Research Article

An Evaluation of Disruptive Innovation in the Automobile Production Industry: Quantitative Research

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Abstract

This study undertakes an assessment of disruptive innovation within the automobile production industry, aiming to uncover implementation challenges and opportunities. Recognizing the pivotal role of disruptive innovation in driving economic growth and sustainability within the automotive sector, this research addresses a notable gap in the literature pertaining to the relationship between disruptive innovation and firm performance. Through a quantitative research methodology, employing an exploratory research design, data were gathered from 99 industry professionals via an online survey hosted on LinkedIn. Analysis of the collected data was conducted using SPSS Statistical Software, facilitating both descriptive and inferential analysis. The findings reveal that disruptive innovation indeed facilitates new market creation, cost-effectiveness, customer-centricity, and the development of unique capabilities. However, challenges such as staff capacity constraints, financial pressures, rapid pace of disruption, and regulatory ambiguity impede its efficacy. Moreover, the study highlights the significant impact of deployment costs and regulatory standards on the effectiveness of disruptive innovation in fostering new market creation and achieving cost-effectiveness.

Keywords: Disruptive Innovation, Automobile Production, Effectiveness, Assessment

Introduction

This expository discourse on disruptive innovation within the context of the automobile industry is not only timely but important, considering the strategic role of the automobile industry in facilitating economic growth and development (Dogan et al, 2019). The companies operating in the automobile industry have been under pressure from external environmental factors, including intense government regulations, competitive rivalry from other automobile companies, the growing interest of stakeholders in sustainability, climate change concerns and other factors (Davis and Tomoda, 2018). The consequence is a need for disruptive

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innovation among automobile companies which ensures that they can cope with political, economic, social, technological, legal and environmental risks (Szmelter, 2017). This, therefore, suggests that the inability of automobile companies to leverage disruptive innovation may significantly affect the continuity of their business, profitability, sustainability, and survival. Yet, it is noteworthy that disruptive innovation is not an easy venture; it requires strategic planning, effective integration in the business process, understanding of the market dynamics and some level of capability in terms of the ability of the companies to innovate disruptively (Dachyar and Dewi, 2015; Krishnan et al, 2020; Rahman, 2017).

The above reality inspired the objective of this research which is to assess the nature of disruptive innovation in the automobile production industry. Beyond assessment, the study is also aimed at identifying the issues and challenges of disruptive innovation in the automobile production industry. This is a novel investigation which contributes to understanding how contemporary disruptive innovation has worked in the industry while also identifying pain points to be addressed. Before this research, previous scholars have advocated for disruptive innovation as the backbone of organizational performance across different sectors (Ahmet, 2020; Arun et al, 2019; Fahmi, 2022). However, very few studies have set out to assess the extent to which the corporate goals of automobile production companies have been attached and there has not been a robust focus on what issues are faced by companies. In these areas, the research shall contribute to knowledge development, empowering industry players, and identifying action points for stakeholders.

The assessment and analysis shall be based on primary data, collected electronically by the administration of online survey questionnaires to employees of automobile companies accessible on LinkedIn. The questionnaire which shall be designed using constructs from literature elicits responses regarding the effectiveness, relevance, performance, and value of disruptive innovation, including the issues or challenges encountered by the firms. Hence, the literature review formed the basis for appreciating conceptual and empirical perspectives on the subject, forming the basis for a robust methodology that will justify the conclusions and next steps from the research.

Literature Review

Generally, existing studies have demonstrated interest in understanding the intricacies of disruptive innovation in the performance of companies across different countries. There were conceptual perspectives on the notion of disruptive innovation which was reviewed to provide a baseline understanding of the subject matter and empirical evidence which highlights different sides to the disruptive innovation of firms between 2020 and 2022. These key discoveries from the literature search conducted using Google Scholar and Sage Journals formed the basis for the critical discourse that follows hereinafter.

It is clear from existing studies that disruptive innovation has significantly transformed the notion of innovation as known some decades ago. According to Zubizarreta et al (2020), disruptive innovation shatters what is currently established and compels industry players to incorporate them into their business model. Cozzolino, Verona and Rothaermel (2018) argued, on the other hand, that disruptive innovation is a technology which alters the features of a product and enhances its value in the marketplace. The same, as contended by Calabro et al (2019), can change the current level of performance of firms and assist in displacing competitors in the increasingly competitive automobile industry for instance.

From the above, two distinct forms of disruptive innovation are noted in the literature, the introduction of novel technologies in the market to create new demand and, secondly, the use of low-range innovation that compliments existing technologies, products, or services (Guo et al, 2019). Irrespective of the option, scholars such as Zubizarreta et al (2020) and Hannibal and

Knight (2018) suggest that effective disruptive innovation needs to pass certain characteristics as highlighted below:

1. They contribute to the creation of new markets;
2. They are cost-effective when compared with existing solutions;
3. They meet the evolving needs of the customers;
4. They possess unique capabilities.

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The above, therefore, serves as a construct for assessing the effectiveness of disruptive innovation used by automobile production companies. Before application in the context of this research, it is imperative to review some empirical works which also point to some of the assessment criteria already identified.

Zubizarreta et al (2020) investigated the impact of disruptive innovation on project management and the study was grounded in the MIVES methodology, a quantitative approach designed to study the nature of disruptive innovation utilization in the machine tooling sector and construction companies. Following the qualitative review approach, it was found that companies face issues with the deployment and management of disruptive innovation even though the issues were not empirically clarified and validated. However, the authors suggested the need for mitigating the uncertainty associated with the application of disruptive innovation which is a gap that this research will address.

In a study that focused on the automotive sector, Rotjanakorn, Sadangharn and Na-Nan (2020) studied the development of dynamic capability through disruptive innovation in the performance of automobile companies. Standing on the resource-based view and operational capability theory, the authors applied a cross-sectional research design which led to the administration and collection of data from 326 companies in the sector. Based on the analysis which was conducted with statistical tools such as SPSS IBM, AMOS and others i.e. PROCESS Macro 3.6, it was found that the performance of automobile companies significantly improved after the application of disruptive innovation, but the study did not address questions around the effectiveness of disruptive innovation nor the challenges facing it.

Benzidia, Luca and Boiko's (2021) research sought to understand the nexus between business models, encroachment strategies and disruptive innovation, using a case study of buyers' perception of automobile products for their inquiry. The study which was based on the disruptive innovation theory harnessed data from 307 respondents and the resulting data were analyzed through the Structural Equation Modelling technique, resulting in the discovery that disruptive innovation caused a significant shift in the production of automobile companies towards hybrid models and also empowered the customer to aspire for a higher level of satisfaction from cars produced through disruptive innovation.

Another study was conducted by Hafner and Modic (2021) to check the European approach to innovation in the automotive industry in this contemporary era of disruption. Following the mixed research method, patient analysis and interviews of about 20 participants were carried out with a focus on Hungary, Austria, and Slovenia where there were clusters of suppliers of automotive products. It was found that disruptive innovation, though closed in the context of Original Equipment Manufacturers in Europe, contributed to significant developmental improvement in production and enhanced the profitability of industry players.

In contrast, the research of Kivimaa et al (2021) sought to review disruptive innovation in the domain of sustainability transition and the study was based on the collection and systematic review of 47 papers. Through the application of the thematic analytics approach, the researchers were able to explore what disruption exists and how disruptions occurred without any specific focus on the effectiveness and challenges of disruptions. From the findings, it was noted that the forms of disruption include market, regulatory, network and business model disruptions. A similar study was conducted by Si and Chen (2020) to understand the 'how's' and 'what's' of disruptive innovation, including its corresponding outcomes. The qualitative study, which was based on the disruptive innovation theory as propagated by Christensen, resulted in the conclusion that disruptive innovation is a valid means for companies to achieve their corporate objective but the effectiveness or challenges were not stated.

Lastly, Cavazza et al (2021) shifted the narrative by investigating the application of disruptive innovation towards enhancing the production of autonomous vehicles in France and Brazil. Based on the application of the qualitative review approach, it was found that differences in the national context, the knowledge gap, lack of standardized approach to disruptive innovation and difficulty in managing disruptive innovation processes or activities limit the effectiveness of disruptive innovation. It was based on this premise that the researchers recommended that appropriate policies, guidelines, and capacity development programs are required to optimize outcomes from disruptive innovation.

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The empirical data suggest that disruptive innovation has the potential to support the performance objectives of automobile production companies but also faces diverse issues which limit its benefit (Rotjanakorn et al., 2020; Benzidia et al., 2021; Hafner & Modic, 2021; Si & Chen, 2020). However, very little is known about the challenges and effectiveness of current disruptive innovation practices (Rotjanakorn et al., 2020; Kivimaa et al., 2021). This is one research gap, as earlier reiterated, that the researcher seeks to address.

Research Methodology

This research is grounded in the exploratory design and cross-sectional time horizon within the domain of the quantitative method (Saunders, Lewis, and Thornhill, 2019). This was considered crucial to assessing the performance of disruptive innovation among automobile production companies and exploring the issues or challenges faced by companies in implementing disruptive innovation. The use of online survey options provided a basis for collecting data from industry professionals accessible through LinkedIn towards addressing the research goals; in essence, the survey took place online through the distribution of online survey questionnaire on LinkedIn. The selection criteria were defined to include employees, consultants, or specialists who work in the automobile production industry.

Following the above, the sampling unit was chosen using the snowball sampling method, which is a non-randomized approach to participant recruitment, considering that the researcher at this initial phase of this study does not intend to generalize the findings. The snowball sampling was expected to reach other participants within the sampling criteria through the initial participants identified from LinkedIn. The instrument for the research was a survey questionnaire, designed using Google Forms and based on constructs identified from the literature (Rotjanakorn et al., 2020; Benzidia et al., 2021; Hafner & Modic, 2021) for ease of dissemination on the LinkedIn professional database. The

questions of the questionnaire were divided into three sections, first, the demographic profile of respondents i.e. age, gender, experience and staff categorization, and assessment of disruptive innovation using five key constructs, and the third section focuses on the issues/challenges based on 5 key constructs.

The demographic section was based on categorical data and the other sections leveraged the Likert scale format with options ranging from Strongly Disagree, Disagree, Unsure, Agree and Strongly Agree, providing a parameter to assess disruptive innovation and the issues/challenges. The data generated from the survey were downloaded from the backend of the Google Forms database, coded and analyzed using SPSS Statistical Software Version 23. Two levels of analysis were carried out, a descriptive analysis of the demographic data using frequency tables and percentage analysis. The second and third sections of the questionnaire were also subject to descriptive analysis while inferential analysis i.e. arithmetic mean and correlation analysis were introduced to make key deductions from the findings of the research. The use of correlation analysis provides a basis for assessing how the issues/challenges identified affect disruptive innovation among companies (Senthilnathan, 2019).

It is imperative to note that the questionnaire conformed to ethical standards including informed consent by attaching a cover note which clarifies the purpose of the study, and the confidentiality and anonymity of the respondents by not having personal questions in the survey questionnaire. Overall, the study conformed to the General Data Protection Regulation (GDPR) which ensures that the respondents are not exposed to any form of harm. The outcome of the research formed the basis for the results and discussion presented in the next section of the research.

Results and Discussion

Demographic characteristics

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Table 1. Demographic Data

Question	Options	Frequency	Percent
1. How old are you?	20 - 25 years	6	6%
	26 - 30 years	49	49%
	31 years and above	44	44%
	Total	**99**	**100%**
2. What is your gender?	Female	3	3%
	Male	92	92%
	Total	**95**	**100%**
3. How long have you worked in the automobile industry?	7 years and above	15	15%
	Between 3 - 6 years	64	64%
	Less than 3 years	20	20%
	Total	**99**	**100%**
4. How would you categorize yourself?	Intermediate Manager/Supervisor	18	19%
	Management Staff	57	59%
	Officer	22	23%
	Total	**97**	**100%**

Source: Author Survey (2024)

From the demographic data presented above in Table 1, it was found that most of the respondents are between 26 - 30 years (49%), 44% were between 31 years and above, while 6% were between 20 - 25 years, indicating a good representation of older professionals in the automobile production industry. It was observed that most of the participants were male, representing 92% of the respondents, while 3% were female. Also, the majority have worked in the industry for between 3 - 6 years (64%), while 15% have worked in the industry for over 7 years, and those with less than 3 years of work experience are 20% of the respondents. In terms of staff categorization, most of the respondents indicated that they were management staff (59%), 23% were officers and 19% were intermediate managers or supervisors.

Effectiveness of Disruptive Innovation

Table 2. Data on the Effectiveness of Disruptive Innovation

Hypothetical Statement	Options	Frequency	Percentage	Mean
5. Disruptive innovation assists	Agree	64	64.65%	3.646
	Disagree	2	2.02%	

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in new market creation	Neutral	32	32.32%	
	Strongly Agree	1	1.01%	
6. Disruptive innovation offers cost-effective benefits to the company	Agree	60	61.22%	3.704
	Disagree	1	1.02%	
	Neutral	32	32.65%	
	Strongly Agree	5	5.10%	
7. Disruptive innovation helps to meet evolving customer needs	Agree	57	57.58%	3.737
	Neutral	32	32.32%	
	Strongly Agree	9	9.09%	
	Strongly Disagree	1	1.01%	
8. Disruptive innovation enables the companies to have unique capabilities	Agree	56	56.57%	3.616
	Disagree	5	5.05%	
	Neutral	31	31.31%	
	Strongly Agree	6	6.06%	
	Strongly Disagree	1	1.01%	

Source: Author Survey (2024)

From the data, the sample mean for all the hypothetical statements was above 3.0 which indicates that all the statements are hypothetically valid as they were higher than the arithmetic mean cut-off mark of 3.0 for a 5-point Likert scale instrument. In terms of the data, most of the respondents agree that disruptive innovation supports new market creation (64.5%), and the same among other categories of response was observed for hypothetical statement 6 which confirms also that disruptive innovation offers a better cost advantage with a valid mean score of 3.704. The result of the study also confirmed that disruptive innovation contributes to meeting the evolving and unpredictable nature of customer needs as agreed by 57.58% and observed with a valid mean score of 3.737. More so, a valid mean score of 3.616 was noted concerning statement 8 which showed that disruptive innovation supported automobile production companies to have unique capabilities.

The findings of the study gave clarity to the research of Zubizarreta et al (2020) since it shows that uncertainty in the automobile production industry was being addressed by disruptive innovation. Similarly, this research showed that Rotjanakorn, Sadangharn and Na-Nan (2020) were apt in their research by arguing that the performance of automobile companies significantly improved after the application of disruptive innovation. Beyond their study, this research also showed the aspect in which disruptive innovations are effective. Although the study was not focused on studying the approach to the adoption of disruptive innovation as in the context of Hafner and Modic (2021), it showed that disruptive innovation enhanced the capabilities of automobile production companies which may have explained why Kivimaa et. al (2021) found that disruptive innovation supported sustainability transition among companies.

Challenges of Disruptive Innovation

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Table 3. The Challenges of Disruptive Innovation

Hypothetical Statement	Options	Frequency	Percentage	Mean
9. The issue of staff capacity limits disruptive innovation integration among firms	Agree	34	34.34%	3.061
	Disagree	22	22.22%	
	Neutral	36	36.36%	
	Strongly Agree	2	2.02%	
	Strongly Disagree	5	5.05%	
10. The cost of disruptive innovation puts significant pressure on the firms	Agree	35	35.35%	3.141
	Disagree	27	27.27%	
	Neutral	32	32.32%	
	Strongly Agree	4	4.04%	
	Strongly Disagree	1	1.01%	
11. The rapid pace of disruption makes disruptive innovation a risky venture for firms	Agree	40	40.40%	3.434
	Disagree	9	9.09%	
	Neutral	36	36.36%	
	Strongly Agree	10	10.10%	
	Strongly Disagree	4	4.04%	
12. The lack of regulatory standards raises a lot of uncertainty about disruptive innovation	Agree	45	45.92%	3.561
	Disagree	4	4.08%	
	Neutral	34	34.69%	
	Strongly Agree	11	11.22%	
	Strongly Disagree	4	4.08%	

Source: Author Survey (2024)

The data shown in Table 3 above also showed the challenges or issues faced by automobile production companies and all the hypothetical statements were found to be valid with a mean score higher than the 3.0 cut-off mark. For instance, it was discovered that the issue of staff capacity limits disruptive innovation integration among firms, and more than 34.34% were affirmative of this fact with a mean score of 3.061. Similarly, the findings show that the cost of

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disruptive innovation put significant pressure on the firms, agreed to by 35.35% of the respondents and validated by a mean score of 3.141. More so, the rapid pace of disruption was discovered to make disruptive innovation a risky venture for firms (mean = 3.434), while the lack of regulatory standard raises a lot of uncertainty about disruptive innovation; this had a valid mean score of 3.561 and 45.92% of the respondents agreed with the fact.

The findings significantly explain why the full potential of disruptive innovation has not been realised in the automobile production industry

as corroborated in previous research (Rotjanakorn et al., 2020; Benzidia et al., 2021; Hafner & Modic, 2021; Si & Chen, 2020). While knowledge about the challenges facing industry players in terms of disruptive innovation was not very well known (Rotjanakorn et al., 2020; Kivimaa et al., 2021), this research brings such issues to the fore, thereby addressing issues such as the lack of knowledge gap among others (Cavazza et al., 2021).

Correlation between Issues/Challenges and Effectiveness of Disruptive Innovation

Table 4. Correlation between Issues/Challenges and Effectiveness of Disruptive Innovation

		9. The issue of staff capacity limits disruptive innovation integration among firms	10. The cost of disruptive innovation puts significant pressure on the firms	11. The rapid pace of disruption makes disruptive innovation a risky venture for firms	12. The lack of regulatory standards raises a lot of uncertainty about disruptive innovation
5. Disruptive innovation assists in new market creation	Pearson Correlation	.002	.250*	-.016	.236*
	Sig. (2-tailed)	.981	.013	.875	.019
	N	99	99	99	98
6. Disruptive innovation offers cost-effective benefits to the company	Pearson Correlation	.156	.127	.368**	.361**
	Sig. (2-tailed)	.125	.211	.000	.000
	N	98	98	98	97
7. Disruptive innovation helps to meet evolving customer needs	Pearson Correlation	.076	.165	.316**	.165
	Sig. (2-tailed)	.454	.103	.001	.104
	N	99	99	99	98
8. Disruptive innovation enables the companies to have unique capabilities	Pearson Correlation	.188	.177	.323**	.211*
	Sig. (2-tailed)	.063	.079	.001	.037
	N	99	99	99	98

Source: Author Survey (2024)

While the findings presented and discussed in Figures 2 and 3 exposed the effectiveness of disruptive innovation and the issues/challenges respectively, the Pearson correlation analysis was conducted to understand which of the

observed challenges limited an aspect of the effectiveness of disruptive innovation. To this end, it was found from Table 4 above that the cost of disruptive innovation which had a mean score of 0.250 had significantly limited the potential for

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disruptive innovation to assist automobile production companies in creating new markets. New market creation was also hampered by the challenge of lack of regulatory standard which caused uncertainty about the type of solution to be deployed; this was observed with a coefficient of 0.236 with the p-value found to be less than 0.05 critical value of alpha. Also, the issue of the rapid pace of disruptive innovation as observed with a coefficient of 0.368 and lack of regulatory standard with a coefficient of 0.361 limited the ability of automobile production companies to leverage disruptive innovation as a cost-effective option for their operation.

The findings confirmed that companies may not have effectively met the evolving needs of their customers due to the issue of the rapid pace of innovative disruptive models or solutions; both had a positive correlation coefficient of 0.316 with a valid p-value of 0.01. Lastly, firms may not have developed the most unique capabilities through disruptive innovation despite such potentials because of the issue of the rapid pace of disruption (0.321) and the lack of regulatory standards (0.211).

Conclusions

This research investigated the impact of disruptive innovation in the automobile production industry and the issues hindering its full potential through a survey among industry professionals.

The findings indicate that disruptive innovation is an effective driver of significant performance improvement among industry players. In this light, most of the respondents agreed that it stimulates new market creation (64.65%), resonating with Zubizarreta et al. (2020) research on the subject. Moreover, over 60% acknowledged the cost-effectiveness of disruptive innovation (61.22%) and its role in adapting to evolving customer needs (57.58%), emphasizing Rotjanakorn et al. (2020) findings on the performance improvement outcome of disruptive innovation. Additionally, disruptive innovation was found to empower companies to develop unique capabilities, as supported by more than half of the respondents (56.57%), resonating with Kivimaa et al. (2021) position on the nexus between disruptive innovation and sustainability transitions.

Despite its potential, disruptive innovation was found to be limited by staff capacity limitations (34.34%), the financial burden associated with

disruptive innovation, the rapid pace of disruption (40.40%) and the lack of clear regulatory standards surrounding disruptive technologies (45.92%). However, the key conclusion of the study is that disruptive innovation presents an opportunity for the automobile industry to create new markets, enhance efficiency, and cater to evolving customer demands. As such, addressing the observed challenges is essential to harnessing its full potential.

On account of these findings, there is a need for future research to expand on the findings of this research by exploring the potential solutions to the identified challenges. Exploring the potential of options such as effective workforce development programs, cost-sharing models, and adaptable regulatory frameworks would be valuable. Additionally, involving diverse industry stakeholders in research efforts could provide a more comprehensive understanding of challenges and opportunities towards fostering effective outcomes in the industry. More so, Automobile Production companies are also expected to form technical committees that will leverage the findings of this research to audit their own approach and adoption of disruptive innovation towards addressing the challenge and exploring an effective way forward.

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