

Developing a model for agility of business organizations based on supply chain processes: A case study of automobile industry in Iran

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Abstract: The present study intended to propose a dynamic model for agility of enterprises based on supply chain processes in automobile industry of Iran. Initially the theoretical principles were discussed. The data gathered in this stage provided us with the possibility to present a conceptual framework for the study. Subsequently, through interviewing with experts, some indices for evaluating the variables in the model were identified. In the following stage, a questionnaire was developed. The questionnaire included 116 items, based on a 7-point Likert scale. After determining the validity and reliability of the questionnaire, 250 experts in automobile industry, chosen by cluster sampling, completed the questionnaire. The results of the research revealed that agility capability, agility outcomes, and the internal supply chain of the organizations were less affected by environmental factors than agility enablers. The environmental drives by means of agility enablers, supply chain processes, agility capabilities and agility outcomes influence organizations. Moreover, using the delta model, the effect of environmental factors on strategic position that an organization finds for itself in marketplace, was analyzed.

Key words: agility, enablers, supply chain processes, Delta model, agility drives

INTRODUCTION

Modification is one of the principal features of each organization, in the current era of competition. It is very common to witness change in an organization's environment during each three-six month or one year period. Due to atmosphere that pervades the business world, the organizations are obliged to modify their attitude, knowledge, approaches, methods, and expected results. Generally speaking, change and specifically the speed and the extent of modification are key determinants of motion toward agility (Gunasekaran *et al.* 2008). It should be mentioned that change is not always undesirable. It is likely that a change which is taken unsatisfactory for a company, to be taken pleasing for other companies or the same company in another period of time. Therefore, the necessary agility for an organization over time can vary according to environmental condition that an organization is placed in (Sharifi & Zhang, 1999). However, since agility is a way for good performance, the agility itself shouldn't be set as an organization's objective. Organizations for adapting to unanticipated changes and achieving favorable results have to take some actions for agility of their processes and infrastructures.

2- Definition of agility:

All the presented definitions for agility have emphasis upon speed and flexibility, these attributes are considered as the main features of an agile organization (Gunasekaran *et al.* 2008), another characteristic of agility which is of identical value to two just mentioned features, is the effective responsibility towards change and uncertainty (Sharifi & Zhang, 1999). Some authors have asserted that responsibility for change in separate ways, and recognition and interpretation of privileges of modifications are basic factors in agility. Another components obtained from agility definitions are high quality and productions with high degree of ... (Aurelie Charles *et al.*, 2010). Agility is also defined as the ability to respond to market changes, as a key determinant in success and survival of enterprises in market (Vindoh *et al.* 2011).

- Agility drives:

Agility drives denote those variables that exist out of organization context and the organization doesn't have enough power to control or influence them. These factors affect the business enterprise of the firm, and through influencing the organizational inputs cause the transfer of disorder and change to the organization (Sharifi & Zhang, 1999).

The review of literature on the topic reveals a list of agility drives including: market to variable the increase of need for financial transactions, shorter delivery time (Sharifi & Zhang, 1999), changes in supply chain, legal and political pressure (Agarwal *et al.*, 2007), demand for specific products and services, incremental rate of innovation and creativity by rivals (Goldman & Nagel, 1995), the rise of expectations compared to

quality, cooperation and collaboration among competitors, the expectations of workforce and labor unions (Sharp *et al.*,1999), sudden changes in amount and features of the orders, the growth of rate of change in product's models, the reduction of the life cycle of products, introduction of new software technology particularly wireless and internet connections (Swafford *et al.* 2006), introduction of efficient, fast and economical equipment for production, number of viruses and cyber threats, shortening the time of offering new products to the market (Mason, 2000), pressure rise for decreasing the costs (Vinodh *et al.*, 2011), cultural and social changes, fundamental changes in the customers' tastes, integration of the rivals in the market (Youndt *et al.*, 1996), the increase of competitive pressure, global market (Dove, 1999), the quick growth of access to technology, changes in the amount of salary and wage and occupational skills, bio-ecological responsibility and the limitation of the resources (Song Hua *et al.*,2011), technology, customer, competition, and ultimately dynamicity related to enterprise itself, changes in the macro level i.e., international changes (Rachel *et al.*, 2010).

-Agility Enablers:

The organization's agility enablers are a set of basic and effective factors inside the organization (Gunasekaran, 2008), put differently, agility enablers are intra organizational factors which can be affected by agility drives and can develop special ability (agility capabilities) in the organization (Sharifi & Zhang, 1999). Different researchers in their studies have referred to these intra organizational factors under the name of agility providers or agility enablers. Some of them are pointed out in the following: such as organization, personnel, technology (Kidd, 1996), individuals, information technology, virtual enterprise, approaches, concurrent engineering, quick production of a specimen, team work (Sharp, 1999), knowledge, virtual enterprise, power of reformulation, basic competencies management (Youndt, 1996), organization, technology, individuals, innovation (Charlene, 2011), strategy, technology, individuals, system (Gunasekaran, 2008), individuals, information, virtual organization, entrepreneurship (Rigby,2000), technology, information systems, strategic capabilities (Swafford, 2006), process, relationships, strategy, individuals (Bessant,2001), product, process, individuals, operation, organization (Stefan Gold, 2010), individuals, customers, technology, culture direction and rewarding system, suppliers (Crocitto, 2003), approaches, technology, individuals, occupational processes (Lin, 2006), knowledge management, technology, human resources, supply chain, concurrent engineering (Ismail & Sharifi, 2006), the quality of human resources, information technology (IT), leadership style, organizational culture, organizational structure, research and development (Yiwei Gong, 2012), technology, individuals, innovation, information technology (Seyedhosseini, 2008).

- Agility Capabilities:

A review of the literature provides us with a list of the variables that researchers have identified as organizations' agility enablers including: Responsiveness, competency, flexibility, speed (Sharifi & Zhang, 1999), constant change, quick response, quality improvement (Sharp, 1999), controlling changes and uncertainty, leveraging skills (Mason, 2002), speed, identification and perception, responsiveness, learning, strategic commitment, innovation (Bessant, 2001), organizational flexibility, human resources flexibility, responsiveness in relationships, strategic agility (Charlene, 2011), flexibility, responsiveness, agile structure, speed, value [cost] (Crocitto,2003), responsiveness, flexibility, competency, speed (Lambert, 2005), expenditure cut, flexibility, quality, quick delivery, readiness, capability to respond (Chopra, 2007), intelligence (response to market and customer), competency, cooperation, the culture of enabling individuals, efficient informative systems (Kristina Rimienè, 2011), quick responsiveness, making easy use of facilities, participation to increase the level of competition, changes management (S.M. Seyedhosseini, 2008).

3-Supply Chain Processes:

Supply chain includes all those steps that can be taken for meeting the customers' expectations, either directly or indirectly. Supply chain doesn't only relate to manufacturer and supplier, rather it also involves transportation, reservoir, retailer, and the customers themselves (Kristina Rimienè, 2010). To date, numerous process models have been presented, such as Handfield and Nicoles (Handfield, 1999), American council of quality and productivity, global supply chain finance (GSCF), Porter's value chain, Chopra and Mendel' model, supply chain council, supply chain operations reference, global supply chain council (GSCF), Chan *et al.*, (Zolait, 2010). Among six presented frameworks, only two models (GSCF and SCOR) have had detailed account of processes, and have been mostly employed by firms in business environment. These two models vary from each other, thus the researchers choosing them should take their differences into consideration (Song Hua, 2011). Generally, GSCF adopts more of a strategic orientation and focuses on long-term value rise of the shareholders via establishing close and beyond operational relationships with key members of supply chain. This model is often employed in the enterprise situations

that recognizing, building up and maintaining business relationship is taken as a competitive advantage. Because of plurality and similarity of the processes from strategic aspect, the number of processes was reduced using the experts' opinions on supply chain management in the institute of management development (Stefan Gold, 2010). Today most of the firms have found supply chain operations reference (SCOR) as a powerful and helpful instrument for describing, analyzing, and improvement of supply chain. Five main processes in this model are (Chung-Yean Chiang, 2012):

- 1- Plan includes those processes that strike a balance between total demand and supply, with the purpose of taking some necessary actions to fulfill sourcing, production, and delivery requirements.
- 2- Source makes reference to the processes that provide goods and services to satisfy planned or actual demand.
- 3- Make denotes the processes that convert product to a finalized state to cope with planned or actual customer's demand.
- 4- Deliver alludes to those processes that supply finished goods and services to satisfy planned or actual demand, and typically encompass order management, transportation management, and distribution management.
- 5- Return involves those processes that pertain to returning or receiving returned products and items.

4- Agility Outcomes:

The agility results are obtained from an organization's performance which in turn is resulted from its capabilities and agility power. Agility outcomes are output of an agile performance, the factor that is used for agility measurement. Most of the researches attribute the agility outcomes to an organization's accomplishments facing agility drives and indicators like enriching customers with products, controlling change and uncertainty, cooperation (developing partnership) to dominate competition, data-based direction of organization (Nagel *et al*, 1995), production based on quick response, global production, bespoke mass production, productivity and quality improvement (sharp, *et al*, 1999), collaboration for raising competitiveness or establishing a virtual organization, satisfying the customers (Rigby, 2000), strategic abilities (Sharifi, 1999), prediction of events, perceiving necessary changes and restructuring the service on that basis, making optimum use of networks, ability to learn how to act appropriately and confront challenges, increasing the efficiency and efficacy of available sources (Ismail *et al*, 2006), satisfying customers more than ever, cooperation to gain more competition power, organization for overcoming change and uncertainty, leveraging the effect of individuals and information (Goldman, 1995), compatible structures, multi-skilled individuals, decision making ability, constant learning, broad and strict view, strategic commitment, implementing strategy, flexible facilities, prompt request for new products, rapid problem solving, comprehensive information system, keeping environment under constant supervision, constant regular customers sighting, expanding supply chain, partnership (Bessant *et al*, 2001), flexibility of individuals (exploiting skills, capability to alternate skills, flexibility of skills), operational responsiveness (introducing new product, supply and distribution, production, supporting production), flexibility of process (formability, innovation, ability to survive, variety), flexibility of product (compatibility, formability) (Swafford *et al*, 2006), putting value on customer, readiness for changes, appreciating human knowledge and skills, virtual participation (Youssef *et al.*, 1992), the state of product infra structure, market, staff and information technology (Agarwal, 2007), putting value on customer, quality improvement, accelerating speed (Crocitto & Youssef, 2003) quality of product, flexibility in volume and variety, on time delivery, readiness, ability to respond (Stefan Gold, 2010), competitiveness, increasing market share, raising quality of services (Gunasekaran, 2008), enriching and satisfying customers in respect of (expenditure, performance, strength, time) Agility in organizational management (data management, inter organizational and intra organizational cooperation, fundamental framework/model) agility in product design (access to customers' demand data, product design speed, product design flexibility), agility in production (reconstruction capability, production speed, flexibility of production process (Lin *et al*, 2006), customer satisfaction, fast production and on time delivery to market, meeting quality standards, flexibility of the process, product's expenditure cut, enriching customers (Seyedhosseini, 2009).

5-Delta Strategic Model:

To give appropriate response to environmental requirements, Hax and Wilde, in their studies, by cooperation of top business world companies' managers, in MIT University came up with three-fold strategic choices which were presented in the form of a triangle. The triangle represented various ways for reacting to environmental drives. The model shows that organizations are regularly placed under environmental pressures, though all of them are not to the same degree important, some pressures are more dominant than others and organization can determine its competitive position based on it (Hax Arnold C & Wilde Dean, 2003). In the following part each aspect has been explained separately in details:

- a- Strategic position of superior product: This position holds true for those firms where pressure related to product, such as decreasing the price or the distinction of the product, is the most frequent

environmental stimulus. Organization's action for confronting these requirements manifest themselves as yield increase compared to scale, simplifying the process and production, increasing the market share, directing finished/final price, product diversification, increasing the number of products characteristics, implementing new technologies

b- Strategic position of providing comprehensive solutions to customer: this position takes a customer as an environmental stimulus. The organization's preliminaries to facing this stimulus are in the forms of make to order, prioritization of customers, relationship-based marketing, managing relationship with customers, developing post-sale service, and supply chain.

c- System lock-in: this feature is placed at the apex of the triangle. The objectives are to have a performance fitting to the size of business network as a whole, and to have significant share of complements and to focus on systemic interests/gains. In this strategy the company instead of focusing limitedly only on product or customer, considers all the existing organizations in the system which play a role in creating economic values. Based on this strategy, companies are looking for cultivation, attracting, and maintaining available complements in the industry. Complements are referred to those companies that one's offered product supplements other's (Wilde & Hax, 2003).

The conceptual framework of the study:

In the present study, we made use of positioning strategic delta model to investigate the effect of environmental drives on agility of organization. The reasons of employing strategic delta model are presented in the following:

- Because of plurality of the number of environmental drives, it was not possible to include all of them in our investigation. Hereupon, they were classified according to their similarity in their nature and origin. In this course, the threefold classification i.e., the delta model (product, customer, business network) classification could be helpful.

The model suggests that organizations can choose effective strategies, considering the type of environmental pressure. Based on the model's view, primarily organizations should determine the competitive position that they are placed in. Subsequently, they can react appropriately according to their position. Success of an organization depends on its appropriate reaction. This response will vary from an organization to another (Wilde & Hax, 2003).

- To obtain agility it is not likely to give a determined and predefined prescription for all the organizations. Each organization's state varies from others, in terms of type of strategy focus.

However, the delta model can account for such variety in focus.

- The model suggests adaptation processes to organizations for facing diverse environmental situations in the form of strategic plans.

- This model holds a comprehensive view and presents all the organization's activities pillars and probable pressure over organizations in three parts:

In the present study we also elicited agility enablers from agility models, and identified the key agility providers in the organizations under study, through interviewing and data analysis using Shannon's entropy technique. Ultimately 5 factors were identified as agility enablers including:

- 1- Strategies: processes like organization's perception from situation, keeping pace with flying market, senior managers commitment to achieve agility, equip staff, and evaluate them (Gunasekaran, 2008).

- 2- Organizational structure: agile organizations should enjoy structural stability and flexibility at the same time. It means that, in addition to having structural features based on bureaucracy, they should possess flat and centered structures, and adhocratic structural features (Zolait, 2010).

- 3- Human resources: Crocitto believes that human resources in the agile organizations are knowledge forces that require perceived knowledge, professional skills, systems understanding, and prediction skill to become prepared for adaptation (Crocitto, 2003).

- 4- Production technology: An agile system is in need of appropriate hardware and software that provide opportunity for rapid change in production system i.e. from one product to another (Zolait, 2010).

- 5- knowledge management: Dove (1999) claims that if knowledge management and agility of organizations are not in an equilibrium, they can act as inhibitors and the efficacy of knowledge management will not be possible through agility of organization or vice versa. On the contrary, some of the other researchers have maintained knowledge-orientedness as one of the pivotal capabilities in agility; they have also mentioned information technology and knowledge management as effective factors on agile factories' performance (Stefan Gold, 2010).

Key identified agility capabilities are presented in the following:

- 1- Perception: ability to seize opportunity and to face environmental threats in the organization. This type of ability is active rather than passive (Goldman & Nagel, 1995).

2- Competency: a broad set of capabilities which guarantee the profitability of the activities in accomplishing the organization's objectives (Yusuf *et al*, 2004).

3- Responsiveness: The ability of organization in responding to changes and environmental uncertainty in the form of action and reaction. Regarding the type of responding, we can refer to four kind of organization: opportunist, innovative, flexible, and agile (Gunasekaran, 2008).

4- Flexibility: refers to ability to produce and offer various products, and achieve different objectives by the same source and equipment, and involves flexibility in volume and variety of products, in form and model of product, in organization and organizational issues, in human resources and market (María Leticia Santos *et al*, 2012).

5- Speed: ability to perform operation in the shortest time, not only in offering service and products, but also in adaptability to changes that are resulted from perception change in organization (Lin CT, 2006).

6- Learning: capacity of an organization for management, extending and spreading knowledge for attaching value to business (María Leticia Santos *et al*, 2012)]

Regarding the above mentioned points, the conceptual framework of the study is displayed in Figure 3:

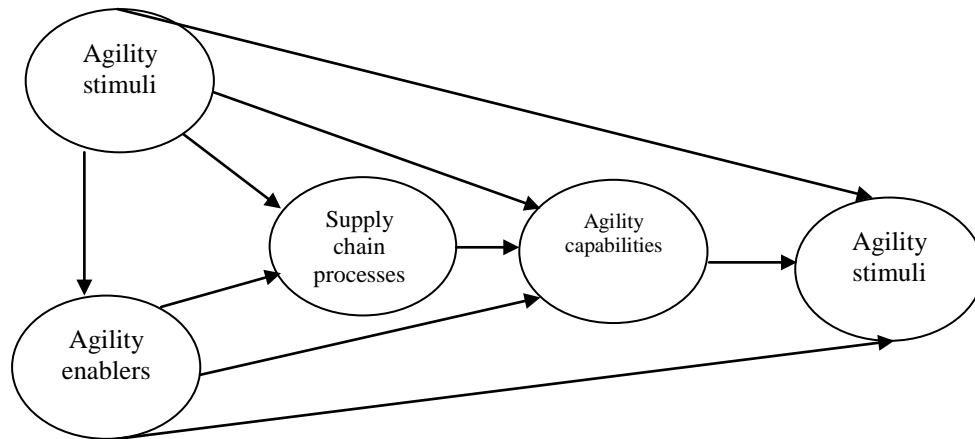


Fig. 3: Conceptual framework of the study

Research questions:

- 1- Do environmental drives affect agility capabilities of automobile companies?
- 2- Do environmental drives affect agility enablers of automobile companies?
- 3- Do environmental drives affect supply chain of automobile companies?
- 4- How different effective environmental drives on agility capabilities of automobile companies can be prioritized?
- 5- Do agility enablers affect agility capabilities of automobile companies?
- 6- Do agility enablers affect supply chain processes of automobile companies?
- 7- How agility enablers of automobile companies can be prioritized?
- 8- Do supply chain processes affect agility enablers of automobile companies?
- 9- How effective processes on agility capabilities of automobile companies can be prioritized?

6-Method Of The Study:

Taking the data collection method into account, the present study can be classified as descriptive survey. And it can be categorized under the list of applied studies, in terms of objective. In this study theoretical framework and aspects related to subject of the study were discussed. The study presented definitions, approaches, theories, models, a review of previous studies, in order to gain sufficient understanding about agility of business in this industry. In the next stage of the study, the set of gathered data provided the researcher with the opportunity to explain theoretical framework or conceptual model of the study. In fact, in this stage, inspired by existing models in the domain of agility, the conceptual framework of the model was provided. Subsequently, to determine the subset of each dimension of the model (drives , providers, capabilities, and agility outcomes), semi-structured interview was carried out with a group of experts. The elicited variables from research literature were put at disposal of the experts of the automobile industry, in order for an unbiased evaluation to be done. Their presence in the primary conceptual model was retested, and finally appropriate indicators were identified for measuring the existing variables in the model. Then using the finalized indicators the questionnaire was developed. The questionnaire contained 116 items, based on 7-

point Likert scale, and was developed in two sections of status quo and ideal. The items 1 to 21 were specified for measuring the environmental drives . The subset of the variable's indicators included focus on product, focus on customer, and system lock-in, which were derived from delta model and other models in this area. For each category, 4 to 10 items were regarded. The items of 22 through 34 were for measuring the agility enablers. Its main indicators encompassed strategy, structure, human resources, technology, and knowledge management. Each index was measured by 3 to 7 items. Items of 35 through 54 in the questionnaire were provided for measuring the variable of agility capabilities. The indicators of the variable were learning, flexibility, perception, competency, speed, and responsiveness. For each index, 2 through 5 questions were assigned. The variable of agility outcomes was another main factor in our research model, which was measured from three aspects of network agility, customer agility, and operation agility. For each indicator 4 to 12 questions were considered. The last 28 items in the questionnaire were included to measure the variable of supply chain processes. This variable involved 5 indices: plan, source, make, delivery, and return.

The designed questionnaire, after being evaluated in terms of validity and reliability, was filled by 250 participants who were chosen by cluster sampling from the pool of automobile industry's experts. Pearson's correlation and regression were used for examining the research hypotheses and DEMATEL technique was used for prioritization.

7-Findings:

According to the calculation carried out for detecting the direct or indirect effect of each proposed variable in the developed comprehensive model, path analysis was done. The results showed that: All the existing relationships in the model except for environmental drives -agility outcomes, environmental drives - supply chain processes, and agility enablers-agility outcomes paths were significant. Thus, the above mentioned paths were deleted from the final model. One of the findings that could be obtained by examining the coefficient estimates was the moderator role for the variables of supply chain processes, agility capabilities, and agility enablers,relationship between dependant and independent variables. It should be mentioned that hierarchical regression coefficients in the standard estimation model have been displayed on arrows:

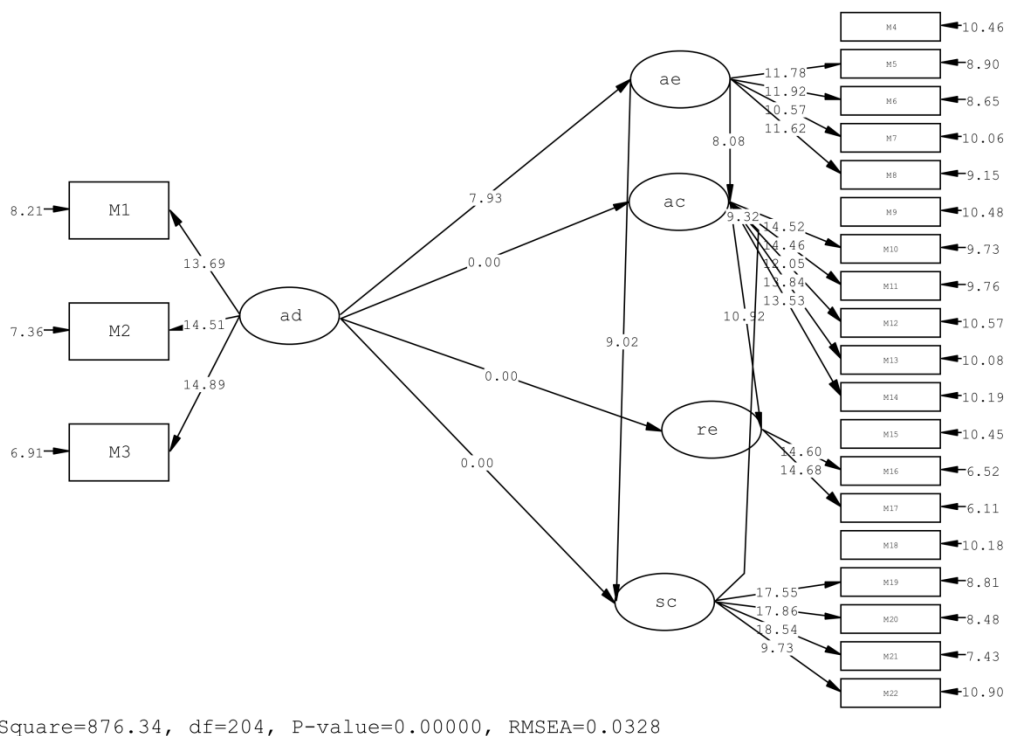
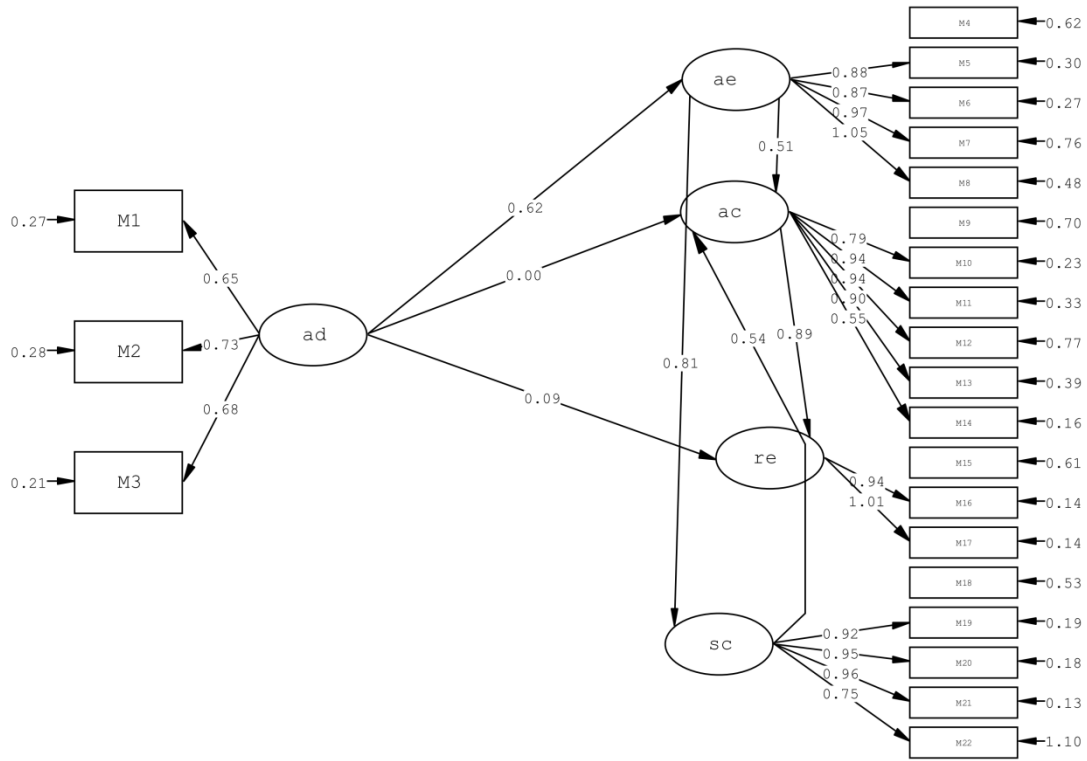


Fig. 4: t-value and non-standardized estimates of path analysis for all the variables of the study



Chi-Square=876.34, df=204, P-value=0.00000, RMSEA=0.0328

Fig. 5: standardized estimates of path analysis for all the variables of the study

Inasmuch as three paths of the final model were not significant, those paths and the existing relationships among variables were reevaluated in the final model. The results can be observed in the following figures:

By matching the value of final model fitness to acceptable range, it can be claimed that all the fitness indices of the model belonged to acceptable range and the data gathered was of good fitness to the model.

Table 4.10: Fitness indices for final model of the study index fitness

P-VALUE	T-VALUE	RMSEA	$\frac{\text{chi - square}}{\text{df}}$	index fitness
0/05>	Below 2 or above 2	0.1<	>5	range acceptable
0	In all the cases above 2	0.08	$\frac{1035.77}{303} = 3.41$	result

8-Testing Research Hypotheses:

In the current study the structural equation modeling or path analysis was used to investigate the existing relationships among the model's variables i.e. the study's research hypotheses. The mutual effect of independent variables and the moderator variables on dependant variables was examined and the relationship among independent and dependant variables wer assessed. The obtained results from investigation of the research hypotheses have been presented separately in the following table:

Table ... Examination of the research hypotheses

Number of hypothesis	Variables relationships	result
1	Direct effect of environmental drives on agility capabilities	disproved
2	Direct effect of environmental drives on supply chain	disproved
3	Direct effect of environmental drives on agility enablers	confirmed
4	Direct effect of environmental drives on agility outcomes	disproved
5	Direct effect of agility enablers on supply chain processes	confirmed

6	Direct effect of agility enablers on agility capabilities	confirmed
7	Direct effect of agility enablers on agility outcomes	disproved
8	Direct effect of chain processes on agility capabilities	confirmed
9	Direct effect of agility capabilities on agility outcomes	confirmed
10	Effect of environmental drives on supply chain processes through enablers	Confirmed
11	Effect of agility enablers on agility capabilities via supply chain processes	Confirmed
12	Effect of environmental drives on agility outcomes via agility capabilities	Confirmed
13	Effect of agility enablers on agility outcomes via agility capabilities	Confirmed

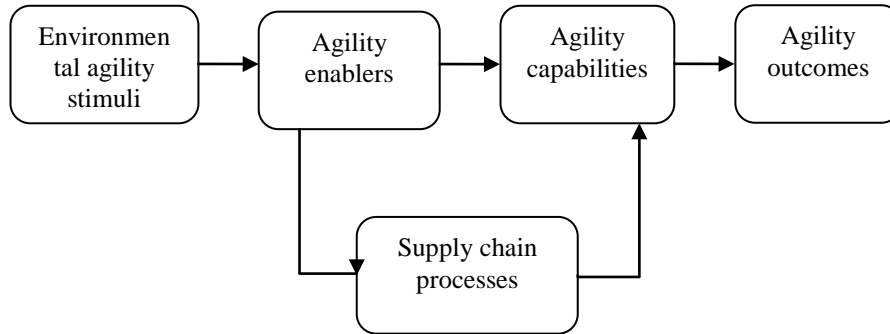


Fig. 2: The final model of the study: agility of enterprise with centrality of supply chain processes in automobile business industry

7. Conclusion and Suggestions:

Analyzing the data revealed that environmental drives in the form of product, customer, and business network exert direct effect on internal supply chain processes, agility capabilities and agility outcomes of the organizations under study. However, the environmental drives affect the above cases through agility enablers. Since the focus of this study was on the internal supply chain of organizations rather than the comprehensive supply chain (accompanying by other supplier organizations, sale or post-sale service) it can be claimed that the internal supply chain of the organizations was mostly influenced by intra-organizational infra structures. The agility capabilities, as well, were most under effect of intra-organizational factors and least under effect of environmental drives. Hereupon, the organization by strengthening the organizational inputs and supply chain processes would be able to expand their agility capabilities. As DEMATEL technique is powerful in prioritization of the elements based on the extent of their effectiveness on other elements of the group, this technique was used in the present study. In the group of environmental drives, business network had the largest effect compared to other drives. Therefore, the factors related to the organization's business network were the most environmental drives in the organization. In the group of agility enablers, structure and strategy were the main variables that provided agility. In the category of agility capabilities, perception ability, competency, and learning were the most prominent factors of agility capabilities. Among the supply chain processes, the main supply chain processes according to SCOR model were plan and return processes. Since conforming to delta model, the type and the amount of environmental pressure depend on the strategic position of the organizations, it seems rational to suggest organizations to determine their strategic position at first, then based on the position that they have acquired and is sign of the type and extent of environmental pressure take a course of agility actions. Put differently, an organization which agility outcomes match its strategic position can be recognized as an agile one. As well, an organization that adjusts its enablers and supply chain processes to its strategic position, can develop agility capabilities.

Besides, factors concerning business network were recognized as the key environmental stimulus in organization under study, it is proposed that these types of organizations achieve the optimal outcomes in agility of organization through variables related to network particularly suppliers and salespersons management, legal and environmental organizations. The most important agility capability of the organizations is perception from environment. Thus, it is suggested that the organizations through organizational learning and knowledge management systems identify, record and predict the environmental drives and don't show reactional response to these drives.

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