Contribution of University Research Centers to Turkish SMEs in Industrial Design Process: A Case of Automotive Seatings

Alper Çalgüner
Gazi University
Department of Industrial Design
Kırım Cad. 6. Sok. Emek
Ankara, Turkey

Serkan Güneş
Gazi University
Department of Industrial Design
Kırım Cad. 6. Sok. Emek
Ankara, Turkey

Cemil Yavuz
Gazi University
Department of Industrial Design
Kırım Cad. 6. Sok. Emek
Ankara, Turkey

Abstract

Indicating considerable impact through the organizational and economical structures and market shares of large scale firms, design management process have to be analyzed in means of the competitive methods of innovation oriented companies that are planning to place in a mature market in the short term. Through the scope of this study, the strategical approaches of a market leader firm in Turkish automotive seating and accessory production sector and its reflections to design outputs are surveyed. Besides, the positive and negative commercial consequences through the product development activity carried out in cooperation with a university research and application center (SANTUM, Gazi University, Ankara), as well as the required organizational management applications towards the commercial aims determined by the informant company; is discussed by a case study.

Keyword: Industrial design, automotive industry, seating design, SMEs, SANTUM.

1. Introduction

Being defined within the context of planning, organization and control of the exposition and achievement of corporate design resources in means of its cultural, strategic and operational extents; design management process on the whole indicates considerable impact through the organizational and economical structures and market shares of large scale firms in developing countries. The operation of R&D and marketing departments as well as progressive systematic and interactive problems should be investigated through various samples of practices and project outcomes in these firms, by questionizing through the entailment for a specified design department.

Through the scope of this study, the strategical approaches of a market leader firm in Turkish automotive seating and accessory production sector and its reflections to design outputs are surveyed, in order to analyze the competitive methods of innovation oriented companies that are planning to place in a mature market in the short term. In process, the positive and negative commercial consequences through the product development activity carried out in cooperation with a university research and application center, as well as the required organizational management applications towards the commercial aims determined by the informant company; is discussed by a case study.

2. Identification of the Area of Study

2.1. A General Glance through the Term 'Travel' and 'Bus Seat'

'Travel' is a phenomenon that has been existing onwards the preliminary ages of humankind. It can be stated that the term was being used to identify an imperative necessity. However, travel as a concept, has become a multipronged and wide ranging case. Technological changes and the developments in mass transport have degraded getting over's to crude progressions. Accordingly; pilgrimage, enchantment, reconnaissance and vacation have appeared to be reasonable occasions for journeys as well as education, sports, culture, art, business and religion.

By all means; travel has a great deal of utilities and functions principally in psychological, cultural and social aspects. By defining passengers as individuals moving in control of a dynamic vehicle without self involvement, it can be stated that the unit that passengers are one to one concerned is a vehicle seat in motorway transportation. In conjunction with this inference, the length of the time spent by seating in a dynamic vehicle seems to be the fundamental factor determining the inconvenience that is experienced by the passenger. That seating is an indigenous need; the problem should be quested in prevalent sitting postures instead of the way of sitting.

Seats are designed to keep the body in upright postural position. They frequently appear as unique forms. In many cases, it is observed as users show tendency for changing their resting types and backrest positions in order to provide comfortable seating. In many ways, comfortable seating positions are aimed to be restricted in seating unit designs. Movement and various postural seating positions are requisite for healthy sitting. An inherent sitting position can be obtained by seating units serving as to liberate the user from being managed by morphological components. According to conventionally embraced seat and mechanism designs, users are reduced to attune the enforced dynamic postures while the seat manages the movement.

Experiences show that the total body length increases in leaning position. This appears because of the load caused by the body weight and stressed muscles on the spinal cord discs.

Sitting back relaxes the muscles, so the load on the compression on the vertebra is sensed to be more excessive while standing than sitting.

The main components of a bus seat as an industrial product can be listed as; seating plane, backrest, mini service table, lower storage area, armband, LCD display, footrest, calf support, seatbelt, seat setting interface, seat numbers, lighting and switch plug items. By implication, bus seat design process principally entails a conceptual combination of the subject components.

2.2. Decisive Data on the Area of Study

A critical growth in the motorway passenger transport activity branch of Turkey has been monitored in the last few years. Besides, a visible quantitative increase is recorded in both the transportation companies and the busses used in transport activities. While 168 million passengers have been travelled with 89.000 interurban busses in 2001, 187 million passengers have been travelled with 170.000 busses in 2006. By the accelerating competition in the subject area, service quality had become a decisive criterion through interurban bus companies. Recent researches show that service quality focused competitive strategies are more efficient and consistent than other strategies in means of both keeping the existing clients (defense) and gaining new clients (offense).

For Çayır and İlçe (2011), considering the anthropometric dimensions are one of the basic requirements in ergonomic product design and product re-development. However, especially in long trips, the aimed comfort cannot be provided only by a dimensional adaptation of seating units to human body. Sabancı (1999) stated that anthropometric data usually represents raw dimensions taken from naked adult bodies, and these dimensions would probably fail in providing suitable data for sinuous body surfaces. Besides, anthropometrical data are dimensions taken from static bodies. It should be an unexpected condition for a human body that has a dynamic nature to stay static on a seating unit for a long time. Especially dealing with the 10-12 hour trips that are ordinary in Turkey, the area of usage determined for a passenger should be identified by seating unit positioning dimensions. Accordingly, the positioning dimensions of seats should be critically considered in seating design for providing comfortable trips, as well as seat dimensions.

It is widely adopted that human body scales differentiate through various local societies, while local anthropometric data undergoes change in time. This indicates an entailment for a pre-research on convenient data on specialized social conditions before production, and also a redesign process by taking account of actual social changes. Duyar (1995) highlights a projection that the horizontal distance between bus seats would be re-handled in the next few decades in Turkey, considering the swiftness of change in the sizes and scales of individuum of Turkish society.

2.3. A Local and Global Glance on the Segment

The bus seat production companies evaluated below are appraised to be pioneering organizations in global and Turkish market. Basing on the product presentations and the corporate vision-mission definitions quoted from the promotion catalogues, three main segments are defined for prosecuting a taxonomic study. These segments and their specifications are given in Table 1. The segments are determined according to the fundamental production features of a bus seat.

Table 1. Segments and Specifications of Subject Global and Turkish Companies

Standard	Luxe	Ultra Luxe
Adjustable Backrest	Backrest Sycronizable with the Stool	Backrest Sycronizable with the Stool
Fabric Overcast	Staggered Adjustable Backseat	Leather / Pad Fabric Overcast
Head Support	Artificial Leather / Pad Fabric Overcast	Comfortable Head Support (V type)
Dynamic Armband	Head Support	Dynamic Armband
Adsorption Handle	Dynamic Armband	Adsorption Handle
Net Storage	Adsorption Handle	Net / Leather Storage
2 Pivot Seatbelt	Net / Leather Storage	2 / 3 Pivot Seatbelt
Fabric Head Support Cover	2 / 3 Pivot Seatbelt	Leather Head Support Cover
Service Table Assembled on the Back of the Seat	Fabric Head Support Cover	Connected Service Table
Footrest	Connected Service Table	Fractional Footrest
	Fractional Footrest	Waste Basket
	Waste Basket	Music Module
	Music Module	LCD Monitor
	LCD Monitor	Shank Support
	Calf Support	Middle Armband
		Extra Head Cushion
		Lumbar Support
		Sideway Sliding Mechanism
		Rotating Seat
		Adjustable Seat Depth

3. A General Outlook on the Subject Company

3.1. Company History

The subject company was founded in 1880, aiming the production of phaeton seats. It has been established and operated various factories in 35 different countries, and has been specialized on office seating design and production as well as automotive seats in time. Within the scope of activities prosecuted in Turkey since 1985, the company has produced the first shock absorber office seat of the country. The company and its products have won 13 international prizes up to now.

3.2. Products, Services and Activities of the Company

The company has registered its recent epoch designs and productions under two trademarks. It has entitled with 4 quality licenses: TSE in Turkey, LGA-GS in Europe, BIFMA in USA and EN ISO 9001 globally.

Latterly, the company has increased its market share by developing licensed technologies on seating ergonomics and has carried out four scientific research projects on seating ergonomics with three universities before the subject project.

The company – having a 65% global market share in bus and truck driver seat production- has been enlarged its production scale for coping with a series of crisis in the last 10 years period, its Turkish factory have headed towards minibus, ship and airplane seat projects. Having a 60% global market share in automotive sector with 18.000 m^2 production facility and 500 employee, the company has decided to initiate the production of automotive seat accessories (seat headrest, central dresser, armrests and inside door panels) in Turkey in 2010. Besides the dislocation of automotive accessories R&D to Turkey, it is planned to increase the passenger and train seat production up to 50% nationally and diversify the product range.

According to the corporate declaration broadcasted in 2011, the detaching items institutionally differentiating the subject company from other producers are stated as follows: 'Ergonomics', 'Design', 'Price – Return Ratio' and 'Ecology'. In the recent 15 years period, the company has worked with prestigious designers and design foundations like Chuck Pelly, Ray Carter, Stauss & Pedrazzini and Françoise Hélene Jourda.

4. Methodology, Limitations and Specified Conditions of the Case Study

Determination of the analyzing unit in a study area that a limited number of companies are activating despite of the increasing demands and resources in Turkish market is materialized by the exposition of market share, endorsements and number of employees as primary criteria. The subject company is determined in the light of the three criteria stated above. Basing on the study conducted by of Yin (1984) stating that more than one data analyzing methods should be used in a case study, the findings of this research is evaluated by both descriptive and contextual substance analysis. As Erginer (2006) has highlighted, this circumstance can be evaluated as a chain of evidences exposing the association modes of various steps of the research. Within the scope of this study, data diversification method that could be defined as 'a multimethodological systematic of data collection and presentation of the findings as to support each other and contribute the holistic deduction', is used.

According to Merriam (1998), a researcher conducting a case study can share the basic findings of the study with the participant individuum, demanding their notions and proposals. Here, approving the main aim as the development of a particular sight regarding a defined occasion, there seems to be no inconvenience for debating with the participants. The fundamental aim should be the description of the situation as accurate and objective as possible. In this study, the researcher has also appealed the sights of other researchers studying in this area on indicating the literalness level of the prevalent findings. This could provide both the stabilization of the final findings, and the cultivation of alternative illustrations regarding to the indications of the study.

In this sense; besides the presentation documents in forms of synchronous levels, negotiation enrolment and published corporate sources; dispatch texts prosecuted for providing communication between the projects participants are used in the research project process. Three researchers from the Arts and Design Research and Implementation Center (SANTUM) and three competent from the subject company are assigned to perform the research project. Besides, personnel of the R&D and marketing departments have been charged to assign the routine meetings and deliver their opinions also in brainstorming sessions. Routine meetings were carried out once a week in the production facility of the company or the meeting room of the research center in the university. The records of the meetings are decoded and exposed to the research team as texts.

The project has last 75 working days; while 4 meetings, 3 presentations and 12 communication texts were exhibited in this context.

5. Project Phases and Outputs

To notice the process from the beginning to the end, the whole project could be discussed under three main phases.

In the first phase, the three researchers from SANTUM have associated to generate a study plan by preparing a brochure draft. In this meeting, discussions on the concepts to be scrutinized were carried out. Besides, a general assessment is performed on the expectations of the company from product design, expenditure criteria, details that could be crossed over and details that couldn't be changed on condition to be sticked to the other constituents.

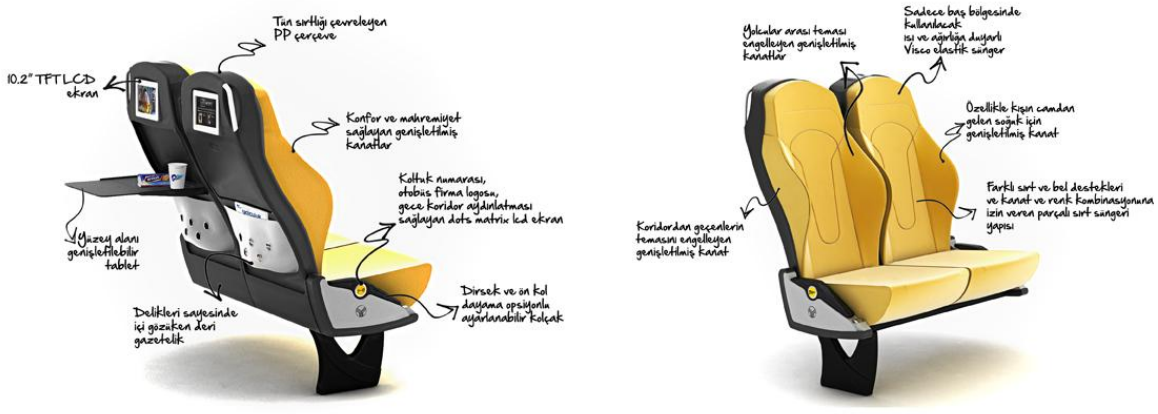
In the next phase, a general brainstorming session has been conducted over the stated conceptual items and afterwards, a self visual idea development session was assimilated by the researchers. By this method, presentation of at least three unaffiliated alternative projects to the company, in the first meeting. After the individual study session, the idea creation team has league together for discussing on the sketches of initial ideas and evaluating the existing conceptual ideas. The outputs of the meeting are materialized by 3D modelings and presentations. Also in this step, design process is carried on by solid modeling by adhering the general design aims and the stable restrictive criteria determined by the company, like color and material compliance.

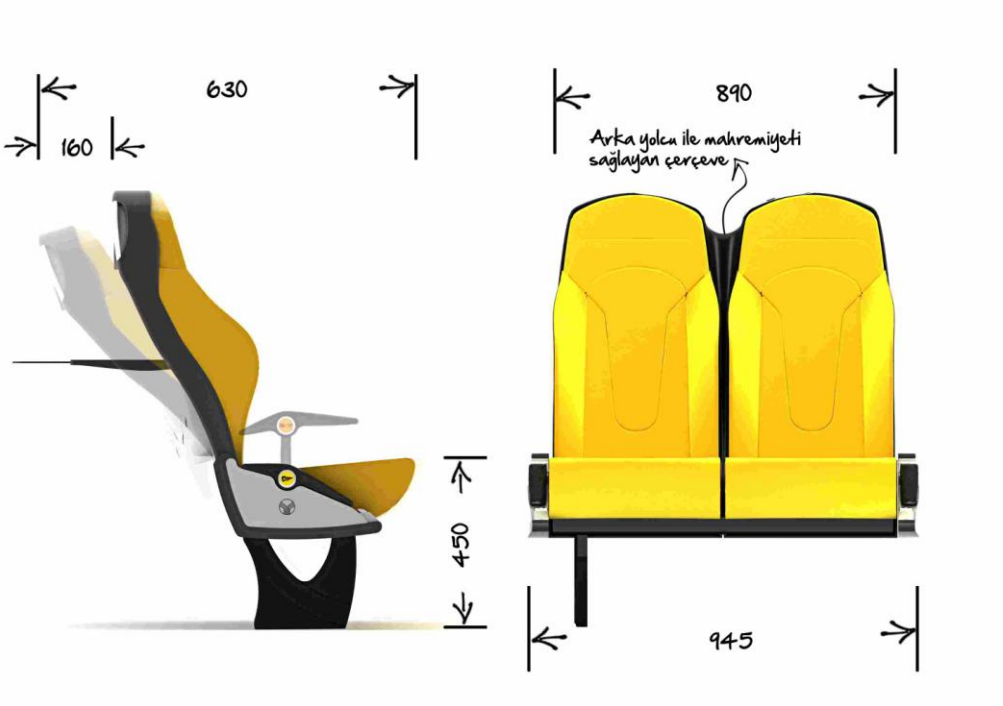
In the last phase of the study, the completed design proposals and visual material are arranged towards the morphological, functional and conceptual template; and made ready for the first presentation that would be performed to the company, by inserting the literary expression. At the end of this phase, the presentation has sent to the company for a general assessment that would be accomplished by authorized personnel in the company. The company have inspected every project and stated the corporate sight on the positive and negative aspects on each of them by a report, submitted to the research center. The literary evaluations performed by the authorities of R&D and marketing departments are stated below:

Design Proposal 1

- Innovative and differentiate approaches could not be monitored.
- The stylistic foam forms that are designed by the team are not suitable for the existing production opportunities
- The backrest foams grasping the seat from the two sides are being used both in the mass production process of the company, and also the processes of the competitors; as suitable to ergonomic design standards.
- Increased surface tablet analysis is being used in Neoplan vehicles for a long while.
- The rear view of the backrest includes LCD display and net grab handle alternatives that are fixed as very similar to existing design solutions.
- The unique point that could be discussed as differentiate in the seat design is the armband structure, however it is interpreted as it could give rise to an adversity in utilization for the end user and it does not promise advantage in usage.
- The proposed visco elastic system is deciphered as not suitable for the expenditure focused studies conducted by the company. (Figure 1)

Figure 1. Design Proposal 1





Design Proposal 2

- In general view, the seat design does not correspond to the new generation bus accessory designs. In modern day bus designs, oval / organic styling approaches are preferred rather than sharp edges.
- The designs evoke train seat designs more than long distance bus seat designs. This would bring no commercial advantages to the company.
- A coaster unit located on the armband can be evaluated as an innovative idea; however the usage of only one armband for each passenger in this type of busses will cause a loss of efficiency. The location and scale of the coaster should be re-studied on the light of valid ergonomic data.
- The design approach on the armband that does not require any mechanisms is interpreted as appropriate.
- That the footrest would limit the movements of the legs and foots of the passengers while they are not in use. This prospect is found to be unhealthy in usage.
- The shapes of the backrest foams are found to be unusable and unsuitable in means of aesthetical approach.
- The stool foam is deciphered to be comfortable in the first view.
- The lack of a grab handle on the passenger seat has not been criticized positively.

(Figure 2)

Figure 2. Design Proposal 2

Design Proposal 3

- That the footrest have a form to force the foot fall down, it is expounded as unusable.
- The evaluations show that the laptop location approach is stated as original, innovative and useable; however, the tablet mechanism that is proposed is criticized negatively. The integrated structure of the tablet with the back cover seems to expose a nice appearance.
- Despite of being partially used in ICE 3000 train seats, the complete use of backrest wires are assessed to be inadequate for coping with the cost and ease of manufacturing problems.
- The competent team have commented that the general appearance of the seating unit do not meet the professional requirements of the company.
- The armband functions are about to cause disadvantage in double seats, that the solution do not serve the same opportunities to the two passengers using the product.
- The newspaper holder proposal is acclaimed in general, and commented as a structure that can be successfully developed.
- A grab handle is strongly suggested to be used on the seating unit.

None of the design proposals include coat hanger, plug, calf rest and plastic units for hiding the safety belt. According to the evaluations of the authorized group, these functions are contingent to provide a critical advantage for an increase in the market share. (Figure 3)

Figure 3. Design Proposal 3

Dealing with the approaches that the company has indicated various challenges, the design team came together to make an estimate of the situation. Analyzing the report prepared by the company, the final design phase is conducted in the light of the predictions and suggestions by an eclectically approach. The solutions that are criticized positively are combined together for constituting the product.

In the stated period, substantive junctions are organized to be in close interaction with the company. As to conclude the final project period, a general feasibility study is conducted in order to corroborate the ergonomical data (Figure 4) of the product and determine the probable problems. The outcomes are presented with a report. The product design process is completed by transmitting the final design (Figure 5) with a technical report to the company.

Figure 4. Sample Ergonomic Analysis According to %95 Man Sample

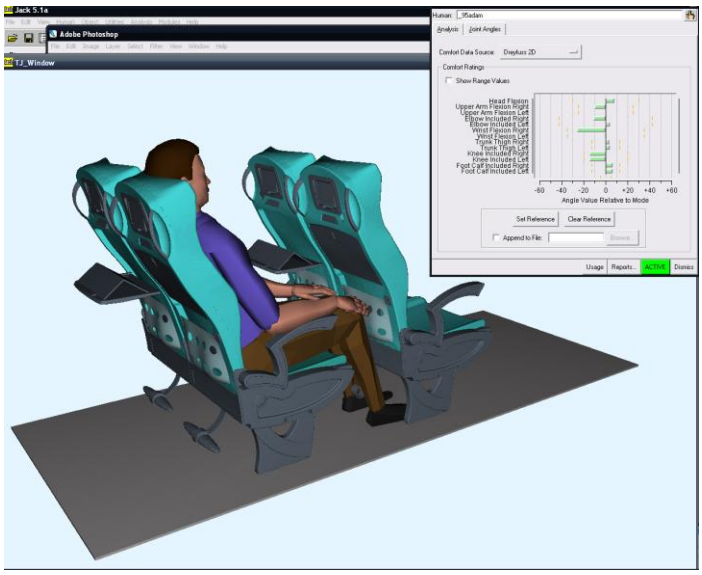


Figure 5. Final Proposed Concept

6. Outcomes and Deductions

Being affiliated with the design contract, SANTUM has competed the project in the planned time interval in conjunction with the subject company. To evaluate the project process in general means, taking account of the specialized requirements of the company and the determined problematic, it can be stated that the study is finalized by original and innovative solutions that would probably contribute the future vision of the company.

The prior components of a bus seat can be listed as; backrest and stool foam, inner carcass, armband, mini service table on the backside of the seat, lower storage area, LCD display, grab handle, coat hanger, foot and calf rest, seat belt, seat numbers, seat adjustment interface, optional plug and reading light. To expose the solution proposals manifested for satisfying the problematics about the components stated above; using local visco foam on the backrest for cost reduction and increase in ergonomically efficiency can be highlighted.

Also the undesirable contacts could be omitted by the coverage of the backrest by two sided foams enlarged to the forefront. Moreover, articulated use of the back foam can contribute the different fabric and color usage. Similarly by using two sided sectional foams on the stool in order to reduce the contact between two passengers. The design team has shown effort for keeping the original carcass structure of the product. Discussing on the armband, it is preferred to omit the mechanical sections for a solution entailing manual usage instead of proposing a mechanical movement.

In order to provide a more effective use of mini service table when the front seat is needed to lie down, the unit is planned to be designed of two layers as the upper layer has the capacity to be positioned as required. The perforated lower layer covered with artificial leather letting the passenger to be aware of his commodity that could have been left there.

En elastic reading lamb is located on the back side of the seat while a plug is integrated on the same region. A radial mini display exposing the road conditions and the distance left is positioned beside the LCD display. While a rattling resolution advisory through a defined route is presented dealing with the footrest, the conservation of the product dialect has been watched over during the analysis of the constituents in their selves in every step of the project.

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