



**REPUBLIC OF TURKEY
ADANA ALPARSLAN TÜRKER SCIENCE AND TECHNOLOGY
UNIVERSITY**

**GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF BUSINESS FACULTY**

**INVESTIGATING THE EFFECTS OF THE “VUCA” FACTORS ON
PRODUCT INNOVATION PERFORMANCE AT TURKISH
BUS & COACH INDUSTRY**

**MSc. ERKAN DÖNER
MASTER OF BUSINESS ADMINISTRATION**



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ADANA 2020



I hereby declare that all information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all information that is not original to this work.

[Signature]

MSc. Erkan DÖNER

ABSTRACT

INVESTIGATING THE EFFECTS OF THE “VUCA” FACTORS ON PRODUCT INNOVATION PERFORMANCE AT TURKISH BUS & COACH INDUSTRY

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Department of Business Administration

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With the expansion of globalization, digitalization, and rapid technological developments over the world, businesses have been challenging with fluctuated markets, unpredicted issues, launching more complex products & services to attract customer preferences and inability to maintain the decision-making process combined with lacking information at several industries. The VUCA concept as an acronym was coined by United States Army War College (USAWC) to describe a chaotic environment, including volatility, uncertainty, complexity, and ambiguity factors. After the global financial crisis in 2008, the VUCA concept has regained the importance through management and leadership perspectives. Employees are one of the critical components for companies to sustain business progress in less adverse effects during the age of disruptive innovation. Within these perspectives, each VUCA factor was analyzed through the scales based on perception, and the researcher aimed to investigate possible relationships among VUCA factors. Additionally, the relationship between Product Innovation Performance (PIP) and each of the VUCA factors was examined to illustrate the effects. As a result of detailed observations and analysis, each VUCA factor had a significant relationship between them and categorized in two distinctive but interrelated dimensions under the circumstances of the Turkish bus & coach industry. Although there is a relationship between VUCA's volatility, uncertainty, complexity factors and the product innovation performance of the Turkish bus & coach industry, it is observed that especially ambiguity ($r = .346$) factor has a high impact on the product innovation performance at Turkish bus & coach industry. The Covid-19 pandemic, international conflicts, terror attacks, economic instabilities, climate change in which humanity has been experiencing nowadays demonstrate that the existence of the VUCA concept may be in the future and can be accepted as the "new normal" occurring in unpredicted intervals of time.

Keywords: VUCA, Innovation, Product Innovation Performance, Turkish Bus & Coach Industry

ÖZET

TÜRK OTOBÜS ENDÜSTRİSİNDEKİ “VUCA” FAKTÖRLERİNİN ÜRÜN İNOVASYON PERFORMANSINA OLAN ETKİLERİNİN İNCELENMESİ

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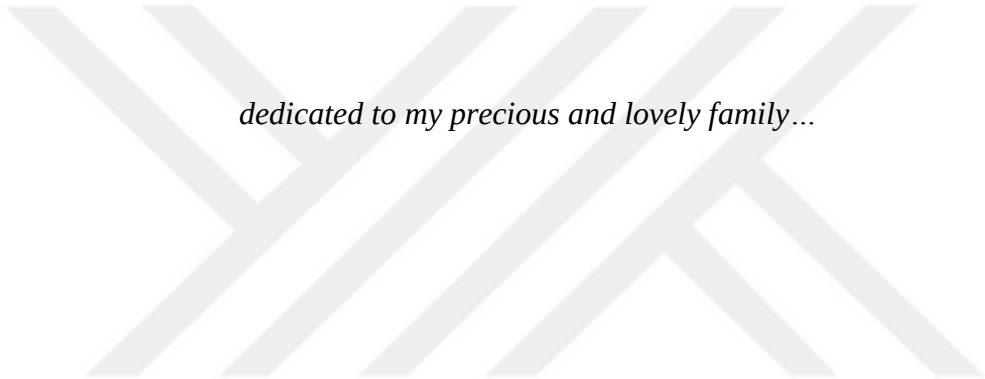
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Küreselleşme, dijitalleşme ve hızlı teknolojik gelişmelerin dünya üzerinde yaygınlaşması ile birlikte, birçok endüstride faaliyet gösteren işletmeler dalgalanan pazarlar, tahmin edilemeyen olaylar, müşteri tercihlerini etkilemek için sunulan kompleks ürün ve hizmetler ve eksik bilgiler ile birleşen karar verme sürecini gerçekleştirememesi gibi etmenler ile mücadele etmektedirler. Dalgalanma, belirsizlik, karmaşıklık ve muğlaklık faktörlerini içeren VUCA kavramı akronim olarak United States Army War College (USAWC) tarafından ortaya konulmuştur. VUCA kavramı, 2008 yılında gerçekleşen küresel finansal krizden sonra yönetim ve liderlik perspektifleri doğrultusunda yeniden gündeme gelmiştir. Çalışanlar, şirketlerin yıkıcı inovasyon çağında daha az olumsuz etkilerle iş ilerlemelerini sürdürmeleri için kritik bileşenlerden biridir. Bu perspektifler içinde, her bir VUCA faktörü, algılamaya dayalı ölçeklerle analiz edilmiştir ve araştırmacı, VUCA faktörleri arasındaki olası ilişkileri ortaya koymayı amaçlamıştır. Ayrıca, VUCA faktörlerinin etkilerini inovasyon perspektifinde belirtmek için ürün inovasyon performansı ile her bir VUCA faktörü arasındaki ilişki incelenmiştir. Ayrıntılı gözlemler ve analizler sonucunda, her bir VUCA faktörü arasında önemli bir ilişki olduğu ve bununla birlikte mevcut koşullar altında Türk otobüs endüstrisinde iki farklı fakat birbiriyle ilişkili boyut olduğu ortaya konmuştur. Yapılan araştırmada VUCA'nın değişkenlik, belirsizlik, karmaşıklık boyutları ile Türk otobüs endüstrisinin ürün inovasyon performansı arasında ilişki bulunmasına rağmen, özellikle muğlaklık ($r = .346$) boyutunun sektör üzerinde yüksek oranda etkisi olduğu görülmektedir. Günümüzde insanlığın deneyimlediği Covid-19 salgını, uluslararası çatışmalar, terör saldırıları, ekonomik istikrarsızlıklar, iklim değişikliği vb. durumların VUCA kavramının gelecekte de varlığını sürdürebileceğini ve öngörülemeyen zaman aralıklarında gerçekleşen olayların "yeni normal" olarak kabul edilebileceğini göstermektedir.

Anahtar Kelimeler: VUCA, İnovasyon, Ürün İnovasyon Performansı, Türk Otobüs Endüstrisi



dedicated to my precious and lovely family...

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The life we live can be described as the experiences, inspiration and dreams of us. Every challenge we continue with the aim of succeeding new objectives can be shaped by the effects of people, lives and even emotions in our environment. This work was carried out as a result of harmonization of academic education and professional experiences in different disciplines in my career path as an industrial engineer. In particular, there are important people I would like to thank for their dedication, understanding and efforts in this continuous development and learning-oriented life cycle. First of all, I would like to thank my father, mother, and grandmother, who provided a healthy life, with my deepest respect. I would like to thank Assoc. Prof. İ. Efe EFEOĞLU (thesis supervisor), who has been working in academic life with high enthusiasm and has effective learning-oriented communication with his students. Additionally, I would like to thank MSc. Mert Umut Özkaynak, who has inspired me with his valuable knowledge, advice and working principles shaping my professional life. Hopefully, this study can be guide and inspiration for students who have a passion for maintaining academic researches.

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ABBREVIATIONS

AI	: Artificial Intelligence
CFS	: Cognitive Flexibility Scale
CFT	: Cross Funtional Teams
HR	: Human Resources
IUS	: Intolerance of Uncertainty
MNC	: Multi-National Corporations
MSTAT-II	: Tolerance of Ambiguity
PIP	: Product Innovation Performance
VUCA	: Volatility, Uncertainty, Complexity, Ambiguity
USAWC	: United States Army War College

1. INTRODUCTION

So far and still, world civilizations that have been witnessing a variety of nations, both technologic and societal developments, industrial revolutions, and historical events are the center of the change, innovation, and growth, including struggles and conflicts among themselves within each period of the humankind history (Diamond, 2005). When observing the last 100 years of today's societies, the impact of world wars, international conflicts, political system challenges, economic crises, terrorist acts, and the pandemics like Covid-19 experienced today affects human life severely. These events also can ruin the essential factor of sustaining human beings as "physiological needs," which is described by "Maslow's Hierarchy of Needs" that led disturbance, stress, fear, inconsistency in behaviour, and unplanned movements and decisions causing psychological troubles among people. These issues which have effects today and may have consequences in the future can be seen as examples of the VUCA world. The VUCA concept is an acronym illustrating the combinations of volatility, uncertainty, complexity, and ambiguity that urge states, businesses, organizations, and also societies to be ready for challenges that are not unpredicted, unknown, and complex circumstances. The idea of the VUCA concept was firstly initiated by Warren Bennis and Burton Nanus, who are both scholars of leadership to figure out how military leaders can react to challenges combined with the chaotic conditions thoroughly controllable like Gulf War in 1990. After the experiences obtained at Gulf War and the end of the Cold War, military scholars and leaders in US Army War College (USAWC) direct military officers to focus on leadership abilities and strategies to handle effects of globalization, geopolitical uncertainties, rapid changes on technological developments and the turbulent environmental conditions transforming decision-making and leadership progress into a more compelling structure. In fact, the VUCA concept has appeared in a variety of contexts on the world stage since ancient times. For instance; harsh climate conditions, lacking food supply, and humankind's striving to survive in wildlife were examples illustrating the VUCA concept existed at the time of the Paleolithic Age. In the world of the 21st century; globalization, digitalization, increasingly competitive economic order, international finance and trade-oriented conflicts and sanctions, insufficient natural resources as a result of increasing world population, climate changes and pandemics influencing both states businesses and individuals along with the VUCA concept. In these chaotic environments, leadership skills gain importance in continuing existing organizations, processes and even plans. In the leadership perspective, research studies continue on how to lead in the chaotic environment defined as VUCA and how to control the current situation by transforming

potential threats into opportunity. Afterwards, especially the fluctuation, uncertainty, complexity and ambiguity effects of 2008 global economic crisis along with several industries and destructive innovations in the last 20 years have directed scholars to conduct research in the discipline of management and organizational behavior to address the VUCA concept. In the study of Bennett and Lemoine (2014), a framework was developed through scrutinizing the VUCA concept in the perspective of management discipline and a detailed understanding of what each factor of the VUCA concept means for companies and employees was examined. When the current structure of the contemporary business world considered; fluctuations in global markets, emerging technologies, international conflicts, legal developments, becoming more complex product features through increasing technology and customer satisfaction, and dilemmas faced by corporate executives in marketing, investment, and strategic decisions can be illustrated as the VUCA concept. Apart from these, emerging markets and developing countries have been in both monetary and infrastructural growth processes can be interrupted and restrained chaotic circumstances, causing any adverse effects during the ongoing progresses. Even, the fact that the industries, which have the largest share in the total GDP of these developing countries, can be exposed to harsh impacts as a result of the macro and micro level of chaotic conditions, directly affecting both the welfare of the society and the growth targets of each developing country. The competitive and rapid-changing technological environment occurring by the 21st century that humankind lives recently leads to the goal of sustainable growth, preserving the market share and obtaining customer satisfaction through maintaining innovation most efficiently and effectively, rather than actualize innovations at each company. As commonly accepted that, giant technology companies such as Kodak and Nokia did not have the previous market and industrial penetration today and that these companies are in the category of “disrupted companies” as a result of radical innovations such as smartphones and digital cameras (Vecchiato, 2017). Consequently, 21st century in which we experience the effects of the VUCA world in different contexts, ongoing product innovations can be evaluated through company and organization dynamics to maintain product appropriateness and sustainability in each related market by managers and leaders. In the research conducted, according to combined perspectives mentioned above, examining the VUCA concept through interrelationships between each factor and investigating the impacts on product innovation performance are main determinants to scrutinize the latest structure of the global bus & coach vehicle manufacturers as a subgroup of the Global Automotive Industry, one of the most important industries of the Turkish Economy through analyzing the empirical

data and research findings supported with a detailed literature review of each subject (The VUCA Concept, Product Innovation Performance, and, Global Automotive Industry, Turkish Bus & Coach Manufacturers).

1.1. The Importance of Study

The VUCA concept, whose initial ideas were presented by Bennis and Nanus (1985) and later brought to the literature by USAWC through considering leadership traits, has been conducting studies on management strategies and the organization's awareness to deal with challenges in which industry and companies encounter. Based on the "Web of Science", "ProQuest Dissertations" databases; Academic studies examined to date illustrates that factors (volatility, uncertainty, complexity, ambiguity) generating the VUCA concept and the interrelationship of each factor have yet to be analyzed via empirical data by scholars. When the general structure of the VUCA concept examined, whether this concept gains effectiveness as a reflection of the industry circumstances & dynamics (external) and the organizational capabilities & competencies (internal) each company possess can be investigated by external (i.e., industry dynamics, market structure) and internal (e.g., employees' attitudes and behaviors, both financial and non-financial resources, corporate culture, innovation performance) perspectives. In the research study conducted, employees' perception shaping their attitudes and behaviors toward the factors of the VUCA concept is measured by individual-oriented scales (Resistance to Change, Intolerance of Uncertainty, Cognitive Flexibility, Tolerance of Ambiguity) to recognize the organizations' stance against to effects of the VUCA concept in the Turkish bus & coach manufacturing industry. The automotive industry in the world is among the locomotive sectors that provide steady growth of developed and developing countries' economies, accelerate technological advancements, and support the development of many other sectors. The automotive sector, which makes up about 5% of the world economy with a total of about 4 trillion dollars, corresponds to the 4th largest economy in the world. Also, the automotive sector employs 80 million people directly and indirectly in the world. Apart from its structure, the automotive industry is closely related to the marketing, dealers, service, fuel, finance, and insurance sectors with basic components (engine, transmission, brake systems, etc.), spare parts, subsidiary and end products to the consumer. Moreover, automotive manufacturing, as part of transportation, is an industry that provides the most critical support for the defense industry's development. The automotive industry, which has a significant relationship with many industries, has strategic importance as trouble can be reflected rapidly in other industries. The technical and environmental regulations continually being renewed in the automotive

industry, lead the development of new production technologies that closely concern other industrial sectors that provide input to the industry. However, it is worth mentioning that automotive production has initiated to slump on a global scale. The total production dropped to 96 million in 2018, following the 97.4 million production record reached in 2017 with an eight-year continuous growth. In particular, Germany grew in Europe, but the UK, France, Italy, and Spain decreased. The U.S. production of 20.8 million units accounted for 21% of global production. Asia-Oceania, which covers more than half of global production, decreased by 2% to 52.5 million units. The main reason for this was the decline of China, the major global manufacturer whose production decreased by 4%. Turkey's global share was 1.8% in 2017, fell to 1.6% in 2018. Its share in Europe has decreased correspondingly and actualized at 7.3%. When the automotive industry in Turkey considered, approximately 6% (200,000 employees in 2017) share in employment, about 90 R&D center and export leadership about 11 years exist. Moreover, the total turnover of Turkish automotive industry is 155 billion TL in 2017 (approximately 10% percent of total manufacturing industry at Turkey). From the perspective of vehicle segment production, bus & coach vehicles other than passenger cars and light vehicles gain importance in the study due to the number of employees, export volume, and the structure of the more complicated product and production processes. Even that, historically, some of the factories established by foreign automotive manufacturers in Turkey are located in the bus & coach production activities. When examining bus & coach vehicle manufacturers, it is recognized that there are both domestic and foreign manufacturers and also suppliers are a supporting factor in this business ecosystem. The current business partnerships between these domestic and foreign companies are also developing by conducting technology transfer. The VUCA concept affecting the ongoing business progress can be considered by bus & coach manufacturers owing to have a significant share in exports of Turkish motor vehicles. Additionally, the manufacturing of innovative products is of utmost importance to preserve market share and embrace sustainable business models in an internationally competitive environment. Innovative approaches supported by leaders and employees can positively affect the level of matching companies' customer preferences as well as the brand image in the customer's perception. Consequently, in the world of VUCA (the new normal of the 21st century), understanding the VUCA concept and its factors comprehensively through business perspectives is essential for maintaining the continuity and sustainability of the locomotive industries possessing a significant share at GDP. Besides, pursuing product innovations, including more efficient and effective progresses, is required to survive in the dynamics of the

Turkish bus & coach industry. The factors of the VUCA concept, such as volatility, uncertainty, complexity, and ambiguity, have been embraced involuntarily by employees during the product innovation processes and maintaining the ongoing business progress. Employees' attitudes and behaviors towards the effects of the VUCA concept may impede business performance. The changing technologies, unpredicted circumstances like Covid-19, political inconsistencies, economic crisis, the digitalized product structure of the bus & coach vehicle, and inability to conduct the decision-making process well among unforeseen scenarios are some of the drivers to drag Turkish bus & coach industry into a severe challenge, observed in today and maybe in the future.

1.2. The Purpose of Study

Determining the purpose of research can guide the researcher along with the importance of study for achieving the integrity of study subjects to be researched and reaching the targeted findings. The purpose of the study conducted is in two different dimensions that enable researcher to observe research study in more detail. These two dimensions related to purpose of study are scrutinizing the VUCA concept and its factors, and investigating the relationship between each VUCA factor and the Product Innovation Performance of the Turkish bus & coach manufacturing companies.

First, scrutinizing the VUCA concept and its factors is a fundamental reason to conduct the research study. As mentioned above, employee perception has been critical driving force to maintain manufacturing and business progress. In times of the VUCA world, employees have been affected by chaotic issues causing volatility, uncertainty, complexity, and ambiguity. Thus, observing perceptions and reactions of employees to chaotic issues (e.g., war, terrorism, international conflicts, the Brexit, financial sanctions, global economic crisis) can be appropriate method to examine the VUCA level of the organizations at Turkish bus & coach manufacturing industry. Besides, the interrelationship among each factor within industry context can be useful to observe and explicate whether a possible categorization along with the VUCA framework.

Second, investigating the relationship between each VUCA factor and the Product Innovation Performance of organization is another reason to conduct the research study. Maintaining the innovation in failure may transform the possible adverse effects into the VUCA fact within Turkish bus & coach manufacturing industry dynamics. Volatility, uncertainty, complexity, and ambiguity have a relationship with the company's product innovation performance owing to employees' motivation, trust, and emotions (Pandya, 2014).

1.3. The Problem Statement

The VUCA concept and its four distinctive factors are occurred by various reasons in each industry group, causing severe impacts on companies' business progress. The main causal agents stimulating the emergence of the VUCA concept can divide into two groups as internal and external dynamics. External dynamics mostly exist owing to the industry and market structure related with company's geostrategic position, and internal dynamics can occur as a result of the attitudes and behaviors of the employees in the company's organization. For instance, a company being part of the related industry, including uncertain circumstances, will be exposed to challenges and disrupted effects of the VUCA concept adversely without intolerance to embrace and inability to adapt uncertainty. With this perspective, measuring the attitudes and behaviors of the employees towards each VUCA factor can also depict the organization's stance against the circumstances related to challenging issues generated by the VUCA concept. As a result of the measurement of attitudes and behaviors of employees towards VUCA factors, companies will be able to execute improvements and development processes more effectively in their existing organizational structure along with company objectives. In this research study conducted, the bus & coach industry as being part of the automotive industry is distinguished, and also domestic & foreign manufacturers that possess MNCs identity are preferred in Turkey to observe in global dynamics. Such determinants like being a developing market, being affected economically and financially by the developments in macro and micro scale in recent years, increasingly widespread of substitute products in transportation (airports, railways), development of new technologies (autonomous vehicles, electricity-powered engines) and international conflicts & political uncertainties in the export markets indicates that the Turkish bus & coach industry has a structure integrated with factors of the VUCA concept. On the other hand, within the internal structure of the Turkish bus & coach industry, ongoing new business partnerships (Joint-Ventures) and business acquisitions can transform existing market conditions into more competitive market conditions. In this regard, to have an effective and efficient performance in product innovations along with industry regulations and technological developments is becoming distinguished qualification for companies to maintain the business in competitive and disruptive market circumstances. However, within the related industry and market conditions under the effects of VUCA factors, achieving optimum product innovation performance can be challenging progress. Consequently, observing the relationship between factors of the VUCA concept encountered by companies and the product innovation performance of the company can be able to lead the

company to designate "how existing organization can develop to perform product innovation process more effectively and efficiently," and increase the level of awareness of leaders towards the VUCA concept in the Turkish bus & coach manufacturing industry.

Research Questions

The VUCA concept has yet to be observed through empirical analysis. So far and still, the existence and effects of the VUCA concept have been investigated by academic scholars and business leaders along with the employees' attitudes and behaviors caused by perceptions. Besides, during the age of disruptive innovation cycle, maintaining product innovation performance efficiently and effectively has been gained importance more than ever. Within these perspectives, research questions are formulated and supported by hypothesis as following.

- **Research Question-1a**

Is there a relationship between VUCA factor perceptions of white-collar workers in the bus industry and the company's product innovation performance?

At this point, investigation of employees' attitudes and behaviors against factors of the VUCA concept caused by perceptions through companies' structure, and organizational capacity and capability under the circumstances of the Turkish bus & coach manufacturing industry. White-collar workers mostly be part of the decision-making processes that designate companies' strategy plans, objectives and aspirations intended to obtain in future among competitors within the both market and industry structure. Besides, white-collar workers have lead operators (blue-collar workers) to be more collaborative, trustful, and motivational employees for enhancing the production progress and the product innovation performance.

- **Research Question- 1b**

Also, can the VUCA factors be grouped into their respective relationships?

At this point, the examination of companies' product innovation performance through employees' assessment and companies' achievements within factors of the VUCA concept under the circumstances of the Turkish bus & coach manufacturing industry. According to Bennett & Lemoine (2014) and Saleh & Watson (2017), the interrelationship between each VUCA factor can exist and need to be analyzed by empirical studies to observe possible correlations among factors. Besides, the VUCA framework illustrates that two dimensions related to both knowledge and prediction consist of the VUCA concept. Thus, in this research study conducted, empirical data and analysis, to be obtained can investigate possible categorizations of the VUCA factors through performed scales.

1.4. Research Limitations & Assumptions

For determining the general frame of the research study, limitations can be useful to maintain research along with objectives and express contents through a specific scope. In this research study conducted, limitations can be considered as follows.

- This research was performed at companies being part of the Turkish bus & coach manufacturing industry.
- Respondents of this research are white-collar employees who graduated from pre-graduate schools and have a knowledge and skills about English language.
- This research was performed at the last quarter of the year 2019, before the Covid-19 pandemic.
- This research was maintained at companies which have MNCs identity that illustrates more than one facility location at both domestic and foreign countries.

The assumptions of the research are statements that are accepted in the research and thought to be correct. Though they are not actual, they have generally accepted thoughts. These are the considerations that are accepted before the beginning of the research. The primary purpose of determining the research question in a scientific research model is to determine the assumption directly. For this reason, the assumption constitutes the first proposition about what the researcher will investigate. The assumption of the research determines the direction and target of the research. In other words, the question of the research and the assumptions to be produced draw the frame of the research; in other words, it represents the research road map. In this respect, the direction of assumptions is always forward. Assumptions are the key to maintaining a scientific research study. Within these reasons, assumptions of the research study conducted can be expressed as follows.

- Companies being part of the Turkish bus & coach manufacturing industry are product innovator and have an intense pursue to adopt new technological advancements.
- The Turkish bus & coach manufacturing industry is affected by the impacts of the VUCA concept on current business progress at both industry and market-level through its existed factors.
- The effects of the VUCA concept can shape employees' attitudes and behavior at the Turkish bus & coach manufacturing industry through changeable perceptions.

- The Turkish bus & coach manufacturing industry embrace fever market competition, challenging product innovation progresses, regulations, rapid technological advancements and requirement for a high amount of employees to maintain production (e.g., manufacturing, supply chain, R&D) and business operation (e.g., finance, marketing, sales, after-sales & services) cycles.

1.5. Research Study Overview

This research study is composed of six distinctive sections, including introduction, literature review, materials and methods, results and discussion, conclusions, and recommendations. Each section has a detailed investigation and examination throughout the research study. The literature review can be grouped into three parts. These are VUCA factors, product innovation performance, and the Turkish bus & coach industry as being part of the Global Automotive industry. The materials and methods section reflects a research methodology of the study conducted by the researcher. In the results and discussion section, obtained analysis and information through conducted research methodology is explicated via the consideration of academic studies performed by scholar from related disciplines.

2. LITERATURE REVIEW

2.1. The VUCA Concept

Since the late 20th century, the world has been challenged with new issues affecting businesses, associations, governments, and also families in any region. As a rising of globalization act through connecting countries without borders, insecurity has become a new culture that is recognized by the world nations (Coker, 2014). The world has been threatening by mass movements between specific groups and nations, refugee policies, terrorism attacks with or without weapons, biologic contagions, etc. States have encountered unpredicted events that lead human lives to transform past habits into new approaches not being experienced without confronting it as a result of rapidness and radical aspect of change (Harsolekar & Munshi, 2017). Nowadays, the terroristic movements continue their impact on the global economy, politics, and international business, transforming the environment into VUCA conditions (Londhe, 2016). After the occurrence of the global financial crisis in 2008 and terrorism attack on USA located trade towers in 2001, several fields of world system such as markets, companies, services, and supply chain confronted to the VUCA world and have embraced as a new normal (Doheny *et al.*, 2012, Bennett & Lemoine 2014). The "VUCA world" is a term to emphasize the whole ecosystem, including environment, humanity, businesses, and states has observable interconnectedness and also combines in a comprehensive perspective originating from various dimensions (Mack & Khare, 2016; Yargar, 2006). The term "VUCA" stands for volatility, uncertainty, complexity, ambiguity has been proposed by U.S. military since the late 1980s to describe the geostrategic aspects of the world combined with power politics initiated by the fall of the Berlin Wall and the occurrence of a new disintegrated framework with tentative alliances and loyalties (Millar *et al.*, 2018; U.S. Army Heritage and Education Center, 2018). The VUCA concept was first coined by the US Army War College to illustrate the turbulence, doubtful, arguable, staggering characteristics of the multifaceted global system as a result of interconnected globalization after the end of Cold War declared by USA and Russia (Kinsinger & Walch, 2012). The appearance of the VUCA term was existed in military literature to have a clear understanding, diversify possible thinking styles and control flexible leading actions in the course of battlefield training and assaults (Allen & Coates, 2009; Schambach, 2004). The U.S. military personnel on the assault environment, including Gulf War, Iraq War, Syrian Civil War, have experienced a variety of learning, analytical thinking, and agile responsiveness techniques during the challenges, problems, complicated issues a part of the VUCA concept they confront (Casey, 2014). VUCA is a definition for explaining today's

chaotic structure to make people swiftly respond to unseen and unknown facts in less amount of severe losses (Stiehm, 2002). So far and still, the VUCA concept has been expanding to fields of world system ranging from state policies to daily human lives (Shaffer & Zalewski, 2011). Nowadays, VUCA represents the high rate of volatility, uncertainty, complexity, and ambiguity of the business world (Automatic Data Processing, 2016). Real examples of the VUCA concept are getting wider through global issues differentiated in each other such as Coronavirus (Covid-19), Brexit, Trade-wars, Syrian Refugees, increasing nationalistic movements, climate change, and etc. The VUCA concept, which has been embraced by business leaders, academics, and politicians since the end of the 1990s has still been expanding its zone of influence by means of some real examples of today's challenges of our humanity such as global economic recession, diminished global security, health problems (e.g., Covid-19 pandemic), increased digitalization with rising disruptive technologies, etc. (Johansen, 2007). Between the year of 2008 and 2009, the global economic crisis arose as a result of the loss of U.S. mortgage payments and spread to all countries, regardless of each level of development. This chaotic problem, whose effects are still observed by economists on the global economy, is another example of embracing the VUCA concept, and its factors are more evident (Pavlinek, 2005). However, the world has been embracing new challenges nominates ecological balance issues, global socio-economic framework deterioration, and chemical side-effects to the environment as an outcome of the VUCA that hinder the ongoing sustainability approach aimed to keep nature in a nonperishable standard (Schick *et al.*, 2017). During the current age confined with abundant of data, news, and enhancements over the world, VUCA concept possess a minor tolerance to being reluctant, rigidity, and less quickness for responding challenges in case of any effort to recognize the facts such as risks, unpredicted issues and tackle with the outcomes of concerns whether possible or not. Dealing with these conditions requires being agile, emotion-sensitive, and tolerant of insecure circumstances (Das & Ara, 2014). The VUCA is not about a limited minute in time, a particular time, nor a situation that can be examined and reacted to inside a specific period; rather the VUCA is still continually changing condition and also would exist in the future— a lot of instant issues, factors, and also limitations that challenge a human's capacity to decide, create solution proposals, and execute them in a well-fitted operational way (Bernstein, 2014). Up to now and also recently, the VUCA concept in literature has focused on leadership, decision-making habits, and how to make a reaction for the VUCA outputs in less adverse effects. The VUCA concept is an outcome of market fluctuations, price volatility, unbalanced macroeconomic indicators among countries, and the supply of production

materials that points out the current business environment has directly affected with the VUCA factors (Schick *et al.*, 2017). The literature has been emphasized since the appearance of the VUCA concept, characterizes the contemporary strategic environment as VUCA (Euchner, 2013; Zahra & Nambisan, 2012). The VUCA concept indicates that this concept mainly based on analytical, investigative, and agile decision-making tools of the military structure due to the term which is first coined by military officers at the US. The interconnected structure of globalism around the world creates the VUCA related issues which are more unpredictable, changeable, multi-dimensional thinking habits and confused decision-making than ever (Wet, 2019). The conditions of today's business world as an output for making strategy have been encountered with unpredictable issues and vulnerable effects, which commonly accepted as a new normal (Manwani, 2013). For both today and tomorrow, business models all around the world have progressively experienced vital challenges leading to the fluctuation of market shares, financial gains, and also customer satisfaction (Kaivo-oja & Lauraeus, 2018). It is a catastrophe to be recognized the change as an incremental, linear, and also steady flow by business stakeholders. The VUCA world has faced with new disruptive innovations that can be replaced by new developments and innovations in a narrow time. There are no cases or reasons that stay for a long time without transformation and adaptation. As a result, the change should be embraced through fostering to possess new technologies and business models instead of resisting it. The VUCA world and its chaotic environment direct businesses to eliminate the possible negative causes and protect themselves from catastrophic outcomes of the VUCA factors by means of comprehensive thinking, innovative enhancements, and the creation of new business models such as merging & acquisitions, project partnerships, and other business development activities (Cracsner & Gherghinescu, 2018). The enterprises on the VUCA world have pursued successful management techniques to handle the VUCA factors in a less adverse effect by being agile, adaptive, enthusiastic, and able to have perfect internal communication between each departmental function through the effectiveness level of management and its model aligned with corporate culture (Popova *et al.*, 2018). As a result of flash changes in today's world, separated but consequently combined four VUCA factors could not be predicted and calculated by specific tools such as forecasting techniques based on mathematics expressing the chance of possible various scenarios (Abidi & Joshi, 2015). Before embraced by business leaders, with the publishment of a new book called "Prepared and Resolved, Daniel Wolf" (2006), the VUCA concept found its place on the business literature (Patoori & Lalitha, 2020). The VUCA concept investigates both inside and outside of the company's business concerns

widely (Chakraborty, 2019). According to Kefalas (1998), due to the global competitiveness and changing customer habits, companies need to alter own point of view to "Think Local, Act Global" instead of "Think global and Act Local" for becoming customer-oriented and also discovering potential supports as a financial instrument, business collaborations, etc. Indeed, the VUCA concept is a reflection of both internal and external issues that companies have been struggling to become survival in the future (Potsangbam, 2017). According to Lahiri *et al.* (2018), the VUCA concept has had three distinctive dimensions as globalization, hyper-competition, and rapid technological change. Transforming threats into opportunities is a critical approach for business owners today due to the still expanding of the VUCA environment by imbalanced actions and happenings during projected plans (Krupp & Schoemaker, 2014). According to Hyken (2016), a new phrase called as VUCA was followed by skilled business leaders to describe today's chaotic and turbulent environment in the recent past. Owing to the VUCA conditions, companies all around the world are being compelled to regulate their ongoing departmental functions through adopting flexible business models by internal and external dynamics (Petrie, 2014). Most of the implemented changes in the company's business models and flows have been increasing the demand for organizations being collaborative, capable, adaptive, and flexible minded coping with factors of the VUCA such as volatility, uncertainty, complexity, and ambiguity (Higgs & Rowland, 2005). In the near future, leaders will need to obtain new skills such as agility, adaptability, and collaborativeness because the outcomes of the VUCA concept would have been grown in a more disruptive shape (Battey, 2012). The VUCA factors as volatility, uncertainty, complexity, and ambiguity are distinctive but should not define each separately. Because, the gap among these factors is too interconnected to observe clearly and seems like a gray-colored area (Watt *et al.*, 2017). The VUCA concept includes the dilemmas of people encountered in daily lives during the decision-making process, regardless of a strategic background (Ruksana & Ahmed, 2019). According to the VUCA concept, businesses, organizations, and other fields related to humanity's economic sectors include factors of the VUCA concept (volatility, uncertainty, complexity, ambiguity) (AREETE, 2011). The winner side of the VUCA world members conduct a successful business strategy through designing a long-term path within considering the short-term requirements and resources. (Shingwal, 2018). According to the VUCA world conditions, the internal communication between employees is not adequate to progress the business cycle well throughout the factors of the VUCA concept rather than among the company's stakeholders (Desai, 2010). The management functions of businesses are no longer the key areas to progress

the business cycle entirely, workers should be open-minded, give suggestions for improving business processes to management functions and also participate in strategic decision-making sessions in the VUCA world (Chakraborty, 2019). Organizations should be able to pursue their enthusiasm for discovering new ideas and fields of experiences in which provide the ability to transform threats into more valuable opportunities than before (Bartscht, 2014). To be survival of the VUCA world, companies and their belongings have better to discover and encounter with new unknown things for dealing with VUCA outcomes by increased flexible thinking and agile responsiveness (Bartscht, 2015). Companies have been effectively utilizing their resources and business models to innovate through the vision of becoming survival in each industry, otherwise, their business processes could be corrupted by the VUCA's conditions (Joshi, 2017). When businesses transform the VUCA conditions as volatility, uncertainty, complexity, ambiguity into vision, understanding, clarity, and agility, their sustainability will be observable through the competitive advantage on to others and being the market leader as a result of existing as an innovator (Halamka, 2011). Although the appearance of non-forecasted risks and threats, businesses should react to the VUCA conditions in a solution-oriented way and optimize its business model by discovering possible VUCA outcomes (Baltaci & Balci, 2017). The effects of the VUCA concept has widely observed in every type of generation from Baby Boomers to Z Generation called Millenials due to the mixture of generations that can be seen as a new normal by today's business environments (Rodriguez & Rodriguez, 2015). Some leaders around the world react to the VUCA conditions with an anger and insulting behavior rather than embracing them in a calming way (Johansen, 2010). Business leaders and managers have preferred to choose an adaptive performance approach to eliminate negative effects on employees during the VUCA world (Potsangbam, 2017). Businesses and business-related functions are still closely examining for a specific approach to enhance department activities, foster creative thinking in designing strategy, and also provide innovativeness culture to lead change rather than an adaptation for being sustainable accordingly (Sucharita, 2016). Most managers, leaders, and executives have a conflict with seeking a feasible alternative for embracing the ideal strategy and management under successful leadership (Horney *et al.*, 2010). In order to successfully struggle with the VUCA challenges, a responsible leadership style with a mixture of ethics, networking ability, business-minded, and generous needs to be required to handle challenges in the business environment (Sarkar, 2016). New skills should be acquired by leaders to deal with the VUCA conditions beyond being agile, adaptive, and embracing smart learning skills (Johansen, 2010). Employees' loyalty and self-determination and productive

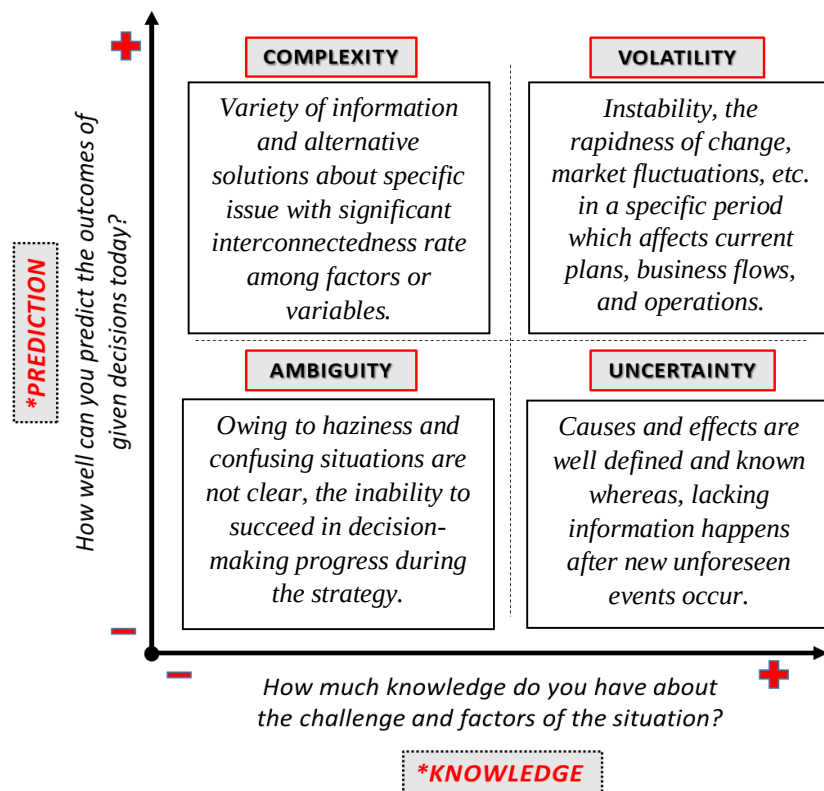
corporate culture provide aspirations to corporate transformational leaders that motivate company employees to generate new enhancements and innovations during the VUCA's rapid change outcome, which will be desirable for every stakeholder under these circumstances (Chatterjee & Mohanty, 2019). In the turbulent, complex, and unpredictable situations brought about by the VUCA world, business leaders and decision-makers aim to preserve the employee performance at a practical level by developing an adaptive structure and solution environment as part of corporate culture (Potsangbam, 2017). The VUCA factors possess a vital impact on a country's prosperity for being survival against other countries, which are seeking sovereignty on foreign lands to utilize physical and capital resources of the targeted ineffectual country in world politics. Under these circumstances, resilience combined with effective leadership styles is the initial determinations of a country's prosperity with independency, like the example of the Basotho nation in Africa, 19th century (Mofuoa, 2016). With the rising transactional capacity of Artificial Intelligence (AI) technologies, Human Resources (HR) businesses have been dealt with the factors of the VUCA world by using of data analyzing required skills for enhancing operations, market and industry predictions with historical data, comprehensive searching techniques for growth with machine learning, and also structured mutual interconnected communication and knowledge transfer between employees from distant functions under volatile, uncertain, ambiguous, and complex business environments (Prakash & Lalitha, 2020). In the VUCA world, systematic thinking and step by step planning methods as linear approaching are a poor technique for struggling with adverse effects of the VUCA concept in more turbulent times rather than non-linear cognitive skills (Franke, 2011). According to the VUCA world effects on the transportation industry, along with the increased costs, complicated operations, and the changing customer demands, companies such as British Airways and Lufthansa companies are a great example of embracing modern management and leadership patterns like agility, open judgment platforms, business collaborations, flexibility and rational risk-taking rather than traditional approaches for sustaining the operations and obtained industry reputation (Mitchell & Moncrief, 2016). Additionally, the creative thinking skills of employees and the culture of organizations are critical factors to reduce the severe effects of the VUCA environment, which exposes risk, planning deficiency, inability to making decisions, etc. Along with creativity, the countermeasure to the VUCA factors such as vision, understanding, clarity, and agility becomes a catalyst for sustainability in the VUCA environment (Chawla & Lenka, 2018; Saleh & Watson, 2017).

2.1.1. The VUCA Concept Framework

The VUCA concept does not only exist in military and political terminology, but also has been encompassing the business models, humanity, and the world ecosystem recently. Today, the developments that affect our daily lives are observed and evaluated under the VUCA concept. In particular, the recent Covid-19 pandemic, political instability, conflicts between states, and the changing financial markets accordingly are some of the main examples that point to the VUCA world today. The VUCA framework study, developed by Bennett & Lemoine in 2014, provides a platform for the VUCA environment to examine four distinctive but interrelated factors such as volatility, uncertainty, complexity, and ambiguity. Thanks to the comprehensive approach, including investigating factors in detail, leaders, and decision-makers can be aware of which factor of VUCA affecting each business's progress and provide possible solutions for these challenges (Bennett & Lemoine, 2014). Designing a strategy plan under industry conditions and maintaining an organizational structure regarding leadership skills and employees' behavior are one of the beneficial tendencies for decision-makers and leader during the issues confronting with it (Codreanu, 2016).

Figure 1

The VUCA Concept Framework, Source: Bennett & Lemoine (2014)

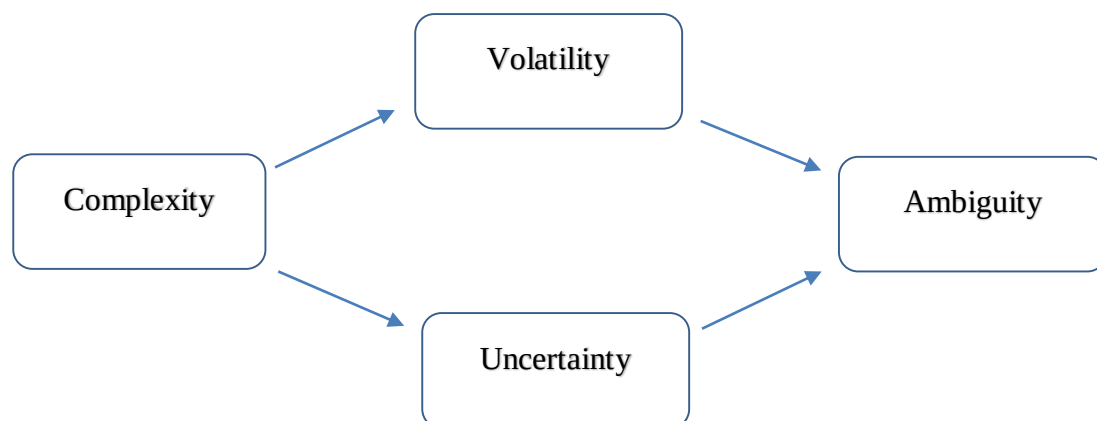


The four distinctive VUCA factors can divide into two groups. According to Figure 1, it can be observed that two distinctive dimensions of the VUCA concept such as "how well can you predict the outcomes of given decisions today" for investigating and analyzing internal knowledge, and "how much knowledge do you have about the challenge and factors of the situation" for investigating knowledge related to the external environment. However, distinctive VUCA factors are interrelated and have a domino effect on each other owing to a cause-effect relationship arising through the structure of today's world dynamics. When each factor is examined in detail, all factors reflect each's results and causes (Clegg *et al.*, 2019). Volatility is defined as a variety of information and alternative solutions about a specific issue with significant interconnectedness rates among factors or variables. Uncertainty is defined as causes and effects that are well defined and known whereas, lacking information placed after new unforeseen events occur. Complexity is defined as a variety of information and alternative solutions about a specific issue with significant interconnectedness rates among factors or variables. Ambiguity is defined as the inability to succeed in decision-making progress during the strategy, owing to haziness, and confusing situations are not explicit.

On the other hand, according to Mack & Khare (2016), the main occurrence point of the “VUCA” effect is "complexity" due to the interdependent knowledge environment, including humanity, being profoundly affected now with the ease of accessing information from everywhere. When the thinking structure of the human brain is examined, humans research the problems with a systematic method and develop solutions. The complexities and unusual situations encountered at this point can trigger volatilities and uncertainties (Espejo & Reyes, 2011; Mack & Khare, 2016).

Figure 2

The Relationship Links Between the VUCA Factors, Source: Mack & Khare, (2016)



2.1.1.1. “Volatility” of the VUCA Concept

"Volatility" word is the noun form of "volatile," which was firstly appeared in the 1620s in literature as a type of Middle English (Oxford Dictionary, 2020). "Volatile" is a combination of two words from different language families, rooted back to the word of "Volatilis" (Latin) and "Volatil" (Old-French) (Oxford Dictionary, 2020). "Volatile" in Middle English during the 1300's firstly meant birds, butterflies, and other winged creatures (Online Etymology Dictionary, 2020). The "Volatile" had another meaning, which points out the rapid change of substances among different types such as solid, fluid, and gas at the beginning of the 1600s by several authors in Europe (Online Etymology Dictionary, 2020). Economist scholars initially used the volatility term started to describe price and cost changes in a specific time to compare with growth, inflation, and commonwealth (Google Scholar, 2020 & Web of Science, 2020). In near following years, the volatility term was used by chemistry scholars to identify the tendency rate of liquids (e.g., oxalic acid) to get vaporized in a specific temperature, in other words, the changing situation between lower and upper boundaries in a given feasible area (Turner, 1831). Other fields of disciplines prefer adopting to the "Volatility" term are finance, engineering, medicine, pharmacy, politics, psychology, and such fields which are effected by data variations and illustrated with a mathematical expression (Gatheral, 2006; Grasset *et al.*, 2009; Dacorogna *et al.*, 1997; Turan, 2003). Within the contemporary meaning, volatility term can be used for identifying the instability and changing conditions via graphs, tables, etc.

Volatility as a sub-part of the VUCA concept seems to occur in a place where rising market competition, rapid technological enhancements, changing business models, and customer preferences have contributed to the rate of Volatility (Minciu & Berar & DIMA, 2019). Volatility factor of the VUCA Concept represents rate of the change, rapidness of transformation, market fluctuations, and also instability of a continuous flow (Barnett & Lemoine, 2014). Volatility is recognized as a critical factor when anything related to human's environment change rapidly without a specific procedure, tool, and information to suppress its severe effects in daily routine (Sullivan, 2012). The variability rate and rapidness of change could be significant factors of Volatility that affect business and humanity's environment unprecedentedly due to the lack of predictability of future outcomes. Volatility is a result of dynamically changing decisions and outcomes that occur in most of the industries, organizations through both internal and external environment variations in undefined time intervals (Shaffer & Zalewski, 2011). For both today and tomorrow, business models all around the world have progressively experienced vital challenges leading to the fluctuation of market

shares, financial gains, and also customer satisfaction (Kaivo-oja & Lauraeus, 2018). From the leadership perspective, Volatility refers to the rapid rate of change experienced from the environment, ultimately imposing enormous pressure on leaders to respond urgently to such change. Uncertainty refers to how the leaders with challenging to manage and make decisions in a remarkably changing environment. Complexity refers to the situation where there is a wide range of factors that account for the situation encountered by the leader; thus, it is considered significantly challenging to diagnose a situation and to formulate effective response and actions. Ambiguity refers to a lack of clarity in that it becomes quite tricky to interpret or understand the impact and meaning of events (Ambler, 2012). From the financial perspective, Volatility refers to the equity, bond, and currency market volatility; the lack of stability and predictability, Uncertainty refers to the potential change in the inflation index calculation; the lack of ability to foresee what significant changes might come, Complexity refers to the state of understanding to increasing Complexity of new financial instruments and regulation to deal with increasingly complex markets. Ambiguity referred to the overall output resulted from the drivers, as mentioned above. Volatility could be emphasized on aims and beliefs that support any personal decision (Rodriguez & Rodriguez, 2015). According to Bauman (2008), any giving decision and plans from decision-makers are entrenched to changing emotions and aspirations of people rather than norms or rules. Volatility as part of the VUCA concept, has been occurred by changing environment reflecting in price fluctuations and the planning cycles.

World politics, relations between states, political movements across the globe, and each country's management framework under its national policy are mostly arisen by external and internal issues confronting with unpredictable challenges as a result of Volatility. The election process in countries directly connected to the voters' desires, perceptions, and individual satisfaction has been dependent on exogenous and endogenous factors of daily lives, making the outcome of the process volatile (electoral volatility) at the time of democracy (Nooruddin & Chhibber, 2008). Globalization movement across the world provided an opportunity for non-developed countries to access resources and start economic advancements in which required to sustain human lives under regular conditions via transferring capital flows (IMF, 1997). As a result of the expanding capital flows, the country's interconnected level has raised, and minimal issues that are ignored can have a significant role in the market's Volatility supported by changing exchange rates, foreign direct investment, etc. (Hays *et al.*, 2003). Nowadays, a trade war is on the world arena between the USA and China, struggling for economic hegemon that paves the way for bilateral loss and profit (Tache & Darie, 2019). Another recent example of

the oil price crisis between Saudi Arabia and Russia illustrates that the price competition for energy commodities among states can have harsh effects on stock market volatility leading to financial loss and governmental budget deficiency (Bradshaw *et al.*, 2019). The effects of Volatility on world issues can be diversified by observing other fields of studies by state actions individually, corporately, and emulously.

Volatility and its effect on several industries through changing the amount of demand, sales, market share, and price & cost fluctuations, can be comprised of different sized companies such as SMEs, corporations, private-public ownership and also solely public ownership around the globe in a defined period during business operations as well. Additionally, with the spreading of globalization trends globally, MNCs and others have preferred to actualize offshore business models on a specific country in which state relationships, trade partnerships, and mutual gains are beneficial for both sides (Bergin *et al.*, 2009). Market share instability leading to changing sales, incomes, and other volatile situations occurs when competition, technological advancements, and ease of entrance to the market as a new player exist in a customer preference related industry such as the automotive industry (Mazzucato & Semmler, 1999). The crisis happenings in the banking industry, which causes financial volatility force companies to restrain themselves from planning new investments and providing financial support tools to customers during the purchasing period as a reflection of collapsed economic activities (Hoggarth *et al.*, 2002; Moshiran & Wu, 2009). Consequently, the insurance industry has been affected by the Volatility of banking transactions and income inconsistency owing to a global crisis in 2008 and other macroeconomic concerns that makes unpredicted contract prices, insurance costs, and incentives are more volatile than before (Eling & Jia, 2017; Mühlnickel & Weiß, 2015; Zang & Nilson, 2015). Firm-level Volatility has been spreading more crucial among companies in each industry when compared to industry-level Volatility because of the changing financial tolerations, meeting customer demands, purchasing power of each company at each market during the export sales process (Vannoorenberghe, 2012). Apart from those mentioned above, technological enhancements on the production line and the transformation of business models have distinguished Volatility on the market by fluctuations arising from customer demands and material costs (Narayan & Narayan, 2007; Zimmermann, 1997). Since the digitalization approaches used by mostly high-sized technology and finance corporations, the rate of volatility effect can be reduced by distributing possible risks and predicting viable scenarios through AI technologies (cryptocurrency, blockchain, etc.) (Yoon *et al.*, 2019; Abrell *et al.*, 2019).

Employees are the critical assets of companies rather than high-tech machines and materials to maintain business excellence, efficiency, the quality consistency of products and the competitiveness level among their competitors in each market during the all industrial history of the world beginning from the Industry 1.0 to 4.0 (Gabčanová, 2011; Shrotryia, 2010; Zaremba *et al.*, 2019). The Volatility of sales, customer demands, and material prices also affect employee's workloads in Production, R&D, Supply Chain, and other departments related to product & service. These inputs of Volatility can be explained as "Business volatility" term, which is defined by Child (1972) to depict several environmental factors that can have an effect on change during the company's operations. When employee's workloads are changed by circumstances of the market and industrial concerns, their motivation for working more efficiently and enthusiastically which is frequently overlooked by managers diminishes, instead of keeping motivation at higher levels (Dasgupta, 2013; Shanks & Dore, 2007). According to Schulz *et al.* (2011), employees work harder in volatile conditions unless the volatility points out a new business transformation, which can be seen as a threat rather than an opportunity. At this stage, managers lead to coping with adverse outcomes of change rising from the external environment in order to keep working efficiency and motivation powerful (Ghosh & Olsen, 2009). During the volatile periods, managers should prefer to pay or provide awards or incentives to employees to prevent adverse outcomes of the volatility on employees for keeping operations efficiency (Chiang *et al.*, 2018). At the any workplace, the conflicts, disagreements, and lacking communication skills between employees cause decreasing rate of efficiency and also financial losses (Mas, 2008). The outcomes of Volatility that influence employee satisfaction and efficiency can be reflected in adverse occasions by increasing stress and distrust level, which mostly affects psychological health (Adler *et al.*, 2006). The change might lead to an increased employee turnover since the dissatisfaction emotions will happen (Baron *et al.*, 2001). Thus, employee's resistance to change, which can be suitable for measuring the volatility level of organizations, becomes more significant than the volatility conditions of both market and industry. Reactions to change can be explained under three distinctive but interrelated sub-factors as affective, behavioral, and cognitive (Piderit, 2000). The resistance from employees is a challenging issue for managers when deciding to make the change (Bovey & Hede, 2001). Resistance and unwillingness to change are observable reactions of humans, mostly in every organization (Worrall *et al.*, 2004). Managing the change successfully as an outcome of volatility is a determiner factor to preserve employees' both motivation and performance that can be considered by HR executives.

2.1.1.2. “Uncertainty of the VUCA Concept

“Uncertainty” word is the noun form of “uncertain” and also an opposite type of the “certain,” which was firstly appeared in the 1300s in literature as a type of Middle English (Dictionary, 2020). In order to analyze the “uncertainty” word in detail, it is possible to investigate the language family of “certainty” word due to inconsistent information about “uncertainty” word on both etymology and dictionary libraries. “Certainty” is a combination of two words from different language families, rooted back to the word of “Certainete” (French) and “Certain” (English) (Oxford Dictionary, 2020). “Uncertainty” in Middle English during the 1300s firstly meant uncertain time or occurrence and afterward meant as “not fully confident” in the late 1400s (Online Etymology Dictionary, 2020). Medicine scholars initially used the uncertainty term started to describe unforeseen events and its outcomes, which are vital for human lives (e.g., Smallpox infection) and then followed by physicians, economists, and law scholars accordingly (Google Scholar, 2020 & Web of Science, 2020). The modern definition of uncertainty is a situation having not enough capability to predict the happenings of future events (Knight, 1921). According to Li & Wun (2006), two sources of uncertainty can be observed as a structure or model related to both internal and external factors, and data as a result of missing values. Insufficient arguments on a related issue can figure out an uncertain situation due to ignorance, lack of reliability, and lack of exactness of each information (Funtowicz & Ravetz, 1990). On the other hand, uncertainty can occur when there is a variety of information in one situation (Asselt & Rotmans, 2002). It can be a failure when predicting future outcomes by observable possibilities during uncertain events (Wellborn & Casten, 2004). From a decision-making perspective, uncertainty is a condition of the specific environment which make decision-maker confused during the decision process in the abundance of possible probabilities or not. (Head, 1967). Within the contemporary meaning, uncertainty term can be used for conditions which individuals’ unreadiness to unexpected events with lacking of information.

Uncertainty, as a sub-part of the VUCA concept, points out the lacking clarity about some questions related to “what will be happening in future?” and “which events coming through to challenge with it?” occurred by situations not being controllable (Egre *et al.*, 2010; Kinsinger & Walch, 2012). Uncertain happenings now and in the future, make the relations, organizations, decision processes, and collaborations among humans more fragile than before cause of diminishing tolerance to uncertainty situations by rapidness of change and a desire to receive information in a short time (Bauman, 2008). Uncertainty can be used to characterize a situation which exists a lack of knowledge with unpredictable outcomes especially causing vital

cause and effects to any environment, group of people, businesses, and also states (Bennett & Lemoine, 2014). During a period of events which are unsteady, disruptive for the ongoing business model and the structure of the organization, and also possess non-predictable outcomes, companies mostly encounter with challenging issues due to lacking clearness of conditions related to market, industry, customer preferences (Watt *et al.*, 2017).

Mostly observable in the last two decades, the world has been encountered with several issues which are not being recognized earlier by humans in a global world arena such as Covid-19 pandemic (2020), OPEC Oil Pricing Crisis (2020), Gulf War, Russian expansionism over East Europe (2016 and still), ISIS terrorist revolt, Cyprus natural gas, the Brexit, US financial crisis (2008) and other examples which generate catastrophes all around the world. These uncertainties make the world more chaotic than previous times and also affect human attitudes towards any decision that will be given by authorities to respond to adverse impacts of outcomes. By the perspective of world politics and international relations among countries, three types of cause point out the uncertainty as modal (what could be the case), empirical (what is the case), and normative (what should be the case) regarding the nature of investigation during the decision-making cycle. Uncertainty can be divided into two groups as being factual and counterfactual to identify the situation by including universal recognition through decision-makers and authorities. For example, in history, WWII was one of the symbols of uncertainty leading to more unexpected outcomes than scholars, policy-makers, and others foresight, such as Cold War, NATO, Warsaw Pact, etc. On the other hand, counterfactual uncertainty represents uncertainties in which situations harder to predict and being controllable by humankind, such as Pandemics (SARS, Ebola, COVID-19), natural disasters (volcanos, earthquakes, tsunamis) (Bradley & Drechsler, 2014). Since the last decade, states have been seeking collaborations to handle uncertainties together in less adverse effects that pave the way for corporations among states which have a mutual natural interest, foreign policy, and security concerns as an example of EU and Brazil (Grevi, 2013). State relationships can also affect the trade volumes in an observable amount. When the possibility of the Brexit talks becomes realized, the EU and UK have been tended to lose their export volumes and net export income (Graziano *et al.*, 2018). According to researchers at the IMF (International Monetary Fund), our world has been challenged with situations that have a significant role in the monetary policies of any country. Thus, some IMF researchers lead to analyze each country's uncertainty index by observing current issues, struggles, and relations as regarding macroeconomic indicators. These observations are transformed into numerical data by using of text mining approach. The

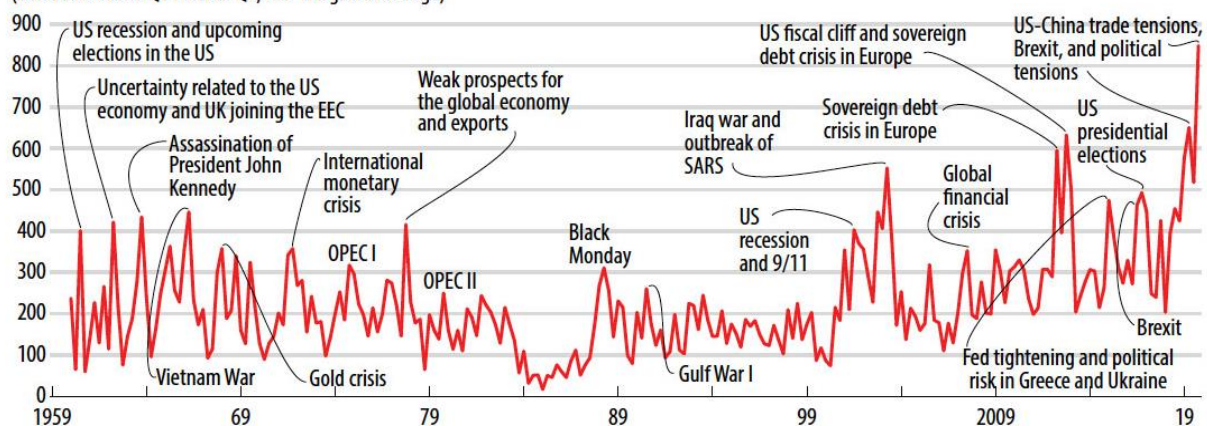
text mining approach is a tool to discover new pieces of information previously unknown by the support of computer-aided software, including machine learning techniques combined with statistical methods. Text mining can be categorized at three distinctive models as information extraction, data mining, and KDD (Knowledge Discovery in Databases), and access information from every written source like websites, articles, newspapers, books, etc. (Hotho *et al.*, 2005). The IMF report about the “World Uncertainty Index,” including 143 countries, provides comprehensive thinking and understanding for observing uncertain events and their effects on states and their economic volume during 60 years of time interval (Ahir *et al.*, 2018). According to Figure 3, as seen below, the significant events have been an effect on economic fluctuations under the vital happenings for humankind like war, pandemic, financial crisis, elections, etc.

Figure 3
World Uncertainty Index (WUI), (Ahir *et al.*, 2019)

Uncertain times

Global uncertainty has surged to a record high.

(WUI index: 1959 Q1 to 2019 Q4, GDP weighted average)



Several years are illustrating significant uncertainties existed from a global perspective. Each of uncertain times connects with unexpected events that have an impact on states' GDP, individuals purchasing behavior, financial institutions and companies' investment, operation and market strategies. When examining main uncertain times through Figure 3, it can be observed that Iraq War, SARS outbreak, the debt crisis in Europe, US-China trade sanctions, the Brexit and assassination of President John Kennedy have caused main uncertainties resulted in an economic depression, international conflict, political inconsistencies, sociologic deterioration of society and other effects present new remarks, policies, regulations and also type of attitudes to world nations and even human lives having strong desire to become survive.

An inevitable cause of uncertainty in today's world can also be seen in industries over the world by changing situations of trade, technology, limited resources, and state policies, as mentioned above. At this stage, the linkage between uncertainty notion and industry is going to be shown in detail by recent examples, ideas of scholars, etc. The changing environments of the world lead the business to encounter uncertain events following in which are more extensive deviations than the past (Schumpeter, 1942). Technological advancements are still on the peak because of the replacement of new technological tools spread all over the world and generate a confusing question to industry authorities about which technologies will have a place soon (Rosenkopf & Tushman, 1994). The main concerns of industries are all about embracing the optimal level to be survival in each market where struggling for competitiveness. Significant factors increasing the uncertainty level of industries can be defined as macroeconomic variables, demand, stock & material planning, capacity planning, technology-oriented production lines, and financial instruments like interest rates, loans. Environmental uncertainty is defined as unseen events with less probabilities like weather issues (storm, thunders, snow, etc.), natural disasters, biologic contaminations, and nature creates both opportunity and threats for decision-makers at organizations (Duncan 1972; Lenz, 1980; McGarthy *et al.*, 1993). Companies at the Thai automotive industry encounter with environmental uncertainties as a reflection of unpredictable technology, customer, and supply variations and eliminate those factors by using integration approaches among them to minimize risk factors through sharing material requirements as a result of supply integration (Wong & Boon-itt, 2008). Since price volatilities have an impact on uncertainty level, investment strategies can be a critical issue when future events are not predictable by decision-makers at most of the industries (Sarkar & Jordan, 2000; Smit & Trigeorgis, 2004). The international oil and gas industry has still faced some challenges that occurred by aggressive pricing models, OPEC's capacity planning, an increasing variety of substitute products (electricity and hydrogen-powered engines), and state policies (regulations. taxes, etc.) (Mohn & Misund, 2009). The characteristics of Industry 4.0 applications regarding to artificial intelligence, universal digitalization, and disruptive innovation provides both advantages and disadvantages to industries simultaneously because of the high interconnectedness of components (Magruk, 2016). Within the conditions of Industry 4.0, one of the successful techniques to handle uncertainties in a less adverse effect is using a scenario planning approach for being ready for instant events with available resources (Schwartz, 2012). When new policies occur as a reflection of uncertainties that actualize by regulator foundations like ITU (International Telecommunication Union), companies prefer

directing to generate a collaboration framework for a standard product like the WLAN module. This approach prevents companies from unnecessary competition and contributes to future technological advancements in solidarity (Warner *et al.*, 2006). When large companies around the world embrace the globalization concept, MNCs found themselves a place on the business stage. According to this new model, the giant automotive manufacturers easily directed to invest far continents like South Africa to maintain production in less costly and excessive amounts until the HIV/AIDS virus initiate to spread fatality (Thauer, 2013). Thus, investment strategies can also face uncertainties in every period, regardless of investment timing. However, growth is still on the demand side of business owners to handle market share and become more competitive than others in each industry for being survival. UK luxury automobile manufacturer companies like McLaren and Jaguar reacted to the Brexit deal, whether its type because of the outsourcing of supply materials, foreign direct investments, and reasonable tariff rates cut. (Grinsteins, 2018). Also, R&D investments in the German automotive industry are confounding situations for managers at the stage of uncertain conditions because of the unknown customer preferences and reactions when the new product or enhanced features are going to be placed in Germany (Sandau & Herstatt, 2011).

Rather than the uncertainty effect on industries, organizations, employees, and also managers are affected by uncertainties through the changing business environment related to technical circumstances. Companies are still applying for M&A tools to eliminate the adverse effects of uncertainty. However, when companies intend to reduce uncertainty level by using the M&A approach, unknown outcomes can occur, which are not embraced by employees owing to morale effects on the organization such as job insecurity, changing business flows, communication, and performance management (Sigamoney *et al.*, 2019). Nowadays, the workplace can be expressed as a changing business environment in which companies tend to adopt new business models, adapt disruptive innovations, and reach growth rates at the more globalized and complicated world being part of it (Pasmore, 2011). Uncertainties associated with a changing environment cause employees to have severe feelings like insecurity, fear, anxiety, etc. reflecting on performance, attitudes, and perception (Cullen *et al.*, 2014). Scholars have begun to observe the behaviour of change recipients in the workplace by analysing employees' adaptability, perceptions, and reactions during the change process initiated by managers (Saksvik & Hetland, 2009; Ployhart & Bliese, 2006). So, it can be said that, while change creates an uncertain environment, uncertainty also creates potential changes (Rafferty & Griffin, 2006; Terry *et al.*, 1996). In order to deal with uncertain situations in changing

business environments, adopting flexibility skills becomes a more outstanding technique for organizations to utilize employee's performance, motivation, and communications (Miller, 2002). Companies have better to foster positive incentives like rewards to the ones who intend to embrace flexible thinking skills, seeking for business opportunities, solution maker ideology rather than problem maker, and also become an admirable example for others in the technology-driven organization (Ngo & Loi, 2008 & Society for Human Resources Management, 2008). Employee's stress reaction is performed at changing conditions of the work environment by individual perception of uncertainty, which is commonly accepted and later adopted (Rafferty & Griffin, 2006). During the changing environment related to uncertainty, employees mostly tend to observe the effects of uncertainty on daily lives, business cycle, and their perceptions surrounded by externalities (Cullen *et al.*, 2014; Fisher & Howell, 2004).

2.1.1.3. “Complexity” of the VUCA Concept

"Complexity" word is the noun form of "complex," which was firstly appeared in the 1700s in literature as a type of Middle English (Dictionary, 2020). In order to analyze the "complexity" word in detail, it is possible to investigate the language family of "complex" word due to inconsistent information about the "complexity" word on both etymology and dictionary libraries. "Complexity" is a combination of two words from different language families, rooted back to the word of "Complexe" (French) and "Complexus" (Latin) (Oxford Dictionary, 2020). "Complexity" in Middle English during the 1700's firstly meant "composite nature, quality or state of being composed of interconnected parts" afterward meant as "complex condition" in the late 1700s (Online Etymology Dictionary, 2020). The "complexity" term was initially used by biology, chemistry, and political science scholars started to describe interconnectedness type of things, issues not easy to understand, and also more than one dependent variables at each problem which still can be seen remarkable at today's world and then followed by educators, economists, and psychologist scholars accordingly (Google Scholar, 2020 & Web of Science, 2020). Up to now, "complexity" term, as mostly result of uncertainty, has been studied in numerous disciplines such as fundamental sciences, economics, medicine, law, information technology, business management, behavioral sciences, etc. to access the clear understanding of mass connected knowledge through a distinctive expression of the term (Abudallah *et al.*, 2015; Bozarth *et al.*, 2007; Galbraith, 1973).

Complexity as a VUCA factor describes the information in which continues to increase intensely through its interconnectedness structure in today's world without the changing effect occurring from external issues (Bennett & Lemoine, 2014). Complexity at the VUCA world

can be observed when organizations circled by complicated issues in chaotic environments have been dealing with interconnected situations combined with more dependent variables for the same problem at backbreaking progress faced by each company's stakeholders (Potsangbam, 2017). More than one decision and solution can be found in several fields of industries, organizations by people who are dealing with any circumstances. So that, numerous information and opinions on a specific issue depict that the issue is complicated and possesses a complex structure not observable in one perspective. The more variations, information, and constraints, the more complex the business environment. Because of having a comprehensive thinking approach in a chaotic business cycle, lean solutions were required to improve business progress in challenging times with complicated issues (Kraaijenbrink, 2014). Mass transportation among regions, easy access to a world of information from one location, and increased cognitive perspectives lead to more complexity in humanity than before the discovering of the Internet, spreading educational institutions, and democratic recognition on the world (Codreanu, 2019). In order to get the excellence level at business management under VUCA conditions, business leaders should maintain a new framework contains collaboration between workers with improved communication skills for dealing with complexity well (Kail, 2010).

When examining the concept of complexity through world perspective, the trade volumes and flows between countries, foreign policies, and related to domestic policies of each state, international relations, and the effects of changes in nature on human life can be described as real examples of the complex concept. The concept of complexity is defined not only as a dictionary meaning but also as being dependent on themselves from a global perspective rather than profound knowledge and easy comprehension. With the globalization trend developing in today's world, more available ongoing partnerships, travel, and cultural changes between countries reveal a more complex and cumulative heterogeneous structure. For example, the globalization that emerged mainly after the cold war and the regional formations such as NATO, EU, and BRICS established in order to provide relative peace in the world create a multi-dimensional and multivariate complex system. The complexity that emerges at this point encourages creative thinking, reducing complexity to simplicity, and continuing processes in collaboration. The increasing trade volume of China has a rapid growth after shifting to produce technology-driven products and services exported to world countries and paving the way for export complexity (Wang, 2019). Biodiversity is another example of complexity depending on cell functions and mutating structures through environmental changes at the ecological system of the world (Bezák, Lyytimäki, 2011). With the expanding factors of the environment,

complexity is being more observable by organizations since the comprehensive thinking methodology for understanding full information occurred inevitably in today's digital world (Halpern, 2007). According to science disciplinary perspective, "complexity" refers to a massive change in science from natural sciences to life sciences, which began after the 1900s, including significant effects of issues like WWI, WII, and Cold War to humanity around the world (Seising, 2012). Dynamic relationships between communities that continue to evolve with increasing complexity can create an environment of chaos, including interrelationship, sensitivity, and also even the smallest factors occurred both internal and external environments that can hurt people during their lives among themselves (Shalaeva *et al.*, 2016). In today's world, to define complexity in details to create awareness for humanity, "the problem of disorganized complexity" term can be useful to express complexity factors and outcomes of the VUCA concept which is defined as "is a problem in which the number of variables is vast, and one in which each of the many variables has a behavior which is individually erratic, or perhaps totally unknown" by Weaver, W. (1942). Problems of complexity might be solved through collaborations from different backgrounds of various disciplines under systemic approach thus, "World Complexity Science Academy" was declared by Andrea Pitasi in 2010 to deal challenges of complexities with scholars, industry representatives, public leaders, and associations on the world (Ferone & Petroccia, 2018). Globalization has been transforming the economy into a complicated system that can be observed in human's daily life. For example, a man purchases some clothes like pants, shirts and then, will be recognized that these have been tailored by an English designer with Japan software, and then produced with Western African cotton and polyester buttons manufactured in Turkey out of Russian petroleum (Andreff, 2017). The complexity effect can be seen on megaprojects around the world such as Nabucco Pipeline Project which connects Eastern border of Turkey to Austria covered 3900 km area by factors of tasks, materials, employee, financial support, administrative, and others cause uncertainty and complicated partnership through cultural, political, and educational differences (Kardes *et al.*, 2013; Mihm *et al.*, 2003; Sommer & Loch, 2004). Global thinking organizations like "Think-tanks" have provided a clear understanding of complicated issues regarding the appearance of globalization, democratization especially after the Cold War, and information technologies to large-scaled businesses, associations, and states as well, South Korea was a recent example of it for transforming worldwide threats into opportunities through collaboration of various ideas and methodologies under complexity framework (Kang *et al.* 2006; Kim, 2007; Lee, 2019; McGann, 2011; Smith, 1993).

Today, the advancing technological developments and the demand due to the increasing population cause companies in specific industry groups in a competitive market environment to develop products and services that include multiple features and meet customer satisfaction. Innovation is rapidly emerging and more effectively as technological developments are becoming increasingly common in all areas. Accordingly, it is essential to manage the complex production and operation environment under the mass knowledge in the best way in order to realize the successful innovation. According to the latest outcomes climate change agreement in Copenhagen (2009), problems issued with complexity are a combination of two distinctive fields, such as business and nature (Levy & Lichtenstein, 2011). The complexity of industry can be defined as a group of companies from different backgrounds combined by some circumstances which cause interconnectedness among them (Caldart & Olivera, 2009). According to the results of the survey applied to Global CEOs at large-scaled corporations, increasing complexity in business environments is the most observable challenge to struggle with it for enabling the organization's success in the long term (Berman, 2010). Complexity merged with technological advancements not only has an impact on innovation dynamics of businesses but also might have an effect on the question about which approach leads knowledge diffusion among industries (Ganco, 2010). "Economic Complexity Index" (ECI) and "Product Complexity Index (PCI)" developed by Hidalgo & Hausmann, have been observed as a volume of knowledge intensity on economy and product through covering different industrial technologies at each country (Lapatinas *et al.*, 2019). According to Juanjuan & Ping (2006), the technical complexity of product and services lead companies to embrace new production technologies and implementing digitalization progress to control interconnected operational cycles during market volatility. Process complexity is a measure to analyze how it can be so difficult to recognize and maintain teamwork and collaboration processes (Cardoso, 2005).

Employees' abilities and behavior are observed as an essential factor in the development of sophisticated technology, production processes, and the services and products that occur accordingly. When complexity is accompanied by uncertainty in the business environment, potential decisions related to entrepreneurship for developing business cycles can be embraced by employees (Lowe & Ziedonis, 2006). Complexity provides benefits to decision-making and enables the ideas to be observable without prejudice of stakeholders (Gavetti, 2005; Klepper & Thompson, 2010). Complexity has been shared interconnectedness between a customer and a supplier is reflected through non-linear systems affected by cognitive and emotional reactions like values, perceptions, biased stereotyping and etc. (Jarratt *et al.*, 2014). Managers should

need to eliminate complexities of tasks in order to increase performances and positive emotions of employees to prevent severe decision-makings generating from mental overload, conflict, and limited time on business progress (Jacko & Ward, 1996; Liu & Li, 2012; Payne, 1976). Complexity theory has recently been used in social sciences, especially at management discipline, to understand leadership and innovation approaches related to behavioral responses comprehending the synergy between employees and managers (Jarratt & Ceric, 2015; Stanley, 2009). Consequently, the inability to decide "trust" can be occurred as an effect of neurologic progress, subjective perception, and cultural background when facing new challenges or someone unknown (Fichman, 2003). Changing trust in a business environment is a result of complexity, which contains psychological background, group interactions, and organizational progress related to both employees and managers in companies (Seppanen *et al.*, 2007). When the level of task difficulties combined with team-building progress, companies face complexity events called "task complexity" which occurs at the more competitive and innovative environments as a reflection of Industry 4.0 applications and measured by some indicators to observe team performances during the harsh challenges which are resulting of complicated factors (Braarud, 2001; Campbell, 1988; Higgs *et al.*, 2005; Nah *et al.*, 2009).

2.1.1.4. "Ambiguity" of the VUCA Concept

"Ambiguity" word is the noun form of "ambiguous," which was firstly appeared in the 1400s in literature as a type of Middle English (Dictionary, 2020). In order to analyze the "ambiguity" word in detail, it is possible to investigate the language family of "ambiguity" word on both etymology and dictionary libraries. "Ambiguity" is a combination of three words from different language families, rooted back to the word of "Ambiguite" (Old French), "Ambiguitas" (Latin), and "Ambiguous" (English) (Oxford Dictionary, 2020). "Ambiguity" in Middle English during the 1300s firstly meant indecision, doubt, and afterward meant as "obscurity in the description" in the early 1500s (Online Etymology Dictionary, 2020). In other words, ambiguity is a reflection of situations that contains decision-making inability under mass information and knowledge such as being confused during the preferences being selected. The "ambiguity" term was initially used by medicine scholars started to describe confusing events and its outcomes which are significant for human's health (e.g., Strangulated Hernia) and then followed by geographers, linguistics, physicist, economist scholars, and political science scholars accordingly (Google Scholar, 2020 & Web of Science, 2020).

The fact that the new situation encountered while having knowledge about a certain subject is different from the previous ones creates ambiguity in the decision making process.

Ambiguity can be defined as the dilemmas and suspicions that cannot be predicted due to the lack of similar situations in the past despite the information available (Bennett & Lemoine, 2014). According to Thoren (2018), issues as possess some characteristics like complicated, conflicted, and lack of clearness describe the ambiguity factor of the VUCA concept. Ambiguity is an unclear situation where abundant information and information-based choices will be preferred during the decision-making process (Horney *et al.*, 2010). The tangled meanings of the blurry of reality and conditions that everyday relationships are completely ambiguous in which facing unknown outcomes of unknown situations, not possess any similarities with antecedents. (Potsangbam, 2017). The ambiguity, which is one of the VUCA factors, emerges as a summary result of the effects of the other three distinctive factors above mentioned (volatility, uncertainty, complexity). Multiple expressions, cause-effect correlation, and difficulties in fiction strategies that decision-makers face represent a few of the sub-dimensions of ambiguity factor in today's business world (Codreanu, 2019). Like uncertainty, ambiguity includes not only lacking information clearness, but also some other aspects, including less awareness about the importance of environmental variables; haziness of cause-effect relationships between variables; and confusion about current forms of action plans, strategies and their potential effects and so on (Carson *et al.*, 2006). Ambiguity is a confusing situation in which facts and outcomes have lacking clarity owing to limited knowledge and unpredictability owing to the uniqueness of events (Horney *et al.*, 2010; Swarbrick & Stearman, 2012). The significance and impact level of events can not easily be recognized without clearness on struggling issues, which leads to the ability to connect the relationship between cause and effects of unique circumstances (Lalitha & Prakash, 2020).

The concept of ambiguity on the world stage, economic crisis, wars, conflicts between states, both foreign diplomatic and domestic political uncertainties, trade agreements & sanctions, and the factors affecting global human health have brought along processes that we have not been more proactive in decision-making processes in recent years (Berger *et al.*, 2013; Boyarchenko, 2012; Costigliola, 2000; Hyman, 1994; Lindsay, 2002). Especially when we consider the last 20 years on a global scale, the emergence of new nationalist, neoliberalist and populist political movements and the rise of tensions between the countries as a reflection, the Iraq War that started after the attack on the trade towers and the ongoing Middle East conflicts, financial crises and the more competitive market conditions that followed. The coronavirus outbreak that has been experienced by all humanity today creates a certain level of ambiguity for leaders and managers (Jinks, 2003; Kagan, 2006; Li, 2020; McGarry, 2009; O'Donnell,

2018; Rubin, 1998). Sometimes, ambiguity is used as a tool to handle a situation by creating flexibility thinking, which makes others confused. From the political perspective, politicians before the elections and maybe also during the elections do not tend to share their preferences and insist on accessing information about rivals that occur ambiguous behaviors that are not predictable by rivals and public leaders under changing perceptions of voters (Janssen & Teteryatnikova, 2017). Although its possibility of realization rate is low, climate change has a catastrophic effect on human lives through floods, drought, increasing volume of oceans due to melting arctic glaciers, and the greenhouse effect rising from reduced ozone layer combined with decreasing oxygen density around the world. Thus, all consequences of climate change can be described as causing ambiguity owing to lacking information, and predictability embraced by humans (Roux, 2016).

According to the globalization trend that is becoming widespread today, the interaction of companies continues to become interdependent processes rather than commercial relations that are in certain periods (Mauro *et al.*, 2008). These situations also present many unforeseen factors that can hinder companies' decision making processes. When we examine the examples, the pricing and demand variations that develop due to raw material dependency, uncertain import-export policies and quotas in the countries where companies are located, the management structure of different cultures and the currency movements of countries can contribute to the ambiguity environment experienced by the industries (Lewis, 1998; Llut & Schneider, 2014; Rich *et al.*, 2010). Especially in the manufacturing and service sectors, which have complex and diverse business processes in Industry 4.0 era and ongoing ambiguity with digitalization, companies need managers who have a vigilant organizational structure and leadership skills that can adapt to flexible management processes (Bloomberg, 2018; Magruk, 2016).

Ambiguity is recognized as a factor that is frequently encountered in today's business environments and has negative effects on employees. In particular, environmental factors that affect the ever-changing daily life of humanity under the external forces continue to influence decision-making processes, motivation levels, and even feelings of the commitment combined with the anxiety. Whether being tolerant for these ambiguities can be one of the major challenges and dilemmas that today's leaders mostly embrace during the team management. Tolerance is a personal trait of individuals in which dealing with new problems or unprecedented issues under the ambiguity framework (Furnham & Avison, 1997; Stoycheva, 2003). Ambiguity tolerant individuals are generally considered as creative-minded owing to the

desire for searching unique techniques to handle challenges, hazy areas, and also complicated issues with consequences of not having satisfied with one direction or frequently used methods (Urban, 2003; Zenasni *et al.*, 2008). Ambiguity is also associated with the current psychological mindset of humanity as an outcome of perception triggered by creativity, critical thinking, job satisfaction, attitudinal behaviors, etc. (George & Johns, 2001; Nicolaidis & Katsaros, 2011; Wilkinson, 2006; Wittenburg & Norcross, 2001). These drivers of perception are related to emotions that have an impact on decision-making cycles of the brain during ambiguous circumstances happened (De Martino *et al.*, 2006). When individuals have more experience with emotions which did not occur before, the level of adaptability to ambiguous situations will increase, and the level of risk aversion will not easily be observed by leaders and managers in the workplace (Nicolaidis & Katsaros, 2011). Gender factors also impactful to different ambiguity preferences among individuals; for example, women are more risk-averse than men due to psychological traits and hormone types. But, women also react to ambiguous situations willingly until the ambiguity level gains vital significance (Borghans *et al.*, 2009). Acquisition of knowledge through brain functions varies from person to person owing to changing neuron and neurotransmitter cell structure related to cognitive skills. These facts have resulted in many types of interpretations on a specified subject/object that causes ambiguous situations for human perception of the environment (Zeki, 2004). Especially, during the decision-making processes, the psychological circumstances of the individual have been held a great role owing to manipulative outcomes of diseases such as anxiety, anger, obsession, panic attacks which point to the reflection of traumatic progress of brain activities in the past (Duhr & Bugas, 2006; Xu & Tracey, 2014). Consequently, these effects can trigger the inability to making decisions due to lacking control of cognitive skills, less utilization of memory process, and being biased rather than rational (Miu *et al.*, 2008). In this way, the group decision-making approach has been embraced by large and multinational companies (MNCs) through fostering communication and mutual work environment among departments to reduce ambiguous effects of circumstances including risks and uncertainties depend on lacking information (Keck *et al.*, 2011). Sharing the knowledge between departments enable the organization to deal with factors of the VUCA concept successfully owing to accessing new information about challenging issues surrounding ongoing business progress within both industry and market perspectives. Moreover, under the ambiguous conditions, the decision-making process can be attractive for employees when collaboration and CFT groups are arranged by HR managers and business leaders to generate synergy for enlightening the blurred areas as possible outcomes of the future.

2.2. The Product Innovation Performance

Innovation has an essential place in today's business and life ecosystem with increasing competition, changing market conditions, and limited resources. For this reason, businesses aim to develop new products by conducting accurate and useful innovation activities to ensure continuous consumption and satisfy both existing and potential customers. The current industry and market conditions, where product innovation is transformed into an environment with challenges, risks, and threats, can obtain opportunities for the businesses through embracing innovation as a corporate culture. In the product innovation process, where carefulness and proactiveness are key drivers, businesses should observe the performance measurements of the activities considering the criteria along with the requirement of business operations under industry circumstances (Henard & Szymanski, 2011). To determine and analyze the main objectives of product innovation performance and how businesses should act to obtain the best performance of innovation against rivals, innovation, and product innovation terms and progress should be examined in detail. Product Innovation Performance (PIP) is a result of innovation management structure and operations during the product innovation at both business and its environmental level.

2.2.1. The Definition and Concept of Innovation

"Innovation" word is the noun form of "innovate," which was firstly appeared in the mid-1400s in literature as a type of Middle English (Online Etymology Dictionary, 2020). "Innovation," is a combination of two words from different language families, rooted back to the word of "Innovatio" (Latin) and "Innovate" (Old-French) (Oxford Dictionary, 2020). The word 'innovation'; It is derived from the Latin word 'novus', which means a new first name, and it was used for the first time in 1548. It originates from the word innovatus (inno + vatus), which is the noun form of the verb 'innovare', which means 'renew or change' (Adair, 2008). "Innovation" in Middle English during the 1400s firstly meant as restoration and renewal (Online Etymology Dictionary, 2020). The "Innovation" had another meaning, which points out the novelties, discoveries, and experimental changes at the beginning of the 1500s by several authors in Europe (Online Etymology Dictionary, 2020). Economist scholars initially used the innovation term started to describe improving business environments by discovering new production systems, management models, and also market competitiveness. (Google Scholar, 2020 & Web of Science, 2020). In near following years, the innovation term was used by natural sciences and political scholars to identify the continuous developing progress under an ongoing cycle (Google Scholar, 2020 & Web of Science, 2020).

With the advent of the Industry 4.0 concept, innovation has clearly become an essential requirement for companies by the edge of business model transformation at different levels (Ibarra *et al.*, 2018). Innovation contributes a sustainable gain to the extent of embracing opportunities for achieving profit maximization through customer orientation in specific markets in which firms still maintain operations (Huhtala *et al.*, 2014). According to Schumpeter (1939), any organization seeking profits must innovate, which causes the deployment of an economic system's existing supplies of productivity and utilization. It has been widely accepted that innovation is considered as a fundamental requirement to keep competitiveness in relation to economic conditions (Sledzik, 2013). Therefore, due to global economic and political volatile conditions combined with increasing competition, innovation management has been gained a continuous flow which integrates multiple disciplines. First of all, the concept of innovation has been named as the main power of economic development and progress, a century ago Australian economist Joseph Schumpeter. Joseph Schumpeter has highlighted that if entrepreneurs intend to gain strategic advantage, they should focus on innovation, and that innovation is the reason for lasting changes, improved productivity and profitability in developed economies (Tidd *et al.*, 1997). According to J. Schumpeter, who identified with the concept of innovation and defined innovation as developing a new production function in a narrow sense, innovation in a broad sense is to invent a new product; creating a new market accordingly; It covers activities such as developing new resources for raw materials and creating a new organization in any industry (Kurz, 2006). Drucker (1985) defined innovation as a successful outcome of a series of activities that provide resources, create a new capacity for entrepreneurship and a new capacity to build prosperity. Drucker explained innovation as the only basic resource that every organization needs. The existence of specific human knowledge is the source of wealth. While Drucker explains "efficiency" as the application of information to the works that are known, "Innovation" has defined the application of information for new and different purposes. On the other hand, Schumpeter distinguishes between invention and innovation. The invented invention (invention) is not accepted as an innovation. According to his / her mindset, innovation is accepted as an innovation if it contributes to production activities (Schumpeter, 1939). The invention, which is the equivalent of efficient work, is transformed into innovation by entrepreneurs (Godin, 2008). Innovation is a tool for entrepreneurs to increase the potential to develop existing wealth or create new wealth-producing resources (Drucker, 2003). According to Roberts (1987), innovation is the revision and development of things that previously occurred to suit new conditions. Innovation

is also to implement an action previously done in a different environment. Dosi *et al.* (1988) stated that innovation is a concept that includes discovery, experiment, development, imitation, and new products, new production systems, and new organization installations. According to Porter (1990), innovation includes both new technologies and methods of doing business that provide a competitive advantage. Rogers (1995) stated that innovation is a new idea, practice, or object known to individuals. Damanpour (1991) identified innovation with the success of a company; He evaluated it as the existence and development of new thoughts. Trott (1998) observed innovation as a management process and defined it as creating a new thought, developing technology, producing a new product, and managing all marketing activities. Innovation has not only one clear definition, but its possible to categorize definitions in three dimensions, such as economic, process, and knowledge perspectives (Afuah, 1998; Schumpeter, 1982; Twiss, 1989). Innovation should be defined as the forerunner of the company's understanding. It can be used as a benefit to keeping up with the ongoing changes in the company's outer and inner environment. The business culture structure should be able to create the firm's perception of innovation (Pervaiz, 1998). Successful product innovation includes combining market needs with technological potential, including creative solutions to problems, managing the process well, and being determined to make efforts in this regard (Dougherty, 1999). Since innovations have been taken into operation, more attention has been paid to improving the quality of goods and services, expanding the product range, and marketing new products and products. In this context, innovation efforts have been mentioned more in recent years. As a management element, innovations determine the power of modern businesses. For this reason, innovation efforts are a separate category of innovation, the essence of which is evaluating the quality of corporate innovation activities (Yermak & Lisnichenko, 2016). According to the innovation literature so far, the concept of innovation has been interpreted from very different perspectives, and no single integrative definition that has been widely accepted has not been achieved. While economists focus on the economic contribution and effects of innovation, organizational experts have examined the structural and procedural relationships of innovative activities. Sociologists have focused on the social effects and results of innovation, and management experts have focused on the practices that are most likely to achieve competitive success (Pavitt, 2005). Innovation is not only making new enhancements or differentiation on products and services. According to Drucker (2007), the key objectives of innovation are developing new products necessary for meeting marketing objectives, making technological changes on current product or progress, being technology leader rather than the

adapter, and also improving the efficiency of several departments such as management, finance, human resources, etc. to sustain commercial productivity. Unique or new approaches that provide financial benefits to the firm on business progress and organizations are also an innovation. Companies mostly lead to making changes in their ongoing business flows, methods, production capabilities, and factors to improve commercial activity and productivity among rivals. So, the concept of innovation is classified within itself, enabling accurate and healthy planning of the change and development process. This classification is accepted globally in terms of product, process, marketing, and organizational innovation (Oslo Manual, 2005). Product innovation involves significant changes in goods or services. These changes include both new products and services and the improvement of existing products. Product innovation focuses on strengthening the organization's product development capability and strategic position. Product innovation, which starts with a new product idea, results in the evaluation of the idea, feasibility analysis, product development, market analysis, and launch. As a result of increasing communication in the new product development process, innovation teams and units are harmonized with each other (Maxwell, 2009; Rainey, 2005).

Process innovation includes technical, equipment, and software changes where new or significant improvements are made. The focus of process innovation is to reduce costs while ensuring the production of new products and services. This type is often an incremental innovation that lowers costs and improves quality. Process innovation is to achieve more efficient workflows and work steps by applying innovation in every process of a product or service from the idea to the delivery stage, using new software, new techniques, and methods. When this type of innovation is applied, the satisfaction and expectation of the customer will be met, and as a result, the enterprise will gain a competitive advantage (Ettie & Reza, 1992; Hine & Kapeleris, 2006; Tushman & Nadler, 1986).

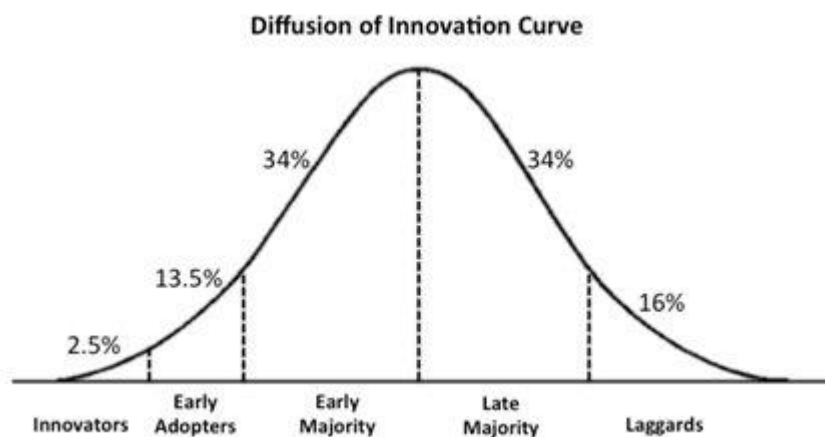
Marketing innovation is an innovation process aimed at renewing the traditional marketing strategy and increasing its market share in this way. Marketing innovation falls into the non-technological innovation class and is just as important as technological innovation. Non-technological innovation requires companies to increase their market shares and enter new markets as they require the implementation of new and more effective business methods (organizational innovation) and the development and marketing of the developed product or service to attract more customers. This means increased competitiveness and growth for both companies and countries (Chen, 2006; OECD, 2005).

Organizational innovation is a combination of activities that refer to keeping innovative capabilities and capacities to compete with rivals in each market through obtaining efficiency. Organizational innovations are designed to improve administrative transaction costs and workplace satisfaction, to provide access to non-traded assets, or to increase the company's performance by reducing material costs (Tiwari, 2008).

Innovation diffusion is a process in which innovative transferring approaches, products, services from suppliers to innovation adaptors in a long period (Caiazza & Volpe, 2017). In this innovation diffusion process, the obstacles encountered are examined in three dimensions, institutionally, structurally, and culturally (Caiazza, 2016). On the other hand, trust, communication skills, and distances between companies or individuals pave the way for utilizing innovation diffusion between innovators and adaptors (Angst *et al.*, 2010; Argote & Ingram, 2000). Recognizing the external environmental circumstances are required to be observed in detail by innovators owing to encouraging and bounding arguments occurred from policymakers, industry leaders, and both tangible and intangible resources each company\organization has during companies\organizations lead to establishing an innovation diffusion framework, (Caiazza & Volpe, 2017; Drury & Farhoomand, 1999).

Figure 4

The Diffusion of Innovation Curve, (Source: Rogers, 1962)



As seen in the figure above, innovation diffusion has a curve that takes place in five separate sections. Different adaptation periods observed in line with this curve may vary depending on the individual's generational differences and behaviors, technology acceptance levels, and reasons for preference, purchasing behaviors, and cultural memory.

Open innovation offers new ways to create value. Companies are working to transform their research results into products and services that meet customers' needs. In particular, the

role of R&D should extend far beyond the firm's boundaries. Innovation providers have argued that businesses that adopt the open innovation model will most likely develop by integrating their ideas, expertise, and skills with others outside the organization to deliver their results to the market using the most effective tools possible. (Chesbrough, 2003). The closed model is based on the view that businesses must produce and develop their ideas to innovate and maintain competitiveness (De Jong *et al.*, 2008). Various studies on open innovation support that the firm's boundaries require porosity to acquire knowledge and skills from the outside environment (Fernandes *et al.*, 2017). Open innovation; It is a paradigm that aims to use the stable flow of information by expanding the markets to accelerate internal innovation and provide external innovations (Chesbrough *et al.*, 2006). Open innovation is based on the use of external and internal ideas to access and use both knowledge and solutions (Saguy & Taoukis, 2017). Open innovation benefits from many new ideas to produce new products, services, and solutions, bringing profit to companies and organizations (Lundström *et al.*, 2014). Thanks to the appropriate expenditures for the development of an external and internal relations network, there is an opportunity to access sufficient resources that shape the joint formation of interests (Lenart-Gansiniec, 2016).

Innovation can be scrutinized in two main groups as incremental innovation and radical innovation related to the progress and technological aspects of innovation. Incremental innovation, emanating from the "learning economics" theory, is defined as maintaining continuous improvements and optimizations on the current technology—incremental innovation results in cumulative efforts of enhancements, which provides advantageous features to customers for product satisfaction. Steps of incremental innovations follow each other to preserve the harmony of the product structure and capabilities (Hui & Qing-xi, 2006; Kotelnikov, 2000). On the other hand, radical innovation is a significant technological evolution of the product, including breakthrough aspects of science and engineering that are hardly expected by customers and observed as unique by related markets. Radical innovations cause changes in the market and technology (Bouncken & Kraus, 2013). Radical innovations often bring uncertainty, as they are based on the application of new and emerging, completely unknown, and untested technologies (Fynes *et al.*, 2004). Thus, radical innovations can be examined as disruptive innovations that present major differences and impacts on current products, business models, and human lives such as electricity, telecommunication, computers, and robotics (Leifer, 2000; Kotelnikov, 2000). Radical innovation makes considerable

differences in the company's existing capabilities, creating the ground for the emergence of entirely new products and services (Ritala & Hurmelinna-Laukkanen, 2013).

Exploratory innovations are radical innovations designed to meet the needs of emerging customers or markets by offering new designs, create new markets, and develop new distribution channels (Benner & Tushman, 2003). Exploratory innovations require new information or separation from existing information. On the other hand, exploitative innovations are increasing innovations and designed to meet the needs of existing customers or markets through utilizing knowledge and skills, developing established designs, expanding products and services, and increasing the efficiency of existing distribution channels (Abernathy & Clark, 1985; Benner & Tushman, 2002; Justin *et al.*, 2006). Exploitative innovation creates value by strengthening the existing knowledge base of organizations and improving existing products or processes. Innovation for discovery creates value by organizations developing new domains or transitioning to different areas to adopt or create new products or services (Popadic *et al.*, 2016).

Ongoing technological developments in the present world and new business models emerging accordingly, replace the old ones and consequently contribute to the formation of a new market, product, and customer balance (Bower & Christensen, 1995; Christensen, 2006; Gilbert, 2003). The term "disruptive innovation," introduced by Christensen & Raynor in (2003), is a situation in which significant changes occur in existing products, services, and business models combined with observable changes in the progression of markets, industries, and habits of customers. When the previous studies were examined, the version of the term "disruptive innovation" with a similar meaning as defined by Schumpeter as "destructive creativity" in 1942, but the invention dimension was expressed rather than the commercial dimension (Dan & Chieh, 2008).

In today's business environment, innovation achievements are mostly seen in developed countries due to the abundance of material and financial resources, smart education, and the availability of multinational innovator companies. However, the limited and externally dependent resources owned by developing countries in comparison to developed countries can enable successful and productive innovation by directing developing countries to platforms that will maximize solutions and innovation in line with their existing resources (Hossain, 2018). This action called as "Frugal Innovation" term to express the innovation of products and services under limited resources to pursue business sustainability (Agnihotri, 2015; George *et al.*, 2012).

Digitalization has become the generally accepted standard of today, with big data increasingly crucial in our lives and developing telecommunications infrastructures. These generally accepted digitization processes trigger adaptation to digital developments in existing innovations and accompanying digital transformation mechanisms (Kohli & Melville, 2017). "Digital Innovation" is a term emphasizing the combination of digital and physical resources to create new products and services (Yoo *et al.*, 2010). The digital innovation mechanism provides an interactive platform for several distinctive entities, groups, and individuals to discover and develop new solutions to existing challenges surrounding the world through agility, proactiveness, and creativity (Criello *et al.*, 2018).

"Innovation ecosystem" is a living platform where all corporations, associations, groups, and individuals mainly focus on improving technology by using innovation diffusion strategy and others in a complex environment of interdependent capabilities (Jackson, 2011). The innovation ecosystem can be divided into two groups as research economy and the commercial economy. The innovation ecosystem is gained its definition by the expansion of digitalization, open innovation culture, external forces like state relations, and the interconnectedness shape of companies owing to globalization. Types of ecosystem innovations that directly affect businesses, people, and nature can be corporate, state-centric, digital, city-based, start-ups, university innovation ecosystems (Oh *et al.*, 2016). According to Pietsch (2004), the innovation ecosystem is a combination of both artificial and natural resources providing a comprehensive approach to maintain new technological enhancements and discoveries through mutual knowledge transfer and beneficial interaction.

Innovation is also required in national well-being, as the effect of developing new products on the country's income flow as resulted in GDP and encouraging citizens to adapt to creative, solution-oriented, and opportunities-tracking mechanisms (Harrison & Huntington, 2000; Porter, 1990; Williams & McGuire, 2010). To analyze country's innovation levels through several dynamics like education, prosperity, security which have impactful variables to measure each country's innovation effectiveness, Global Innovation Index (GII) validated by European Commission Joint Research Center (ECJRC), has been provided a more broad expression regarding innovation rankings of each country and suggestions about which variables need to be supported or abandoned by policymakers and industry leaders rather than other innovation measurement tools including limited metrics (Cox & Khan, 2017). GII report published annually has been examined countries' current position and attitudes towards maintaining and spreading innovation and has been suggested possible guides that each of country should adopt

to obtain innovativeness in a global shape through developing infrastructure and technological capability for increasing the GDP level of state and common-wealth of the society.

Table 1

GII Country Rankings 2019, (*Global Innovation Index Report, 2019*)

<u>Country/Economy</u>	<u>Score (0-100)</u>	<u>Rank</u>	<u>Income</u>	<u>Rank</u>	<u>Region</u>	<u>Rank</u>
Switzerland	67.24	1	HIGH	1	EUR	1
Sweden	63.65	2	HIGH	2	EUR	2
USA	61.73	3	HIGH	3	NAC	1
Netherlands	61.44	4	HIGH	4	EUR	3
United Kingdom	61.30	5	HIGH	5	EUR	4

According to the Table (1) above, Switzerland placed at the first grade with 67.2 points among other countries through have a great significance on education, producing technology outputs, and also fostering individuals' creativity. The GII report analyses and scores each country's innovation level through some critical factors in which companies and individuals apply to acquire abilities and skills during the innovation process. The innovation level of Switzerland was observed by five distinctive main factors like institutions, human capital & research, infrastructure, business sophistication, knowledge & technology outputs, and creative outputs. These factors possess different weights to measure innovation level accurately via defining necessities of innovation by innovation scholars at WIPO, INSEAD, and other accredited associations and organizations (GII, 2019). According to the GII Report in 2019, Switzerland gained the first rank of the innovative international country by utilizing the physical infrastructure of the states, education, and economic factors through embracing strict and effective innovation policy. The useful innovation policy should be designed to obtain innovation-oriented mindsets and expand the creative and free-thinking environments of the citizens encouraging with motivating arguments. Also, the establishment of collaboration teams from different cultures in solidarity by strengthening modern education and international communication connections will make a significant contribution to the degree of country innovativeness in the competitive world arena (Edler & Fagerberg, 2017). Apart from all these factors, there should be an essential integration between culture and innovation for innovation to take place as a valid, continuous, and traditional ritual in every process through utilizing supportive innovation cultures in highly populated organizations. Innovation supportive culture is the factor that enables the emergence of innovative behaviors by combining the shared

beliefs, perspectives and values that are present to combine basic social and cognitive practices among individuals (Khazanchi *et al.*, 2007).

2.2.2. Product Innovation

The product is the output of a company to the market. The product meets concrete customer demand with its specific functionality and features. Product innovation can be considered as the first step of the entire production cycle from design to developing a product (Parry *et al.*, 2009). Product innovations are mostly aimed at producing new products and services. These new products are aimed at creating new markets, attracting the attention of consumers, and increasing the level of satisfaction by making changes different from the current situation (Wan *et al.*, 2005). Product innovation is based on increasing the consumer benefit of the company to create more value. Product innovation is about change in which creating a new product with a new function or applying new principles for improved functionality (Kang, 2009). The term 'product' in the term product innovation is not just goods. Product innovation includes making innovations, enhancements, and developments on the product in the manufacturing and services industry. Product innovation mostly accepted as a vital necessity for becoming a survival and technology leader under contemporary economic balances between companies and related stakeholders (Bauomol, 2004). Product innovation is the only approach to become survival in every industry under conditions of rapid changing environment dealing with difficulties, limited resources, and high competitiveness (Cooper & Kleinschmidt, 1987). While product innovations are realized, new information and technologies can be utilized, or product innovation is created with new and different combinations of these existing resources (OECD, 2005). Product innovation is not a new phenomenon emerging suddenly. This type of innovation has shaped and continue to shape our lives for thousands of years. Product innovation can be interpreted as changes in the current design of the product, the use of new techniques or new tools in production, and the addition of new functions that the product does not have before. The continuity and continuity of a company against the rapidly and aggressively spreading competition depend on meeting the changing demands of consumers, that is, developing product innovation (Reguia, 2014). Product innovations are important for businesses as well as for economies as a whole. When considered as a whole, launching new products to the market is the basis of economic growth (Christensen & Lundvall, 2004). The main idea of product innovation is to manufacture new services and products. Thanks to the new products manufactured, it is aimed to participate in new customers and market environments. It aims to acquire new products, new customers and markets, and to increase the

level of satisfaction by making different innovations from existing situations (Wan *et al.*, 2005). According to Reiney (2005), the primary objective of product innovation is obtaining a competitive advantage through developing new and enhanced products and services to reach long-term market leadership by creating values for customers. In addition to being extremely important for sectors and their subsidiaries, product innovations are important for global economies as a whole. The introduction of new products to the market is one of the important foundations of economic growth (Christensen & Lundvall, 2004; OECD & EUROSTAT, 2006). Successful product innovation includes combining market needs with technological potential, including creative solutions to problems, managing the process well and being determined to make efforts in this regard (Dougherty, 1999). Product innovation requires flexible management and decision-making, adaptive leadership, creative thinking, and great financial background to deal with price volatilities (Slack *et al.*, 2006). Im & Nakata (2008) found that an innovation culture with market-oriented reward systems that encourages risk-taking management significantly increases cross-functional integration for the new product development process. Tidd *et al.* (1997) argue that innovation culture affects employees' creative solution skills and leads to higher levels of participation in the new product development process. Tipu *et al.* (2012) also found that the culture of innovation predicts a strong desire and tendency. In other words, the culture of innovation contributes to the reverberation of innovation in organizational processes (Sattaaraksa & Boon-itt, 2016). Leaders at organizations should foster creativity through building cross-functional teams to cope with challenges of product innovation via Human Resources Management practices which present ideal utilization of the learning environment to expanding the number of innovative employees (Hatch & Dyer, 2004; Lau & Ngo, 2004). Creativity level of employees also supported by task autonomy and employee empowerment to generate impactful innovation grounds on work environment (Drucker, 1999). These supporting units of creativity lead managers and employees to be proactive and familiar with changing situations which are combined with uncertainty and ambiguity during decision-making and operational cycles (Griffin *et al.*, 2007). Redesigned products are mainly derivatives of previous products with some design or production problems to launch new features related to quality, efficiency, and customer-tailored on the market (Li *et al.*, 2006). Unfortunately, the redesigning process can impede product innovations because of the limited areas of functional change and mostly focused on problems by engineers and employees rather thinking from out of the box to prevent design conflicts and provide innovative solutions embedded to current products like the transformation of personnel

vehicles since horses replaced by Henry Ford's technology (Smith *et al.*, 2012). On the other side, disadvantageous effects of product innovation can be observed with negative outcomes to the company's operations, customer benefits, and business environment. These factors are technology disruption, vital failures of the business process, and losing customers forever (Bloodgood, 2013). Thus, to handle these upcoming possible disadvantageous circumstances, companies (called themselves as product innovators) should firstly analyze customer requirements, potential growing market areas, and test the product with implementing trial packages and present product samples to specific customers which have shared a common history on the product framework with the manufacturer or service provider. Based on this perspective, the product innovation might not be happened excellent without organizing a technology strategy of each company at different industries owing to the requirement for capacity planning, technological advancements, and also organizational structure leading by top management coordinated with employees. Product Innovation and Technology Strategy (PITS), enable companies to become survival of leading product innovations in less failure during the turbulent periods including high competitiveness, price volatilities, and unprecedented technological enhancements around the several industries (Cooper, 2000).

2.2.3. Product Innovation Performance

Ongoing literature has proved that manufacturing and services companies mostly adopt new technologies and digitalization tools for developing the current product portfolio to satisfy customer expectations via a combination of knowledge intensity from both internal and external environment (Katila & Ahuja, 2002; Rosenkopf & Nerkar, 2001). Product Innovation performance (PIP) is a tool to diagnose the impact of innovative developments and processes on business indicators such as profitability, competitiveness, organizational effectiveness, and departmental functionalities (Löfsten, 2014). PIP can be observed as the consequences of utilizing contemporary knowledge related to specified industry and business continuity (Amabile *et al.*, 1996).

PIP comprehends a wide range, including design, R&D, planning, production, quality investigating, marketing activities, and sales operations along with customer relationship management (Pascual *et al.*, 2019). PIP can be analyzed through two distinctive but interrelated factors such as efficiency for measuring productivity and efficacy for measuring organizational influence (Alegre *et al.*, 2006; Curado *et al.*, 2018). On the other side, most of the scholars have a different point of view to analyze the performance of product innovation. However, all of them concentrate on one aspect that product innovation performance is dependent on both

external and internal circumstances through considering the essential drivers of company unit price, production progress, market conditions, etc. (Gao *et al.*, 2015). PIP is continuous progress in an organization which observes the performance of new product innovation during the product life-cycle, including marketing & sales operations (Menguc & Auh, 2010). A great success of product innovation performance is related to the organizational structure of the company and employee characteristics under the circumstances of the work environment (Evanschitzky *et al.*, 2012). Unless a work environment does not support creativity as a driver of innovation, companies will not easily maintain technological advancements through product innovations and also become a market leader in each specified industry (Dul & Ceylan, 2014; Pitta *et al.*, 2018). As the increasing globalization around the world, organizations contain different employees from various nations. Thus, Hofstede's (1991) cultural differences framework used in the organizational analysis have a significant impact on firms' innovation progress and also product innovation performance which is divided into two distinctive groups such as project and commercial (Beyene *et al.*, 2016 & Casey *et al.*, 2005). In different cultures, factors affecting innovation processes such as motivation, prioritization, team cohesion and solutions to problems are changing (Hofstede, 2015). Leadership and team collaboration are seen as an essential tool for product innovation performance to be effective, especially in sectors where competition is intense, and there are multiple cultures (Eisenbeiss *et al.*, 2008). Due to the continuous and long-term flow of product innovation processes, the company's current business model and strategy should be flexible and always adapted to unpredicted events in order to ensure efficient product performance (Jajja *et al.*, 2017). To reduce barriers of obtaining aimed product innovation performance, companies lead to prefer building collaborations among industry stakeholders and others like universities, unions, etc. for designing and implementing progress of a new product and penetrating to the market *along* with pursuing customer satisfaction (Gnyawali & Park, 2011; Ritala & Hurmelinna – Laukkanen, 2009). Collaboration is one of the critical solutions to eliminate factors that impede innovation activities of each firm and provides more outcomes rather than implementing the process with unaided (Lu & Beamish, 2001). Collaboration among rivals at each industry called as coopetition which has been used by scholars recently. According to Estrada *et al.* (2015), coopetition provides advantageous effects on firms' product innovation performance through sharing knowledge about external dynamics of industry to deal with transform risks, disruptive occasions, and unpredicted happenings into opportunities with protecting internal mechanisms of organizational drivers like capacity, production techniques, and leadership approach to

maintain sustainability. Geographic location is critical for companies to keep PIP level because of the supply logistics, clusters of stakeholder, closeness to potential and prosperous markets, and business collaborations to enlarge innovation effect zone (Sarpong & Teirlinck, 2017). For example, Turkey's geographic location is preferred by giant automotive manufacturers like Volkswagen, Toyota, Mercedes to reduce the cost of production, access to the Middle East & North Africa markets, and utilize young employees owing to pursue profitability and innovativeness.

To sum up all aspects under a framework, main determinants of PIP are divided into four distinct groups such as strategic factors, market factors, business progress factors, and organizational factors related to both human capital and behaviors on work environment (Hannachi, 2015; Montero *et al.*, 2017). For obtaining better understand, these main determinants required to explain in details to make familiar business leaders to product innovation dynamics. Firstly, strategic factors can be observed by-product advantage, technological synergy, company resources, strategy, and marketing synergy. Secondly, business progress factors can be observed by technical & marketing activities, top management support & skill, design stage, speed of access to market, financial gains, and costs. Thirdly, market factors can be observed by market potential, competitiveness, and the environment. Lastly, organizational factors can be seen through both internal & external communications, and other managerial factors regarding leadership, motivation, teamwork, commitment, and adaptability to change (Montero *et al.*, 2017; Montoya – Weiss & Calantone, 1994).

2.3. The Automotive Industry

The automotive industry, as a term, is the business sector that designs, develops, produces and markets engine-powered vehicles including three distinctive product groups such as automobile, light commercial, and heavy commercial vehicle (OICA, 2020). The automotive industry is considered to be the primary driver of the economy in all industrialized countries (D'Automobiles, 2005). The reason for the industry's immersive-locomotive effect in the economy is its close relationship with other branches of industry and other sectors of the global business environment (Biesebroeck & Sturgeon, 2010). The automotive industry is the main customer in basic industries such as iron-steel, petro-chemistry, and tire, and it is the guide of technological development in these sectors. All kinds of automotive vehicles required by tourism, infrastructure and construction, transportation and agriculture sectors are provided with industry products. Changes in this industry affect the entire global economy closely. The automotive industry covers not only the sale of cars and other motor vehicles but also their

design, manufacture and repair. The frame of the automotive industry also covers services such as the sale of various accessories and auto parts, which are important to ensure that an automobile operates efficiently within its systems. The automotive industry is a collective business framework that produces engine-powered vehicles. About 70% of the total engine-powered vehicle production in the world consists of automobile production.

2.3.1. The History of the Automotive Industry

When direct to analyze the history of the global automotive industry, the automotive industry developing to date can be understood more clearly. The automotive industry was firstly appeared in the late 19th century by Karl Benz who invented the first liquid fuel (petroleum)-powered engine in 1885 at Mannheim, Germany after the invention of the first internal-combustion engine by Samuel Brown in 1825 (Bedir, 2002). Then, Benz applied to the patent office for legalized ownership of the invention. Benz's wife achieved the first road trip (approximately 105 km) in 1886, and the first production of automobiles began following in 1888. Since 2008, Mercedes-Benz has celebrated the history of the automobile production on the "Bertha Benz Memorial Route" road (Ziegler *et al.*, 2014). However, the most well-known inventor of automotive vehicles is Henry Ford owing to initiate mass production in high amounts. Afterward, manufacturers continue to maintaining the carrying operations without horses in the United States by the guide of technological advancements in Europe. Subsequently, the infrastructure for automotive vehicles (roads, fuel deployment areas) was constructed, Henry Ford invented the assembly line to produce cheaper vehicles with less lead time in response for high amounts of demand that occurred by US people. In 1908, the first automobile (a part of automotive vehicles) was produced through assembly line systems rather than handcrafting tools by Henry Ford called "Model T" (Tinn Lizzie) in Detroit, USA. The "Model T" had a unique engine as front-mounted 2.9-litre four-cylinder displacement with the contribution of fuel-saving. The wheel-drive located at the rear part of the vehicle was cycled by transmission systems integrating two front and one reverse move. This innovation has revolutionized the world economy. The socio-economic system, which is now described as "fordism", has affected the public not only in the field of economy but also in the social field. Because, with the assembly line production system, it was able to produce a commodity that was not available to the public, making prices cheaper to everyone. Following the peril catastrophe of the Second World War, the recovery in economic growth increased advertising channels with the new technology of television, and the expansion of the road systems of the world provided a noticeable growth in the automobile industry worldwide. (Brooke, 2008).

Figure 5

Ford Model T, (Britannica, 2020)



“Truck”, another called as “lorry”, is an engine-powered vehicle invented to transport high amount of goods in size or quantity from one place to another and also used for critical public services such as ambulance, fire truck, military operations, etc. (OICA, 2020). Trucks are rooted back to horse-embedded wagon technology used for carrying goods in the middle ages. In 1896, the electricity-powered truck supplied with four horse-power (hp) engine and 2+1 transmission (2 forward + 1 reverse drive) was invented by Gottlieb Daimler. Afterwards, the year 1898, first gasoline-powered truck supplied with one cylinder- six hp invented by the manufacturer company at the US called as Winton Company (Cromer & Easton, 2020). Subsequently, the semi-truck, tow truck, mack truck, and forklift truck were invented at the truck industry by American manufacturers. Semi-truck, invented by Alexander Winton in 1898, is a vehicle to carry long trailers to far distances with the assistance of three axes durable for weighty goods like automobiles, stones, steel, etc. Tow-truck, invented by Ernest Holmes in 1913, is a vehicle to pull automobiles with a hook and transport to specific destinations like maintenance centers, fire departments, police stations, and delivery points (Bellis, 2020). At present, truck vehicles can be categorized as main product groups like ultra-light, light, medium and heavy vehicle responding to necessity for supporting business, mostly used in the US at various industries (e.g., construction, logistics, transportation, agriculture, mining).

Figure 6

Daimler World's First Truck, (Daimler Company, 2017)



“Bus”, another called “Omnibus”, is an engine-powered vehicle to transport many passengers (humans) up to 300 from a current point to far distances in safety and comfort. Main types of buses are minibus, midibus, citybus, schoolbus, coaches (sequenced by sizes) which have single-deck and double-deck construction around the world (Soloviev, 2015; Wikipedia, 2020). There many fields of areas for using buses like tourism, school transportation, city transportation, and other fields related to human transportation. When examining the history of buses around the world, the first appearance was observed in the 1830s as a steam-powered engine invented by Walter Hancock and partners of Sir Goldsworthy Gurney in England to able to maintain transportation on roads which are not appropriate for horse-supported vehicles. Subsequently, the first electricity engine-powered and gasoline engine-powered buses were appeared in 1882 by Dr Ernst Werner Siemens and in 1895 by Karl Benz. Afterward, a new bus was developed with some additional features by Daimler to actualize first long-distance transportation between Munich and Berlin (Bowman, 2018; Cromer & Easton, 2020). Following, a combination of electricity and gasoline-powered engines were occurred to increase the efficiency of vehicles followed by rear engines, air suspensions, durable carrier axes, luggage departments, and comfortable seats with the contribution of personal adjustments for passengers (Britannica, 2020). When observing the first buses on the world, these vehicles had independent chassis with suspension, front wheels controlled via chains, two-cylinder engines powered with steam engine connected with rear wheels, and steam boiler. In line with the innovations that took place over centuries, steam-powered engines were replaced by fossil-

fueled engines, liquid-fueled engines, electric engines, hybrid engines, and now hydrogen-powered engines.

Figure 7

Benz World's First Bus, (Mercedes-Benz Company, 2015)



Today, the technological developments around the world pave the way for new engines with several fuel types like a hybrid, fuel cells, compressed natural gases, and electricity. And also with the age of digitalization, driverless buses and on-road data collector & analyzer buses have been spreading to the world for reducing operational costs and optimizing traffic congestions (Lopez-Lambas & Alonso, 2019; Musaelian *et al.*, 2019). As with new technologies, the automotive industry experienced patent discussions in its early years. Most importantly, it was two long court cases in Britain and the United States, each of which a supporter tried to take control of the new industry by offering comprehensive patents. In England, the claim was dismissed by the courts in 1901, five years after the patent application. There was a legal battle over the Selden patent between Ford and the Licensed Automobile Manufacturers Association in the United States, and this union claimed that the union was a basic patent on liquid fuel-powered automobiles. In 1911, the courts had a "valid but not infringed" patent by Ford. The main result of the decision was the predecessor of the Automobile Manufacturers Alliance to oversee an agreement for cross-license patents approved in 1915 (Britannica, 2020). During daily transportation, vehicle instruments offer supportive indicators and controls for both comfortable driving and analyzing the current state of the vehicle and the driver. The Model-T vehicle produced by Henry Ford after the first car invented by Karl Benz includes the speedometer system developed by a German engineer for the first time. This system is shown

on display according to the pressure between the gearbox and the acceleration trigger in 1902. The first example of the indicators in the driver's section, which is shaped as a cockpit design and includes the factors that can be measured in terms of temperature, water balance and fuel condition, which is of interest to the mechanical parts, is seen in the Mercedes 300sl vehicle in 1953 (Knoll, 2017).

The automotive industry today is not limited to any geographic region and actually spreads throughout the planet. However, in terms of the flawlessness of automotive manufacturing, the US automotive industry is at the top and has one of the largest automotive industries in the world (Cooni & Yacobucci, 2007). European countries increased their car production after 1950. Japan, on the other hand, continued its production, which started in 1960, with a production volume of 11 million pieces in 1980, making it an important position. After 1980, South Korea gained an important place in the automotive industry with its export figures. Due to the increase in the competition after 1990, it moved the large automotive production centers to other countries to reduce costs (Bedir, 2002). By 2000s, the automotive industry has become one of the most important sectors in the world. However, manufacturers in the automotive industry have changed. Japan realized a production close to the production amount of the USA. Today, China, a new automotive manufacturer, draws attention to its production amount. Change in the automotive industry is linked to reasons such as increased competition and labor costs.

2.3.2. The Technological Developments in Automotive Industry

Technology, which has revolutionary effects in the world and continues to evolve, transforms the manufacturing industry into the Industry 4.0 dimension through digitalization today as a result of scientific studies and developments that have been continuing since the steam industry structure called as Industry 1.0 was appeared (approximately 250 years before). Today, the means of transportation we use in every point of our lives emerge as a result of technological developments and improvements starting from Industry 1.0, and it continues to develop in line with different engine types, media and wireless communication tools, powertrain and even new fuel systems. For example, the air conditioning systems we use while in transit, (Anti-Lock Braking System (ABS) and Electronic Stability Program (ESP) security systems, adaptive headlights, multimedia tools, and other features emerge as a result of the evolution and development of the car Carl Benz first discovered in 1885. These and similar developments gain innovations with the realization of industrial revolutions with the development of the Industry 4.0 technologies from the Industry 1.0. By explaining the technologies that provide

important gains and changes in the automotive industry, the technological developments in this sector are analyzed in the following with general details.

After Henry Ford's mass production technology, which is accepted as the first turning point of the industry, the second turning point is accepted as the transition to Lean Production under the leadership of Toyota company after the 1960s—owing to the lean production system, which enables the production of high-quality cars without stocks and cheaper according to customer demand, quality and affordable products can be produced effectively (Freeman & Soete, 1997). In the 2000s, the production and sales of environmentally friendly vehicles began to increase gradually instead of vehicles using internal combustion engines using fossil fuels. Among the most important reasons for this are the reduction of dependence on depleted oil and other fossil resources, as well as the elimination of human-caused air pollution and harmful carbon emissions. As a result, it is claimed that environmentally-friendly vehicles will realize the third major turning point or possible transformation in the automotive industry (Lepetun, 2011). Electric vehicle sales worldwide increased by 54% in 2017 compared to 2016, reaching over one million. Norway has become the country where these vehicles have become the most successful worldwide with 39% market share. Iceland and Sweden follow Norway with 11.7% and 6.3% market shares, respectively. China emerges as the most important electric vehicle market in the world as the country that has more than 40% of the electric vehicles sold all over the world. The United States follows China. The number of global electric vehicles sold in the period of 2010-2017 has exceeded 3 million vehicles (Global EV Outlook, 2018).

With the increasing automation technologies that bring contributions related to safety, reduced costs than wired platforms, mobility, dynamic chain, and remote-controlled instruments, wireless technology leading factories to optimize production progress at the automotive industry for producing more vehicles in a short period with low cost and high quality than before, like FIAT example (Calcagno *et al.*, 2006).

After the 1970s when the rising of Industry 3.0 era, electronics, and its applications are progressively implemented in the automotive industry by manufacturers to enhance driver's safety, entertainment, comfort, and road efficiency with the support of several instruments like Anti-Lock Braking Systems (ABS), Electronic Stability Program (ESP), Adaptive Cruise Control (ACC), active suspensions, led-lights, multimedia interfaces, and diagnosis device for vehicle maintenance through CAN and MAC protocol owing to embedded assistance of computer technology on vehicles (Navet *et al.*, 2005).

The Industry 4.0 revolution, which has emerged since 2010, continues to make an important contribution to the development of autonomous vehicles with the Internet of Things, communication sensors, digitalization current and software technologies. Especially the traffic that has been affected more recently and the traffic accidents due to this are mostly caused by human errors, and it can disrupt the daily life we compete with over time. Automotive manufacturers seem to turn to autonomous vehicles in order to reduce the consequences of safety, sustainable life, less stress and physical injuries. Of course, as some risks and threats are expected along with cyberattacks, software disruptions, insufficient legal regulations and transportation infrastructures, the penetration into the global automotive market in the long term continues to be carried out through tests conducted by major automotive manufacturers such as Google, Tesla, Daimler etc. When looking at its historical starting point, in 1926, the first semi-autonomous vehicle was named and introduced as Linriccan Wonder by "Houdina Radio Control", with the support of technology controlled by radio waves. Recent history, the first full-autonomous vision-guided van vehicle using GPS technologies was invented and improved by Ernst Dicmanss, Mercedes-Benz in 1980, and subsequently is being developed and maintained by other manufacturers to spread world's transportation system until the 2030s (Bagloee *et al.*, 2016; Bimbraw, 2015).

Air conditioning systems used in the passenger and driver section of the vehicles were produced by General Motors (GM) in 1955 to create a comfortable and healthy environment during transportation. Thanks to this system, the transfer of fresh air in rainy weather and cool air relaxing in sunny weather is provided to vehicle users in line with humidity, air circulation control and particle filtration that may come from outside (Shah, 2009).

An automotive vehicle is made up of many subcomponents. Therefore, it is a very complex product compared to many products. The product development process, which requires a large number of researchers, is long and costly. When the end of product development is reached, having a product that was originally planned may pose a great risk in financial as well as financial aspects. Therefore, the product development process requires validation on both virtual and physical prototypes. Even if virtual verifications have been made in the product development process, the product must be legally approved according to the physical test results before it's released (Durgun, 2015). Especially before the 2000s, it took quite a long time for each piece to be produced in accordance with the design in the prototype process. The developments in rapid prototyping methods in recent years have also had a positive effect on the shortening of the prototype production process. Today, developments in rapid prototyping

methods generally used in verification activities will be seen as functional prototypes in the near future. In addition, many production methods have been developed for the production of prototype sheet metal parts (Hoffman & Leimeister, 2011; Durgun, 2015; Lazoğlu & Bank, 2010). Nowadays, 3D printers have a great contribution to rapid prototyping in the automotive industry by using polymer, steel, and other raw materials in powder shape related to automotive components. 3D printers can be observed in every section of production lines with assistant guiding of robotic arms to lead any place where it is a requirement for replacement or additional layer to fill empty or broken pieces (Attaran, 2017; Zang *et al.*, 2014).

Today's automotive technology continues to evolve in line with the need to transform production and R&D processes starting from Industry 1.0 into Industry 4.0 structure that is more efficient, effective and able to respond to demands. The main trigger and supportive force of the developments in these industrial transformation ranges is the continuous renewal of the production systems and the flexibility to be optimized. Efficiency, planning and strategy studies by Frederick Taylor, who is accepted as the father of scientific management discipline, firstly fulfilled the demand for the "Model T" vehicle by implementing Henry Ford's mass production system through assembly lines at the Ford factory and then inspired the Toyota's lean manufacturing cycle as called TPS by actualizing low cost and demand-oriented production in the era of the Industry 2.0. Afterward, the rising influence of computer-aided systems on assembly lines and R&D operations, Industry 3.0 was occurred to enhance the productivity of cycles and maintain more accurate design procedures for creating new vehicles by leading of automotive engineers in Japan. As a result of aiming to reduce emission standards, automotive vehicle manufacturers lead to create electricity powered-engines with battery capacity and reduce weights of vehicles accordingly. In order to actualize these objectives with intended low faultless, managers and engineers has been focusing on cyber-security, 3D printer production technologies rather than prototyping, internet of things (IoT), robotic production without human intervention, and big data technologies to produce more effective, secure, optimized, and environment-friendly vehicle around the world (Yin *et al.*, 2018). The main observed and technologies that continue to occur in the automotive industry continue to emerge as a result of physical (e.g., ergonomics) and behavioral (e.g., entertainment) examination of human life. The main goal is to make the transportation process, which is important in the daily life of human life, more streamlined, unobstructed and useful within the platform of smart cities that interact with nature (Akamatsu *et al.*, 2013).

2.3.3. The Global Automotive Industry

Today's world automotive industry, along with its 127-year historical development, has important contributions in various technological developments, the daily life of humanity and operational processes in the business world. Being able to divide the main groups of this industry into technology, producing and vehicle producing groups can be an approach that helps to observe the world automotive industry with a general perspective. In particular, a tremendous globalization trend around the world, which continues to increase worldwide after the cold war and is accepted today, is a driving force for automotive manufacturers and other stakeholders to operate in an interconnected world ecosystem. When examined today, as a result of the globalization trend, while giant automotive manufacturers develop their technology in their own country, they can open production factories in different countries in order to carry out low production costs and logistic operations more efficiently, and by providing technology transfer, the opportunity for automotive technologies to become widespread and to develop with different perspectives. The Foreign Direct Investment (FDI) flows, which have continued to increase since the 1980s, and the trade agreements signed between the countries, have expanded some of their existing operations by providing orientation to major automotive manufacturers with lower costs, resources and transportation advantages, potential markets, and even strong supply chain structures (Sturgeon & Lester, 2004). Differing regulations among countries and changing structure of components due to each market conditions leading major automotive manufacturers like “Mercedes” in South Africa, “Fiat” in Italy, and “GM” (General Motors) in China to arrange an agreement between local suppliers to produce basic or complicated materials and to develop new factories integrated with technological assembly lines adapting to regional manufacturing progress (Sturgeon & Biesebroeck, 2010). However, as a result of the globalization trend, the technology and production of the countries integrated into each other can be disrupted in case of any conflict, conflict or even discussion, and may have a negative impact on the operations of the current automotive manufacturers and the brand perception of the customers. The recent struggles between states have resulted in customers' preferences due to manipulated perception to brands called as relationship quality which is greatly affected by country image (Hilman & Hanaysha, 2015). In addition, unlike the decreasing demand and production in the axis of crisis in Europe and America, especially in the period of 2008 global financial crisis and before, the increase in shifting production from western to eastern countries, purchasing power, population density and the resulting demand volumes in developing and also developed Asian countries increased in both sales and production factors in which are

accounted for 23.5% growth in production volume after the global financial crisis (Gastrow, 2012; Wad, 2010). As to observe impacts of the global financial crisis on the global automotive industry, the total numbers of top 10 manufacturer countries' production were gathered from OICA (Organisation Internationale des Constructeurs d'Automobiles) public database and illustrated as the following table.

Table 2

Automotive Manufacturers' Global Production Statistics (2007 – 2010)

Country	2007	Change (%)	Cumulative (%)	2008	Change (%)	Cumulative (%)	2009	Change (%)	Cumulative (%)	2010	Change (%)	Cumulative (%)
Japan	11,569,327	1.0%	15.8%	11,575,644	-0.2%	16.4%	7,934,057	-31.5%	12.8%	9,628,920	21.4%	12.4%
USA	10,780,729	-4.5%	14.7%	8,672,141	-19.6%	12.3%	5,709,431	-34.3%	9.2%	7,743,093	35.6%	10.0%
China	8,882,456	22.0%	12.1%	9,299,180	4.7%	13.1%	13,790,994	48.3%	22.3%	18,264,761	32.4%	23.5%
Germany	6,213,460	6.8%	8.5%	6,045,730	-2.7%	8.5%	5,209,857	-13.8%	8.4%	5,905,985	13.4%	7.6%
South Korea	4,086,308	6.4%	5.6%	3,826,682	-6.8%	5.4%	3,512,926	-8.2%	5.7%	4,271,741	21.6%	5.5%
Brazil	2,997,150	14.8%	4.1%	3,215,976	8.0%	4.5%	3,182,923	-1.0%	5.2%	3,381,728	6.2%	4.4%
India	2,253,729	11.6%	3.1%	2,332,328	3.5%	3.3%	2,641,550	13.3%	4.3%	3,555,073	34.7%	4.6%
UK	1,750,253	6.1%	2.4%	1,649,515	-5.8%	2.3%	1,090,139	-33.9%	1.8%	1,393,463	27.8%	1.8%
Russia	1,660,120	10.4%	2.3%	1,790,301	7.8%	2.5%	725,012	-59.5%	1.2%	1,403,244	93.5%	1.8%
Turkey	1,099,413	11.3%	1.5%	1,147,110	4.3%	1.6%	869,605	-24.2%	1.4%	1,094,557	52.9%	1.4%
TOTAL	73,266,061		86%	70,729,696		70%	61,762,324		72%	77,583,519		73%

According to Table (2), whereas Japan was the greatest manufacturer in a total amount of production, China replaced Japan's position by the year of 2009 that can be considered as an effect of global financial crisis owing to reduced costs of production and labor quantity. Interestingly, apart from China, all countries placed at top 10 manufacturers on the world had severely affected by outcomes of the global financial crisis with greatly diminished production volumes in a short period.

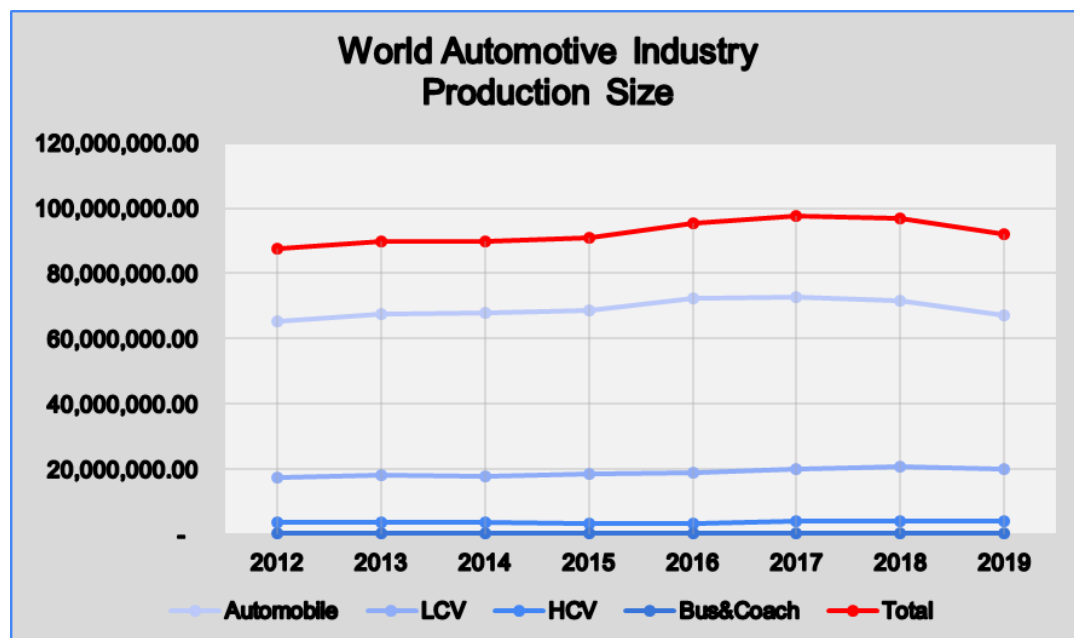
The shortage of fossil fuel sources in the Far East Asian countries, and the high import costs resulting from the economic restrictions with the countries providing fossil fuel resources have led these countries to produce green energy-based automotive vehicles such as electric and hybrid vehicles. The first successful example of this approach started commercial operation as a hybrid electric Toyota Prius vehicle manufactured in Japan in 1997. As a result of the infrastructure support required by the new technology, approximately 1 million vehicles were sold as a result of the market penetration that took place over a 10-year period. Subsequently, after Honda was the first company to follow this hybrid engine technology, other global giant automotive manufacturers (e.g., Ford, GM, Chrysler, Tesla, Daimler, etc.) continue to produce vehicles with green energy. Also, this new green energy-based technology has been embraced by several governments like Brazil and China with legislations, regulations, and providing incentives to citizens for acceptance of these products (Gastrow, 2012). Awareness of climate

change globally was signed in 2005 with the aim of reducing the carbon emission and other ozone layer damage factors in line with the cooperation of Kyoto protocol between different countries around the world (Kolk & Pinkse, 2005). In particular, nearly 22% carbon emissions in the transportation field have led existing automotive manufacturers and government administrations to focus on green energy-focused production and powertrain technologies (i.e. solar energy panels at factories and electricity engines on vehicles), components (i.e. power batteries, telematics) and supportive incentives (i.e. taxes, buyback) as well as more specific regulations to reduce existing emissions through corporate climate change strategy (Damert & Baumgartner, 2017; IEA, 2013; IPCC, 2014). However, the supplier infrastructure and technological competencies of countries create flow-preventing factors in these climate awareness-focused emission reduction studies, and emission reduction as a whole cannot be achieved from the targeted perspective without cooperation between suppliers and manufacturers of different countries around the world (Damert & Baumgartner, 2017; Sprengel & Busch, 2011). The European automotive industry, which corresponds to 4% of the GDP of the European Union and employs about 8 million people, will be replaced by electric and other alternative green energy platforms, transforming fossil fuel vehicles according to the 2050 European climate vision. In this way, it is aimed to reduce 400.000 deaths per year caused by air pollution and to prevent potential respiratory ailments (European Commission, 2018; Fredriksson *et al.*, 2018). In the year 2006, the World Class Manufacturing (WCM) is founded by a group of leading manufacturers to enhance automotive makers' resource and technological capability for reaching efficiency and effectiveness through smart production systems having been upgraded. WCM provides continuous manufacturing with applied systems including quality optimization, customer-oriented manufacturing, reduced costs and production lead time by using of four distinctive methodologies such as Total Industrial Engineering (TIE), Total Quality Control (TQC), Total Productive Maintenance (TPM), Just in Time (JIT) (Djordjevic, 2010). Along with the increasing globalization orientation worldwide, a significant acceleration is observed in the export volumes and profitability opportunities of automotive manufacturers. However, the decrease in production processes, developing aggressive competition policies and customer-oriented product and technology development studies in the business ecosystem where these advantages are realized, evolves disadvantage environments to a more threatening perspective (Giachetti, 2012; Khanna & Palepu, 2010; Volpato & Stocchetti, 2008). In order to reduce these adverse effects on automotive manufacturers, companies have transformed their business into the structure of Multi-National Companies (MNCs) for enhancing profitability,

benefitting from raw materials, operational costs directly related to geography, and also increase production and technology capability to access potential markets and meet customer demands respectively (Giachetti, 2012). As a consequence of globalization, automotive manufacturers belonging to a certain country have started to produce in different countries and accordingly, the expansion in the supplier network, a decrease in prices in transportation vehicles and a wide range of products. As a result, the purchasing activities of many economic groups and sales in some developing countries has grown due to the high population combined with demand. The production volumes of vehicles in the daily trade, transportation, agriculture, construction sub-industry and other related business fields, called as (Light Commercial Vehicle) LCV, increase significantly in the various sectors belonging to daily business activities. As the global financial crisis gradually loses its effect and the increase in the import-export volumes of the countries, the growth in LCV is seen as a result of the reflection of the financial growths that have developed in the domestic market. As to observe the production size of the world automotive industry by vehicle segments, the total amount of production data was gathered from the OICA public databases and illustrated in the following figure via using lines to emphasize trends between the year of 2012 and 2019, after the global financial crisis in 2008.

Figure 8

World Automotive Industry Production Size, 2012-2019



According to the Figure 8 above, after the collapsing result occurred from the global financial crisis in 2008, the world automotive industry has continuously grown with the benefits of the monetary expansion of FED and embracing globalization trend by several major

developed and developing countries around the world. Especially, with the regulation of the European based emission and the US-based emission standards are followed by governments strictly, automotive manufacturers initiated to produce and sell new vehicles with reduced carbon included engines to customers. The new technology, which is an alternative for fossil-sourced fuels called electricity, increased the global automotive production size after the year of 2014 with the guide of Chinese technology leadership. China has a great capability to produce electricity-powered vehicles (EV) to reduce dependability of petroleum imports from the US and other countries and also prevent air pollution which potentially affects a billion of people on the China land. Nowadays, stretched tensions among the G-20 (Group of Twenty) countries have resulted in the actions which are not favorable in coordinating trade relationships and volumes. Since 2013, the US government has been applied severe sanctions to Iran to prevent him from launching and maintaining nuclear weapon programs. In 2018, the additional sanctions happened, including the scarcity of automotive supplies and limitations for sales around the global market (Congressional Research Service, 2020). Along with the US-led sanctions, FDI, bank credit loans, and international automotive supplier & dealer network are remarkably affected by the force of US and related allies, associations, partners, and business networks to Iran. These circumstances obliged Iran to collaborate with China for manufacturing vehicles and reviving the Iran automotive industry (Zhe & Dapdarvar, 2017).

In the year 2020, the United Kingdom left the European Union (EU) as a result of diplomatic negotiations and agreements started in 2016. The UK automotive industry gained remarkable contributions from the EU with EU Single Market, ease to access skilled employees, and expanding market places. Supply chain functions and manufacturing plants are located in other countries in Europe (e.g., Germany) to reduce the cost of operations, utilize material resources, and arrange possible technological collaborations (SMMT, 2016). These contributions from the EU finalized after the actualization of the Brexit. The United Kingdom has been maintained new strategic plans, agreements, and policies to attract foreign countries and investors for obtaining FDI, new trade relations including low tariffs & incentives, and also an effective supply chain network as like the Single Market structure of the EU (Bailey & De Propriis, 2017).

The Covid-19 pandemic, which has recently had a fatal effect, continues to greatly affect people's daily habits. Demand for global automotive vehicles is gradually decreasing in urban transportation and intercity travel rates due to both the restrictions applied by countries and the measures taken by citizens. For instance, there is a decrease in demand for existing coaches

used in intercity transportation owing to the compact seat places and non-suitable areas providing full social distance environments. Therefore, researches are being done on new design solutions. Potential long term effects of Covid-19 will compel automotive manufacturers to focus on more cost reduction, controlled cash flows, tightened fiscal policies, production operations, optimized existed product portfolios within customer's primary demands and hygiene & safety enhanced materials than before (KPMG, 2020). In addition to those effect of Covid-19, new transportation technologies and models would be expectedly recognized by manufacturers such as autonomous drive, connected & shared vehicles, and electricity-powered mobility. The technological infrastructure of vehicle manufacturing plants has transformed into robotics systems without the intervention of human efforts owing to prevent virus contamination through maintaining industry 4.0 applications (Accenture, 2020). With the severe impact of Covid-19, a total of 28 countries including the United Kingdom have discontinued the production cycle for 32 days, and loss of employee revenues and company incomes are notably observed in Europe (ACEA, 2020). As can be seen above, the global automotive industry which provides observable contributions to the GDP level of each country is affected by the fluctuations, unpredicted cases, financial crises, and complex interdependence structure of the business models pointing out the concept of VUCA environment.

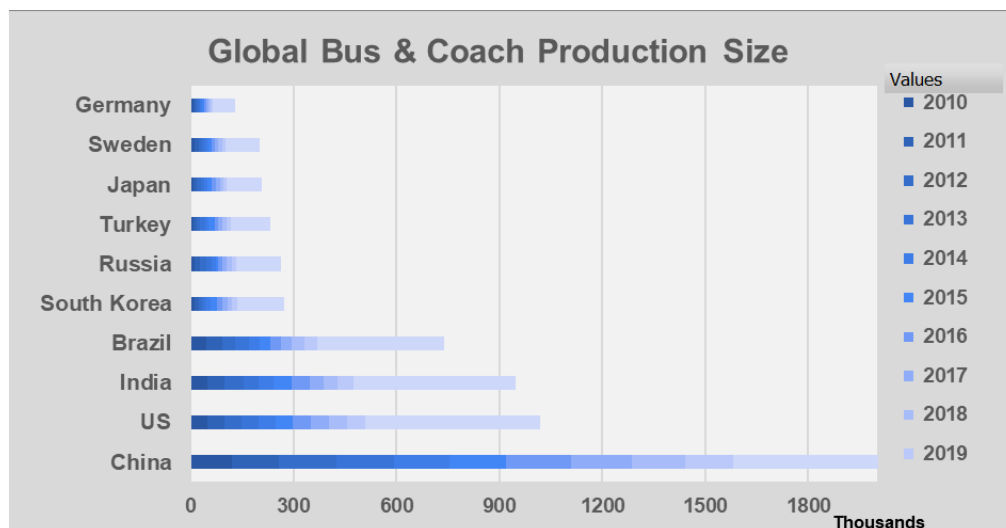
2.3.3.1. The Global Bus & Coach Industry

Bus and coach industry; It is an industrial type that contributes to the state economy, which differs in terms of regional, national, administrative, strategic, scale, economic size, technology, product type and design. Bus production is a sensitive, dense and integrated industry (Özsungur, 2018). It has a complex structure due to its compounds, processors and manufacturing process. This industry requires high co-operation due to the wider range of production lines than others (Jan & Hsiao, 2004). Bus production is capital intensive and requires high investments with technology. Developing a new model or leaving the old system requires huge costs and investments. Security in this industry information flow requires systemic security and mechanical security systems. The accuracy of the information flow depends on the quality and reliability of the communication system. All these requirements constitute obstacles to market entry in the industry (Bedir, 2002; Jack & Gibbins, 2015; Özsungur, 2018). The first buses and coaches were rudimentary and had a high degree of similarity with trucks. Vehicle development, including buses, took place rapidly in the 1920s and 1930s. Buses became much more reliable and refined over between 15 and 20-year period. In the developed economies, bus and coaches remained closely derived from trucks, until

designers began to make some fundamental changes. On city-buses using for city transportation, frames were lowered between the axles, to reduce the height of the floor and later, on buses and motorcoaches using for long-distance travelling, engines moved to the rear, to give better space for entrance and reduce internal noises occurred from the engine. Most of the earliest buses & coaches had steel chassis and wooden bodywork in US and Europe. The first steel-framed bodies were developed in the 1920s, but it took some years before effective anti-corrosion enhancements were developed which is a still a huge problem in developing countries embrace high humidity and salt air affecting from seaside. With the increasing of nanotechnological improvements around the world, today bus & coach manufacturers have directed to use composite materials to reduce weight and durability of chassis. Whereas, the composite materials are much more expensive than the stainless-steel one, owing to its unseparated piece combination these materials provide man-hour costs reduction and durability to manufacturers (Jack & Gibbins, 2017, OICA, 2020). As to observe the production size of the global bus & coach industry through the most significant manufacturing countries in production volume, the total amount of production data was gathered from OICA public databases and illustrated in the following figure via using bar charts to emphasize total production of each country between the year of 2010 and 2019, after the global financial crisis in 2008.

Figure 9

Global Bus & Coach Production Size, 2010 - 2019



The global bus & coach industry can be divided into three sub-groups to analyze in detail by means of customer preferences and technological structure, including dimensions from 7 meter to 18 meters. These sub-groups are city buses (using for city transportation), intercity buses (using for school services and rural areas transportation), and coaches (using for long-distance

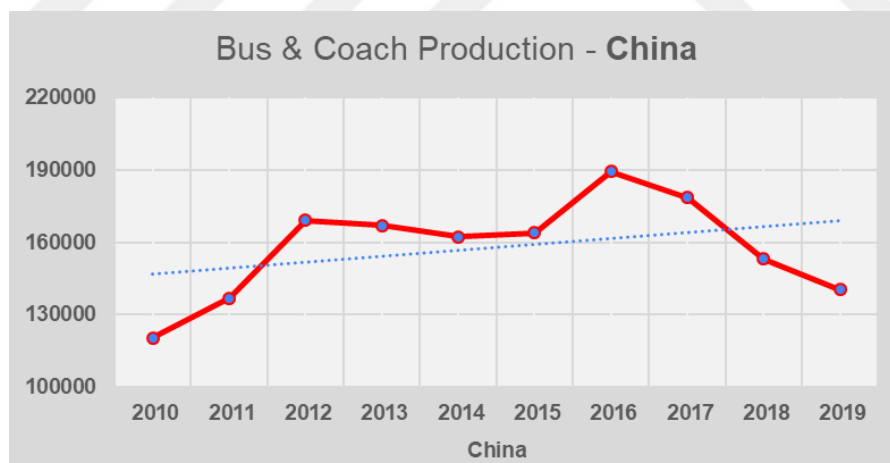
transportation). According to Figure 9, the world's highest bus & coach unit belongs to China due to the large population density and possess a great supplier of bus & coaches for other Asian countries which closely located and have a similar emission standard with China (OICA, 2020). Apart from population-based preferences, which are the main factor affecting bus & coach demands, tourism, periodical organizations and urbanization rates that continue to increase day by day also have a significant impact on global bus & coach production sizes. According to the report of Frost & Sullivan (2011), the population of the world greater than %50 (approximately 4.5 billion people) would prefer to live in cities. As the trend towards urban living grows, and both potential congestion and pollution become severe, investment in public transport will have to increase substantially. Buses and coaches offer environment-friendly and economical solutions to these challenges (Lerner & Audenhove, 2012). With the globalization effect, giant bus & coach manufacturers like Daimler, MAN, Iveco and others preferred to invest and organize new factories in potential market countries like Brazil, China, Turkey, India providing low operational costs, closeness to emerging economies and spreading urban areas, and high production capacity (Jack & Gibbins, 2019). Recently, the young engineer talents and employee motivation of these countries have directed the source of new technological developments towards these new regions. Especially, the fact that the major global organizations taking place in recent years in Asia and Latin America are becoming a center of attraction for meeting the high demands, while the potential market and customer fluctuations that the producers will meet after the global organizations are emerging. The aviation and rail systems transportation platforms, which increase due to the increasing urbanization rate, cause a decrease in the preference for long-range travel coaches. These adverse effects on bus & coach industry can be summarized as low ticket prices of airways companies, transportation in a short time, and comfortability as well. Global bus & coach manufactures have dealt with this challenge with investing more financial and technological resources on electricity powertrains to reduce operational costs reflected in ticket prices, creating more comfortable seat zones, and collaborate with governments to build more safe and well-structured roads to prevent obstacles which interrupt travelling (ACEA, 2016). In the bus industry of the future, besides the vehicles that communicate with each other along with the increasing urbanization rate, the buses that will communicate with hospitals, police stations, advertisers will intelligently reflect today's technology. These gains will make existing buses safer, more user-friendly, operational optimization-oriented and provide financial benefits to their environment. In particular, buses, which can be integrated into urban transportation systems with autonomous technology, can

reduce traffic density and lead people to use their transportation times more effectively (Lom *et al.*, 2016; Mohanty *et al.*, 2016; Sherly & Somasundareswari, 2015).

In the global bus & coach industry, which is analyzed with a world perspective above, the top 10 countries in terms of volume production, production technology, increasing domestic demand, and the power of access to both current and potential markets are China, USA, South Korea, Japan, India, Brazil, Russia, Turkey, Germany, and Sweden respectively. According to the production statistics of OICA, findings represented the bus & coach industry as volatile and vulnerable for external issues like trade war, limited imported-exported goods, tariff sanctions, competition, and changing events on a global scale. To analyze and to investigate the causes of volatilities and production history of each country, production statistics derived from OICA can be a great guide for ongoing research related to bus & coach industry at following. As to observe the production size of the Chinese bus & coach industry, the total amount of production data was gathered from OICA public databases and illustrated in the following figure via using trend lines to emphasize total production of China between the year of 2010 and 2019, after the global financial crisis in 2008.

Figure 10

Bus & Coach Production – China, 2010 - 2019



Foreign investments from developed countries after the global financial crisis enabled growth in the bus & coach industry in China since 2010. Apart from foreign investments, urbanization and visits to other town areas, which continue to increase in China, are preferred by the population owing to enhanced road infrastructure, which can lead to increased bus & coach production (Jack & Higgins, 2017). In addition, the widespread use of electric vehicle technology and the operational gains it brought have led to an increase in domestic demand and export volume to other countries in the Asia-Pacific region. However, the impact of trade wars

with the US as of 2017 has left its place of growth to shrink, directly due to the need for supplier industry services and other supply components provided by the US and Europe (Hamilton, 2019; Moeller, 2018; Wenten, 2020). As a result of these factors, China has largely eliminated its reliance on fossil fuels and has turned to the battery-embedded electric motors produced by itself, and has focused primarily on domestic demand and subsequent exports to the Asia-Pacific region through various significant partnerships (Jack & Higgins, 2019; ACEA, 2016).

2.3.3.2. The Turkish Bus & Coach Industry

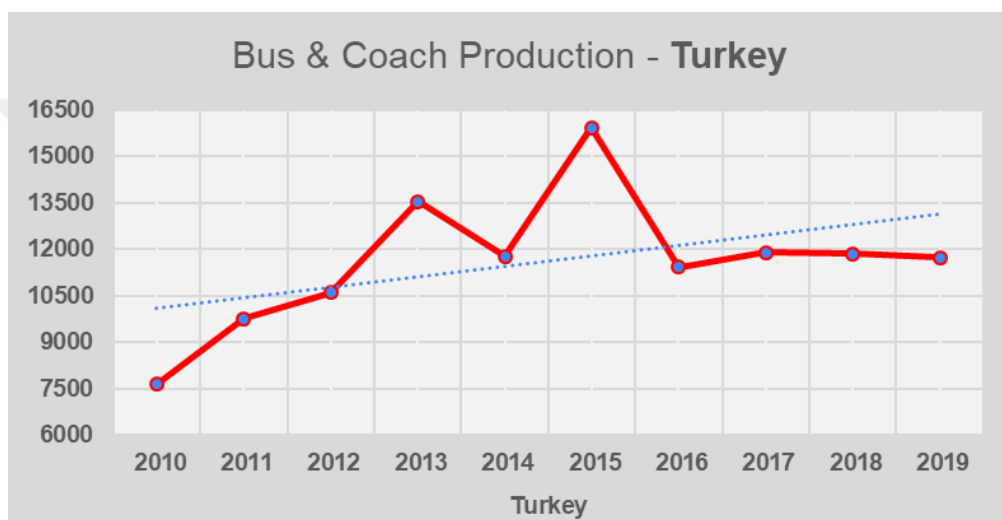
In Turkey, the automotive sector is seen as one of the most rapidly developing sectors (Karbuz *et al.*, 2017). In the first six months of 2017, the rate of exports increased by 8.2%, and the sector with the highest exports compared to other sectors was the automotive sector (ODD, 2017). Nowadays, when compared to other automotive manufacturers in countries with a high level of competitiveness in the truck and bus segment, Turkey is situated in the position of Europe's largest commercial vehicle manufacturer. Especially in the first half of 2016, it increased by 8% in light commercial vehicle production and ranked 8th in the world and 2nd in Europe (Pişkin, 2017). The first production attempts in Turkey's automotive industry to produce automobiles, tractors, and trucks, was established in 1929 by the “Ford Motor Company” assembly factory. However, this attempt was unsuccessful due to the 1929 economic crisis. In the 1950s, production attempts were started again in the industry. “Turkish Willys Overland Ltd.”, the first Turkish partner to provide jeeps and pickup trucks to the army in 1954. Afterward, “Türk Otomotiv Endüstrisi Ltd” company was founded to manufacture trucks, and then, “İstanbul Otobüs Karoseri Sanayi Ltd” company was founded to manufacture buses in 1963 (Bedir, 2002; TAYSAD, 2017). In 1968, “Otomarsan Bus Body and Motorlu Araclar AS” started production of “O302” series buses (Deniz, 2009). The commercial vehicle industry has developed since the 1960s through license agreements, principally with Fiat, Ford, Iveco, Leyland, MAN, Mercedes-Benz, and Mitsubishi. Cummins is an engine licensor, and Eaton has licensed the manufacture of gearboxes and axles. With great foresight, the government at that time insisted that licensors had to transfer technology for a product that was then current. The government also encouraged the establishment of the complete component supply industry, which can meet the highest international quality and technology standards. Turkey has a population approaching 85 million, with a high proportion of people below 50 years old (mostly X, Y, and Z Generation). The economy has been growing at around %5 per annum but might be pulled down by recent political and international relations turbulence. The financial sector was regulated strictly and, therefore, largely escaped the worst of the global financial crisis.

Turkey used to have relatively low levels of car ownership, but cars now cause serious congestion in all the main cities, particularly in Istanbul. Suburban rail and metro networks are very limited, and therefore the government is raising investment in buses and bus services. In Turkey, minibuses and vans provide many urban services. These vehicles run like taxis on specific routes, and a little bit higher ticket prices than larger buses owing to the fast transportation and limited seat and standing zones. Called as the "dolmuş" causes major congestion and air pollution. The management of cities intends to replace these vehicles with larger low floor vehicles, but it is not able to actualize in a short period due to the small bus capacity for carrying many people. The manufacturing industry has reacted to this challenge with the launch of a variety of low floor buses and low entry midibuses for city transportation. On the other side, when examining the travel and intercity coach industry, there is a still requirement for coaches, whereas a continuous rising of rail systems and airports in Turkey. The Turkish rail system is sparse and slow, although a high-speed line is under construction between Istanbul and the capital city, Ankara. There is an excellent network of competitive intercity coach services throughout the country and across neighboring borders. Recently, on some of the main routes, there has been increased competition from low-cost airlines. There is a nationwide network of intercity services operated by a large number of private companies. Operators charge higher ticket prices for coaches with high luxury offers. Turkey was one of the very first countries to specify the option Wireless – Fidelity (Wi-Fi) connectivity from every seat on the most luxury coaches and charging points both located at standing and seat points inside of the city buses. Recent expansion by almost all domestic manufacturers like Mercedes, MAN, has boosted total capacity in Turkey for bus and coach production to a level that is higher than in any Western European country. In the year 2016, the bus & coach production in Turkey reach the peak point as manufacturing approximately 14.000 units annually (OSD, 2020). Recently, Turkish bus & coach manufactures have been developing vehicles that meet current European standards of engineering and quality. Indeed, the Turkish factories of Mercedes-Benz, MAN, Mitsubishi (after called Temsa, in Turkey) are the sole source for several new models introduced in the last few years (Jack & Higgins, 2016). Most of the industry also continues to offer simpler models that are more suitable for operating conditions in Turkey and neighboring countries (e.g., Karsan, Otokar, BMC). As to observe the production size of the Turkish Bus & Coach industry, the total amount of production data was gathered from OICA public databases and illustrated in the following figure via using trend lines to emphasize total production of Turkey between the year of 2010 and 2019, after the global financial crisis in

2008. The production trend can be considered as high volatility owing to noticeable fluctuations between the year of 2012 and 2015 caused by municipality tenders, global organizations, touristic visits, elections and other unexpected events that diverge from the trend line depicted at Figure 11. But, in overall, it can be said that the production volume of Turkish Bus & Coach industry is approximately between 10,000 and 12,000 units because of the steady export sales are more than the domestic demands causing stability when considering the following years after 2016.

Figure 11

Turkish Bus & Coach Production, 2010 – 2019

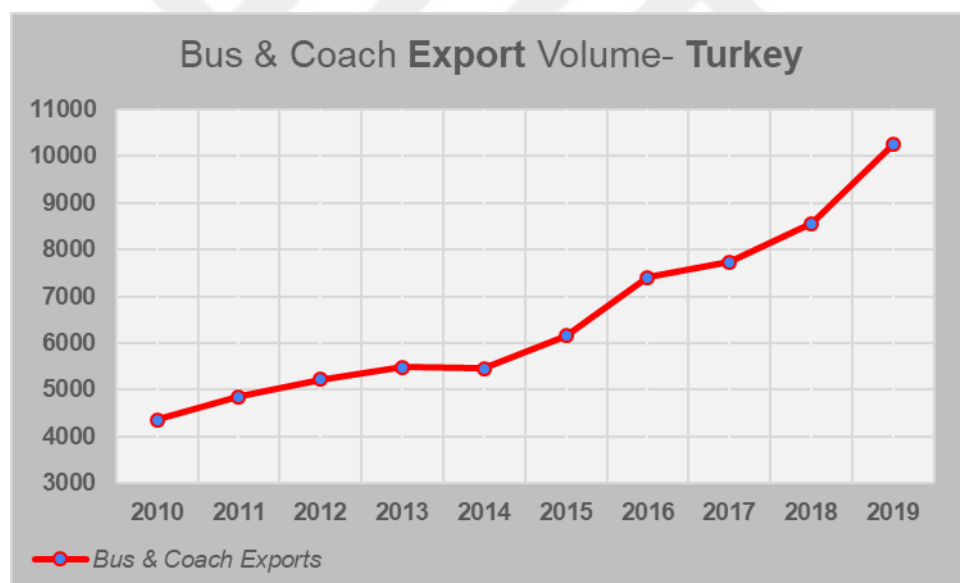


After the global financial crisis influenced the European bus & coach manufacturers, Turkey became a more attractive place with potential opportunities to enter new markets at MENA region, lower cost of production and operations, variety of SME's to maintain production of vehicle components, and also high amount of young employees. Especially, a period between 2013 and 2015, citybus sales were increased by the renewing approach of city transportation and preventing traffic congestions in major cities like Istanbul, Ankara, and Izmir. According to the graph above, the total production of buses & coaches is around 10.000 and 12.000 units (Jack & Higgins, 2018). Main bus & coach manufacturers in Turkey are Mercedes, MAN, Temsa, Otokar, BMC, Karsan, Isuzu, and others. Mercedes has the production and market leadership with launching new products and providing innovative solutions to customers in Turkey (OSD, 2020). Domestic and foreign manufacturers in Turkey, export the amount of remaining production to Europe, MENA, and USA markets after meeting the demand of the Turkish market. Main export markets by sales and market size are France, Germany, Italy, Spain, the USA, and others, respectively (TİM, 2020). Export volumes of Turkey have steadily increased owing to tourism industry's attraction, spreading of urban areas

through smart city platform applications, and the requirement for renewing of old bus and coaches around the world market by the support of tariff and incentive supports from foreign countries (Frost & Sullivan, 2013). As to observe the export volume of the Turkish bus & coach industry, the total amount of exported sales data was gathered from OICA public databases and illustrated in the following figure via using trend lines to emphasize total exported sales of Turkey between the year of 2010 and 2019, after the global financial crisis in 2008. When examining the Figure 12, exported sales volume of Turkey has continuously increased by the year of 2010 except 2014 due to the steady demand from the both European and US markets. In year 2014, increased fairs like EXPO, touristic organizations held in large cities and also political elections caused a high demand from municipalities, private operators. Moreover, volume of fleet renewal is considerably less when comparing to following years in Europe owing to transition to Euro-6 emission standards by the year of 2015.

Figure 12

Turkish Bus & Coach Export Volume, 2010 – 2019



Turkey emerging as a major tourist destination will positively impact the growth of the bus & coach market. The increasing urban population and rise in government spending on urban public transport systems are expected to contribute to the growth of the bus and coach market. The legislation will favor green energy supplied transport solutions and authorize cleaner fuel such as compressed natural gas (CNG) for city transportation. All major suppliers are expected to strengthen their portfolios with CNG powered vehicles for the bus and coach market. Turkey is likely to adopt Euro 6 norms from 2015. Because the EU and NA (North America) would have shifted to this standard before Turkey, foreign suppliers will already have the expertise

and technology. However, local suppliers will have a disadvantage as they must invest and develop technologies to meet regulatory standards. New smart city mobility concepts, such as bus rapid transit (BRT), and intercity bus & coach connectivity will expand the market size and market share growth opportunities for Western European suppliers. Turkey is expected to emerge as a major production and distribution center for bus and coaches for Africa, the Middle East, and Eastern Europe (Frost & Sullivan, 2018).

2.3.4. The Turkish Bus & Coach Industry and The VUCA Concept

Today's new normal "VUCA" concept provides opportunities to companies in case of awareness to environments, which includes the main drivers of VUCA concepts such as volatility, uncertainty, complexity, and ambiguity; otherwise the effects on companies' ongoing business models and gains can be severe. The Turkish bus & coach industry is a great example of VUCA concept because of the challenges erupted from external circumstances along with geostrategic location, dependent on more FDI and credits, and also decreasing purchasing power of customers combined with barriers of exports occurred by volatile European market consequences of the Brexit, and nationalist preferences of US market. From this perspective, the Turkish bus & coach industry can be scrutinized through VUCA lenses to make sense of the challenging environment of the Turkish bus & coach Industry.

Firstly, the effects causing volatility are changing prices due to currency rates, customers purchasing power, aggressive competition by decreasing prices, financial support, and other initiatives, and changing demands in a short time. When considering the last ten years of the Turkish bus & coach industry, it is observed that industry has a high volatility shape triggered by causes of economic, political, and competition outcomes. In particular, the production size in the year 2016 is enormous due to the new regulation compelling manufacturers to produce Euro – 6 emissions based vehicles replacing the old ones at the market. Also, the renewing period of vehicles is approximately 10 years without any engine-based regulations that causes high volatility when sales are actualized by bus and coach operators to modernize fleets. Manufacturers tend to focus on customers' preferences and requirements by presenting attractive offers and additional product solutions to affect less from the volatile conditions of the market. Moreover, the changing rate of tax policies like "ÖTV" (Special Consumption Taxes), trade barriers combined with a strict customs union, and sanctions have a significant impact on volatility level of bus & coach industry. Apart from all of the above, seasonal events like global fairs, sports tournaments, holiday resorts, and urbanization contribute opportunities for increasing amount of production causing a positive

impact on volatility (Busworld, 2018; Jack & Gibbins, 2015). Secondly, main factors causing uncertainty are unstable both domestic and foreign policies (i.e., trade-war, governmental regulations, international conflicts, foreign investments, political inconsistencies), radical technological advancements rather than incremental enhancements (autonomous drive, green-energy powered engines, expansion of railways and airways, and also disruptive innovations). And even, both local and global issues reflecting chaotic environments such as conflicts, wars, natural and biological disasters. After the global financial crisis in 2008, the industry has faced with the US-based sanctions against China and Russia, domestic political inconsistencies, increased airlines replacing coach operations, new regulations pointing out the expansion of electricity-powered vehicles by 2020 in Europe, and also Covid-19 epidemic today. Climate change with an increasing impact on ecology, urge governments to follow strict regulations for reducing carbon emission rates and encourage manufacturers to produce alternative-fueled engines such as biofuels, fuelcells (hydrogen), both CNG (Compressed Natural Gas) and LNG (Liquid Natural Gas), and also electricity (today's widespread technology). Developing infrastructure of rail systems and offer low ticket prices to passengers can reflect as a critical diminishing factor of market size. Although governments regulate electricity-powered bus and coaches in Europe, manufacturers are not ready for batch production owing to long test cycles and high costs of production reflecting in prices that are not affordable to customers without incentives and financial supports. With the digitalization of buses & coaches with new technologies such as autonomous vehicles, shared vehicles platform, and telematics integrated with big data have reflected in uncertain circumstances owing to adapting new production processes, competencies, and resources to manufacture. With intense data-driven vehicle technologies, the vulnerability to cyber-attacks remains a confusing and threatening issue for buses & coach manufacturers because of the possible malfunction of battery charge stations, Global Positioning System (GPS), virtual vehicle-operator-passenger communications, telematics, and electricity-powered engines during the era of pervasive digitalization through "5G" technologies and cloud databases. For instance, Yutong and Scania have been analyzing possible future outcomes, and customers' requirement resulted in new product features (e.g., autonomous drive, vehicle to vehicle connectivity, self-charged batteries, reduced weights via composite materials, etc.) which cause a significant disruptive innovation at bus & coach industry over the world and also in Turkey (Busworld, 2020). Thirdly, complexity can be seen through ongoing regulations leading by governments to meet European standards, high amount of demand for customized products to satisfy both operators and passengers, and management

of expanding dealer & services network. Also, buses & coaches themselves are complex products which include approximately 15,000 materials, and many of them are interconnected owing to large structured parts such as the engine, transmission, steering, and driver's area. These interconnected parts compel engineers to think flexibly and comprehensively for utilizing materials' efficiency, accurateness, and harmonization with other components at vehicles. In the case of any design and manufacturing failure, it can result in the product launch cycle failure, which reflects the company's market share and severe perceptions of customers. Thus, employees, engineers, and leaders have to possess cognitive flexibility to manage this complicated and risky process successfully with fewer revisions. On the dealer & service network, today's global and highly competitive markets oblige companies to organize each dealer and service center well and support with the latest information, marketing documents, components like diagnose device, and other requirements to keep customers in an extended period. Owing to each market has different geographic, demographic, and regulative conditions, managing those dealer & services become more challenging structure requiring cognitive flexibility mindsets of the related company. New technologies introduced by the industry 4.0 platform recently, are autonomous drive, vehicle to vehicle connectivity, telematics (using for analyzing instant information about road and vehicle conditions) and new electricity-power engines combined with batteries which increase the complexity level of vehicle production during the R&D, manufacturing, and also sales & marketing operations. These new complexities require skills including collaboration, flexible thinking, information sharing and urge HR managers to embrace horizontal organizational structure with high interconnectedness between different levels and departments for accessing information and interpret in a more framed shape along with the environment of industry circumstances (Jack & Gibbins, 2019; OSD, 2020). Lastly, changing both industry and market conditions lead companies to be part of critical decision-making processes. Along with the limited resources, aggressive competition, and rapid technological developments, companies find themselves in an ambiguous framework causing managers and leaders unable to make the right decisions in an agile way. The factors paved the way to ambiguity can be categorized in four dimensions. These are organizing dealers & services, factories, customer groups, and new product development cycles in existing or potential markets, including lacking information combined with several unexpected and unknown facts. Penetration to new market consists of vast ambiguities owing to lacking information, vagueness, inability to predict future outcomes that drive companies to prefer partnership strategies to adapt each market's business model, Turkish bus & coach

manufacturers are a great example of it for dealing with challenges within both internal and external environment of the industry (Jack & Gibbins, 2017; OSD, 2018).

2.3.5. The Turkish Bus & Coach Industry and Product Innovation Performance

Owing to the fever competition, rapid technological developments, varied customer preferences, Turkish bus & coach manufacturers tend to focus on implementing product innovations. Within the industry regulations, fleet modernizing, new value offers combined with technologies to customers, product innovation gains an essential factor to sustain bus & coach businesses in future. Exterior designs changing every two years, improved emission standards, safety technologies, and powertrain enhancements are the main factors that urged companies to make product innovations. Thus, observing the performance of each product innovation becomes a critical approach for companies to deal with both industry and market challenges. In the last ten years, Turkish bus & coach manufacturers have produced more technologic vehicles, including electricity-powered engines, autonomous drive, and several components preventing traffic accidents. For instance, Otokar launched first electricity-powered bus in 2012 and subsequently, Temsa launched the first rapid charged electricity-powered bus in 2016. The product innovation cycle takes approximately three years, with a high amount of expenditures because of the design, manufacturing, and test processes. Apart from vehicle-based innovations, the digitalization of vehicles has been progressed through big data technologies enable the communication between vehicles and passengers to improve quality and safety standards of transportation. The "Fleetics" launched in 2017, is an outstanding example of how analyzing of data affect each operator' decision towards driver behavior and road conditions via big data supported components and cloud technologies (Terzi *et al*, 2020). Also, Turkish bus & coach manufacturers prefer structuring partnership business model to actualize innovations by knowledge and technology transfer and shared resource allocation. For example, in the year 2020, Iveco and Otokar had an agreement on manufacturing buses & coaches in Turkey that enables both companies to maintain coach manufacturing and sales operations in the Turkish market (Busworld, 2020).

Product innovations require a flexible and adaptive organization structure to handle possible malfunctions and response customer demands in a more agile way. So, Cross-Functional Teams (CFT) which are the combination of several groups of people to utilize efforts in a mutual framework for reducing locus of control to maintain PIP within an efficient and effective strategy. In Turkish bus & coach industry, the PIP can be analyzed through observing R&D expenditures, COGS (Cost of Goods Sold), customer satisfaction, market share and also

organization's performance under product innovation cycles along with time, motivation, attitudes and perception-based aspects.

3. MATERIALS AND METHODS

3.1. Research Methodology

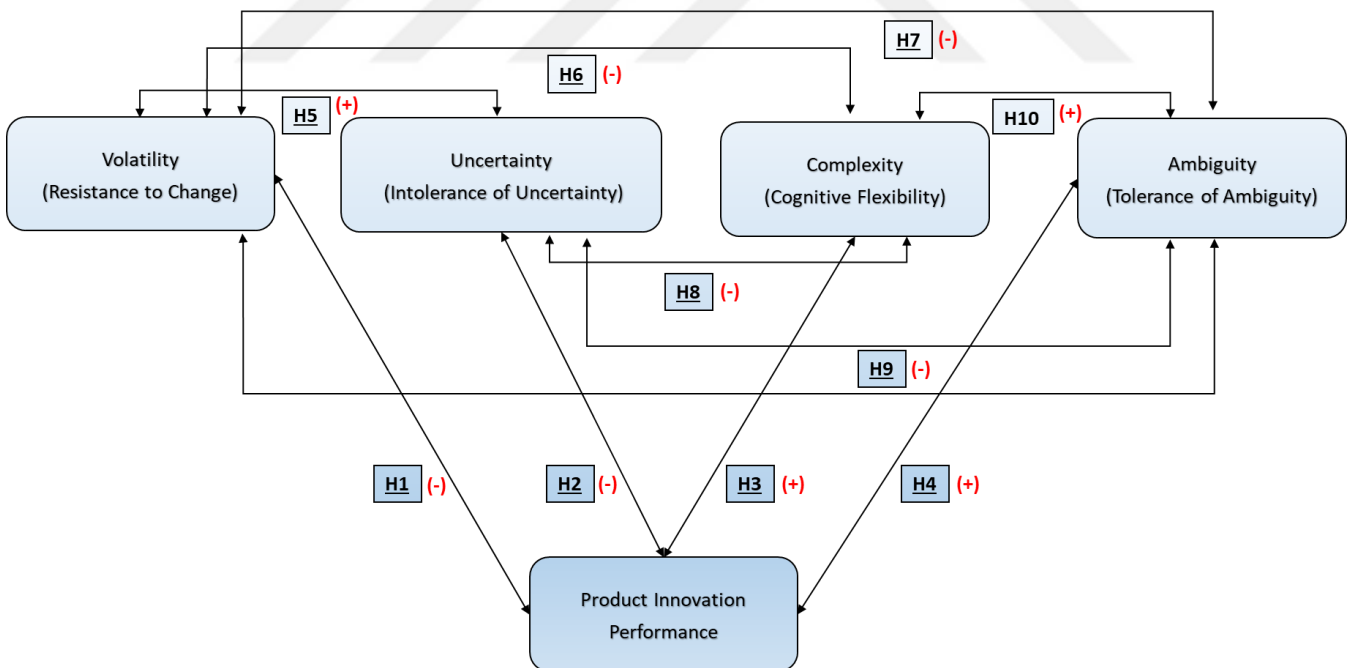
In the research study conducted, it is primarily aimed to examine VUCA factors and product innovation performance with conceptual details and then integrate them with current cause-effects. Firstly, a comprehensive literature review approach was implemented along with studies related to the VUCA and its contemporary issues, detailed understanding of product innovation performance, and both description of automotive and bus & coach industry. In particular, the historical and technological developments of industries have been explained in line with access to old sources. The researcher chose the detailed examination of the concepts with an etymological approach as the beginning of the in-depth studies on the related theory. The conducted research study was correlational research as a part of quantitative analysis, which is used for analyzing the relationship between two different variables to observe cause-effects with objective understanding mechanisms. Quantitative research is a type of research that can be observed, quantified, and expressed numerically, and provable by objectifying facts and events. In the quantitative research method, numerical data are gathered from the sample representing the universe related to the subject being analyzed. After these data are justified in line with research problems and hypotheses, the results are clearly obtained through interpretations (Morrell & Carroll, 2010). Quantitative research studies are conducted through surveys performed in specific groups of respondents to have precise and reliable results. There are five distinctive and possibly interrelated variables such as volatility, uncertainty, complexity, ambiguity, and product innovation performance. Scales for measuring the factors of the VUCA concept and PIP are Resistance to Change, Intolerance of Uncertainty, Cognitive Flexibility, Ambiguity Tolerance, and Product Innovation Performance. Especially, the inter-correlational results of factors of the VUCA concept can be expected by scholars. In this regard, the research model applied to this study emphasized the consider possible correlations among the elements of the VUCA concept. In addition to quantitative research, a diagnostic tool has been developed that provides an overview of how much each VUCA factor affects the bus & coach industry using a bar-chart graph.

3.1.1. Research Model

In social science studies, the model is defined as abstract phenomena that cannot be directly observed and analytical frameworks used to simplify understanding of the relationships between these phenomena. Thanks to the models, complex and difficult-to-understand patterns are able to provide a more comprehensive perspective. Models determined in the social sciences research are derived from theories. Each proposed model should be based on a theory or the findings of a previous scientific study (Gürbüz & Şahin, 2014). The research model illustrates the progression summary of the research in a way to include the variables considered important. It provides the necessary conditions for the collection, analysis and interpretation of data suitable for the purpose of the research. The benefits of the research model, determine how to create a research path (1), support the design of research processes (2), prevent methodological errors (3). The research model can be able to respond to each hypothesis and research questions in the research study (Creswell, 2012). Figure 13, illustrated below, represents the research model of the study aimed to observe research questions analyzed in the subsequent sections.

Figure 13

The Research Model of the Study



This study includes exploratory correlational model as being part of the quantitative research. Correlational research models focus on the relationship between two or more variables in quantitative research is measured by correlational statistical analysis. The result obtained indicates how relevant the two variables are or whether one predicts the other (Creswell, 2012).

In other words, in correlational research studies, relationships between cases are determined by statistical calculations (Scott & Usher, 2011). Such research aims to determine the level of the relationship between two or more variables. In correlative patterns, researchers usually work on two or more variables on a single group. Whether the variables are related, if they are related, the magnitude and direction of the relationship are investigated. Having a relationship between the variables does not mean causality. It can give an idea about causality, but in this sense, it does not allow definitive judgments. (Lodico *et al.*, 2010). In the correlational model, the researcher does not control or manipulate the variables. Two types can be mentioned as exploratory and predictive correlational patterns. In the exploratory correlational pattern, one of the two variables is concerned with how the two are mutually variable. Here, significant cases are tried to be understood by examining the relationships between variables. In the predictive correlational pattern, the researcher determines one or more predictive variables and one criterion variable and tries to predict the other based on one of the variables (Fraenkel & Wallen, 2006; Gay & Airasian, 2000). According to Creswell (2012), typical features of exploratory correlational models can be classified as follows: (1) the researcher observes the correlation of two or more variables, (2) the data are collected at once, (3) the participants are analyzed as a single group, (4) data is collected through both variables from each participant in the group, (5) the researcher applies and describes one of the correlational statistics in his analysis, (6) comments and draws conclusions as a result of these analyses.

As can be seen in Figure 14, this study aims to observe a relationship among VUCA factors and also the relationship between these VUCA factors between Product Innovation Performance along with determined significant directions (positive and negative) through previous studies conducted by scholars. Whereas each VUCA factor is the independent variable, the PIP is the dependent variable due to the nature of innovation in contemporary business environments. Product Innovation Performance is a general framework that contains both internal and external variables within both industry and market structure. The research model is designed via “Microsoft Visio” software to create appropriate shape and present a clear recognition for audiences by the researcher. Ten different hypotheses within the model aim to analyze the research question in detail. Descriptions of each hypothesis became integrated with references and reasons examined through considering academic studies maintained by scholars in different fields of disciplines.

Figure 14

Hypothesis Descriptions

Descriptions of Each Hypothesis
H ₁ : There is a negative correlation between “Volatility” and “Product Innovation Performance”
H ₂ : There is a negative correlation between “Uncertainty” and “Product Innovation Performance”
H ₃ : There is a positive correlation between “Complexity” and “Product Innovation Performance”
H ₄ : There is a positive correlation between “Ambiguity” and “Product Innovation Performance”
H ₅ : There is a positive correlation between “Volatility” and “Uncertainty”
H ₆ : There is a negative correlation between “Volatility” and “Complexity”
H ₇ : There is a negative correlation between “Volatility” and “Ambiguity”
H ₈ : There is a negative correlation between “Uncertainty” and “Complexity”
H ₉ : There is a negative correlation between “Uncertainty” and “Ambiguity”
H ₁₀ : There is a positive correlation between “Complexity” and “Ambiguity”

In volatile environments stemming from market fluctuations, changing amount of supply and demand, variable costs reflected in prices, have been impeding effects on product innovation process and performance owing to hard to determine pricing strategy, market strategy of product versatility, and also continuing production strategy (Thomas & Ambrosini, 2015). Moreover, the degree of volatile environments tends to increase when organizations’ reaction to change is being resisted rather than embracing the change process as an input of progressing the innovation cycle. Thus, it can be said that the “Volatility” and the “PIP” have a negative correlation.

H₁: There is a negative correlation between “Volatility” and “PIP”

Uncertain conditions have a severe impact on employees’ behavior, managers’ decision-making processes and also company’s productive investment and other strategies due to lacking clearness of the future outcomes and prediction of whole possibilities including industry, market and internal environment of the company (Sauner-Leroy, 2004). When investigating employees’ behaviors during uncertain times, it observed that innovation performance tends to decrease (Min, 2014). Thus, it can be said that the “Uncertainty” and the “PIP” have a negative correlation.

H₂: There is a negative correlation between “Uncertainty” and “PIP”

With the expanding customer preferences and needs, manufacturers have been encountered new product development cycle which includes complexity and interdependency as a result of the integration of more features to differentiate its product and satisfy customers in a competitive market (Gottfredson & Aspinall, 2005). During the product development cycle, organizations need to be flexible in thinking for obtaining solution and finding innovative ideas. In complex business environments, flexible thinking provides lean management, versatile

analyzing, combining distinctive aspects of ideas for dealing with challenges of product development and product innovation cycle (Georgsdottir & Getz, 2004). Thus, it can be said that the “Complexity” and the “PIP” have a positive correlation.

H3: *There is a positive correlation between “Complexity” and “PIP”*

Ambiguous situations which have a noticeable impact on decision-making and strategy implementation processes have been appeared in a competitive market environment compelled businesses to embrace ambiguity as a new normal to become survival during the era of disruptive innovation. In this sense, both employees and managers have to be tolerant for ambiguous situations for being proactive combined with creativity at the hazy decision-making environment along with the changing industry and competitive market structure (Rigotti *et al.*, 2003). The level of tolerance to ambiguous situations provides organizations to conduct innovation process successfully during the new product development period owing to sharing knowledge among departments, involve additional both tangible and intangible features on product for matching customer requirements in each market, and have rational thinking rather than emotional behaviors triggered by anxiety disorder in the environment of unpredictability and lacking information related to business challenges (Owen & Sweeney, 2002). Thus, it can be said that the “Ambiguity” and the “PIP” have a positive correlation.

H4: *There is a positive correlation between “Ambiguity” and “PIP”*

The rapidly changing environment as a reflection of volatility has been affecting business environments due to price fluctuations, lacking safety stock of inventory, macro-economic imbalances at countries where an organization is continuing operations, and also customer purchasing behavior related to preferences and wealth (Hosley, 2011). On the other side, uncertainty has significantly placed in today’s world as consequences of unpredictable challenges such as international conflicts, domestic political concerns, economic policies, expansion of disruptive innovations and biological diseases (Covid-19) (Chen *et al.*, 2012). When the volatility and uncertainty are both combined, it causes more turbulent times than ever for businesses and human lives. Thus, it can be said that the “Volatility” and the “Uncertainty” have a positive correlation.

H5: *There is a positive correlation between “Volatility” and “Uncertainty”*

In the dynamic changing environment of volatile conditions, being cognitive flexible enable both employees and managers successfully respond to unprecedented or complicated problems. When the organization and its counterparts do not tend to maintain or adapt changes, flexible thinking strategies as a primary driver for embracing change are abandoned. This

approach will cause severe outcomes of economic, financial, managerial, employees' behavioral reactions and harsh competition which burden throughout the organization. According to Chung *et al.* (2012), in environments that are resistant to change, the level of cognitive flexibility diminishes. Thus, it can be said that the "Volatility" and the "Complexity" have a negative correlation.

H₆: *There is a negative correlation between "Volatility" and "Complexity"*

Change is a structure replacing habits, outmoded business models, and processes that enable organizations to adapt contemporary issues of the global world which includes several unpredicted events, ambiguous circumstances, and risks. In this perspective, when organizations continue to resist to change, an unexpected issue combined with risky outcomes make employees intolerant to ambiguous conditions. According to Pascari (2013), organizations adopting to change have dealt with ambiguous conditions in a tolerant way by focusing on problem-solving methods and integrated social solidarity between individuals. Thus, it can be said that the "Volatility" and the "Ambiguity" have a positive correlation.

H₇: *There is a negative correlation between "Volatility" and "Ambiguity"*

Individuals who are intolerant to uncertainties face with anxiety and fear that causes the inability to react and also decision to make. During the uncertain periods, individuals mostly focus on confusing questions such as "why does this problem still occur" and "how can we deal with it?" rather than seeking for appropriate methods and solutions such as product adjustments, enhancements, developments, rapid prototyping, and new business operations to sweep challenging problem in a short period without many severe effects embraced by each organization (Aarts & Woerkum, 2002; Johnson, 2013). Thus, it can be said that the "Uncertainty" and the "Complexity" have a negative correlation.

H₈: *There is a negative correlation between "Uncertainty" and "Complexity"*

Uncertainty is mostly representing the unpredictability of challenges which have apparent influences on current business flow (Grenier & Ladouceur, 2004). Ambiguity is also mostly representing the threats, fuzzy areas, and confounding factors which have an impact on the main structure of businesses (McLain, 1993). In this perspective, when the intolerance of uncertainty level increases among individuals, organizations can encounter with confusing situations harnessing progress of decision-making and new strategies to be implemented. Whereas "Intolerance of Uncertainty" and "Ambiguity Tolerance" have similarities like common perception to environment as a threat, differentiations are observed through the period of circumstances; uncertainty focuses on future outcomes and ambiguity focuses on current

outcomes (Grenier *et al.*, 2005). Moreover, when comparing these factors in detail, knowledge intensity during uncertain periods are more than the ambiguous one. Thus, it can be said that the “Uncertainty” and the “Ambiguity” have a negative correlation.

H₉: *There is a negative correlation between “Uncertainty” and “Ambiguity”*

In complex business environments, employees and managers deal with inability to decision-making in an agile way. With lacking of information about related issue causing haziness, organizations have a challenge with more complex framework. Cognitive, flexible employees and managers can solve problems and generate possible scenarios about “which causes will shape the future business,” and “how competitors will adapt to new circumstances that occurred by future outcomes?”. Those ambiguous conditions combined with the unpredicted future can result in severe effects by employees’ lacking out of box thinking and team-work skills. Also, employees’ perceptions and behaviors can be determinant of being tolerant of ambiguity that has a significant relationship with educational level, gender, and generation types. Employees who have cognitive flexibility, mostly tolerate ambiguity, and even it can exist when leaders maintain trust, motivation, and successful communication throughout the organization. Thus, it can be said that the “Complexity” and “Ambiguity” have a positive correlation.

H₁₀: *There is a positive correlation between “Complexity” and “Ambiguity”*

All hypotheses mentioned above in detail enable the researcher to observe empirical results along with the research model by considerations of the cause and effect relationship.

3.1.2. Research Sample & Participants

In the research carried out before Covid-19 pandemic, the research population consists of white-collar employees at bus & coach manufacturers in Turkey which have also facilities regarding sales and after-sales operations in foreign countries. These manufacturers are also considered as MNCs owing to continuing operations in both domestic and foreign countries. So, the research population includes different nations of people from Europe and the USA. The applied sampling method in this study is a criterion sampling model as being part of the purposive sampling method that enables the researcher to examine the research questions and cases in detail with predetermined factors (Fraenkel & Wallen, 2006). In the criterion sampling approach, predetermined factors are used for accessing ideal respondents along with types and contents of scales performed in the research study (Creswell, 2012). These predetermined factors are educational level ranging from pre-graduate to a Ph.D. degree, knowledge of English language (reading and writing skills), and being a white-collar employee that provides

accurateness and deep-focus to research study. The observed population of the sample size was determined through job functions and business titles by the guidance of the Turkish Automotive Association (OSD), HR managers and C-level executives in each manufacturing companies. The total population of the research is approximately 1,600 potential respondents who are white-collared personnel ranging from “Specialist” to “CEO” level. Within this perspective, researcher sent scales to 520 respondents and 346 respondents answered these scales without any missing values. The actual respondent size represents 22% of the total numbers of white-collared employees at bus & coach manufacturers in Turkey. The number of research participants is 346 personnel from different nations, companies, and departments will be explained and analyzed in detail at the descriptive statistics chapter.

Table 3

Required Sample Size, (The Research Advisors, 2006)

<u>Population Size</u>	<u>Confidence Level = 95%</u>			<u>Confidence Level = 99%</u>		
	Margin of error			Margin of error		
	5%	2,5%	1%	5%	2,5%	1%
100	80	94	99	87	96	99
500	217	377	475	285	421	485
1.000	278	606	906	399	727	943
2.000	322	869	1,655	498	1,141	1,785
10.000	370	1,332	4,899	622	2,098	6,239

According to Table (3), the size of the research participant is appropriate when calculations are implemented to consider the validity of the sample suggests that more than 346 respondents are adequate in 95% confidence interval with 5% margin of error (Newby, 2014). Thus, sample used in this research study matched with conditions of required sample size calculation.

3.1.3. Data Collection Procedure

The research carried out has been implemented through the attending of participants intently. As every conducted research has encountered challenges including reaching participants and gathering information in total. The method of this research is to apply mostly internet-based platforms such as E-mail, LinkedIn, WhatsApp groups rather than face to face interviews and phone calls. Thanks to using internet-based platforms, the amount of participants is very satisfactory due to reach employees at both domestic and foreign countries simultaneously. The procedure of collecting data is beginning from having a connection with HR managers at each bus & coach manufacturing company to get an idea about employees’ characteristics and contact information as well. This connection with HR provides clear data along with

predetermined factors mentioned in the research sample section to the researcher. Subsequently, choosing the “LinkedIn” platform to reach employees who overlooked the e-mail researcher sent. Interestingly, a significant number of employees prefer using the “LinkedIn” platform owing to social networking opportunities and privacy of access details which often investigated by Information Technology (IT) departments of companies. Another platform, “WhatsApp” is used for an enriching network of respondents via sending messages to colleagues who were still on business travel, fever meeting, and holiday. The scales performed were prepared on Google Survey which provides a digital platform for users to work on from any place. Moreover, Google Documents enable the researcher to get and analyze the data simultaneously. Within the data collection procedure, 346 respondents sent responses to researchers’ requests and fill scales accurately without any missing and inappropriate values. Each respondent’s reply time to scales is approximately between 5 and 7 minutes, and respondents found scale questionnaires and both demographic and company-related questions easy to understand. Before performing scales to whole respondents of the conducted research, a pilot study was implemented to control respondents’ reaction and observe the accurateness of responses. The pilot study was performed to 18 respondents by the researcher, and results showed that all sections were understood except company type called as capital structure of the company now to reduce possible misunderstandings. Thus, the pilot study contributed appropriateness of research study able to performed to whole respondents in the research sample.

3.1.4. Research Questionnaires & Measurement

In order for a research study to become empirical, statistical expressions have a significant role throughout the observations. Within this context, “research questionnaires” is a tool composed of several questions aimed to collect information from each respondent participated in the research study via face-to-face, e-mail, digital open sources, and telephone. Information can be collected more quickly, cheaply, and efficient by research questionnaires. However, research questionnaires sometimes may not able to gather detailed information about the related topics from respondents and also, time, place, mood, and other things affect cognition can replace the respondents’ answers to each question by different views (Fraley *et al.*, 2000). Each question should be clear, along with the research purpose and brief-expression, and lead respondents to complete research questionnaires intently. On the measurement side, the “Likert-type” scale is used for evaluating attitudes and perceptions of respondents’ towards determined questions. The structure of the Likert-type scales is ranged from 5 to 7 point depending on the researchers’ approach along with the accessing respondents’ view in a detailed manner (McLeod, 2019).

3.1.4.1. Resistance to Change Scale

Although the necessity of change is accepted by every discipline of studies, it is not simple for individuals in the organization to adapt to change management practices at the coveted level. Resistance to change is the prevailing attitude within the organization that can seriously hinder the change process and cause negative consequences such as decreased satisfaction, efficiency, performance, psychological well-being, and increased absenteeism, intention to quit the job under rapidly changing and volatile business environments (Piderit, 2000; Stanley *et al.*, 2005). Organizations should firstly adapt to external changes (e.g., technology, business model, customer satisfaction) to maintain the change progress successfully in extremely competitive business conditions and subsequently redesign the internal management systems, structures, and operations for embracing the change as a new normal while some of the employees inevitably demonstrate resistance against to change (Caldwell & Clapham, 2003; Lawrence, 2009). In this regard, Resistance to Change (RTC) scale was developed by Oreg (2006) to investigate the factors of resistance to change caused employees' attitudes and managers' approaches and observe the degree of resistance to change at the organizational business level. RTC scale has a multi-faceted structure emphasizing various attitudes such as affective, cognitive, and behavioral, which are the major determinants of being resisted to change originating from personality characteristics (Oreg, 2003). These personality characteristics as self-esteem, risk-tolerant, aspiration for success, locus of control, adaptability skills have influenced the attitudes towards both current and potential rapidly changes in competitive business environments (Judge *et al.*, 1999; Lau & Woodman, 1995; Martin *et al.*, 2012; Miller *et al.*, 1994; Wanberg & Banas, 2000). On the other hand, culture in organizational context has been a critical issue about arranging resistance to change mechanism for managers. Maintaining closeness to change the culture by leaders for employees has been a challenging issue, especially along with some major factors related to job security, trust, social influence, and prestige owing to cultural characteristics at firm-level and individual levels combined in work environments (Danışman, 2010). According to the RTC scale at following Table (4), items able to measure attitudes of employees towards change through a combination of three distinctive but interrelated dimensions such as affective, cognitive, and behavioral in general The RTC scale respondents were chosen from the defense industry comprised of between 700-800 employees. The items of the RTC scale was analyzed through the 5-point Likert type. Item 3, 10, 14, and 15 are reverse-coded to analyze respondents' answers better. The reliability (Cronbach's alpha) result of the sub-groups of the RTC scale was 0.77, 0.78, and 0.86

respectively and validated and confirmed through several analyses as Confirmatory Factor Analysis (CFA) and Structural Equational Methods (SEM) (Oreg, 2006).

Table 4

Resistance to Change (RTC) Scale

#	Resistance to Change (RTC)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
	Affective Attitude					
1	I was afraid of the change.					
2	I had a bad feeling about the change.					
3	I was quite excited about the change.*					
4	The change made me upset.					
5	I was stressed by the change.					
	Behavioral Attitude					
6	I looked for ways to prevent the change from taking place.					
7	I protested against the change.					
8	I complained about the change to my colleagues.					
9	I presented my objections regarding the change to management.					
10	I spoke rather highly of the change to others*					
	Cognitive Attitude					
11	I believed that the change would harm the way things are done in the organization.					
12	I thought that it's a negative thing that we were going through this change					
13	I believed that the change would make my job harder					
14	I believed that the change would benefit the organization*					
15	I believed that I could personally benefit from the change*					

The volatility dimension of the VUCA concept, demonstrates rapidly changing environment, financial fluctuations, and outcomes of the changes that affect the employees' attitudes in specific organization. Thus, RTC scale enables the analyze of volatility factor of the VUCA concept through investigating employees', managers', and also organizations'

reactions to change in turbulent periods and rapidly changing environments related to each business. To measure the level of RTC along with the volatility factor of the VUCA concept, items are required to be observed through one dimension as a whole rather than observing sub-groups of attitude mechanisms towards change for obtaining a clear understanding of resistance to change causing volatility in general. When the resistance or reluctance to make changes is commonly happened by individual in an organization, the volatility factor has severe effects on business progresses inevitably due to the lacking adaptation, and proactiveness to the change (Bennett & Lemoine, 2014 & Johansen & Euchner, 2013). Consequently, attitudes for change in organizations are determinative approach for observing the degree of volatility effects on organizations being part of the VUCA world.

3.1.4.2 Intolerance of Uncertainty Scale

Uncertainty is a situation that includes lacking information for any specific issue related to the occurrence of the unpredicted circumstances that have a remarkable impact on continuing processes in organizations, businesses, and daily lives. Intolerance of uncertainty is the inability to react well to uncertain conditions being encountered. Intolerance of Uncertainty is a concept confined to indecision and perceived as a possible negative situation, which is unacceptable even if the probability of realization is very low (Buhr & Dugas, 2002). The intolerance of uncertainty is considered to be part of a personal trait and has associated with anxiety (Rassin & Murris, 2005b). If the individual is not able to make decisions or strategies and also has anxiety triggered by stress levels in an uncertain environment, this attitude can be recognized as intolerance of uncertainty (Dugas *et al.*, 2001; Teoh & Foo, 1997). Increased intolerance of uncertainty caused impairment of problem-solving skills, agility, and also abstaining from ambiguous situations as a result of the inability to predict future events and its outcomes (Dugas *et al.*, 1997; Heydati *et al.*, 2003). The Intolerance of Uncertainty Scale (IUS) was firstly developed in the French language to observe how individuals react to uncertain conditions that occurred by hardly and impossibility predicted events through 27-items (Freeston *et al.*, 1994). Afterward, Norton (2005) reduced the items of the IUS scale for increasing validity and internal consistency of scale and suggested that more abridged IUS enable researchers to be effective and efficient in analyzing the measurement of uncertainty than previous studies. Thus, Carleton *et al.* (2007) directed to create a new IUS scale, which is more shortened and focused on uncertainty evaluation via 12-items with a 5-point Likert type, as seen in Table (5). The new IUS scale was performed to university students & graduates in Canada including 252 respondents from various fields of disciplines (between ages 18 – 50) and resulted in high

reliability (Cronbach's alpha: 0.96) with two sub-factors as perspective anxiety and inhibitory anxiety through validated and investigated correlations between two factors via CFA analysis with appropriate factor loadings between 0.59 and 0.79 (Carleton *et al.*, 2007).

Table 5

Intolerance of Uncertainty Scale (IUS)

#	Intolerance to Uncertainty Scale (IUS)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
	Prospective Anxiety					
1	Unforeseen events upset me greatly.					
2	It frustrates me not having all the information I need.					
3	One should always look ahead so as to avoid surprises.					
4	A small, unforeseen event can spoil everything, even with the best of planning.					
5	I always want to know what the future has in store for me.					
6	I can't stand being taken by surprise.					
7	I should be able to organize everything in advance.					
	Inhibitory Anxiety					
8	Uncertainty keeps me from living a full life.					
9	When it's time to act, uncertainty paralyzes me.					
10	When I am uncertain I can't function very well.					
11	The smallest doubt can stop me from acting.					
12	I must get away from all uncertain situations.					

The uncertainty dimension of the VUCA concept demonstrates lacking information and the inability to react to unpredicted events and its outcomes along with uncertain circumstances in a specific organization. Thus, the IUS scale enables the analysis of the uncertainty factor of the VUCA concept through investigating employees', managers', and also organizations' reactions to uncertain circumstances and outcomes influencing the businesses. To measure the level of IUS along with the uncertainty factor of the VUCA concept, items are required to be observed through one dimension as a whole rather than observing sub-groups of anxiety mechanisms towards uncertainty for obtaining a clear understanding of the degree of intolerance to uncertainty causing uncertainty in general. When growing intolerance level toward uncertain circumstances, the uncertainty factor has severe effects on business progresses

inevitably due to the unpredictability of future outcomes, and the inability to decision-making under a competitive industry environment (Bennett & Lemoine, 2014 & Johansen & Euchner, 2013). Consequently, whether being tolerant of uncertainties in organizations are the determinative approach for observing the degree of uncertainty effects on organizations being part of the VUCA world.

3.1.4.3 Cognitive Flexibility Scale

Along with the increasing interconnectedness of several industries and globalization surrounding the world, complexities have been remarkably observed by employees, managers, scholars, and leaders (Léautier, 2014). Nowadays, organizations have encountered challenges occurring from intense information spreading via digitalization that provide ease of access to data, which enables them to have much knowledge about any issue. So that, owing to the competitive and rapidly changing environment of industries, employees and managers require obtaining new information and also transfer among each other through communication skills to solve complex problems and learn complicated mechanisms. Moreover, flexible thinking and analyzing the issues are critical factors to deal with complexities hindering the progress of business operations and services. Cognitive flexibility is defined as an individual who has an awareness of more than one possible solution for each problem, desire for being flexible under complex issues, and also possesses self-efficacy personality (Martin & Rubin, 1995). It can also be defined as the ability to adapt cognitive process strategies to new situations in unexpected, changing environments (Canas *et al.*, 2003). Cognitive flexibility refers to the person's ability to adapt existing problem-solving tools to new situations (Krems, 2014). Cognitive flexibility is a multi-dimensional process that involves processing multiple pieces of information, generating different ideas, evaluating alternatives, and changing plans to adapt external circumstances simultaneously (Stevens, 2009). In this regard, Martin & Rubin (1995) developed the Cognitive Flexibility Scale (CFS) to measure cognitive flexibility levels of individuals through a combination of two distinctive but interrelated scales such as Communication Flexibility Scale and the Rigidity of Attitudes Regarding Personal Habits Scale for investigating the flexibility mechanisms of cognition comprehensively. The CFS is seen as Table (6), consisted of 12 items under one dimension, and measured in a 6-point Likert type, is firstly applied for 275 respondents at university level students by researchers. Items 2, 3, 5, and 9 are reverse coded. The internal consistency (Cronbach's alpha) result of the CFS scale is approximately .80. The cognitive flexibility level of genders is not differentiated. The high level of cognitive flexibility provides quick adaptation to unexperienced events, successful decision-

making processes, clear understanding with flexible thinking, and share knowledge and combine them in a common framework through communication skills (Martin & Rubin, 1995).

Table 6

The Cognitive Flexibility Scale (CFS)

#	Cognitive Flexibility Scale (CFS)	Strongly Disagree (1)	Disagree (2)	Slightly Disagree (3)	Slightly Agree (4)	Agree (5)	Strongly Agree (6)
1	I can communicate an idea in many different ways.						
2	I avoid new and unusual situations.						
3	I feel like I never get to make decisions.						
4	In any given situation, I am able to act appropriately.						
5	I can find workable solutions to seemingly unsolvable problems.						
6	I seldom have choices to choose from when deciding how to behave.						
7	I am willing to work at creative solutions to problems.						
8	My behavior is a result of conscious decisions that I make.						
9	I have many possible ways of behaving in any given situation.						
10	I have difficulty using my knowledge on a given topic in real life situations.						
11	I am willing to listen and consider alternatives for handling a problem.						
12	I have the self-confidence necessary to try different ways of behavior.						

The effects of the VUCA concept have a noticeable severe impact on business environments when cognitive rigidity embraced by organizations dealing with complex issues that seem not to be easily recognized. Rigidity in thinking and analyzing of each challenge is combined with bias and stereotyping that could fail in maintaining the business process. Thus, the Cognitive Flexibility scale provides us to observe organizations' reaction to complex issues and environments. This scale is the opposite one of the cognitive rigidity that drag organizations in more complexity effects which hinder each organizations' response to change with problem-solving, comprehensive thinking and overarching approaches for dealing with challenges. The more cognitive flexibility level possessed, the more being successful in dealing with the organization and management-related complexities. Each question of the Cognitive Flexibility scale enables the researcher to analyze perceptions of organizations to complexity factor that

has a critical role in today's complicated product design and structure, assembly lines, market dynamics and customer preferences as well. When examining each question in detail, especially item-1, item-2, item-3, item-5, item-7, item-11 and item-12 are being applicable and focused on the Complexity factor of the VUCA concept which requires an excellent communication, creativity, decision-making, knowledge management and self-confidence skills.

3.1.4.4 Tolerance of Ambiguity Scale

Ambiguity can be defined as lacking information linked with uncertainties required for understanding the new issues comprehensively with causes and its following effects in the future (Pich *et al.*, 2002). Rather than uncertain events where unpredictable outcomes exist, ambiguous circumstances have arisen through more than one alternatives mostly have never been experienced in decision-making processes, and lacking clearness of cause-effect relationships existed in new and extraordinary issues placed on the frontline of related business and organizational context. Some scholars defined ambiguity and uncertainty in similar aspects. However, when comparing both uncertainty and ambiguity, ambiguous situations have less predictability similar to uncertain conditions but have lesser knowledge, clues about the issue which is never confronted with it, and independent from the current framework, described as "unavailable antecedents." In today's competitive and proactive structure of the industry, being tolerant of ambiguous circumstances is a critical factor to survive in each industry, and business environments. For instance, an emerging market has the potential to grow in long term, but this market is beyond the knowledge of the firm has been possessed so far and also has some potential risks to obtain profits owing to unforeseen market conditions, aggressive rivals, and unstable customer preferences. These factors and others generate ambiguity environment that has a striking impact on large businesses, especially MNCs. Apart from the factors regarding industry and market perspectives, the perceived ambiguity stems from stimulants like complex, unfamiliar, and insoluble outcomes individuals confronted with (Budner, 1962). Frenkel-Brunswik (1948) firstly explained the "tolerance of ambiguity" as "emotional and perceptual variable." Individuals' responses to ambiguity mostly observed as stress, postponing habits, avoidance, and ignoring the realities (Budner, 1962). Several research studies were implemented to develop a scale for measuring the tolerance level to ambiguity, but none of them have strong reliability and validity results (McLain, 2009). To improve more generally acceptable and appropriate measurement in shortened structure, Multiple Stimulus Types of Ambiguity Tolerance Scale-II (MSTAT-II) was developed by McLain (2009), including 13-items under single-dimensional factor and scaled via 5-point Likert type. MSTAT-II scale is

related to stimulants of perceived ambiguity suggested by studies of Budner and prevents respondents from confusion during the measurement period with clear meanings and reduced items compared to previous studies. Except for items 2, 7, 10, 13, all items are reverse coded. MSTAT-II scale was firstly performed to 528 university students ranging from 19-42 years old, and the internal consistency reliability value (Cronbach's alpha) is 0.83 points.

Table 7

The Tolerance of Ambiguity Scale (MSTAT-II)

#	The Tolerance of Ambiguity Scale (MSTAT-II)	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	I don't tolerate ambiguous situations well.					
2	I would rather avoid solving a problem that must be viewed from several different perspectives.					
3	I try to avoid situations that are ambiguous.					
4	I prefer familiar situations to new ones.					
5	Problems that cannot be considered from just one point of view are little threatening.					
6	I avoid situations that are too complicated for me to easily understand.					
7	I'm tolerant of ambiguous situations.					
8	I enjoy tackling problems that are complex enough to be ambiguous.					
9	I try to avoid problems that don't seem to be have only one "best" solution.					
10	I generally prefer novelty over familiarity.					
11	I dislike ambiguous situations.					
12	I find it hard to make a choice when the outcome is uncertain					
13	I prefer a situation in which there is some ambiguity.					

Ambiguity can affect decision making challenging as a result of raising insufficient knowledge-based doubts about the subject. In an ambiguous environment, both situational awareness and predictability of the outcome of actions are deficient, a situation where an entirely new business model has been brought to the market or a combination of technologies has never been tried before. In the case of ambiguity, the possibility of gathering more information or making predictions using past experiences is minimal, and establishing a cause-

effect relationship between various factors is just as critical. In this perspective, ambiguity leads to disorder, turmoil, and stress, especially in poorly structured organizations. The ambiguity factor of the VUCA concept represents the organizations' inability to make decision among multiple alternatives or determine which resources can be used for current strategy. Organizations that are more tolerant of the industry's uncertain situations can be more agile to implement new strategies and decisions throughout the business model. When examining each question in detail, especially item-2, item-4, item-5, item-9, item-10, and item-12 are being applicable and focused on the Ambiguity factor of the VUCA concept which requires a decisiveness, analytical observation, sense-making, sharing & accessing knowledge, teamwork and innovative thinking skills.

3.1.4.5 Product Innovation Performance Scale

In today's challenging business environment, along with the rising effectiveness of "Industry 4.0" resulted in disruptive innovations, organizations need to pursue innovative processes and business models rather than adapting to the new technologies owing to the accelerated rapidness of change within digitalization. Manufacturers have focused on implementing product innovation strategies to be sustainable in the competitive market through observing unknown techniques and considering how will new technologies be embedded in the current structure of products the company had. Product innovation is the ability of a firm to successfully and efficiently adopt new ideas, products and processes, and the ability to acquire current and relevant information related to products and processes that can support companies to organize their innovation capacity successfully (Chang, 2017). Product innovation is the leading way for companies to adapt to turbulent environments and achieve sustainable competitive advantage (Wu, 2014). Product innovation performance is an essential indicator of product innovation success in terms of demonstrating the company's profitability, sales volume, and achievement of revenue targets for newly developed products and services (Chen *et al.*, 2015). Product innovation performance can be achieved as a result of companies successfully adapting their processes and products to changes in the environment (Bakar & Ahmad, 2010). It can be said that product innovation performance has a significant relationship with company performance (Zhan & Doll, 2001). Thus, measuring product innovation performance during each period of innovation operations is a vital factor to maintain innovation processes and incrementally optimization of the product, structure, resources and customer requirements (Hoonsopon & Ruenrom, 2012). In this regard, Product Innovation Performance (PIP) Scale was developed by Alegre *et al.* (2006) to investigate performances of innovative operations and efforts through

two dimensions as efficacy and efficiency perspectives, and including 12-items with 7-point Likert type. The primary sources of scale are OECD-EUROSTAT and scholars who have studied on product innovation and its performance. The PIP scale was firstly performed to mostly R&D employees (127 respondent) from different companies at biotechnology industry which embraces innovations and pursue new technologies in Europe. The internal consistency (Cronbach's alpha) of two dimensions are 0.89, and 0.85 respectively and the correlation between two dimensions is 0.82 (Alegre *et al.*, 2006). As seen in Table 8, the questionnaires of scale focus on objective responses along with general measurements related to tangible outcomes resulted in an organization without bias and perception of individuals.

Table 8

The Product Innovation Performance Scale (PIP)

#	Product Innovation Performance (PIP)	Much Worse (1)	(2)	(3)	(4)	(5)	(6)	Much Better (6)
1	Replacement of products being phased out							
2	Extension of product range within main product field through							
3	Extension of product range within main product field through technologically improved products							
4	Extension of product range outside main product field							
5	Development of environment-friendly products							
6	Market share evolution							
7	Opening of new markets abroad							
8	Opening of new domestic target groups							
9	Average innovation project development time (an innovation project refers to the creation of a new product or a new component)							
10	Average number of innovation projects working hours							
11	Average cost per innovation project							
12	Global satisfaction, satisfaction degree with innovation projects efficiency							

The rapid technological advancements, globalization, and accessing information via digital open-sourced platforms enable markets more competitive and challenging than before. These factors generate VUCA conditions that affect businesses' decision-making, progression, and future strategic plans severely. In the VUCA environment, maintaining effective and efficient innovation is a crucial capability to become survival in a chaotic business structure (Joshi, 2017).

3.1.5 Data Analysis Methods & Tools

In this research, apart from observing demographic values, reliability analysis, normality tests, correlation tests are used to support research methodology and verify research model. With the reliability analysis, it is aimed to identify the variables that do not share the common value that is desired to be measured by the scale equally and to increase the internal consistency of the scale through excluding these variables from the analysis. Before expressing the statistical test and analysis used in this research study, the type of variables like both dependent and independent can be determined by the researcher to conduct the study well. Independent variables are factors of the VUCA concept mentioned above, such as volatility, uncertainty, complexity, and ambiguity, which impact the business environment. The dependent variable is PIP, which is severely affected by the effects of the VUCA environment due to each factor's characteristics integrated with the dynamics of the bus & coach industry in Turkey. There are ten different demographic items to consider both respondents' and companies' characteristics that enable the researcher to observe distinctive and determinative information about the bus & coach industry in Turkey. Total number of item at each scale is between 12 and 15 questions, and 65 questions in overall. In the reliability analysis, generally accepted reliability values are calculated for the studies in that area, and information is given about the relationship between the items forming the scale. Whether the prepared questionnaire questions are sufficient to measure a certain situation is revealed with the help of this method. As a result of the analysis, some scale items can be removed from the questionnaire since they do not meet the purpose. Alpha (Cronbach's), Split-half, Guttman, Parallel, Strict parallel models are used in reliability analysis. The reliability of the scales used in this study was evaluated using the value of the Alpha (Cronbach's) model. The Alpha (Cronbach's) model is an internal consistency model based on the average of the correlation between scale items. Alpha coefficient is widely used in Likert type scale questions. This coefficient investigates the consistency of the questions in the scale or to what extent all the questions trying to measure the same thing are consistent among themselves and whether they form a whole to explain a homogeneous structure (Punch, 2005; Nakip, 2013). The scale is not reliable if it is in the range of $0.0 \leq \alpha < 0.40$, the scale is low if it is in the range of $0.40 \leq \alpha < 0.60$, the scale is very reliable if it is in the range of $0.60 \leq \alpha < 0.80$, the scale is a highly reliable scale in the range of $0.80 \leq \alpha < 1.00$ (Akgül & Çevik, 2003). To observe adequacy of sampling and the internal correlation between items, KMO (Kaiser-Meyer-Olkin) and "Bartlett's Test of Sphericity" were used to analyze each scale to conduct and use factor analysis if applicable and necessary for the research

study. When the KMO result of each scale is higher than 0.50 and getting closeness to 1, each scale possesses an adequate sampling size ($x < 0.50$: *not acceptable*, $0.50 < x < 0.59$: *miserable*, $0.60 < x < 0.69$: *mediocre*, $0.70 < x < 0.79$: *middling*, $0.80 < x < 0.89$: *meritorious*, $0.90 < x < 1.00$: *marvelous*). The Bartlett test's findings are significant if the alpha (α) value is smaller than 0.05, which represents internal correlations among valid items and can be used for potential factor analysis if required. Normality tests enable researcher to decide the structure of data whether linear or non-linear. Whether the data of the study is normally distributed or not, is decided as a result of the values of skewness and kurtosis results. The kurtosis and skewness values between -2 and +2 assume that the number of observations is large enough ($n > 30$) according to the central limit theorem and the data is normally distributed (Fidell & Tabachnick, 2014). Correlation analysis is a statistical method used to test the linear relationship between two variables or the relationship of one variable with two or more variables, and to measure the degree of this relationship, if any. The purpose of the correlation analysis is to see how the dependent variable (Y) will change when the independent variable (X) changes. In order to perform correlation analysis, both variables must be continuous and show normal distribution. As a result of the correlation analysis, whether there is a linear relationship and the degree of this relationship, if any, is calculated by the correlation coefficient (Kalaycı, 2010). If the correlation coefficient (r) indicating the correlation between the variables subjected to analysis considering the sample size of the research is between 1,00 and 0,70, it is high; Medium if it is between 0,70 and 0,30; If it is between 0.30 and 0, it is accepted that there is a low level of correlation (Büyüköztürk, 2003). On the other side, the data included in the study were primarily arranged and string values were translated into numerical version and reverse coding was done in a more practical way through Microsoft Office 2016 software. Support of Microsoft Visio software has been obtained to design the research model in a simpler and more organized way. SPSS 20.0 (Statistical Program for Social Sciences) software was used to analyze the data and to observe the findings of the research regarding both demographic values and hypothesis proposed in the research study.

4. RESULTS AND DISCUSSIONS

The “results” is a section where the research, data obtained, and analysis are explained with the tables. This section provides detailed information about the gathered data and results, but it is not appropriate to include comments. In particular, the analyzes made in this section are conducted along with the research question. The purpose of the results section is to create a guideline resource by the transferring of analyzed observations through the data (Creswell, 2012).

The “discussion” is a section in which clear findings obtained are interpreted in line with different perspectives with the support of the literature. The purpose of the discussion section is to investigate and observe the results obtained objectively rather than a subjective approach. The inferences acquired in this section can contribute to both the conclusion and suggestions section of the study (Büyüköztürk, 2003).

4.1. Results

In the research conducted, results were gathered through scales and specific questions about personal information. Scales were intended to analyse each VUCA factors level and these factors relationship with Product Innovation Performance at Turkish bus & coach industry. Results can be divided in two groups as descriptives and scales. At the descriptive statistics section, conducted research focused on personal information, nationalities, educational level, job experience, etc, and apart from those investigates the organization’s innovativon culture and innovation training. Subsequently, there are 5 distinctive scales to observe factors of the VUCA concept and product innovation performance of bus and coach industry. Firstly, normality analysis is applied to each scale to decide whether “Pearson” or “Spearman” correlational test is applicable for this research. Afterward, the Cronbach’s alpha value was obtained to observe internal consistency of each scale. Apart from statistical test used so far, distribution of answers to each scale was observed to understand both respondents and their industry framework. At final stage, correlational test was implemented to analyze each hypothesis claimed by researcher.

4.1.1. Individuals' and Companies' Demographic Results

In order to understand clearly and comprehensively of the research, descriptive statistics including respondents' information is a supportive tool for enhancing research quality. Researcher divided descriptive statistics in three different groups illustrated as following such as personal information, occupational information, and organization's attitudes to innovation.

Table 9

Demographic Items by Personal Information

Demographic Items	Valid	Frequency (#)	Valid Percent (%)	Cumulative Percent (%)
<u>Gender</u>	Man	251	72.5	72.5
	Woman	95	27.5	100.0
<u>Age</u>	20-25	38	11.0	11.0
	25-35	134	38.7	49.7
	35-50	149	43.1	92.8
	50+	25	7.2	100.0
<u>Marital status</u>	Single	130	37.6	37.6
	Married	202	58.4	96.0
	Divorced	14	4.0	100.0
<u>Nationality</u>	Turkish	246	71.1	71.1
	Europe	56	16.2	87.3
	USA	44	12.7	100.0
<u>Education level</u>	Pre-Graduate	17	4.9	4.9
	Bachelor's Degree	219	63.3	68.2
	Master's Degree	102	29.5	97.7
	PhD	8	2.3	100.0

The distribution of gender differences is Woman, 72.5% and Man, 27.5. Age of respondents is ranging from 20-25 to 50+. Most of the respondents are 35-50 years old. When examining age differences in detail, it can be seen that four distinctive generations placed on this research such as Baby Boomers, Generation X, Y and Z. These generations have different personality traits, abilities, mindsets and perceptions. Thus, Generation X mostly involved in this research owing to the structure of the bus & coach industry, which requires both experience and agility. Marital status of respondents is mostly married (58.4%), and singles have a significant rate (37.6). There are less divorced individuals placed in this research just by coincidence (4%). Because this study was done on the basis of the firms that manufacture in Turkey and aimed to analyze the global structure, are also included countries where operational activities abroad. Thus, nationality is divided into three groups, such as Turkish, European, American. According to the respondents analyzed in the research, these nationalities' rates are 71.1% (Turkish), 16.2% (European), and 12.7 (American), respectively. Most of the respondents are Turkish people owing to the high amount of personnel required operations (i.e.

Manufacturing, R&D, Finance, and others) maintained facilities located in Turkey. The educational level, which is a predetermined factor to conduct this research, is ranging from pre-graduate degree to PhD degree. Due to the competitive and innovative nature of the bus & coach industry, respondents are mostly graduate with bachelor's degree (63.3%) from universities to embrace analytical skills, comprehensive thinking and investigates problems in detail. Master's and PhD degree individuals are lesser than bachelor's degree owing to restricted time for attending class in working hours. However, along with the expansion of e-learning platforms, employees tend to prefer master's degree classes more willingly than before (29.5%).

Table 10

Distribution of Respondents by Departments

Descriptives	Type	Frequency (#)	Valid Percent (%)	Cumulative Percent (%)
<u>Department Name</u>	Accounting	9	2.6	2.6
	After Sales & Services	43	12.4	15.0
	Business Development	11	3.2	18.2
	Board of Directors	2	0.6	18.8
	Board Member	4	1.2	19.9
	Corporate Communications	10	2.9	22.8
	Customer Relations	8	2.3	25.1
	Finance	17	4.9	30.1
	Human Resources	13	3.8	33.8
	Health Safety Environment	6	1.7	35.5
	Information Technologies	14	4.0	39.6
	Marketing	24	6.9	46.5
	Order Management	6	1.7	48.3
	Procurement	14	4.0	52.3
	Production & Operations	24	6.9	59.2
	Production Planning	9	2.6	61.8
	Quality	11	3.2	65
	R&D	51	14.7	79.8
	Sales	46	13.3	93.1
	Spare Parts	17	4.9	98.0
	Stock & Logistics	7	2.0	100.0

Respondents of this conducted research consist of various departmental functions such as R&D, Sales, Marketing, Production & Operations, and others. Each department has different business flows and processes. So, individuals' perceptions and reactions to any issue can be differentiated through departmental mindsets. In the bus & coach industry, most employees are hired and worked in R&D and After Sales & Services departments owing to the complexity and interdependency of the product model and its features. When examining the respondents'

departments, employees at R&D (14.7%) was placed at the top, followed by After Sales & Services (12.4%). According to OSD (2020), manufacturers in Turkey produces more than 10.000 bus and coaches which have been in operation in different countries around the world. So, after-sales & services department is strictly required to continue transportation with maintenance, dealer networks, and road assistance in a successful way around the world. The other core departments which respondents attended from are Sales (13.3%), Marketing (6.9%), and Product & Operations (6.9%) enabling the manufacturer to compete in aggressive market conditions, and response possible innovations and product enhancements in rapidly changing industry circumstances. The other departments such as HR, Finance, and Corporate Communications are supportive departmental functions to support business successfully as a guide to arranging the internal and external structure of a company in VUCA environments.

Table 11

Job Related Information & Company's Capital Type

Job Information	Type	Frequency (#)	Valid Percent (%)	Cumulative Percent (%)
<u>Job Title</u>	CEO	6	1.7	1.7
	Director	20	5.8	7.5
	Manager	70	20.2	27.7
	Unit Manager	66	19.1	46.8
	Specialist	184	53.2	100.0
<u>Total Job Exp. (Year)</u>	0 – 2 Year	27	7.8	7.8
	2 – 5 Year	34	9.8	17.6
	5 – 10 Year	101	29.2	46.8
	10+ Year	184	53.2	100.0
<u>Job Exp. At Automotive Industry (Year)</u>	0 – 2 Year	46	13.3	13.3
	2 – 5 Year	63	18.2	31.5
	5 – 10 Year	128	37.0	68.5
	10+ Year	109	31.5	100.0
<u>Company's Capital Structure Type</u>	%100 Turkish Company	180	52.0	52.0
	Turkish – Non-Turkish Partnership	67	19.4	71.4
	%100 Non- Turkish Company	99	28.6	100.0

In the research conducted, most respondents are a manager (20.2%) in the bus & coach industry followed by unit managers (19.1%) along with a high amount of attending from Generation X employees. Especially, bus & coach industry in Turkey requires experience to become a part of the management level. In this context, total job experience of employees mostly is 10+ year (53.2%). However, total job experience has a broad range from 0-2 years to 10+ years in more than one industries owing to the need for new mindsets and financial

volatilities which sometimes oblige employees to change their companies. Job experience at bus & coach industry is mostly 5-10 years (37.0%). When comparing the results of total job experience versus job experience in bus & coach industry, it can be observed that employees have more years of experience in total rather than in bus & coach industry. Thus, it can be said that the global bus & coach industry hires employees from different industries that create a supportive environment for innovative approaches. Global Bus & coach manufacturers in Turkey has been differentiated in capital structure perspective. This differentiation can be grouped as three distinctive aspects such as %100 Turkish company, Turkish & Non-Turkish Partnership, and %100 Non-Turkish Company types. Most of the respondents were attended from %100 Turkish company (52.0%) and followed by %100 Non-Turkish Company (28.6%). According to the OSD, Turkish origin bus & coach manufacturers have had to increase of population with both Turkish and Non-Turkish citizenships. Thus, it can be said that the total of Turkish companies which have conducted operations in foreign countries have more employees than other company types in Turkey.

Table 12

Innovation based Exploratory Items

Innovation based Exploratory Items	Type	Frequency (#)	Valid Percent (%)	Cumulative Percent (%)
<u>Employees are mostly trained about "Innovation & Change Management" by company.</u>	Yes	272	78.6	78.6
	No	74	21.4	100.0
<u>Company's culture always support new ideas and foster personal development of employees.</u>	Yes	310	89.5	89.5
	No	36	10.5	100.0

Most of respondents (78.6%) in bus & coach industry are trained about “Innovation & Change Management” in company. Most of respondents (89.5) worked in a company which supports new ideas and foster personal development of employees. Owing to the nature of bus & coach industry, awareness and training programs related to innovativeness have been critical function to sustain in future under competitive market circumstances. However, as it can be seen that the amount of employees who are trained about innovation & change management is not similar with amount of employees perceive company as supporting new ideas and fostering personal developments. It can be said that, the amount of all employees perceive company as innovation supporter have not trained about innovation & change management owing to

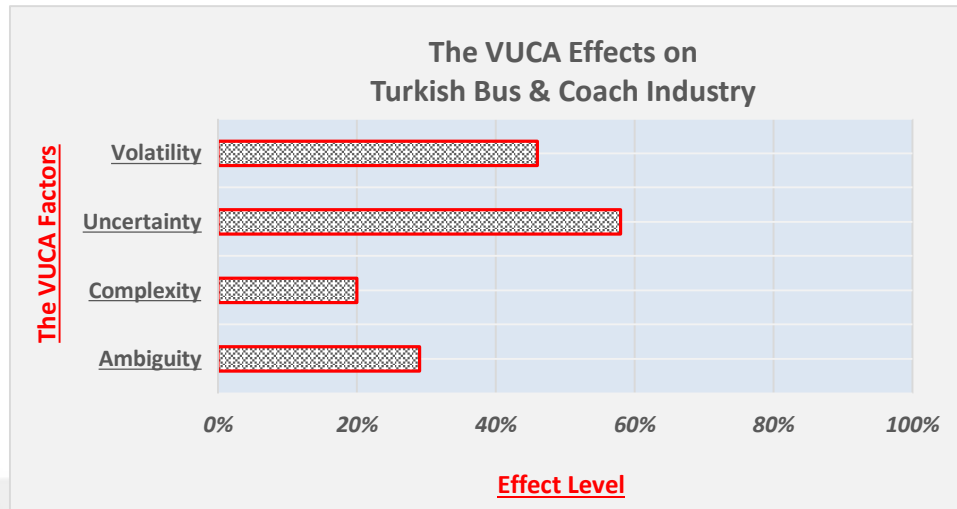
circumstances such as companies' limited financial budget, departmental functions, employees' experience, educational-level, age, and may be the gender. However, the differences between these groups seems to be not too much significant to observe in detail. As mentioned previous sections, innovation has been vital role for companies in today's global and rapidly changing world.

4.1.2. The Diagnosis Tool for Observing the VUCA Effects

Whereas the VUCA concept mostly focuses on studies on how leadership and management approaches should be possessed in organizations, it can be seen in the light of extensive literature reviews that data-driven observation has not been made yet to what extent the groups in the current organization are affected by the VUCA concept (Saleh & Watson, 2017). According to Bennett & Lemoine (2014), a diagnosis tool for observing the VUCA concepts' effect on each organization can be required for enabling leaders' awareness and proactiveness to deal with the outcomes of the challenges related to the VUCA concept in a more agile and effective way. Several management consultants had an attempt to develop a VUCA diagnosis tool called "vucameter" through generating variables related to specific projects by subjective approaches that were not validated by scientific research like scales. However, when observing the contents of each diagnostic tool, variables connected with several factors have a significant impact on the progress of business and project management. Within this motivation and perspective, the VUCA diagnosis tool was developed by the researcher with the contribution of 4 different scales for observing the effects of the VUCA concept. Implementation principles of the VUCA diagnosis are composed of four different steps to be explained as follows. Firstly, the average result of the "RTC" scale is used as a total Volatility level of respondents. Secondly, the average result of the "IUS" scale is used as a total Uncertainty level of respondents. Thirdly, the average result of the "CFS" scale is used as total Complexity when subtracted from the highest point of the "CFS" scale regarding Likert-type (7). Lastly, the average result of the "Ambiguity Tolerance" scale is used as total Ambiguity when subtracted from the highest point of the "Ambiguity Tolerance" scale regarding Likert-type (5). To explain the point that led to this approach, when researcher intends to examine the Complexity and Ambiguity of each organization, the opposite one "Cognitive Flexibility" or "Ambiguity Tolerance" are a great reference point for observing the complexity with using reverse thinking strategy resulted in subtraction as a part of arithmetic operation to obtain remaining value.

Figure 15

The VUCA Effects on Turkish Bus & Coach Industry by Employees' Perception



According to Figure 15, respondents at the Turkish Bus Coach industry are primarily influenced by the impacts of the VUCA concept's uncertainty factor, among others. The main factors affecting business progress as being part of the VUCA concept are volatility and uncertainty that reflect employees' perception during the challenges and routine management progress of the Turkish bus & coach industry. The "Complexity" and "Ambiguity" effects are lower than the "Volatility" and "Uncertainty" due to the essence of companies being part of the Turkish bus & coach industry directing employees to acquire cognitive flexibility and ambiguity tolerance skills throughout the organization by the support of leaders within the corporate culture. Besides, the effects of the VUCA factors have not severe impacts on the perception of employees, as can be seen in the figure illustrated that the most effective level is below 3.

4.1.3. The Descriptive Statistics & Normality Analysis of Scales

The normality analysis is used for determining the structure of responses to each scale that enables the researcher to decide which test can be applied to investigate the hypothesis put forward. To understand the normality of scale by observing skewness and kurtosis values, which should be between -2 and +2. Moreover, descriptive statistics of each item included in scales provide a comprehensive point of view to analyze respondents' perception and have a general idea from the bus & coach industry with examining mean, standard deviation, and min & max values. Mean illustrates the average value of response along with Likert-type. Standard deviation illustrates the closeness of each response to average value. If the standard deviation is greater than 1, it can be recognized as data that is far from the average. Min & Max values represent the lower and upper limits of items that provide a detailed analysis to examine scale.

Table 13

Descriptive Statistics of the “RTC” Scale

Scale 1	<u>Mean</u>	<u>Variance</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
<u>Resistance to Change</u>	<u>2.3427</u>	<u>.265</u>	<u>.51445</u>	<u>1.20</u>	<u>3.67</u>	<u>.119</u>	<u>-.540</u>
<i>Item-1</i>	1.9335	.764	.87389	1.00	4.00	.732	-.100
<i>Item-2</i>	1.9566	.697	.83467	1.00	4.00	.443	-.610
<i>Item-3</i>	2.1618	.304	.55151	1.00	4.00	.688	1.553
<i>Item-4</i>	2.0116	.788	.88785	1.00	4.00	.477	-.622
<i>Item-5</i>	3.0896	.725	.85164	1.00	4.00	-.654	-.253
<i>Item-6</i>	2.0578	.681	.82505	1.00	4.00	.266	-.713
<i>Item-7</i>	1.4624	.487	.69785	1.00	3.00	1.190	.340
<i>Item-8</i>	2.5780	.668	.81719	1.00	4.00	.052	-.545
<i>Item-9</i>	2.5347	.313	.55972	1.00	4.00	-.387	-.650
<i>Item-10</i>	2.3988	.420	.64821	1.00	4.00	-.550	-.572
<i>Item-11</i>	2.5145	.720	.84858	1.00	4.00	-.203	-.587
<i>Item-12</i>	2.3960	.721	.84913	1.00	4.00	-.028	-.655
<i>Item-13</i>	2.9653	.607	.77942	1.00	5.00	-.309	-.073
<i>Item-14</i>	2.4451	.451	.67127	1.00	4.00	-.001	-.211
<i>Item-15</i>	2.6358	.626	.79147	1.00	4.00	-.066	-.443

According to Table (13), “Resistance to Change” scale has 15 items with different statistical values. In total, the average response (mean) to “Resistance to Change” scale is 2.34, with a 0.51 standard deviation. Whereas the minimum response value to scale is 1.20, the maximum response value to scale is 3.67. Skewness and Kurtosis values are .119 and -.540, which corresponds to the boundaries of normality analysis that depicts this scale is appropriate for linear statistical methods. When examining each item separately, it can be seen that average response values are ranging from 1.4624 to 3.0896. In particular, the average response value of item-5 is higher than the other average response values of each item. The standard deviation of each item is ranging from 0.51445 and 0.88785, and mostly the standard deviation of each item is more than 0.70 indicating moderate closeness to average response value. In particular, the standard deviation value of item-4 is higher than the other standard deviation values of each item. Skewness and kurtosis values of each item are conformed with the boundaries of normality analysis. In particular, the skewness value of item-7 and kurtosis value of item-3 are higher than the other skewness and kurtosis values of each item. Whereas the minimum response value to each item is 1.00, the maximum response value of each item is 5.00 (only item – 13).

Table 14

Descriptive Statistics of the "IUS" Scale

Scale 2	<u>Mean</u>	<u>Variance</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
<u>Intolerance of Uncertainty</u>	<u>2.8964</u>	<u>.311</u>	<u>.55727</u>	<u>1.58</u>	<u>4.42</u>	<u>.312</u>	<u>-.050</u>
<i>Item-1</i>	3.4046	.845	.91897	2.00	5.00	-.280	-.970
<i>Item-2</i>	3.5173	.685	.82777	2.00	5.00	.145	-.550
<i>Item-3</i>	3.4595	.695	.83394	2.00	5.00	.114	-.539
<i>Item-4</i>	2.8468	.895	.94621	1.00	5.00	.455	-.089
<i>Item-5</i>	3.6127	.505	.71039	1.00	5.00	-.794	.521
<i>Item-6</i>	2.7341	.422	.64950	1.00	4.00	-.632	0.676
<i>Item-7</i>	3.9538	.357	.59773	2.00	5.00	-.558	1.569
<i>Item-8</i>	2.1243	.712	.84383	1.00	5.00	.634	.296
<i>Item-9</i>	1.9046	.550	.74182	1.00	5.00	.454	.041
<i>Item-10</i>	2.3902	.818	.90462	1.00	5.00	.638	.446
<i>Item-11</i>	1.9133	.740	.86040	1.00	5.00	.937	.878
<i>Item-12</i>	2.8988	.972	.98608	1.00	5.00	.149	-.586

According to Table (14), the "Intolerance of Uncertainty" scale has 12 items with different statistical values. In total, the average response (mean) to the "Intolerance of Uncertainty" scale is 2.89, with 0.55 standard deviation. Whereas the minimum response value to scale is 1.58, the maximum response value to scale is 4.42. Skewness and Kurtosis values are .312 and -.050, which corresponds to the boundaries of normality analysis that depicts this scale is appropriate for linear statistical methods. When examining each item separately, it can be seen that average response values are ranging from 1.9046 to 3.9538. In particular, the average response value of item-7 is higher than the other average response values of each item. The standard deviation of each item is ranging from 0.59773 and 0.98608, and mostly the standard deviation of each item is more than 0.80, indicating slightly moderate closeness to average response value. In particular, the standard deviation value of item-12 is higher than that of each item's other standard deviation values. Skewness and kurtosis values of each item are conformed with the boundaries of normality analysis. In particular, the skewness value of item-11 and kurtosis value of item-7 are higher than the other skewness and kurtosis values of each item. Whereas the minimum response value to each item is 1.00, the maximum response value of each item is 5.00 (except item - 6).

Table 15

Descriptive Statistics of the “CFS” Scale

Scale 3	<u>Mean</u>	<u>Variance</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
<u>Cognitive Flexibility</u>	<u>4.8049</u>	<u>.336</u>	<u>.57926</u>	<u>3.33</u>	<u>6.00</u>	<u>-.417</u>	<u>-.513</u>
<i>Item-1</i>	4.8873	.674	.82110	3.00	6.00	-.421	-.280
<i>Item-2</i>	4.8150	.806	.89792	2.00	6.00	-.835	.163
<i>Item-3</i>	5.3035	.606	.77858	3.00	6.00	-1.032	.741
<i>Item-4</i>	4.8006	.647	.80441	3.00	6.00	-.530	.014
<i>Item-5</i>	4.3699	1.961	1.40046	1.00	6.00	-.667	-.680
<i>Item-6</i>	3.3092	1.165	1.07933	1.00	6.00	.236	-.125
<i>Item-7</i>	4.9653	.642	.80142	3.00	6.00	-.515	-.082
<i>Item-8</i>	5.2803	.463	.68059	3.00	6.00	-.472	-.569
<i>Item-9</i>	4.5954	.879	.93770	2.00	6.00	-.618	-.014
<i>Item-10</i>	5.3295	.471	.68618	3.00	6.00	-.640	-.264
<i>Item-11</i>	5.1965	.535	.73156	3.00	6.00	-.369	-.909
<i>Item-12</i>	4.8092	.740	.86042	3.00	6.00	-.419	-.389

According to Table (15), “Cognitive Flexibility” scale has 12 items with different statistical values. In total, the average response (mean) to the “Cognitive Flexibility” scale is 4.80, with 0.57 standard deviation. Whereas the minimum response value to scale is 3.33, the maximum response value to scale is 6.00. Skewness and Kurtosis values are -.417 and -.513, which corresponds to boundaries of normality analysis that depicts this scale is appropriate for linear statistical methods. When examining each item separately, it can be seen that average response values are ranging from 3.3092 to 5.3295. In particular, the average response value of item-10 is higher than the other average response values of each item. The standard deviation of each item is ranging from 0.68059 and 1.40046, and mostly the standard deviation of each item is more than 0.80, indicating slightly moderate closeness to average response value. In particular, the standard deviation value of item-5 is higher than the other standard deviation values of each item. Skewness and kurtosis values of each item are conformed with the boundaries of normality analysis. In particular, the skewness value of item-6 and kurtosis value of item-3 are higher than the other skewness and kurtosis values of each item. Whereas, the minimum response value to each item is 1.00 (only item – 5 and item - 6), the maximum response value of each item is 6.00.

Table 16

Descriptive Statistics of the “TA” Scale

Scale 4	<u>Mean</u>	<u>Variance</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
<u>Tolerance of Ambiguity</u>	<u>3.5319</u>	<u>.322</u>	<u>.56729</u>	<u>2.15</u>	<u>4.77</u>	<u>-.349</u>	<u>-.410</u>
<i>Item-1</i>	3.4942	.755	.86893	2.00	5.00	-.262	-.671
<i>Item-2</i>	4.1127	.564	.75105	2.00	5.00	-.353	-.660
<i>Item-3</i>	3.3960	.762	.87270	2.00	5.00	-.152	-.788
<i>Item-4</i>	3.1734	.799	.89377	2.00	6.00	.118	-.863
<i>Item-5</i>	3.2399	.548	.74033	2.00	5.00	.015	-.468
<i>Item-6</i>	4.1705	.588	.76696	2.00	5.00	-.533	-.421
<i>Item-7</i>	3.4422	.688	.82943	2.00	5.00	-.183	-.605
<i>Item-8</i>	3.6850	.576	.75884	2.00	5.00	-.363	-.085
<i>Item-9</i>	3.9682	.431	.65641	2.00	5.00	-.215	.047
<i>Item-10</i>	3.5173	.697	.83475	2.00	5.00	-.221	-.540
<i>Item-11</i>	3.3439	.835	.91378	2.00	5.00	-.185	-1.020
<i>Item-12</i>	3.6734	1.009	1.00448	2.00	5.00	-.155	-1.068
<i>Item-13</i>	2.6965	.676	.82204	1.00	5.00	.110	-.607

According to Table (16), the “Ambiguity Tolerance” scale has 13 items with different statistical values. In total, the average response (mean) to the “Ambiguity Tolerance” scale is 3.53, with a 0.56 standard deviation. Whereas the minimum response value to scale is 2.15, the maximum response value to scale is 4.77. Skewness and Kurtosis values are -.349 and -.410, which corresponds to boundaries of normality analysis that depicts this scale is appropriate for linear statistical methods. When examining each item separately, it can be seen that average response values are ranging from 2.6965 to 4.1705. In particular, the average response value of item-6 is higher than the other average response values of each item. The standard deviation of each item is ranging from 0.65641 and 1.00448, and mostly the standard deviation of each item is more than 0.70 indicating moderate closeness to average response value. In particular, the standard deviation value of item-4 is higher than the other standard deviation values of each item. Skewness and kurtosis values of each item are conformed with the boundaries of normality analysis. In particular, the skewness value of item-4 and kurtosis value of item-9 are higher than the other skewness and kurtosis values of each item. Whereas, the minimum response value to each item is 1.00 (only item-13), the maximum response value of each item is 6.00 (only item – 4).

Table 17

Descriptive Statistics of the “PIP” Scale

Scale 5	<u>Mean</u>	<u>Variance</u>	<u>Std. Deviation</u>	<u>Min</u>	<u>Max</u>	<u>Skewness</u>	<u>Kurtosis</u>
<u>Product Innovation Performance</u>	<u>4.7517</u>	<u>.271</u>	<u>.52079</u>	<u>3.42</u>	<u>6.42</u>	<u>.197</u>	<u>-.268</u>
<i>Item-1</i>	4.4075	.364	.60323	4.00	6.00	1.197	.393
<i>Item-2</i>	5.0145	.866	.93084	4.00	7.00	.665	-.386
<i>Item-3</i>	5.7717	.861	.92777	4.00	7.00	-.232	-.848
<i>Item-4</i>	3.9422	.779	.88276	3.00	7.00	.774	.096
<i>Item-5</i>	6.1590	.795	.89160	4.00	7.00	-.836	-.121
<i>Item-6</i>	4.5896	.672	.81955	3.00	7.00	.886	.638
<i>Item-7</i>	4.0780	1.150	1.07257	2.00	7.00	.964	.676
<i>Item-8</i>	4.5867	.869	.93235	3.00	7.00	.307	-.347
<i>Item-9</i>	5.0867	.648	.80469	3.00	7.00	-.226	-.227
<i>Item-10</i>	4.5636	.612	.78223	3.00	7.00	.245	-.117
<i>Item-11</i>	4.3902	.488	.69850	3.00	6.00	.012	-.238
<i>Item-12</i>	4.4306	.478	.69122	3.00	6.00	.728	.071

According to Table (17), the “Product Innovation Performance” scale has 12 items with different statistical values. In total, the average response (mean) to the “Product Innovation Performance” scale is 4.75, with a 0.52 standard deviation. Whereas the minimum response value to scale is 3.42, the maximum response value to scale is 6.42. Skewness and Kurtosis values are .197 and -.268, which corresponds to boundaries of normality analysis that depicts this scale is appropriate for linear statistical methods. When examining each item separately, it can be seen that average response values are ranging from 3.9422 to 6.1590. In particular, the average response value of item-5 is higher than the other average response values of each item. The standard deviation of each item is ranging from 0.60323 and 1.07257, and mostly the standard deviation of each item is more than 0.70 indicating moderate closeness to average response value. In particular, the standard deviation value of item-7 is higher than the other standard deviation values of each item. Skewness and kurtosis values of each item are conformed with the boundaries of normality analysis. In particular, the skewness value of item-1 and kurtosis value of item-7 are higher than the other skewness and kurtosis values of each item. Whereas, the minimum response value to each item is 2.00 (only item – 7), the maximum response value of each item is 7.00.

4.1.4. The Reliability & Validity Analysis

Reliability analysis is a method to observe internal consistency of each scale via Cronbach's alpha value. If the Cronbach's alpha value is greater than 0.60, the responses of scale are reliable to maintain hypothesis tests and other statistical measures to support research model of studies. According to Table (18), each of scale's reliability value is higher than bottom value.

Table 18

The Reliability & Validity Results of Scales

Scales	# of items	Respondents	Cronbach's Alpha	KMO & Bartlett's Test (sig.)	
Resistance to Change	15	346	.910	.887	.00
Intolerance to Uncertainty	12	346	.891	.886	.00
Cognitive Flexibility	12	346	.874	.896	.00
Ambiguity Tolerance	13	346	.905	.888	.00
Product Innovation Performance	12	346	.851	.804	.00

KMO.

4.1.5. The Observation of Scale Responses

In the research study conducted, each scale has more than one items, and responses to each item are varied through the mindset, perception and characteristics of individuals in the Turkish bus & coach industry. Thus, observing responses of each item can be a supportive tool for understanding respondents' background along with the dynamics of industry and market circumstances. As mentioned at previous sections, employees' perception can be affected by both internal and external factors of the company and the industry. Most of employees' performance are depending on attitudes and behaviors towards challenging circumstances. Thus, responses to each questionnaire within the scale performed to respondents can be differed by the distinctness of the demographic information, educational backgrounds, company's structure and corporate culture shaping the employees' attitudes and behaviors. These varied responses were occurred using the Likert-type that enables the researcher to investigate them separately as a categorization. The distributions of responses are illustrated in percentages. Respondents' answers and related impressive results differentiated among others are going to be interpreted in the discussion section.

Table 19

Distributions of the Responses by “RTC” Scale

Resistance to Change	<u>Strongly Disagree</u> (1)	<u>Disagree</u> (2)	<u>Neutral</u> (3)	<u>Agree</u> (4)	<u>Strongly Agree</u> (5)	<u>Total</u>
<i>Item-1</i>	35.0%	43.4%	15.0%	6.6%	0.0%	100.0%
<i>Item-2</i>	33.5%	40.8%	22.2%	3.5%	0.0%	100.0%
<i>Item-3</i>	6.6%	72.3%	19.4%	1.7%	0.0%	100.0%
<i>Item-4</i>	32.9%	38.8%	22.5%	5.8%	0.0%	100.0%
<i>Item-5</i>	4.9%	17.4%	41.6%	36.1%	0.0%	100.0%
<i>Item-6</i>	27.7%	42.2%	26.6%	3.5%	0.0%	100.0%
<i>Item-7</i>	65.6%	22.6%	11.8%	0.0%	0.0%	100.0%
<i>Item-8</i>	7.8%	39.9%	39.0%	13.3%	0.0%	100.0%
<i>Item-9</i>	2.3%	42.8%	54.0%	0.9%	0.0%	100.0%
<i>Item-10</i>	8.7%	43.1%	47.9%	0.3%	0.0%	100.0%
<i>Item-11</i>	13.3%	32.1%	44.5%	10.1%	0.0%	100.0%
<i>Item-12</i>	15.6%	37.6%	38.4%	8.4%	0.0%	100.0%
<i>Item-13</i>	3.5%	21.1%	51.4%	23.4%	0.6%	100.0%
<i>Item-14</i>	6.1%	47.4%	42.5%	4.0%	0.0%	100.0%
<i>Item-15</i>	6.6%	36.2%	44.2%	13.0%	0.0%	100.0%
Item-Total	18.0%	38.5%	34.8%	8.7%	0.0%	100.0%

According to Table (19), “RTC” scale is categorized by five different levels of response such as “strongly agree” (1), “disagree” (2), “neutral” (3), “agree” (4) and “strongly agree” (5). In this scale, which consists of 15 different questions, and 346 people answered, no missing data was found. In general, responses to “RTC” scale placed between disagree and neutral. Item-3 has a higher percentage than the other items at level of disagree. There is no value pointing out level of “strongly agree” preferred by respondents. On the other side, the level of “strongly disagree” is preferred by less respondents except item-1, item-2, item-4, item-5, item-7. Additionally, the level of “agree” is preferred by less respondents except item-5, item-13 and item-15. Briefly, when examining the category of “Item-Total”, it is clearly seen that respondents mostly preferred to choose both “disagree” (38.5%) and “neutral” (34.8%) answers.

Table 20

Distributions of the Responses by “IUS” Scale

Intolerance of Uncertainty	<u>Strongly Disagree</u> (1)	<u>Disagree</u> (2)	<u>Neutral</u> (3)	<u>Agree</u> (4)	<u>Strongly Agree</u> (5)	<u>Total</u>
Item-1	0.0%	22.3%	22.8%	47.1%	7.8%	100.0%
Item-2	0.0%	9.0%	43.0%	35.3%	12.7%	100.0%
Item-3	0.0%	11.3%	42.5%	35.2%	11.0%	100.0%
Item-4	4.3%	34.1%	40.5%	14.7%	6.4%	100.0%
Item-5	0.3%	7.8%	26.9%	60.4%	4.6%	100.0%
Item-6	4.3%	24.9%	63.9%	6.9%	0.0%	100.0%
Item-7	2.0%	14.2%	70.2%	13.6%	0.0%	100.0%
Item-8	22.0%	51.2%	19.9%	6.3%	0.6%	100.0%
Item-9	30.9%	49.1%	18.8%	0.9%	0.3%	100.0%
Item-10	13.3%	47.4%	28.9%	7.8%	2.6%	100.0%
Item-11	34.4%	46.2%	13.9%	4.6%	0.9%	100.0%
Item-12	5.8%	31.8%	34.1%	23.4%	4.9%	100.0%
Item-Total	9.6%	28.1%	30.8%	26.1%	5.4%	100.0%

According to Table (20), “IUS” scale is categorized by five different levels of response such as “strongly agree” (1), “disagree” (2), “neutral” (3), “agree” (4) and “strongly agree” (5). In this scale, which consists of 12 different questions, and 346 people answered, no missing data was found. In general, responses to IUS scale placed between disagree and neutral. Item-7 has a higher percentage than the other items at level of neutral. There is no value pointing out level of “strongly disagree” preferred by respondents on item-1, item2, and item-3. Moreover, the level of “strongly disagree” is preferred by less respondents except item-8, item-9, item-10, and item-11. Additionally, the level of “strongly disagree” is preferred by less respondents except item-2 and item-3. Briefly, when examining the category of “Item-Total”, it is clearly seen that respondents mostly preferred to choose both “disagree” (28.1%) and “neutral” (30.8%) answers.

Table 21

Distributions of the Responses by “CFS” Scale

Cognitive Flexibility	<u>Strongly</u> <u>Disagree</u> (1)	<u>Disagree</u> (2)	<u>Slightly</u> <u>Disagree</u> (3)	<u>Slightly</u> <u>Agree</u> (4)	<u>Agree</u> (5)	<u>Strongly</u> <u>Agree</u> (6)	<u>Total</u>
Item-1	0.0%	0.0%	5.8%	22.5%	48.9%	22.8%	100.0%
Item-2	0.0%	0.3%	13.3%	9.5%	58.4%	18.5%	100.0%
Item-3	0.0%	0.0%	3.5%	9.2%	40.8%	46.5%	100.0%
Item-4	0.0%	0.0%	7.8%	20.8%	54.9%	16.5%	100.0%
Item-5	2.6%	10.4%	17.9%	6.9%	40.8%	21.4%	100.0%
Item-6	4.0%	15.0%	45.1%	19.7%	14.2%	2.0%	100.0%
Item-7	0.0%	0.0%	4.9%	19.1%	50.6%	25.4%	100.0%
Item-8	0.0%	0.0%	0.3%	12.1%	46.8%	40.8%	100.0%
Item-9	0.0%	2.0%	12.5%	22.8%	49.4%	13.3%	100.0%
Item-10	0.0%	0.0%	0.6%	10.7%	43.9%	44.8%	100.0%
Item-11	0.0%	0.0%	0.3%	17.9%	43.6%	38.2%	100.0%
Item-12	0.0%	0.0%	8.4%	23.1%	47.7%	20.8%	100.0%
Item-Total	0.6%	2.3%	10.0%	16.2%	45.0%	25.9%	100.0%

According to Table (21), “Cognitive Flexibility” scale is categorized by five different levels of response such as “strongly agree” (1), “disagree” (2), “neutral” (3), “agree” (4) and “strongly agree” (5). In this scale, which consists of 12 different questions, and 346 people answered, no missing data was found. In general, responses to cognitive flexibility scale placed between agree and strongly agree. Item-6 has a higher percentage than the other items at level of “slightly disagree”. There is no value pointing out level of “strongly agree” preferred by respondents. On the other side, the level of “strongly disagree” is preferred by less respondents except item-5 and item-6. Additionally, the level of “disagree” is preferred by less respondents except item-5 and item-6. Briefly, when examining the category of “Item-Total”, it is clearly seen that respondents mostly preferred to choose both “agree” (45.0%) and “strongly agree” (25.9%) answers.

Table 22

Distributions of the Responses by “MSTAT-II” Scale

Tolerance of Ambiguity	<u>Strongly</u> <u>Disagree</u> (1)	<u>Disagree</u> (2)	<u>Neutral</u> (3)	<u>Agree</u> (4)	<u>Strongly</u> <u>Agree</u> (5)	<u>Total</u>
Item-1	0.0%	15.6%	28.9%	46.0%	9.5%	100.0%
Item-2	0.0%	1.2%	19.6%	46.0%	33.2%	100.0%
Item-3	0.0%	18.2%	31.8%	42.2%	7.8%	100.0%
Item-4	27.5%	32.6%	35.3%	4.3%	0.3%	100.0%
Item-5	0.0%	15.3%	48.3%	33.5%	2.9%	100.0%
Item-6	0.0%	1.7%	17.1%	43.6%	37.6%	100.0%
Item-7	0.0%	14.5%	34.3%	43.7%	7.5%	100.0%
Item-8	0.0%	6.9%	28.6%	53.5%	11.0%	100.0%
Item-9	0.0%	1.2%	19.6%	60.4%	18.8%	100.0%
Item-10	0.0%	12.7%	32.4%	45.4%	9.5%	100.0%
Item-11	0.0%	23.4%	25.7%	44.0%	6.9%	100.0%
Item-12	0.0%	14.2%	29.4%	31.3%	25.1%	100.0%
Item-13	4.9%	38.5%	39.0%	17.3%	0.3%	100.0%
Item-Total	0.4%	14.7%	29.8%	41.7%	13.4%	100.0%

According to Table (22), “MSTAT-II” scale is categorized by five different levels of response such as “strongly agree” (1), “disagree” (2), “neutral” (3), “agree” (4) and “strongly agree” (5). In this scale, which consists of 13 different questions, and 346 people answered, no missing data was found. In general, responses to “Ambiguity Tolerance” scale placed between neutral and agree. Item-9 has a higher percentage than the other items at level of “agree”. There is no value pointing out level of “strongly disagree” preferred by respondents except item-4 and item-13. Additionally, the level of “strongly agree” is preferred by less respondents except item-2, item-6, item-9, and item-12. Briefly, when examining the category of “Item-Total”, it is clearly seen that respondents mostly preferred to choose both “neutral” (29.8%) and “agree” (41.7%) answers.

Table 23

Distributions of the Responses by “PIP” Scale

Product Innovation Performance	<u>Much Worse</u> (1)	<u>Worse</u> (2)	<u>Slightly Worse</u> (3)	<u>Neutral</u> (4)	<u>Slightly Better</u> (5)	<u>Better</u> (6)	<u>Much Better</u> (7)	<u>Total</u>
Item-1	0.0%	0.0%	0.0%	0.0%	65.3%	28.6%	6.1%	100.0%
Item-2	0.0%	0.0%	0.0%	33.2%	41.4%	16.2%	9.2%	100.0%
Item-3	0.0%	0.0%	0.0%	9.2%	29.2%	36.7%	24.9%	100.0%
Item-4	0.0%	0.0%	34.7%	43.3%	15.3%	6.4%	0.3%	100.0%
Item-5	0.0%	0.0%	0.0%	6.1%	14.7%	36.4%	42.8%	100.0%
Item-6	0.0%	0.0%	2.9%	50.9%	33.5%	9.8%	2.9%	100.0%
Item-7	0.0%	1.7%	27.7%	48.6%	8.7%	9.5%	3.8%	100.0%
Item-8	0.0%	0.0%	10.1%	40.2%	32.7%	15.0%	2.0%	100.0%
Item-9	0.0%	0.0%	2.3%	19.7%	46.8%	29.5%	1.7%	100.0%
Item-10	0.0%	0.0%	6.1%	43.0%	39.9%	10.4%	0.6%	100.0%
Item-11	0.0%	0.0%	8.4%	48.2%	39.4%	4.0%	0.0%	100.0%
Item-12	0.0%	0.0%	3.2%	58.9%	29.5%	8.4%	0.0%	100.0%
Item-Total	0.0%	0.1%	8.0%	38.9%	30.0%	15.7%	7.3%	100.0%

According to Table (23), “PIP” scale is categorized by five different levels of response such as “strongly agree” (1), “disagree” (2), “neutral” (3), “agree” (4) and “strongly agree” (5). In this scale, which consists of 12 different questions, and 346 people answered, no missing data was found. In general, responses to “PIP” scale placed between neutral and slightly better. Item-5 has a higher percentage than the other items at level of “much better”. There is no value pointing out level of “much worse” preferred by respondents. On the other side, the level of “worse” is preferred by less respondents except item-7. Additionally, the level of “slightly worse” is preferred by less respondents except item-4 and item-7. Briefly, when examining the category of “Item-Total”, it is clearly seen that respondents mostly preferred to choose both “neutral” (38.9%) and slightly better (30.0%) answers.

4.1.6. Hypothesis Analysis

In order to analyze validity of hypothesis, Pearson's correlation analysis is used owing to the normality values of scales and the structure of research model which are mentioned both in research methodology and results section. According to Büyüköztürk (2003) correlation coefficients (r) between variables can be at least more than 0.30 with $p < 0.05$ to determine as there is a correlation. Thus, when examining each hypothesis with this approach, the correlation values can be presented and explained as following table.

Table 24

Correlational Findings Between Scales

Correlations		VAVG	UNAVG	CAVG	AAVG	INAVG
<u>VAVG</u>	Pearson Correlation	1	.307**	-.577**	-.566**	-.327**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	346	346	346	346	346
<u>UNAVG</u>	Pearson Correlation	.307**	1	-.426**	-.475**	-.319**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	346	346	346	346	346
<u>CAVG</u>	Pearson Correlation	-.577**	-.426**	1	.557**	.292**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	346	346	346	346	346
<u>AAVG</u>	Pearson Correlation	-.566**	-.475**	.557**	1	.346**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	346	346	346	346	346
<u>INAVG</u>	Pearson Correlation	-.327**	-.319**	.292**	.346**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	346	346	346	346	346

** . Correlation is significant at the 0.01 level (2-tailed).

According to the H₁ claimed that, there is a negative correlation between “Volatility” and “PIP”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. ($r = -0.327$; $n = 346$; $p = 0.00$) According to the H₂ claimed that, there is a negative correlation between “Uncertainty” and “PIP”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. ($r = -0.319$; $n = 346$; $p = 0.00$) According to the H₃ claimed that, there is a positive correlation between “Complexity” and “PIP”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. ($r = -0.292$; $n = 346$; $p = 0.00$) According to the H₄ claimed that, there is a positive correlation between “Ambiguity” and “PIP”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. ($r = 0.346$;

n=346; p=0.00) According to the H₅ claimed that, there is a positive correlation between “Volatility” and “Uncertainty”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. (r= 0.307; n=346; p=0.00) According to the H₆ claimed that, there is a negative correlation between “Volatility” and “Complexity”. The results approved that correlation is existed by appropriate results of analysis matched with moderate correlation. (r= -0.577; n=346; p=0.00) According to the H₇ claimed that, there is a negative correlation between “Volatility” and “Ambiguity”. The results approved that correlation is existed by appropriate results of analysis matched with moderate correlation. (r= -0.566; n=346; p=0.00) According to the H₈ claimed that, there is a negative correlation between “Uncertainty” and “Complexity”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. (r= -0.426; n=346; p=0.00) According to the H₉ claimed that, there is a negative correlation between “Uncertainty” and “Ambiguity”. The results approved that correlation is existed by appropriate results of analysis matched with low correlation. (r= -0.475; n=346; p=0.00) According to the H₁₀ claimed that, there is a positive correlation between “Complexity” and “Ambiguity”. The results approved that correlation is existed by appropriate results of analysis matched with moderate correlation. (r= 0.557; n=346; p=0.00)

Table 25

The Results of Research Hypotheses

#	Research Hypotheses	Results
1	H ₁ : There is a negative correlation between “Volatility” and “Product Innovation Performance”	<i>Accepted</i>
2	H ₂ : There is a negative correlation between “Uncertainty” and “Product Innovation Performance”	<i>Accepted</i>
3	H ₃ : There is a positive correlation between “Complexity” and “Product Innovation Performance”	<i>Accepted</i>
4	H ₄ : There is a positive correlation between “Ambiguity” and “Product Innovation Performance”	<i>Accepted</i>
5	H ₅ : There is a positive correlation between “Volatility” and “Uncertainty”	<i>Accepted</i>
6	H ₆ : There is a negative correlation between “Volatility” and “Complexity”	<i>Accepted</i>
7	H ₇ : There is a negative correlation between “Volatility” and “Ambiguity”	<i>Accepted</i>
8	H ₈ : There is a negative correlation between “Uncertainty” and “Complexity”	<i>Accepted</i>
9	H ₉ : There is a negative correlation between “Uncertainty” and “Ambiguity”	<i>Accepted</i>
10	H ₁₀ : There is a positive correlation between “Complexity” and “Ambiguity”	<i>Accepted</i>

4.2. Discussion

In the global world structure where developing technological innovations, digitalization, borders between countries are relatively flexible, the effects of the concept of VUCA continue to exist in the ecosystem and business world with a more evident and more comprehensive impact (Brodie, 2019). It can be seen that each factor in VUCA causes different events in its own way and even has a stronger effect as a result of these events. Considering how VUCA factors emerged and strengthened, it can be seen that a certain group continues their current work and life processes under the influence of internal or external variables (Codreanu, 2016). External factors arise as a result of the conditions and dynamics of the environment in which companies or individuals reside and may vary depending on the structure and characteristics of the environment. Under these conditions, the less damaging effects of the VUCA concept can be observed with the support of common solutions among companies and individuals, potential collaborations, public regulations, and financial instruments, composed of modern and interconnected global formations. However, the technology, international developments, and increasing competition among companies that continue to progress more intensely since the end of the 20th century emphasize the organization of companies' requirements for being dynamic, proactive, adaptive, innovative, and solution-oriented, as being part of internal factors. Within these conditions, employees' perception, attitudes, and behaviors can be critical aspects to continue business progress successfully in a long term. Factors generated by the VUCA concept as volatility, uncertainty, complexity, and ambiguity should be examined through perceptions and reactions of employees to the causes or outcomes of the VUCA environment. In this regard, owing to the competitive structure, frequent changes and renewal of technologies, variations in customer preferences, fluctuations in market demands and the complexity of product & production processes, researching the VUCA concept in the Turkish bus & coach industry can be the appropriate example, considered at literature review section in detail. Especially, innovations have been maintained so far can enable researcher to analyze the VUCA concept comprehensively and to observe the relationship between the VUCA concept and PIP. In this perspective, perception-based and actual performance-based product innovation scales were used to measure employees' reactions to each factor triggered by the VUCA environment during the innovation processes of companies. When investigating the convenience and applicability of scales, each item was analyzed and interpreted through its literature background by considering the VUCA concept. Before observing and interpreting the statistical results of each scale performed, the researcher should explicate the demographical results of each

respondent combined with the company's capital structure and its approach toward innovation and change perspectives. When the participants are examined in terms of gender characteristics, they are seen as 72.5% men and 27.5% women. According to the studies carried out, it is seen that women's participation in the organization provides a more effective environment in the company's productivity, creative thinking and team harmony processes (Rajesh, 2019). When the participants are examined in terms of generational differences, it's observed that X (the ones born between 1965 and 1980) and Y (the ones born between 1981 and 1995) generations exist in the conducted research study (Oblinger & Oblinger, 2005). This can show that the company's existing organizational culture can have both rational behavior-oriented cautiousness and agile mechanisms that can take risks through maintaining innovations by employees (Reeves & Oh, 2008). When the national identities of the people working in the Turkish bus & coach industry are analyzed, it is seen that the number of European and American employees is significant, and this result can be shown as a supporting argument that the companies have a multinational structure. Considering the educational background of the employees, it is seen that the white collar personnel working in the Turkish bus & coach industry are mostly bachelor's degree graduates that illustrates analytical and observation skills could be acquired. When the departments of the employees are examined, the number of personnel is high in the fields of R&D (14.7%), sales (13.3) and after-sales services (12.4) in line with the competitive and innovative dynamics of the industry. The fact that the experience period of the employees in the Turkish bus & coach is mostly 5-10 years (37%), depicts that the organization is renewed at certain intervals but consider experience as an important factor. Companies at Turkish bus & coach industry, notice the trainings of employees about innovation & change (78.6%) and also foster employees creative and innovative ideas through corporate culture (89.5) supported by leaders and managers. In the study, scales are performed in order to observe the VUCA factors empirically. According to the Saleh & Watson (2017), empirical study of the VUCA concept has not been actualized through quantitative research method. In some questions of each scale, important findings were obtained depending on the dynamics of the industry.

Volatility as a sub-factor of the VUCA concept, RTC scale is used, and results are impressive. According to Table 13, the average response value to item-5 is higher than the average RTC scale because the management approach caused significant stress levels with long work hours, hierarchy, ergonomic design of offices, and the relationship between employees (Carayon & Smith, 2000; McCleese *et al.*, 2007; Spurgeon *et al.*, 1997). The average response value to item-13 is higher than the average RTC scale because of the complexity of the design,

manufacturing, and also customer management in the Turkish bus & coach industry during the change. The average response value to item-7 is lower than the average RTC scale because of the fear of losing the job in an environment of high unemployment rate in Turkey (Çakır, 2007). It can be said that employees do not tend to leave their comfort zones in which acquired habits are existed and preferred by employees (Brown, 2008). Additionally, the standard deviation of item-4 depicts that the feeling of anxiety to change is varying from employees to employees owing to the factors such as departmental differentiations, job title, job experience, age groups, marital status, and educational level (Miller & Monge, 1985). Apart from those findings, the volatility level of employees at the Turkish bus & coach industry is not high enough to claim that volatility is the main critical factor among the VUCA factors affecting companies in general. On the other hand, examining the response rate for each item to observe employees' common reactions illustrate other significant findings to explain the volatility aspect of the VUCA concept in the Turkish bus & coach industry during the actualizations of volatilities or issues caused volatility. According to Table 19, the response rate to item-3 (agree) is higher than the others because of the change is recognized as an exciting happen by employees. Change increases enthusiasm levels of employees when the organization fosters creativity and provides innovative work environments with trust that result in employees' motivation, loyalty, increased communication, and collaboration skills (Bledow *et al.*, 2013; Hattori & Lapidus, 2004). The response rate to item-7 (strongly disagree) is higher than the others because of the lacking communication with managers caused by hierarchy and employees' risk-aversion owing to losing authority and esteem within the company (Karaçor & Şahin, 2004).

Uncertainty as a sub-factor of the VUCA concept, IUS scale is used, and results are impressive. According to Table 14, the average response value to item-1 is higher than the average IUS scale because of the historical effects of uncertain events such as global financial crisis in 2008, political inconsistencies, international conflicts and terrorism made employees upset during the designing, planning and adapting to individual objectives (Howie & Campbell, 2017). The average response value to item-2 and item-7 are higher than the average IUS scale due to the complicated issues employees struggling for to compete at the Turkish bus & coach industry during the abundance of information era. The average response value to item-5 is higher than the average IUS scale because of the rising anxiety level during the uncertain times combined with financial, social and health problems. It cannot be said that employees are not affected by uncertainties through perceptions triggered by external impacts. Additionally, the standard deviation of item-4, item-10, and item-12 depicts that reactions to cases causing

increased effect rate of uncertainty as organizing the business, avoiding uncertainties, and fear of being unsuccessful are varying from employees to employees owing to the factors such as departmental differentiations, job title, job experience, age groups, marital status, and educational level. Apart from those findings, the Uncertainty level of employees at the Turkish bus & coach industry is high enough to claim that uncertainty is the main critical factor among the VUCA factors affecting companies in general. On the other hand, examining the response rate for each item to observe employees' common reactions illustrate other significant findings to explain the uncertainty aspect of the VUCA concept in the Turkish bus & coach industry during the actualizations of uncertainties or issues caused uncertainty. According to Table 20, the response rate to item-4 (strongly agree) and item-7 (neutral) is higher than the others because of the characteristics of each departmental functions possess uncertainty during overcoming market challenges and transforming potential threats into opportunities through the competition among rivals at Turkish bus & coach industry. The response rate to item-8 (disagree) and item-11 (strongly disagree) are higher than the other items because of the employees' positive reaction and adaptability to uncertain events rather than being paralyzed within the agile dynamics of the Turkish bus & coach structure industry.

Complexity as a sub-factor of the VUCA concept, CFS scale is used, and results are significant. According to Table 15, the average response value to item-8 and item-10 are higher than the average CFS scale due to the fact that employees tend to focus on analyzing complicated and interconnected problems with using rational thinking approach through the possession of analytical mindset and interdisciplinary educational background matched with recognition the dynamics of both industry and market (Toplak *et al.*, 2014). The average response value to item-3 and item-11 is higher than the average CFS scale owing to the rapid technological developments and competitive structure of the industry that urge employees to embrace decision-making processes ambitiously and to consider more than one possible scenario for being proactive and agile in case of any failure (Joroff *et al.*, 2003). In contrast, the average response value to item-6 is lower than the average CFS scale because the employees' moderate intention to work in seeking creative solutions for problems caused by restrictive industry regulations, abstaining from losing locus of control and role ambiguity (Tang & Chang, 2010). It cannot be said that employees are not affected by complexities through the structure of the process, product, and organization that has an impact on employees' perception and behavior when the standard deviation of item-5 and item-6 is considered, higher than the other items in CFS. Apart from those findings, the Complexity level of employees at the Turkish bus

& coach industry is not too high enough to claim that complexity is the main critical factor among the VUCA factors affecting companies in general.

Ambiguity as a sub-factor of the VUCA concept, *MSTAT-II* scale is used, and results are impressive. According to Table 16, the average response value to item-2 and item-6 are higher than the average *MSTAT-II* scale because employees have an intention to task with problem-solving facts in which can be viewed from several disciplines owing to the innovative, competitive and collaborative aspects of Turkish bus & coach industry forced employees to be open-minded and solution-oriented. In contrast, the average response value to item-6 is lower than the average *MSTAT-II* scale depicts that most of employees do not tend to prefer ambiguous situations willingly owing to possibility of avoiding risk behavior caused by characteristic factors such as factors such as departmental differentiations, job title, job experience, age groups, marital status, and educational level (Ghosh & Ray, 1997). It cannot be said that employees are not mostly affected by ambiguity throughout the dynamics of both related industry and market environment which are vulnerable to external factors caused by fluctuations and uncertainties affecting employees' perception and behavior when the standard deviation of item-12 is considered, higher than the other items in *MSTAT-II*. Apart from those findings, the Ambiguity level of employees at the Turkish bus & coach industry high enough to claim that ambiguity is the main critical factor among the VUCA factors affecting companies in general. On the other hand, examining the response rate for each item to observe employees' common reactions illustrate other significant findings to explain the ambiguity aspect of the VUCA concept in the Turkish bus & coach industry during the actualizations of ambiguity or issues causing ambiguity. According to Table 22, the response rate to item-4 (strongly disagree) is higher than the other items because employees mostly accustom to ongoing business processes without uncertainty, lacking of knowledge, unpredicted future outcomes causing anxiety, inability to make decisions, and hazy future plans of the related company. The response rate to item-6 (agree) and item-9 (strongly agree) are higher than the other items because of the amount of solution-oriented employees' existed with interdisciplinary educational background integrated with cognitive flexibility trait they have to deal with events causing haziness throughout the combined proactiveness and complicatedness dynamic of the Turkish bus & coach structure industry. After the AI technologies expanded throughout several industries, organizations have been struggling eagerly with complexities triggering ambiguity via big data technologies during the era of the VUCA concept affecting businesses severely (Elkington, 2018).

Innovation as a driving force to become survival in turbulent VUCA times measured by the “PIP” scale and interesting findings reflect both companies’ and employees’ capacity, capability, and reaction to processes of the maintained product innovation. According to Table 17, the average response value to item-3 and item 5 is higher than the other items because of the market dynamics urged companies to manufacture products within main product field, technological capacity and adaptability of industry, and governmental regulations regarding to preventing air pollution such as emission standards. Turkish bus & coach industry is compelled to develop an environment-friendly product for exporting products to both Europe and the US by regulation of emission and transportation standards. In contrast, the high standard deviation of item-2 illustrates that some of the companies tend to focus on manufacturing different vehicles outside of the main product range for attracting customer preferences and developing niche markets in which competition is less aggressive (Guerzoni, 2013).

According to the Bennett & Lemoine, the VUCA concept can have observable relationship among each factor of the VUCA concept such as volatility, uncertainty, complexity, and ambiguity. In line with this perspective, within the context of Turkish bus & coach industry, scales measuring each VUCA factor were analyzed and findings illustrate that there is a significant correlation between each factors, expressed in details with structuring hypothesis in the research study (Table 25). “Volatility” and “Uncertainty” has a correlation because the change can create uncertainties, where the emergence of innovations often and the consequences of innovations are not clearly predicted. “Uncertainty” and “Complexity” has a significant correlation because the occurrence of “intolerance of uncertainty” causing inability to deal with uncertainties happens as a reflection of cognitive rigidity (oppose to cognitive flexibility) which cannot enable employees’ adaptation to outcomes of unpredicted events. “Complexity” and “Ambiguity” correlate among themselves because ambiguity is a condition that requires flexible thinking approaches for dealing with its effects in a successful way through observing possible scenarios to be actualized in the future. Due to the fact that, the complexity appears both with uncertainty and ambiguity with similar characteristics, Mack & Khare (2016) claimed that complexity is a central point which causes both uncertain and volatile environments resulted in ambiguity, considered as decision-making through a determined system perspective. The more variables included, the increasing effect of complexity exists in each business process and organization (Anderson, 1999).

On the other hand, the VUCA factors may be categorized in two interrelated groups by observing the time intervals that affect. According to the VUCA framework developed by

Bennett & Lemoine (2014), it can be seen that there two dimensions of the VUCA concept related with prediction and knowledge. “Volatility” and “Uncertainty” factors are mostly drivers and outcomes of the today’s unexpected events having an impact on current routines, plans, and traits of each organization or individual. “Complexity” and “Ambiguity” factors are mostly agents transforming the organization or individual into an environment that obliged those to deal with more severe effects of the VUCA concept which cannot be expected, known, predicted and observed apparently owing to the nature of future times. Thus, these factors should be grouped as “the outcomes of today’s actualized realities” and “the outcomes of tomorrow’s possible realities”. According to Kail (2010), after the 9/11 attacks happened, its outcomes caused uncertainties such as ensuring security, maintaining international relations, managing financial crises combined with significant volatilities (i.e., structural & organizational changes, political inconsistencies, market fluctuations) at business flows. As being recognized that “the outcomes of today’s actualized realities,” causing a chaotic environment within the VUCA concept. On the other side, according to Kail (2011), due to the context of ambiguity as “inability to accurately conceptualize threats and opportunities before they become lethal” supported by complexities such as interconnectedness, increasing variables and unforeseen limitations, the group of “the outcomes of tomorrow’s possible realities,” can pointing out the unpredicted and unknown aspect of the future within the VUCA concept. Consequently, in the context of the Turkish bus & coach industry, the concept of VUCA can be observed as the universal set, and it should be thought that there are two different sub-sets of the VUCA concept that covers the present and the future. For instance, whereas the Covid-19 outbreak is a fact that generates volatility as fluctuations of the product demands; uncertainty as new regulations to prevent virus contagion among passengers through reduced seat capacities during the transportation, renewal of citybus vehicles, decreasing travels by coach vehicles, there are unknown and unpredicted facts like Covid-19, Trade-wars, the Brexit and AI technologies will change market dynamics and regulate the transportation of the future causing complexity and ambiguity with lacking information and expectation embraced by manufacturers and customers as well.

In Turkish bus & coach industry, product innovation is a critical process to become survival in a market environment embracing factors of the VUCA concept such as volatility, uncertainty, complexity, and ambiguity owing to the competition, changing technologies and regulations, customizations, increased expansion of alternative transportation platforms (e.g., airports, railways) and also the purpose for obtaining more efficient and effective products

adapting road conditions and operator's preferences. Findings of the research conducted observed that each factor of the VUCA concept has a relationship between product innovation performance as claimed and analyzed by many scholars. In particular, maintaining product innovation performance becomes more critical through guiding employees' perception and attitudes within the purpose of corporate strategy when competition, price volatilities, changing technology and unexpected outcomes of future in the VUCA times (Abidi & Nakagawa, 2018). First, according to Table 24, employees' resistance to change causing severe effects of volatility is negatively correlated with companies' product innovation performance because innovation itself emerges as a result of the changes and provides financial contributions to the company. In business environments and organizations, where there is no change and even resistance, it is not possible to carry out innovation effectively, successfully, and even continuously. Second, according to Table 24, employees' intolerance of uncertainty causing severe effects of uncertainty is negatively correlated with companies' product innovation performance. According to Min (2014), the innovative behavior of employees decreases when the increasing level of being intolerant to uncertain conditions, which are the indigenous outcome of maintaining innovation progresses owing to generating or adapting new technologies without possessing profound knowledge and utilized techniques related to each business within the industry dynamics under the pressure of limited time intervals occurred by rapid technological developments.

Third, according to Table 24, employees' cognitive flexibility preventing complexity is positively correlated with companies' product innovation performance. Cognitive flexibility provides dealing with complicated issues like product innovations, including more variables and constraints well through embracing several observing & analyzing approaches, adaptation to changing perspectives, and out of box thinking by the support of multidisciplinary recognition skills (Barman & Potsangbam, 2017; Georgsdottir *et al.*, 2003). Within the Turkish bus & coach industry, multiple production processes with combination of interconnected parts lead employees to be cognitive flexible to maintain product innovation through adopting new technologies such as electricity powered engines, telematics, V2V and autonomous drive.

Last, according to Table 24, employees' ambiguity tolerant reactions preventing severe effects of ambiguous conditions is positively correlated with companies' product innovation performance. Ambiguity combined with lacking of knowledge can impede the performance of product innovation because of the detailed market dynamics, complicated design procedures, and unpredicted customer preferences which are critical factor to embrace competitive

advantage in related industries and markets (Ciabuschi & Martin, 2012). Ambiguity tolerant employees possess entrepreneurial skills to diffuse innovations throughout the new markets and potential customers through agile decision-making approaches for seeking the appropriate solution to clarify fuzzy areas where the exactness of information not exist (Rigotti *et al.*,2003). Within the Turkish bus & coach industry, deciding to launch new vehicles at both domestic and foreign markets sometimes results in failure when manufacturers cannot determine the customer preferences, road conditions, and also operators' attitudes towards new technology. To reduce these possibilities causing ambiguity, manufacturers tend to focus on collecting information about the market through performing surveys, observing the voice of the customer (VoC), tracking competitors' strategies, and form business collaborations as a merging or acquisitions.

5. CONCLUSION

The globalization that has become widespread in the last 20 years, the prevalence of technological developments and the disappearance of obstacles in accessing information with digitalization address today's business a structure that is more complex, unprepared for radical changes and where it is necessary to make fast and accurate decisions by leaders. This research was designed to observe the VUCA comprehensively and each factor separately in assessing effects on innovation performance of the global bus & coach industry being part of the human lives through contributions for mobilization and economic benefits both companies and individuals. The VUCA concept, which reveals the general structure including these conditions, encourage leaders to observe both internal and external environment of each industry struggling for being tolerant to market challenges, aggressive competition among rivals. In particular, the endurance and adaptability level of employees at each organization has become more critical factor rather than dealing with external dynamics of the industry owing to the value of outcomes and progression of operations enable companies to embrace challenges more willingly and ardently without reduced motivation and focusing power. Scrutinizing the VUCA factors in three perspectives such as global, industry and employee enable research to understand in detail of the meaning of each factor and how it can be associated with industry conditions toward employees' reactions to the VUCA environment. Thus, perception-based employees' reactions to the structure and outcomes of the VUCA environment, which are composed of volatility, uncertainty, complexity, and ambiguity, have been recognized as a significant aspect for observing the VUCA effects on the companies which are part of innovative and competitive global bus & coach industry in Turkey. In line with its historical development, the global and local structure of the industry and market data, the Turkish bus & coach industry was examined in detail. An observation was made regarding its suitability for the research conducted integrated with innovation structure VUCA effects existed. In the VUCA studies carried out to date, vast research was conducted towards examining leadership skills and management techniques to deal with the challenges of the VUCA outcomes. The interrelationships between factors of the VUCA concept were expressed by Bennett & Lemoine (2014), Codrenau (2016), and Mack & Kahre (2016) but yet to observed the effect level of the VUCA factors separated and interconnected via empirical data. In this perspective, as a result of comprehensive researches and arguments of different management scholars, in accordance with the meaning of each VUCA factor in the literature and its effects in real life, the scales (RTC, IUS, CFS, and TA) that were found appropriate were used in the study. On the other hand, the relationship

between “PIP” and VUCA factors have been observed in the Turkish bus & coach industry where the research took place due to its innovative and competitive structure focused on the technological advancements such as digitalization, alternative energy-fueled engines, powertrains, and also the dynamics of smart mobility. As a result of research conducted through aspects of the VUCA concept (Bennett & Lemoine, 2014; Codreanu, 2016; Mack & Khare, 2016), results proved that the interrelationship between factors (complexity as an initial point causing uncertainty and volatility) and grouping in two dimensions were valid and convenient when examining remarks of scholars claiming that the VUCA has two distinctive dimensions as "How much do you know about the situation?" ("Volatility" & Uncertainty") and "How well can you predict the results of your actions?" ("Complexity & Ambiguity). Uncertainty can exist as a reflection of high volatility, and ambiguity can be a reflection of complexities encountered. Hypothesis claimed by researcher were designed to investigate these relationships and possible categorization of two distinctive dimensions. When examining the effects of each VUCA factor, it should be compared with actual dynamics and structure of the industry or company for recognizing cause and effect relationships and expressing awareness to leaders who are living in the VUCA environment. Briefly, the main research question of the study as "Is there a relationship between perceptions of VUCA factors on white-collar workers in the bus industry and the company's product innovation performance" was considered as an accepted remark that proves the relationship between the two variables through quantitative analysis supported with significant correlations. The sub-main research question of the study as "Also, can VUCA factors be grouped into their respective relationships?" was considered as an accepted remark that proves the relationship between the two variables through quantitative analysis supported with significant correlations. The Covid-19 pandemic, international conflicts, terrorist attacks, economic instabilities, climate change in which humanity has been experiencing nowadays demonstrate that the existence of the VUCA concept may be in the future and can be accepted as the "new normal" occurring in unpredicted intervals of time.

6. RECOMMENDATIONS

In research study conducted, the VUCA concept was investigated in detail by examining each factor through the world politics, industry and employee perspectives. In the studies carried out to date, the VUCA concept has been examined by leadership, management and strategy disciplines. However, the empirical analysis of the VUCA concept and its factors is an important case for both business leaders and academic scholars after the global financial crisis in 2008. Within this context, recommendations of the researcher can be grouped in two categories such as recipe for business leaders and future studies for academics.

First, as mentioned and expressed in this research study, employees are the key function each company has under the competitive and rapidly changing environment of the Turkish bus & coach industry. With the rising of globalization and digitalization over the world, many of the industries also monopolist businesses will encounter with the severe outcomes of the VUCA world. Thus, it can be a crucial requirement for leaders to adapt VUCA outcomes and lead employees to transform severe effects into opportunities. The VUCA prime developed by Bob Johansen (2007) is an effective approach to deal with the VUCA outcomes for business leaders through acquiring beneficial leadership skills such as vision, understanding, clarity and agility. Additionally, business leaders should be able to aware of the VUCA effects at times which the disruptive innovation combined with digitalization is accepted as a new normal.

Last, as mentioned and expressed in this research study, the VUCA concept has been examined by several disciplines to observe effects, relationship with other subjects such as leadership, innovation, strategy, economics, medicine and engineering. This research study was performed through calls of Bennett and Lemoine (2014) about enhancing the literature background, understanding and investigation of the VUCA concept via empirical researchs. Within this motivation, the relationship between VUCA factors, observing the each VUCA factor with statistical data and generated VUCA diagnosis tool were developed by the researcher. However, this study was conducted within a certain group and these outcomes were reached as a result of the findings. Thus, the implementation of the research methodology and the scales used in the study in different samples may be supportive for the suitability and validity of the study and its academic contribution can be reinforced. Since the concept of VUCA is a new field of research in management science, detailed analysis and observations will enable scholars to access or create new knowledge in the academic environment that will result in a better understanding of the VUCA world under the management discipline.

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