can immediately be given feedback in real time. This technology is very useful in terms of driving safety, traffic management, vehicle maintenance, to entertainment facilities. However, this technology has an important concern and is deemed necessary to maintain the confidentiality of data, user privacy, and in terms of investment and infrastructure, also requires massive funds and complex systems to support this technology. In the future this Connectivity challenge requires regulations and standards that can be used together, so customers have a sense of security in using it.

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Tomás, J. M. S., José, M. L., and Patrícia, C. **Figure 1.** Depiction of customer experience in 3 dimensions

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