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Impact of market dynamics on supply chain network and capabilities: The case of automotive industry in Morocco

Impact de la dynamique du marché sur le réseau et les capacités de la chaîne logistique : Le cas de l'industrie automobile au Maroc

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Abstract:

Current research and industry trends often lean towards supply chains that can adapt to dynamic markets, but sometimes at the expense of efficiency. In contrast, over the past decade, a series of research projects have been initiated to investigate, comprehend, and formulate operational models for supply chains catering to highly personalized products across various study contexts.

In the specific context of the automotive industry in Morocco, this paper aims to initially assess whether the local supply chain effectively manages the demands of a market requiring highly personalized products, such as cars and components. It begins with an impact study before progressing to subsequent inductive studies, examining how the supply chain navigates these demands. The ultimate objective of this research and its predecessors is to develop a supply chain model capable of effectively addressing the variation and variability in demand.

The study findings reveal that the supply chain network of the automotive industry in Morocco is strategically structured, allowing it to navigate market turbulence, particularly in response to diverse market demands. However, despite these accomplishments, its inherent capabilities do not fully align. Subsequent inductive studies can delve into a qualitative and comprehensive analysis of this supply chain network to better understand the factors facilitating its adaptability and explore the reasons behind the misalignment of capabilities.

Keywords: Turbulent markets, market dynamics, supply chain network, supply chain capabilities, product customization
JEL Classification: L20
Paper type: Empirical research

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1. Introduction

Nowadays, many markets are turbulent and this forces supply chains to adapt (Stevens and Johnson, 2016; Waller et al., 1999). Researchers and practitioners are thus trying to develop operational models of the supply chain to face the volatile demand (Shi et al., 2023). Like the agile model that is now designed to cope with turbulent markets. However, some researchers and practitioners note that the agile model developed in response to market turbulence reduces or even eliminates the effect of certain criteria such as complexity (advanced level of customization) (Vázquez-Bustelo et al., 2007). Indeed, as complex or hard customized products are studied, they challenge the agile model, which among its basic principles is to drive out complexity (Salvador et al., 2007).

Aichner and Salvador (2023) show that it is not possible to cope with turbulent markets in different situations; each market situation requires a specific supply chain network. Otherwise, Jafari et al. (2023) highlight the importance of the supply chain capabilities to deal with turbulent markets. However, certain supply chains remain guided more by efficient practices rather than coping with market changes and being reactive (Reyes et al., 2023).

Prior research underscores a discernible negative correlation between agility, characterized by its proclivity to adeptly respond to market volatility, and the lean paradigm, which prioritizes efficiency above all. In essence, these studies elucidate that as organizations embrace agility to navigate the uncertainties of a dynamic environment, they may find themselves in a trade-off situation with lean principles, which strive to optimize processes and eliminate unnecessary resources (Nazari et al., 2023).

This intricate relationship implies that as a company endeavors to enhance its agility, thereby fostering adaptability and responsiveness, it may inadvertently sacrifice some of the streamlined efficiency championed by lean methodologies. The tension between these two approaches necessitates a nuanced understanding of how organizations strike a balance to effectively manage both the inherent uncertainties of the market and the imperative for operational excellence. This dynamic interplay between agility and lean principles serves as a pivotal consideration for strategic decision-makers seeking to optimize their organizational structures in the face of an ever-evolving business landscape. Other authors, however, confirm their complementarity in certain supply chain configurations (Bezuidenhout, 2016).

However, it is commonly noted that certain supply chains today achieve a good level of efficiency and flexibility, like the automotive industry supply chain. This justifies our choice of field to advance research in this direction. However, we first want to ensure through this research that we ensure the relationship between market dynamics and the supply chain through its network and capabilities.

The purpose of this paper is to ensure that the supply chain of the automotive industry in Morocco meets the requirements of the market. If so, the next qualitative studies may deepen the question in this context by studying how the capabilities and the supply chain network of the automotive industry in Morocco are configured to allow the delivery of highly personalized products (car and components). Our question becomes the following: **What impact does market dynamics have on the supply chain network and capabilities in the automotive industry in Morocco?**

To address our research question throughout this paper, we begin with a theoretical section that summarizes the main points of the literature review. We then state the research hypotheses and the model. Before analysing the results of the study, we present the research methodology adopted and the data collection process. Finally, we move on to the conclusion of the article.

2. Literature review and hypothesis development

2.1. Background

In the contemporary business landscape, markets are widely recognized as being more volatile and turbulent than ever before (Fisher, 1997). Pioneering researchers such as Fisher delved into this challenge, seeking pragmatic solutions. According to Fisher, functional products, deemed essential or high-consumption goods with predictable demand and a long life cycle, contribute to market stability. However, this stability often becomes a breeding ground for heightened competition that, over time, erodes profit margins.

To counter stagnation and enhance profitability, companies strategically introduce innovation, offering customers a diverse range of choices. However, this innovation comes at a cost - making demand unpredictable due to new product introductions and simultaneously shortening product life cycles by a few months, as competitors swiftly imitate and diminish competitive advantages.

Presently, innovation is emerging as a dominant force in markets, turning them into turbulent arenas. The primary challenge faced by most supply chains today is the volatility of demand (Nguyen et al., 2023). Competition is no longer a mere positioning game but a contest of mobility, urging companies to enter markets swiftly, capitalize on peak demand, and withdraw rapidly during declines. Achieving such a level of responsiveness remains a considerable challenge for many companies, resulting in slowed supply chains and the accumulation of unsold inventory during demand declines. The recovery phase, when it occurs, often requires a substantial amount of time (Pimor and Fender, 2008).

In response to these market dynamics, researchers are actively engaged in developing sophisticated operational models of the supply chain to effectively address the challenges at hand (Stevens and Johnson, 2016).

Christopher (2000) defines the agile supply chain as a holistic business capability encompassing organizational structures, information systems, logistics processes, and mindsets. Market sensitivity, shared information among partners, process integration, core competency focus, postponement, strategic supplier identification, and complexity reduction constitute key features of an agile supply chain (Christopher and Towill, 2002).

Adhering to the principles of agility is paramount, with postponement and complexity reduction emerging as crucial strategies. These principles empower the delivery of a diverse array of products to the market without necessitating major changes in the supply chain, thanks to the strategic placement of the decoupling point close to the downstream end of the supply chain (Vázquez-Bustelo et al., 2007).

Lee (2004) proposal of the triple-A supply chain (Agile-Adaptable-Aligned) goes beyond addressing demand volatility to account for structural market changes. Additionally, the ambidextrous supply chain, marked by high efficiency and flexibility, presents another innovative model (Aslam et al., 2018). These avant-garde supply chain paradigms offer strategic responses to the evolving dynamics of modern markets, paving the way for resilience and adaptability in the face of unprecedented challenges. This is developing further today through the development of digital capabilities that enable these high levels of efficiency and flexibility (Lu et al., 2024). Other researchers support this relationship between digital or, in particular, big data analytics and performance (Munir et al., 2023) or supply chain models and performance (Khan, 2024). However, these relationships remain confirmed on the whole, without specifying what type of performance is involved, given that it is commonly confirmed that performance indicators are negatively correlated.

2.2. Hypotheses development

It is necessary to distinguish between products that allow reducing complexity called soft-

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customized product and products that do not allow it called hard-customized product. Hence, complexity requires to be integrated into models that study the supply chain in turbulent and volatile markets.

Aichner and Salvador (2023) show that it is not possible to cope with turbulent markets in different situations ; each market situation requires a specific supply chain network. As far as soft customized products are concerned, these allow for long distribution channels, unlike hard customized products that require shorter distribution channels, the manufacturer is required to deliver the products directly to the final consumer via dealers just as in the case of the automotive industry or gardening machinery. Hard customized products also affect all suppliers and strong interactions are needed, some suppliers come even to settle near their customers' plants. Unlikely to soft customization which affects only swappable components suppliers.

However, when demand fluctuates in terms of volume, engagement with suppliers may be problematic. When demand increases some suppliers may become bottlenecks and not keep up. When it goes down, the commitment with the suppliers would become a burden, and in general a very strong relationship with the suppliers risks making the supply chain less responsive to the variation of the demand in terms of volume (Salvador et al., 2019).

H1: The level of complexity of the products demanded by the market (demand variety) and demand variability (market turbulence) have an impact on the supply chain network.

Otherwise, faced with the constant change in the market situation, the supply chain must have cross-functional teams ready to learn new working techniques and launch new products (Stewart, 1995 ; Suarez et al., 1996). Moreover, Hallgren and Olhager (2009) highlights the factor integration with customers and suppliers that allows the rapid flow of information and hence better responsiveness. In addition, the turbulence of markets does not allow the company to invest in resources that can quickly become obsolete, it is therefore necessary to outsource the manufacture of certain components or processes (Mason et al., 2002). And when it comes to processes not being outsourced, the supply chain must rely on reliable process reengineering (Bevilacqua et al., 2009) or on digital capabilities (Li et al., 2023). Alternative scholars contend that the capabilities for innovation driven by data assume a pivotal role in the contemporary dynamic markets (Alghamdi and Agag, 2024). It also requires the involvement of human resources (Gu et al., 2023).

Human resources in the supply chain must work together and follow a transversal rather than hierarchical management style, and be equipped with different skills and know-how. On the whole, however, it's in the company's interest to concentrate on its core business, and to outsource everything that doesn't fall within the scope of its core business (Charles and Ochieng, 2023).

H2 : Market turbulence has an impact on supply chain capabilities.

3. Research methodology

3.1. Field study and data collection

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It's common knowledge that the Moroccan automotive industry has changed Morocco's economic landscape in recent years, dethroning agriculture as the kingdom's leading export sector. The sector topped the 50 billion dirham mark in 2015, surpassing all other export sectors (BOUSSAS et al., 2018).

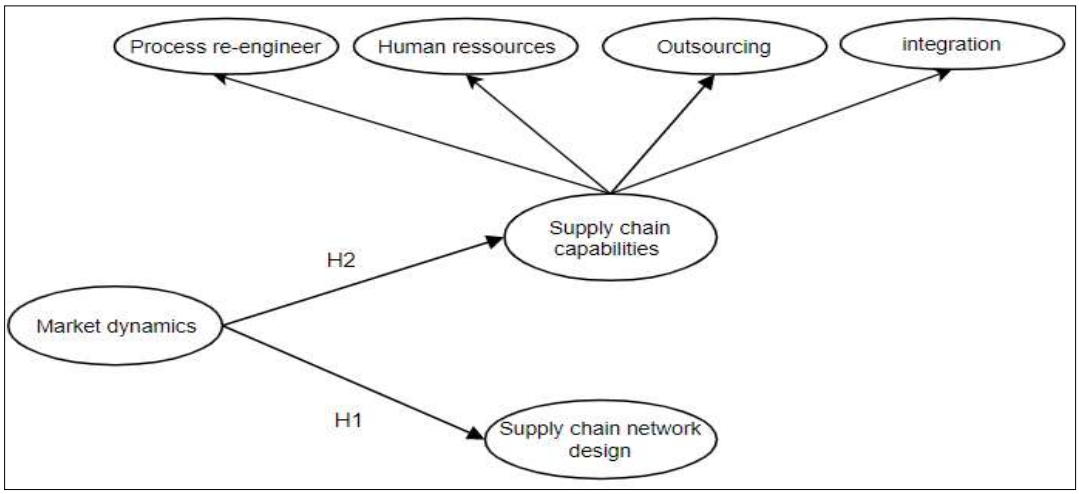
Several global giants in the wiring industry have set up shop in Morocco, including Leoni, Yazaki, Delphi and others, who deliver just in time to factories in Europe like Fiat, Volkswagen and BMW. French automakers have turned their attention to outsourcing and offshoring (MOUSTACCHI, 2016).

We carried out the research in the automotive industry sector in Morocco marked by the presence of two carmakers and more than 152 equipment suppliers. We presented our questionnaire consisting of 26 questions with answers based on the Likert scale. We collected 67 questionnaire responses from managers and operational staff at both manufacturers, as well as from first-, second-, and third-tier suppliers.

3.2. Research model

According to the hypotheses we developed above, we wish to study the relationship between market dynamics, supply chain capabilities and the supply chain network. Supply chain capabilities we have considered in this study are: process re-engineering, human resources, outsourcing and integration.

Figure 1 : Structural model



Source: Conducted by the authors

3.3.Data processing

Our impact study was carried out using the structural equation method on PLS software. Before assessing the causality between the variables, it is necessary to check the reliability and the validity of the measurements. To evaluate convergent validity, it's necessary to consider the outer loadings or factor loadings of the indicators and the average variance extracted (AVE). The first must have at least a value of 0.7 or more, while the second must have at least a value of 0.5 which means that the construct explains more than half of the variance of its indicators. If not, more variance remains in the error of the items than in the variance explained by the construct (Hair Jr et al., 2013). It is therefore necessary to remove certain items with a factor loading of less than 0.7. However, those can remain if their factor loading is between 0.4 and 0.7 and allow the improvement of the AVE. But if it's less than 0.4 it must be removed (Bagozzi et al., 1991; Hair et al., 2011). Much like Cronbach's alpha, composite reliability measures the internal consistency, with a threshold of 0.7 (Netemeyer et al., 2003).

Once convergent validity is confirmed we move on to discriminant validity which tests whether the construct is represented by itself. This implies that the measurement items do not overlap, nor measure another model construct (Hair Jr et al., 2013 ; Hubley, 2014). For this reason, an indicator's outer loading on the associated construct should be greater than any of its cross-loadings. It's also necessary to assess the discriminant validity by the Fornell-Larcker criterion. It compares the square root of the AVE values with the latent variable correlations, the objective is to avoid multicollinearity issues" (Hair Jr et al., 2013 ; Ab Hamid et al., 2017).

In order to test the research hypotheses, the first step is to calculate the standard beta, standard error, t and p-value and the latter (the p-value) must be less than 0.05 (Hair Jr et al., 2013).

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Regarding the quality of the model, the R-squared must be greater than 0.1 (Falk and Miller, 1992). Chin (1998) suggests that the R-squared values of 0.67, 0.33, and 0.19 can be considered substantial, moderate, and weak, respectively. The effect size f^2 is the degree of impact of each variable separately on the endogenous variable. The Effect size, on the other hand, is the degree of impact of each variable apart on the endogenous variable which is, in our case, of a value of 0.323, being between 0.15 and 0.35. The effect of market dynamics on supply chain work design in this case is medium (Cohen, 2013). The effect size Q^2 above 0 indicates that the exogenous variable has predictive power over the endogenous variable, and in this case, is 0.098.

4. Impact assessment

While some factor loadings are slightly below 0.7, they remain acceptable according to the literature. Additionally, the AVE above 0.5 supports the validity of the first test.

Table 1: Results of measurements model – convergent validity

Constructs	Items	Loading	CR	AVE
Market dynamics	AV	0,797	0,760	0,612
	HCP	0,768		
Process reingeniring	SPPD	0,941	0,869	0,770
	EID	0,809		
Human resources	HR2	0,834	0,742	0,591
	HR3	**0,698**		
Outsourcing	OS1	0,983	0,764	0,636
	OS6	**0,553**		
Integration	IC1	**0,604**	0,707	0,554
	IC2	0,862		
Supply chain network design	LDN2	**0,695**	0.761	0.617
	LSN	0,866		

Source: Conducted by the authors

Convergent validity having been established; we turn to discriminant validity using two tests. The first, cross-loading, delivers encouraging results: no cross-loading exceeds the loading of an item on its intended variable.

Table 2: Discriminant validity – cross loading

	Market dynamics	Human resources	Integ-ration	supply network design	Out-sourcing	Process rein-geniring
AV	0,797	0,396	0,167	0,346	-0,146	0,093
HCP	0,768	-0,023	-0,106	0,431	-0,230	-0,111
HR2	0,174	0,834	0,445	0,162	0,272	0,295
HR3	0,212	0,698	0,349	0,070	-0,059	0,213
IC1	-0,349	0,313	0,604	-0,177	0,052	-0,035
IC2	0,278	0,450	0,862	-0,066	-0,087	0,080
LDN2	0,312	0,107	-0,044	0,695	-0,235	0,209
LSN	0,450	0,139	-0,162	0,866	0,197	0,332
OS1	-0.268	0.143	-0,021	-0,004	0,983	0,048
OS6	0,019	0,179	-0,123	0,145	0,553	-0,149
SPPD	0,013	0,354	0,169	0,241	0,015	0,941
EID	-0.041	0,204	-0,179	0,466	0,008	0,809

Source: Conducted by the authors

It's also necessary to assess the discriminant validity by the Fornell-Larcker criterion (Table 3). The diagonal values in the table below are always the highest. This means that the test is validated. The items of each variable depend more on their corresponding variables than on the others.

Table 3: Latent variable correlations

	Human resources	Market dynamics	Outsourcing	Integration	Process reingeniring	supply network design
Human resources	**0,769**					
Market dynamics	0,246	**0,783**				
Outsourcing	0,165	-0,239	**0,798**			
Integration	0,521	0,044	-0,044	**0,744**		
Process reingeniring	0,335	-0,007	0,014	0,046	**0,877**	
supply network design	0,158	0,494	0,025	-0,143	0,354	**0,785**

Source : Conducted by the authors

With both convergent and discriminant validity confirmed, the stage is set for hypothesis testing. We start with the p-value, which confirms the relationships between the latent variables.

Table 4: Path coefficient of research hypotheses

Hypo	Relationship	Std. Beta	Std. Error	T- value	P-value	Decision
H1	Market dynamics→ capabilities	0.613	0.678	0.904	**0.366**	Rejected
H2	Market dynamics→ supply chain network design	0.503	0.141	3.574	**0.000**	Supported**

Source: Conducted by the authors

According to the results shown in the table above, hypothesis one is rejected while the second is accepted.

Table 5: Test of model quality

Construct	**R^2**	**Adjusted R^2**
Supply chain network design	0.244	0,223

Source: Conducted by the authors

As mentioned above, Chin (1998) suggests that the R-squared values of 0.67, 0.33, and 0.19 can be considered substantial, moderate, and weak, respectively. In this case, our R squared of 0.223 ; between 0.19 and 0.33 and this relationship can be considered weak.

5. Discussion

Through this study, the relationship between market dynamics and the supply chain network is confirmed and can jugged strong with a p-value of 0. We can deduce that the automotive supply chain network partly follows the nature of the market being characterized by a complex product. This is in line with the results of studies carried out in markets delivering complex products

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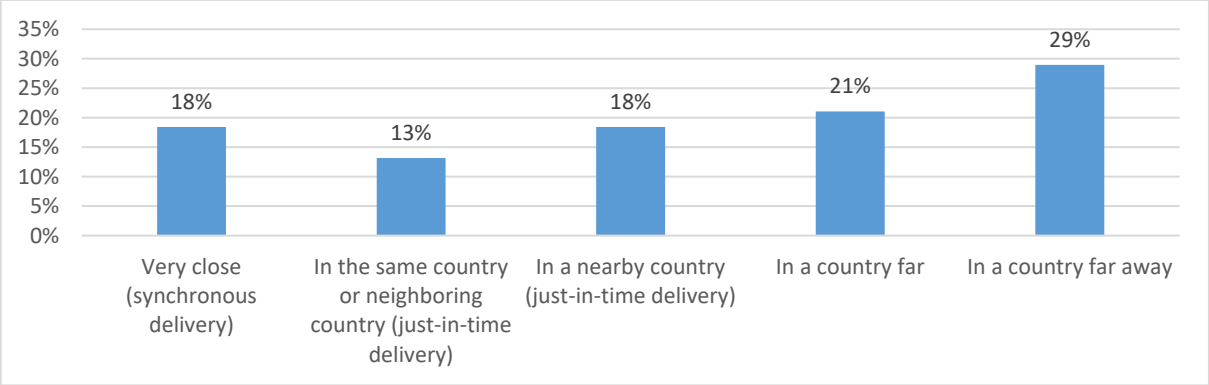
different from the automotive sector, such as gardening machines, microwaves, and others (Aichner and Salvador, 2023).
These markets require that suppliers be located close to, or at least very close to, the manufacturer's plant so that they can make just-in-time (daily deliveries) or synchronous (delivery within a few hours) deliveries. The results obtained in our study confirm this.

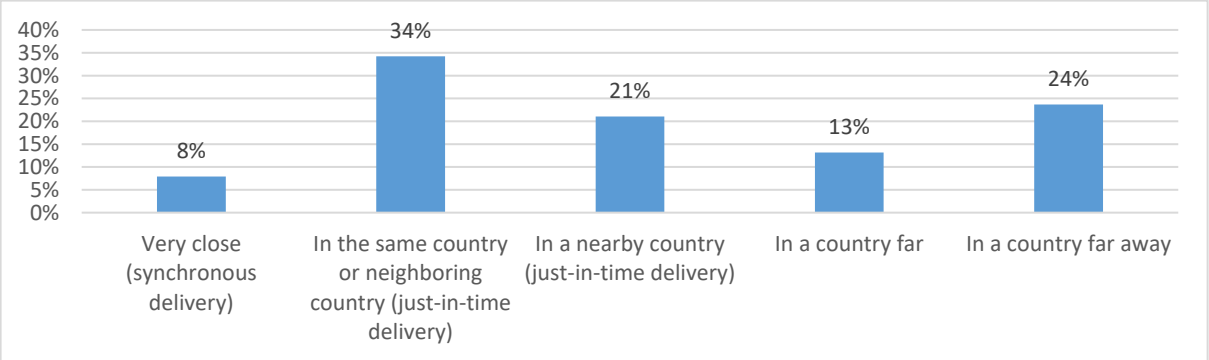
Figure 3: Type of delivery made by the supplier



Source : Conducted by the authors

In our sample, 68% of companies report that their suppliers make synchronous or just-in-time deliveries. Synchronous delivery represents only 18%. However this result remains quite significant because this type of delivery is not easy to establish and requires a heavy investment, in addition to the long-term commitment with the supplier in question. This is also due to the variation in demand in volume, which also does not encourage deep relationships with suppliers, as the supply chain may become unable to keep up with market trends and lack adaptability. If demand increases, suppliers may become bottlenecks.
Concerning the distribution chain of responding companies, 8% deliver synchronously and 55% deliver just on time for the same reasons cited for procurement.

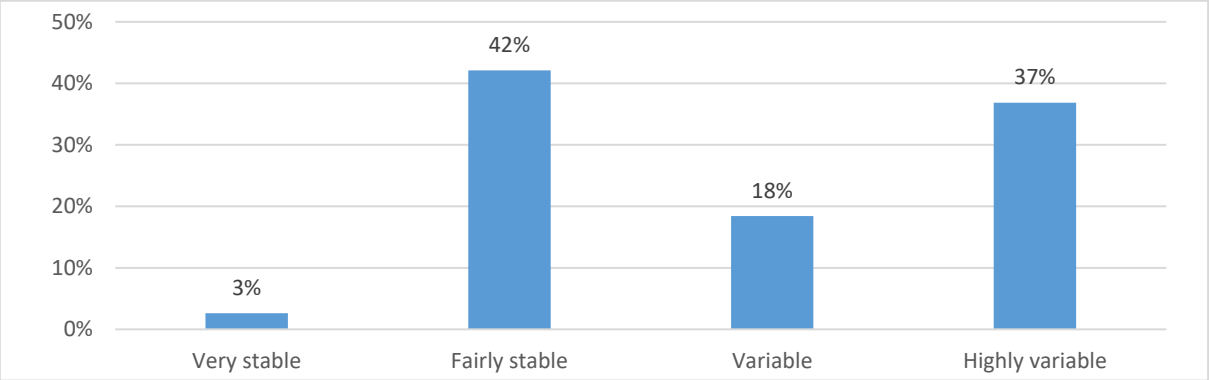
Figure 4: Type of delivery made by responding companies



Source : Conducted by the authors

On the other hand, the relationship between market dynamics and supply chain capabilities has not been confirmed. The capabilities of the automotive supply chain in Morocco do not follow the market trend and can be explained by other factors. Capabilities may depend on other factors as well as performance (Dewi et al., 2023). Some companies focus on financial performance and in particular productivity rather than customer satisfaction and responding to market trends. The new supply chain lessons encourage avoiding this mentality by confirming that competitiveness can be conditioned by lower productivity (Khan et al., 2023).
If the market becomes more unstable in the future, supply chain capabilities may have to follow the market trend, which is not currently very unstable. Figures 4 and 5 show that only 37 % of companies face a highly variable demand.

Figure 5: Variation in demand (in volume)



Source : Conducted by the authors

However, demand variety is high, this is explained by the high level of customization/complexity of products in the automotive sector; the finished product, i. e. the car and equipment.

Future exploratory inductive research may focus more on the design of the supply industry network for the automotive industry in Morocco, which is designed to meet market requirements, unlike capabilities that are more oriented towards efficiency than reactivity. Other research can also ensure this by carrying out an impact study whose object is the relationship of supply chain capabilities in the automotive industry in Morocco with financial performance (cost control) as well as operational performance (Quality – delivery - flexibility).

6. Conclusion

Operational supply chain models are not always capable of coping with turbulent and volatile markets. Certain product configurations require specific chain configurations. Consequently, the study of the relationship between the market and the configuration of the supply chain that serves it still needs to be investigated further.

We conducted our study in the Moroccan automotive industry market, to study in particular the supply chain configuration for highly customized products, following the studies of several researchers in this area, notably Salvador et al. (2019) et Aichner and Salvador (2023).

Before conducting in-depth qualitative studies, we started with quantitative research, an impact study with an exploratory logic, even though impact studies usually have a confirmatory logic (Balambo and Baz, 2014). We then relied on structural equation modeling using the PLS software specific to this field.

We modeled the supply chain in a way that allows for a more in-depth study. We divided it into two main variables: capabilities and network. We found that the supply chain network depends on the market structure (hypothesis confirmed), unlike the capabilities that do not depend on its structure.

We can conclude that the supply chain network of the Moroccan automotive industry is designed to meet market requirements in terms of the configuration of complex or highly customized products, while the capabilities of the supply chain are not.

Qualitative or quantitative studies can then investigate this question: Why are the capabilities not designed to allow a good match with the configuration of the products demanded by the market?

Future studies can also induce, through in-depth qualitative studies, the good practices of the network of this supply chain, given that it can meet the market's need for highly customized products.

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We point out as a limitation of this study that in the Moroccan market, while there are many equipment suppliers, there are only two manufacturers. If the study had been qualitative, it could have answered the questions we asked ourselves above in this conclusion. However, this opens up a good research perspective for future qualitative or even quantitative studies that can answer this question: Why do the capabilities of the Moroccan automotive industry supply chain not perfectly match the market configuration demanding highly customized products?

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