



INVESTIGATING THE RELATIONSHIP BETWEEN FURNITURE AND ACCESSORIES MANUFACTURERS IN NEW PRODUCT DEVELOPMENT PROCESSES IN TURKISH FURNITURE INDUSTRY

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Abstract

This paper will investigate the relationship between furniture manufacturers and furniture accessory producers for new product development (NPD) in Turkish home furniture industry. A rich body of knowledge exists on supplier integration in NPD process in various industries such as automotive, textiles and consumer electronics whereas little is known on the subject in furniture industry. The importance of supplier integration in NPD processes especially in products consisting of multiple components is widely accepted. With the increase in the complexity of products and high requirement of efficiency and specialization, management of a network of suppliers to introduce meaningful products into the market has become crucial. This paper will represent partial findings of a study into the relationship between furniture manufacturers and furniture accessory producers in Turkish home furniture industry. The paper will depend on the data received through semi structured interviews with the representatives of both parties. The study aims to find out the channels of communication and collaboration between the companies designing whole sets of furniture and suppliers of components for these sets. The paper will discuss the findings of the semi structured interviews so far.

Keywords: Turkish furniture industry, new product development, component producers, supplier integration

TÜRKİYE EV MOBİLYA SEKTÖRÜNDE FAALİYET GÖSTEREN MOBİLYA VE AKSESUAR ÜRETİCİSİ FİRMALARIN YENİ ÜRÜN GELİŞTİRME SÜREÇLERİNDEKİ İLİŞKİLERİNİN ARAŞTIRILMASI

Özet

Çalışma kapsamında Türkiye ev mobilya endüstrisinde faaliyet gösteren mobilya ve aksesuar üreticilerinin yeni ürün geliştirme süreçleri içerisindeki ilişkileri incelenecektir. Otomotiv, tekstil ve tüketici elektroniği gibi çeşitli sektörlerde üretici-tedarikçi ilişkileri üzerine zengin bir bilgi birikimi olmasına rağmen, mobilya endüstrisi bu alanda çokça araştırılmamış, dahası ihmal edilmiş bir alan olarak göze çarpmaktadır. Yeni ürün geliştirme süreçlerinde üretici-tedarikçi ilişkilerinin önemi, özellikle çok parçalı ürünlerden oluşan sektörlerde yaygın olarak kabul görmektedir. Ürün karmaşıklığının artması, verimlilik ve uzmanlaşmaya olan yüksek ihtiyaç, tedarikçilerin talebe yönelik ve anlamlı ürünler sunabilmesini zorunlu kılmaktadır. Bu çalışmada Türkiye ev mobilya endüstrisinde faaliyet gösteren mobilya ve aksesuar üreticisi firmaların arasındaki ilişkiye dair yapılan bir çalışmanın kısmi sonuçları ortaya konacaktır. Çalışma, her iki tarafın endüstrideki temsilcileriyle yapılan yarı-yapılandırılmış görüşmeler sonucu elde edilmiş verilere dayandırılacaktır. Çalışma, bir mobilya ürünü ve bu üründe kullanılan parçaların tasarlanma ve üretilme aşamalarında taraflar arasındaki iletişim ve işbirliği kanallarını ortaya koymayı hedeflemektedir. Bildiride yarı-yapılandırılmış görüşmeler sonucunda elde edilen veriler ortaya konulacak ve değerlendirilecektir.

Anahtar Kelimeler: Türkiye ev mobilya endüstrisi, yeni ürün geliştirme, parça üreticileri, tedarikçi katılımı

1 Introduction

With the help of technologic advances, intercontinental communication opportunities have increased greatly and this situation has changed the lifestyles of humankind and the perception of commerce. Trade is no more restricted by the borders of the nations and every passing day it becomes more global. High-tech products and manufacturing possibilities have emerged by this technological progression and the emerged countries has directed their investments to these kind of products. Emerging countries such as Turkey, tend towards to low-tech products in order to gain a strong position to themselves in the global competitive environment.

Furniture industry has a strong position with the help of its labor intensive structure for the emerging countries. Furniture industry secures its position day by day as the furniture products are essential for human life, not necessitating a critical know-how and having relatively low investment costs compared to high-tech industries.

Companies gain competitive advantage with their quality, design and cost management abilities in the low-tech industries. Therefore, the companies in such industries operate their actions by focusing on quality and low-cost, they try to be differentiated from their rivals and gain a secure position in the market with their design competencies.

At this juncture, furniture hardware which are composed of decorative handles, hinges, fasteners, lighting accessories and such, contribute to design characteristics of furniture products highly and become more and more important. Despite the fact that traditionally, furniture products used to be produced in small ateliers under favor of crafts people's savoir faire, today these products have turned into a complex structure that consist of multiple components. Furniture manufacturers deal with so many component suppliers in order to supply the requisite materials, components and raw material until they deliver the products which they design and produce to the market.

It can be observed that the general attitude in the industry is designing the furniture and furniture parts distinctly by different agents. These products which are designed by diversified designers and diversified design perceptions, ultimately merge into one on a furniture product in order to constitute the final product. Both parties who are willing to utilize the design as a competitive advantage, occasionally condemned to fail because of the inharmoniousness among their design language. In this respect, it is important for the furniture and furniture hardware manufacturers to play an active role in the new product development and design phases together.

In the literature, it draws the attention that manufacturers and suppliers play an active role in new product development and design phases together in the industries which are emerged and rooted such as automotive, electronics and textile. There are intensive academic studies regarding to this subject in such industries both domestic and foreign. These academic studies, have been implemented successfully in the field of application and open a road for the companies with positive impact. These positive impacts might be presented as increase in the profit, decrease in the delivery time, better product-component adaptation, beside with the help of customer satisfaction it contributes to create a gratifying brand perception for the customers. However, this subject is quite neglected in the furniture industry.

This study investigates the relationship between furniture and accessories manufacturers in the Turkish home furniture industry in new product development processes. The past and current situation of the industry has been presented throughout the research process, and the importance of the industry for both global and Turkish economy is emphasized. The research has been conducted by literature review and field study. Furniture and furniture accessories manufacturers have been interviewed during the field research in order to gain understanding of both parties' perspective. The literature is reviewed under four titles: Furniture and furniture industry in general, Turkish furniture industry, furniture hardware and industry and manufacturer – supplier relations.

The first part of the study is related to the fundamentals of the research, the aim, importance, scope, method and the structure of the study are discussed in this chapter. The first part is the introduction chapter which gives the reader an insight about the study basically.

The second part is the literature review about the furniture and furniture industry generally. This chapter starts with the definitions and classifications of the furniture and furniture products. After defining it, the furniture industry is taken into account. Past, present and future projections of the furniture industry is presented in this chapter. Furniture industry is evaluated in the global borders of the international economy. Foreign trade transactions, import and export values of the furniture industry in global scope is presented in this chapter. The volume and the importance of the furniture industry is emphasized.

The third part is related to the Turkish furniture industry. In this chapter the general situation of the Turkish furniture industry is presented and the importance of the industry for Turkish economy is emphasized. Number of company and employees are given and the import and export figures have been presented for the last ten years in order to present the evaluation of the industry in Turkey and also the importance of furniture sector for Turkish economy.

As the study investigates the relationships between furniture and furniture accessories producers, the fourth part is related

to the furniture accessories and its industry. In this chapter the definition and classification of the furniture accessories is presented. The manufacturing techniques and used materials are emphasized in order to give reader an insight about the industry.

In the fifth part manufacturer-supplier relations are taken into account in the manufacturing sector. The references are mainly related to the automotive industry as this subject is fundamentally researched and analyzed for this sector. The new product development processes are mentioned and the techniques, method, advantages and disadvantages of the supplier integration in the product development processes are tried to be presented. Finally, a case study related to furniture industry is represented.

The field research is gone through interviews with the design managers of large-scale furniture manufacturers and furniture accessories manufacturers. The method of the research is semi-structured interview method. With the help of predetermined questions, the interviews are done face to face, and when necessary the interview is deepening with additional questions.

The findings show that, there is a relationship between furniture manufacturers and accessories manufacturers regarding to design to a certain extent. But this relationship is weak and it is done mostly unintentionally by both parties. This relationship is needed to be supported by some agencies, institutions or state institutions. The companies in the both side tend to develop strong partnerships with their suppliers and customers. However, the difficulties of the process and the lack of experience in the field restrain the company's motivation for further breakthrough. Therefore, activities such as university-industry collaborations and governmental incentives would motive the industry actors to come up with a new approach to their new product development processes and their perception of partnership in the relations.

2 Manufacturer-Supplier Relations in New Product Development Process

New product development process complexity and difficulty gets more challenging when foreign suppliers involve in. In this case suppliers get involved in concurrent engineering activities along with internal departments. The model proposed by Cordon and Vollman [1] argues that manufacturer-supplier relations has transformed into "cooperative" attitude rather than "combative" attitude by time. Manufacturer-supplier relations used to be in the form of a sordid gain in the past, however recently it has turned into a collaborative nature which is for the benefit of both parties [2]. Members of western industries has an approach relying on the competitive attitude in supplier-manufacturer relations, it was observed that Japanese competitors of these industries embraced a more collaborative attitude [1].

Despite the fact that traditional approaches have been enhanced recently, opportunities still exist in improving supplier-manufacturer relations. Figure 1 compares the classic, today's and tomorrow's best practices:

While supplier-manufacturer collaboration may simply be defined as shared participation to the decision making process, supplier integration in new product development process is a complex process which the collaborative use of R&D sources and abilities of both parties in order to achieve a shared goal [3].

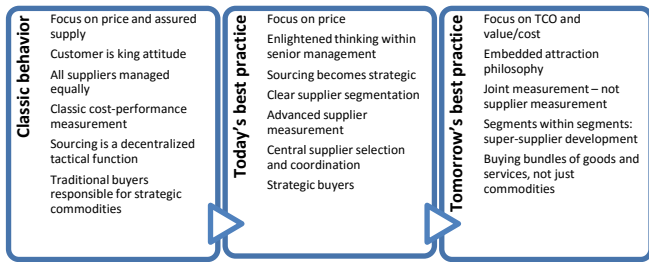


Figure 1. Evaluation of manufacturer-supplier relation [2]

The main purpose of supplier integration in product development process is to match the customer's needs with the supplier's abilities in order to overlap the design and manufacturing process, thus to attain a more active and effective product development process [4]. Supplier integration in product development process starts with the supplier's active participation in design process. As design is a toilsome qualification, it requires attention in the early phases of development process. Design is the fundamental source of general issues basic product and process related issues such quality, cost, sustainability etc.

2.1 The advantages of supplier integration in new product development

Manufacturers who apply concurrent engineering methods and integrate their suppliers in their product development process especially into product design phases receive the highest possible level of efficiency from their suppliers [5]. It was observed in various studies that such collaborative product development process shortens the product delivery time, reduces the total cost, increases the product quality and encourages the innovation. Advantages of the supplier integration in product development process are listed as follows:

- Reduces the development costs,
- Provides standardization in components,
- Enhances consistency in design and manufacturing phases,
- Reduces the technical revision needs in product,
- Ensures product with few flaws and high quality.
- Provides improvements in suppliers' manufacturing process,

Reduces product delivery times

Knowledge sharing and collective learning,

Shorter product development times [6], [7]

In addition to these advantages, long-term and short term advantages of supplier integration was presented by Echtelt [8]. Short-term advantages of supplier integration are:

Technical performance of supplied component,

- Component cost,
- Component development cost,
- Component delivery time,

Long term advantages of supplier integration are:

- More effective and efficient collaboration,
- Ease of access to suppliers' technological infrastructure,
- Setting a course concerning to technology and innovation,
- Knowledge and solution flow resulting from previous projects.

In addition to these researches Mikkola and Skjoett-Larsen [7] mentioned various disadvantages of supplier integration to product development process. These are:

- Loss of possessed unique know-how,
- Atrophy of authentic internal abilities,
- Risk of emanation the key technological know-how to the rival companies,
- Over-reliance to the companies in the role of strategic partnership [7].

A study conducted by Bozdogan et. al. [9] showed that supplier integration reduces the unit cost at the rate of %75 while reduces the delivery time at the rate of %33. Yet another important gaining of the supplier integration providing source of innovation [8]. Suppliers taking part in this process get a chance to increase their technical competencies and with the help of this chance they may embark on a quest of new technological advances and increasing their standards. Betterment in the conditions of the suppliers directly affect the performance of manufacturers.

Supplier-manufacturer relations are reciprocal and both parties take advantage of this relation. While the manufacturers benefit from the outputs of the process, suppliers benefit from the process by learning to manage projects better [2].

3 New Product Development Process in Furniture Industry

Product development according to Clark et al. [10] is a complement of activities aiming at optimizing performance parameters by the participation of engineers from different departments in scope of problem solving cycle in a certain period of time. Performance criteria for the new product development activities in furniture industry are quality, delivery time and product cost: main targets are decreasing the delivery time and product cost to the minimum level and fulfilling the quality standards.

Manufacturers, due to the lack of expertise in a particular area or source supply components required for production through the use of outsourcing [11]. Considering furniture industry, any component used in a furniture product requires a different area of expertise and different part suppliers exist for each area of expertise. Suppliers specialized in their area of interest and they maintain similar product development process for different customers. During this process there are opportunities for them to enhance their feasibilities in order to perform more efficient and effective [8]. Manufacturers respect their suppliers as the most important compound of their product development process under rapid changing technological advances and shortening product life cycle circumstances [12].

The collaborative partnership among the suppliers and manufacturers requires to be enhanced in administrative level. Likewise, integration of part suppliers into design process or extending the effectiveness during the process is an important manner in supplier-manufacturer relations. Currently, furniture manufacturers and their suppliers are considered to be supplementary. Furniture manufacturers need to take advantage of their suppliers' engineering competencies as they can't produce all the components required for furniture production by themselves. In the same way, component suppliers don't have the freedom to design and produce solely relying on their criteria, they need to sustain their product development activities conceiving the criterion of their customers. Joint effort of suppliers and manufacturers makes a furniture product successful in the market by meeting the quality criteria, customer needs and demands and releasing the

product on the right time to the market. Carr et al. [13] revealed that manufacturers started pay more attention to the collaboration with suppliers since then they realized the role of suppliers in customer satisfaction. One of the most important factors that determines the quality of the furniture product is the quality of the supplied components. In this regard, it is important to create a strong collaborative bond with the suppliers right in the beginning of the product development process [14].

The common trait of all advanced industries is to have advanced subsidiary industries alongside with the competition. Such advanced industries are supported by quick-witted, sophisticated, technically and executively developed, rapid responsive suppliers. For instance, automotive industry takes advantage of such equipped suppliers [15].

At this point, furniture accessories and hardware along with the producers of these equipment worth to be investigated due to their importance in both for furniture production and usage. In conjunction with the industrialization, furniture production severely transformed into a different dimension distinctly from its traditional roots. Traditionally furniture products used to be produced in ateliers by carpenters with restricted additional hardware. Today, by using mass production techniques furniture products turned out to be modular and multipartite. Legs, wheels, PVC profiles, fasteners, fixtures, hinge systems, aluminum components, rails, door knobs, handles, locking systems, paint and colorants, roving and a lot more are essential compounds of a mass produced furniture. Conscious and malcontent customer profile push furniture manufacturers to produce well designed, equipped, high quality and cheap furniture. It is crucial to expand collaborative relations with the suppliers to meet demands of the customer from the early beginning of the hardware and furniture design stage.

4 Method

Qualitative research methods have been applied in scope of the investigation as this study aims at evaluating the opinions of participants, investigating the cases in their natural environment and to gain a broader understanding of the inquiry. Various approaches might be practiced in qualitative research techniques such as interview, focus groups, observation, case study etc. [16].

The objective of the study is to investigate the relationship between the furniture manufacturers and suppliers in Turkish home furniture industry in new product development process. Face to face interviews expedites the opportunity of in depth analysis in gathering data process. It is evident that non-face-to-face interviews limit questioning opportunities and receiving reliable responding, becloud investigation and reduces the reply rates [17]. Hence, interview method was evaluated as the most appropriate method for scope of the study.

Interview method is one of the most approached qualitative research method among others as it makes possible to receive standardized answers, annihilates the possibility of prejudice, enables to compare findings and its ease of application. Interview method leans on personal communication and it is known as one of the oldest research methods [18]. There are three types of interview method: structured, semi-structured and unstructured interview.

In this study data gathering method was semi-structured interviews. In semi-structured interviews, even if the questions are prepared in a certain structure, the approach might change route during the interview depends on the flow, interviewer may ask improvised questions in order to deepen the subject.

Originality of the research sample is more important than its quantity in qualitative research. Hence, while the research sample consists of a wide range in quantitative research, in qualitative research originality trait is aimed to be expanded [19]. Research sample in scope of this study is limited to large-scaled furniture manufacturers and their suppliers. According to the SME definition of KOSGEB, the companies with the employee of less than 250 and the annual financial statement of less than 40 million Turkish Liras are classified as small-scaled companies [20] and other companies are classified as large-scaled companies. Large-scaled furniture companies in Turkey are presented in Table 6.1., semi-structured interviews were conducted with the companies marked in red by considering the time and cost limitations.

5 Results

5.1 Contribution of Supplier Integration in New Product Development Process to the Companies

Furniture manufacturers have been asked questions related to their supplier choice criteria and the demanded characteristics of the suppliers were tried to be defined through these questions. In line with the answers to these questions, it was found out that manufacturers consider the production techniques, technological possibilities possessed by the suppliers, their quality perception and design capabilities in order to constitute long-term relationships with the suppliers. In case of suppliers' inabilities in above mentioned factors, furniture manufacturers declared that they support their suppliers in order to enhance their competencies.

5.1.1 Contributions regarding to quality

Furniture manufacturers constituting the research sample are large-scaled companies who undertake the Turkey's furniture exportation to a great extent along with their domestic sales. In respect to their exportation mission, their furniture products have to meet certain quality standards. The only way to attain these quality standards is to collaborate with capable suppliers. The interviews showed that, furniture companies who are willing to be successful in global marketplace has a strong motivation in achieving the quality standards. At this point, the existent quality policy of the manufacturer turns into a must for the supplier which needs to be granted and by time this quality policy becomes existent for the supplier as well [21]. The buying manager of Boytaş Mobilya, one of the companies in the research sample, Erkan Tuzcuoğlu summarizes the buying process as follows:

“When our furniture designers choose a new furniture accessory of a supplier’s collection, we ask them to send us a product sample. The sample is tested in our high standard, TSE certified quality laboratories. After applying the needed quality tests, a detailed quality report is prepared and the report is shared with the supplier. The report contains both the optimum values of our company and the values the tested sample. If the values are lower than the optimum values, the supplier is expected to make the necessary improvements on the product. It is an iterative process and we ask the supplier to make the further improvements until our quality standards are satisfied.” Figure 2 shows the approval process of new component in furniture industry.

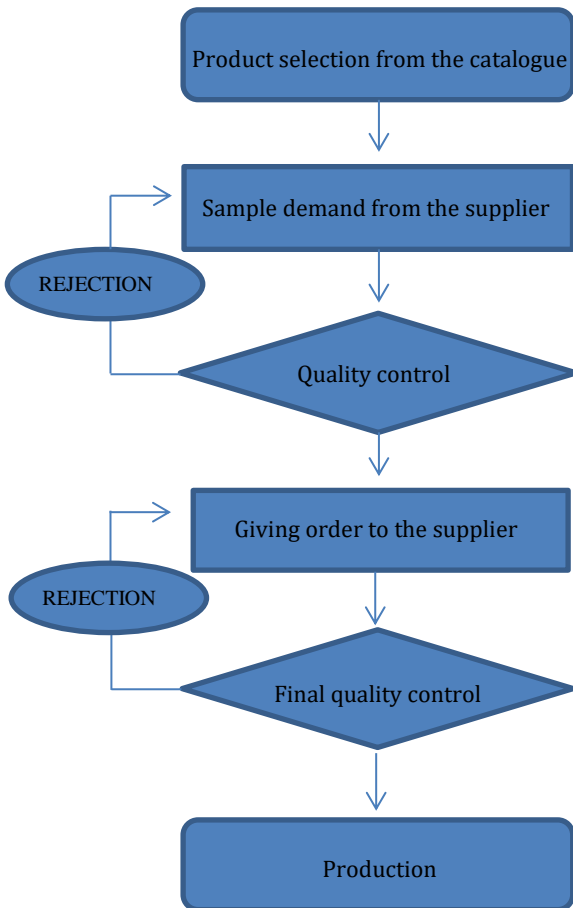


Figure 2. Approval of new component process in furniture industry

In the same interview, it was stated that, in the previous years suppliers used to be all alone in the improvement process, but recently Boytaş Mobilya started to take an active role in this process with their expert material engineers. It has turned to a more mutual process which prevents supplier being alone during the improvements and gives Boytaş Mobilya an opportunity to develop its capability in engineering abilities.

It was also stated that, a brand new unit has been established in Boytaş Mobilya which is called “Supplier Development Department” whose role is to trace and support the developments of the suppliers consistently, for instance concerning with occupational health and safety etc. It was declared that they terminate their engagement with suppliers who are likely to refuse their criteria.

Similar approaches related to quality manner were observed in other manufacturers in the research sample. It was concluded that, irrespective of the accessory’s visual, structure or other

positive characteristics, quality values are the most important feature of the products of suppliers.

In this context, the contribution of supplier integration in new product development process to quality function of the manufactured furniture has been presented. It was concluded that the production of wholly quality furniture might emerge as a result of consistent and continuous supplier-manufacturer relationship.

5.1.2 Contributions regarding to production and technology

It was exhibited that supplier integration in new product development process might contribute to the production techniques and technological infrastructure of both supplier and furniture manufacturer in a long-term relationship. As a natural outcome of the mass-production techniques in furniture industry traditional production methods fall short in meeting the required quality standards and also incapable of meeting the demanded order of quantity. Hence, it was observed that, furniture manufacturers push their suppliers to invest in new production techniques and force them to use contemporary manufacturing machines in order to get more productive service.

For example, wood carving as a traditional furniture decoration technique, had to be replaced with the polyurethane casting technique. Recently, furniture manufacturers have begun to use polyurethane legs, handles and decorative panels as it is faster for production and more consistent for standards. These change push suppliers to learn polyurethane casting techniques and necessitate them to be equipped with the required machines and technological infrastructure.

In this way, suppliers have amended their production techniques, they have attained time and cost acquisition and also they have possessed superior and contemporary manufacturing techniques which is well accepted in the global market place. The change in the suppliers’ production method would be painful at first, however in long term it has beneficial acquisition. Suppliers hold modern production techniques, produce quality and low-cost products may conveniently service to domestic furniture manufacturers while they might be serious actors in the global market place.

5.1.3 Contributions regarding to design ability

In accordance with the interviews conducted with the furniture companies, it was found out that the integration of supplier and furniture manufacturers lead to progression of design perception and abilities of both parties. Generally, furniture industry and furniture accessories industry might be classified as distinct industries in terms of material usage, production techniques, product development processes etc. Nevertheless, the products of these two distinct industries meet in a single final furniture product. It is a seminal activity to work together and exchange opinions for expert designers and engineers of both parties who are specialized in different areas.

One of the important factors affecting the supplier election criteria of the manufacturer is having a design department in their organization. One of the interviewees, a designer in a furniture company, stated that they can build rapport with suppliers who have in-home designers and they can get faster responds to their design related demands. Besides, suppliers who employ in-home designers have a better product and design language which enable furniture designers to use their products [22]. Traditionally, suppliers tend to copy or imitate the existing furniture accessories products of foreign brands, however, their intimate relationship with furniture manufacturers open a road for them to perceive the importance of the design and employ in-home designers. Many suppliers

have started to perform their product development processes in a more genuine way. This progression is for the favor of both parties, while the suppliers started to produce more competitive products, the furniture manufacturers can attain well-designed and quality product in domestic market, most probably with reasonable prices and rapidly.

Suppliers and furniture manufacturers who create decent, long-term relationships, have started to produce demand-oriented, innovative, high-quality and low-cost products.

5.2 Contribution of Supplier Integration in New Product Development Process to the Product Characteristics

As stated in the previous sections of the study, integration of suppliers in new product development process is beneficial in various ways. It was proved that supplier integration reduces the product development cost and time significantly [23]. According to Gupta and Sauder [24] companies have short product development span can more effectively integrate their suppliers to their process than the companies who have long product development span. Kessler [25] stated that external ideas and technological framework supplied by suppliers significantly reduce the product development costs. Also, Clark [26] in his product development analysis in automotive industry concluded that integration of suppliers positively affects the final product delivery time.

Some other researchers investigated the quality and performance outputs of supplier integration and found out positive results. McGinnis and Vallopra [27] stated that supplier integration provides precise improvement in product quality beside reducing cost and delivery time. Ragatz et al. [28], after their comprehensive research project including 60 different companies, presented positive impacts related to the quality of the purchased material, accessing the technological facilities, project cost and project delivery time.

Additionally, researches showed that new products would have better manufacturability features with the help of supplier integration. Wasti and Liker [29], presented that designers working with suppliers tend to consider producibility criterion much more than before. Similarly, Swink [30] found out the positive impacts of suppliers in producibility of new developed products'. According to him, an improved producibility standard has direct positive impacts on product characteristics such as development time, unit cost, reliability and total quality. Above mentioned researches show that active supplier integration in new product development processes has valid and direct positive effects on product characteristics such as cost, quality and delivery time. Field researches conducted in scope of this study has parallel findings with the literature. Additionally, field research showed that synchronized collaboration between supplier and manufacturer leads to customer satisfaction, standardization in the supplied materials from different suppliers, producibility with different techniques and materials.

5.2.1 Contribution to product cost

Furniture manufacturers who work in collaboration with suppliers constitute a fund of knowledge related to material technology, production techniques and possible improvements during time and this knowledge turns into practice in convenient situations. Interviews conducted during the study showed that the collaborations might result in changes in existing accessories and hardware related to dimension and material.

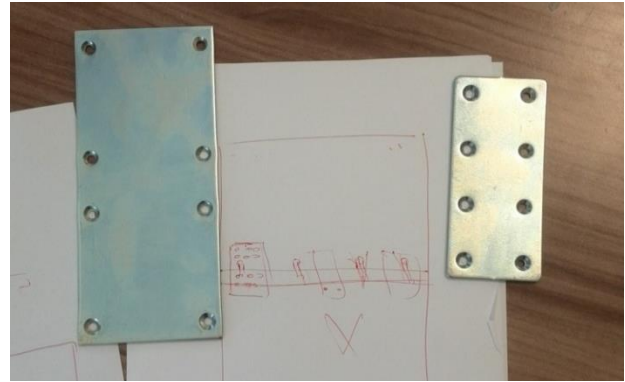


Figure 3. Assembly pieces of wardrobe doors

Metal components presented in Figure 3 is used to assemble the sliding doors of the wardrobe. Because of the dimension limitation of the lamination line the doors can not be produced in monolith-type, but in two separate parts. The two-pieced doors have been assembled with the bigger metal component presented in the figure for years until furniture manufacturer and the component supplier made a collaborative work. After the improvement work supplier cut the size half and manufacturer stopped using pins during the assemblage. Following, customer complaints related to this joint apparatus dramatically reduced. It was stated by the purchasing agent of the manufacturer that in the year of 2014 725.000 pieces of joint apparatus were purchased and the cost of the component to the company was 1.2 TL. After the improvement work the cost has been reduced to 0.6 TL, additionally the manufacturer stopped using pins during the assemblage. Moreover, the reduction in the dimension enabled to use the same component fixing the toilet table and tv units. This case shows that, a minor collaboration between the manufacturer and supplier result with roughly 750.000 TL annual profit, more standardized stock and simple workmanship. Table shows the positive effects of the improvement work to the manufacturer.

Table 1. Results of renovation work of assemblage component

	Previous component	Renovated component
Product cost	1.2 TL	0.6 TL
Production	Doors need to be processed in drill line	Doors don't need to be processed in drill line
Assembly	With the help of threaded insert	Direct connection to the surface
Customer satisfaction	Customer complaints related to door adjusting and deflection	Significant decrease in customer complaints

5.2.2 Contribution to standardization

As stated in the previous sections of the study furniture manufacturers are in connection with various suppliers. Collaboration with too many different suppliers, procuring components with similar qualification from different suppliers causes discordances in furniture manufacturers' mass production inventories. For instance, existence of plenty of suppliers in the field of wardrobe hinges push furniture manufacturers to make an election between suppliers. However, changing supplier would be bothers for furniture manufacturer if the production standards have been set according to a certain kind of hinge model and the other variations are not harmonical with these standards. In this respect, certain technical specifications published according to the existing standards in the industry. Although this kind of standardization is set for several product groups, it doesn't exist for rest and these cause problems for the furniture manufacturers who adopted to mass production techniques. Hence, collaboration between manufacturers and suppliers

maximizes the standardization opportunities. Figure 4 sets an example to this standardization mission.

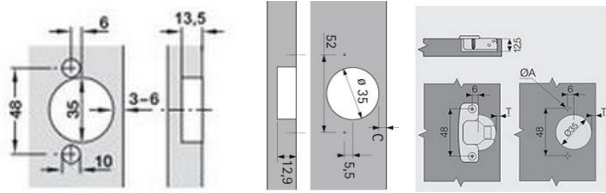


Figure 4. Hinge montage guides of supplier companies

As seen in the figure hinge producers Samet, Hafele and Hettich set the same assembly standards for their hinge collections. Accordingly, a furniture manufacturer using the hinge product of Samet can conveniently substitute the hinge of the other suppliers Hettich or Hafele. This situation provides a valuable advantage for the furniture manufacturers as they do not need to make any changes in their production drawings and plans.

Collaboration between suppliers and manufacturers give an opportunity for the products which do not have this kind of standardization. Rails used in furniture rails can be presented as a contemporary example to this opportunity. In the furniture accessory industry there are three major suppliers perform in Turkey. Blum is claimed to be leader in this field with its experience and expertness. Hettich as a foreign company and Samet as a local firm are the other two alternatives who produce equivalent drawer rails. Though, because of the differences in the connection details, one furniture manufacturer using the rail of a supplier couldn't be able to switch with the rail of another. Due to this reason furniture manufacturers would face with time and cost loss in case they need to consume products of different suppliers depending on the factors such as cost, logistics and stocking. In order to prevent these kind of casualties Boytaş Mobilya and suppliers performed a collaborative work and as a result they came up with standard connection details with the rails of all suppliers and the industry has reached a new standardization in a product group. Since then furniture manufacturers could be able to use the drawer rails of any supplier and they can interchange between the suppliers conveniently. Figure 5 is an example of a recent standardization work with suppliers.

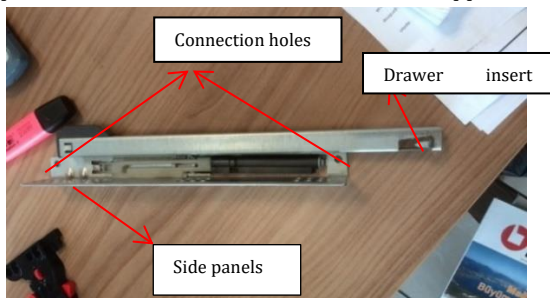


Figure 5. Standardization work in drawer rails

Such standardization attempts conduce toward various advantage for both furniture manufacturers and suppliers as presented in Table 2.

Table 2. Advantages of standardization to the companies

	Advantages for furniture manufacturers	Advantages for supplier companies
1	Opportunity to work with different suppliers	Accessibility to the rival supplier companies
2	Providing flexibility in logistics, cost and stock.	Gaining new customers
3	Accommodation with the mass production parameters	

5.2.3 Contribution to producibility

Supplier integration and collaboration between suppliers and manufacturers lead to a wide range of positive impacts related to producibility. Manufacturers would face with difficulties while using the purchased components of suppliers as they are producing their product groups with their established manufacturing techniques. Findings related to these problems will be presented in the following parts of the study.

Decorative panels are accessories that are used widely in the furniture industry in order to enhance the visual properties of the furniture and authenticity in an applicable and affordable way. This kind of visual properties used to be attached with the furniture by carving-inlaying techniques traditionally, however recently these decorative panels are used by using mass production methods. Figure 6 shows examples of decorative panels.



Figure 6. Decorative panel examples

Decorative panels seen in the Figure 6 are produced by polystyrene material with the extrusion method and the patterns are imprinted with the help of foil cylinders. These decorative panels are purchased by furniture manufacturers and used as seen in Figure 7.



Figure 7. Usage of decorative panels on furniture

Polystyrene panels have a wide range of usage area in furniture industry, however they are exposed to deflection based upon contraction factor and this causes customer complaints frequently. Furniture manufacturers who face with this kind of customer complaints share the problems with their suppliers and expect them to come up with suitable solutions. Though, suppliers couldn't be able to provide solid solutions for a long time and both parties had to get together to achieve progress.

Engineering teams of Boytaş Mobilya and Dörtdivan Profil executed a collaboration in order to find efficient solutions to the customer complaints originated from deflection deficiency. In this context parties organized corporate travels, exchange correspondences, remote connections and try to enhance proper solutions for the deficiency. As a result of the comprehensive collaboration between both parties the material used in panel production turned into PVC with the same extrusion technique and visual patterns proceed to be imprinted on the PVC panels with foil cylinders. In conclusion, supplier ended up with a brand-new production line for PVC extrusion and the furniture manufacturer prevented the customer complaints in a significant extent.

This example is a valuable indicator to show how integrated sources of both parties such as experience, knowledge, engineering skills etc. can be used in order to achieve deficiencies related to producibility and how to come up with a process innovation. Figure 8 shows the samples of PVC decorative panels and Figure 9 shows the usage areas.



Figure 8. Examples of PVC decorative panels



Figure 9. Usage of PVC decorative panels on furniture

5.2.4 Contribution to customer satisfaction

The accessories and hardware used in furniture products are usually designed and produced in compliance with suppliers' production and technical conditions. Material type and production method of the produced accessories are related with the supplier's production technique and fund of knowledge. However, these accessories and hardware reach significance as long as the furniture are exhibited and

purchased by the customers. Problems and complaints related to these accessories and hardware are primarily in the responsibility of the furniture companies. In this sense it can be said that furniture companies have a better understanding of customer needs and demands as they are the competent authority who face with the customer feedbacks in the first place.

Sharing the complaints and demands coming from customers with the suppliers, giving them feedback about their requests, moreover taking steps in the direction of solving problems originated from accessories and hardware are important factors for furniture companies in order to create a valid and quality brand identity and perception.

Especially products supplied from international suppliers tend to behave differently in different climate conditions. For example, the company of Renolit is a Germany based, internationally well-known PVC foil manufacturer. The PVC foil produced by this company is purchased by local melamine coated chipboard manufacturers, is covered over MDF plates and these chipboards are used in furniture manufacturing. Local furniture manufacturers' exportation has significantly increased recently to the Middle East countries and accordingly customer complaints related to blenching are increased as well. Boytaş Mobilya, an important customer of Renolit, shared these complaints to the supplier and demand them to prevent their PVC foils' blenching issue also propose them to have an active role in their improvement process. Boytaş Mobilya itself has established a climatization laboratory, tested PVC foils under high climate conditions and supported Renolit's improvement trials by sharing the quality reports with the supplier. The improvement trials which last more than a year has been terminated with success and the company managed to produce PVC foils that don't blench even under harsh climate conditions. The interesting factor here is Renolit as a European company didn't have a clue that their foils had blenching problem as they have never been tested under Middle East's climate conditions. In conclusion, they became aware of a deficiency of their product with the help of their Turkish customer who export furniture to Middle East, thus, they could make an improvement on their product and they advanced their quality standards on a higher level. This was a good example of a win-win situation gained by creating a consistent collaboration between parties as both supplier and manufacturer satisfy their customers with more quality products. Figure 10 represents a photo related to the blenching complaints by the customers.



Figure 10. Image showing the blenching complaints by customers

5.2.5 Contribution to the new product development

Furniture manufacturers conduct their new product development activities by the help their in-house designers and engineers aiming at designing and producing innovative and unique furniture products. These designers and engineers sometimes might be in need of non-existing accessories and hardware in the market place. In this cases they attempt to produce the accessories or hardware that were designed by themselves by using their suppliers' manufacturing facilities. As furniture designer don't have a comprehensive knowledge related to accessory manufacturing techniques they come together with the technical staff of their suppliers' and as a result they would come up with innovative products.

Figure 7.11 represents a good example how designers of both parties may create unique accessories that provide added-value to the furniture products. In this case the designer of furniture manufacturer is in the process of designing a child room with the concept of tree and nature theme. He wished to use a branch shaped furniture leg in his design. Instead of producing a totally new leg, he decided to use an existing plastic leg of a supplier and transform it into branch-like shaped with a minor change.

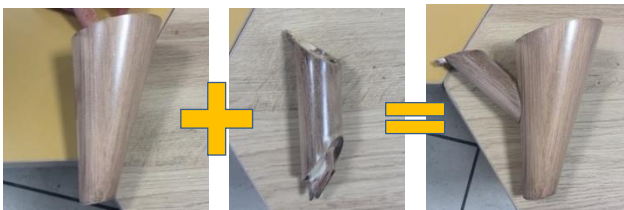


Figure 11. ABS furniture leg developed with collaboration of supplier and manufacturer

Figure 12 shows a laptop table attached on the mitt of a sofa. The table was designed by the furniture manufacturer's designer and the supplier's technical staff materialized the design into actual life.

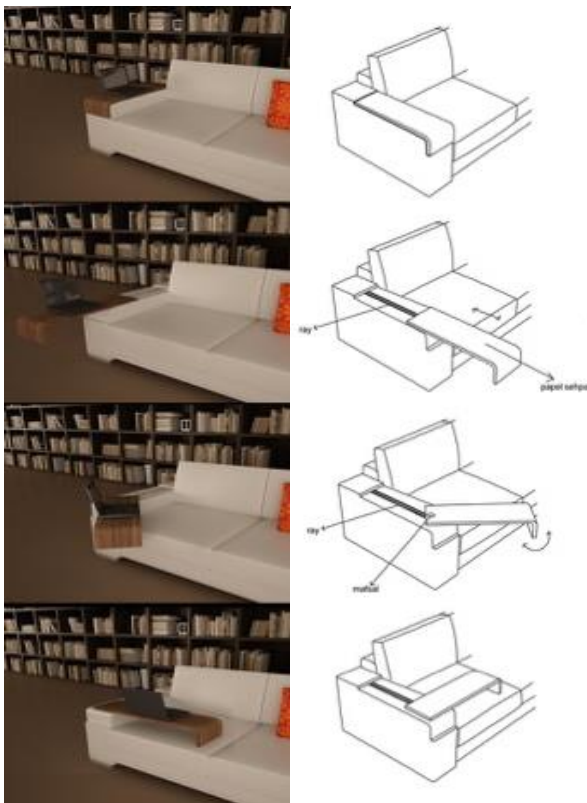


Figure 12. Laptop table design

In conclusion, it can be said that furniture designers according to their needs related to the workpiece, can design accessories or hardware and with the help and desire of their suppliers' technical support the innovative ideas might be actualized.

6 Conclusion

The relationship between the furniture manufacturers and their suppliers in the Turkish home furniture industry has been investigated in the scope of the study. Although the subject has been neglected in the literature from the standpoint of furniture industry, detailed and valuable investigations exist in various manufacturing industries which support the current research with valuable findings, therefore these findings were represented in the related sections of the study. The interviews and field research conducted with furniture manufacturer and suppliers strengthen insight related to the importance of the subject for furniture industry. It was found out that limited, though continuous integration endeavors exist between the suppliers and manufacturers. Although these endeavors are in voluntary and companies' self-pushing level, it was observed that supplier integration in furniture industry would come up with considerable positive results.

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8 References

- [1] Cordon, C., & Vollman, T. (2008). *The Power of Two*. New York: Palgrave Macmillan Ltd.
- [2] Burt, D., S.D.Petcavage, & R.L.Pinkerton. (2010). *Supply Management*. Boston: Mc GrawHill Irwin.
- [3] Wagner, S., & Hoegl, M. (2006). Involving suppliers in product development: insights from R&D directors and project managers. *Industrial Marketing Management*, 35, 936-943.
- [4] Kamath, R., & J.K.Liker. (1994). A second look at Japanese product development. *Harvard Business Review*, 72(6), 154-170.
- [5] Langner, B., & Seidel, V. P. (2009). Collaborative concept development using supplier competitions: Insights from automotive industry. *Journal of Engineering Technology and Management*, 26, 1-14.
- [6] Jayaram, J. (2005). Supplier involvement in new product development projects: dimensionality and contingency effects. *International Journal of Production Research*, 46(13), 3717-3735.
- [7] Mikkola, J. H., & Skjoett-Larsen, T. (2003). Early Supplier Involvement: Implications for New Product Development Outsourcing and Supplier-Buyer Interdependence. *Global Journal of Flexible Systems Management*, 4(4), 31-41.
- [8] Echtelt, V. (2004). *New product development: shifting supplier into gear*. Eindhoven: Technische Universiteit Eindhoven.
- [9] Bozdoğan, K., Deyst, J., Hoult, D., & Lucas, M. (1998). Architectural innovation in product development through early supplier integration. *R&D Management*, 28(3), 163-173.
- [10] Clark, K., B.W.Chew, & T.Fujimoto. (1987). Product Development in the world of auto industry. *Brookings Papers on Economic Activity, Special Issue on Macroeconomics* 3, 729-778.
- [11] Coronado, A., & C.E.Coronado. (2006). Ready to drive. *IEEE Manufacturing Engineer*, 85(1), 36-39.
- [12] Chiena, S., & Chen, J. (2010). Supplier involvement and customer involvement effect on new product development

- success in the financial service industry. The Service Industries Journal, 30(2), 185-201.
- [13] Carr, A., Kaynak, H., Hartley, J., & Ross, A. (2008). Supplier dependence: impact on supplier's participation and performance. International Journal of Operations & Production Management, 28(9), 899-916.
- [14] Chung, S., & Kim, G. M. (2003). Performance effects of partnership between manufacturers and suppliers for new product development: the supplier's standpoint. Research Policy Vol. 32, 587-603.
- [15] TAYSAD. (2013). Parça Sektörü (Otomotiv Yan Sanayi) 2023 Vizyonu . Kocaeli: TAYSAD.
- [16] Yıldırım, A., & H.Şimşek. (2005). Sosyal Bilimlerde Nitel Araştırma Yöntemleri. Ankara: Seçkin Yayıncılık.
- [17] Tuckman, B. W. (1999). Conducting Educational Research. Orlando: Harcourt Brace College Publishers.
- [18] Büyükköztürk, Ş., Çakmak, E. K., Akgün, Ö. E., Karadeniz, Ş., ve Demirel, F. (2012). *Bilimsel Araştırma Yöntemleri*. Ankara: Pegem Akademi.
- [19] Kıncal, R. (2013). Bilimsel Araştırma Yöntemleri. Ankara: Nobel Yayıncılık.
- [20] KOSGEB. (2012, Kasım 4). www.kosgeb.gov.tr. Mayıs 4, 2015 tarihinde www.kosgeb.gov.tr: <http://kosgeb.gov.tr/Pages/UI/Haberler.aspx?ref=606> adresinden alındı
- [21] Aykurt, M. E. (2014, Mayıs). Türk Mobilya Sektöründe Faaliyet Gösteren Büyük Firmaların Küçük ve Orta Ölçekli İşletmelere Etkisinin Tasarım Perspektifinden İncelenmesi: Kayseri Örneği. Yüksek lisans tezi. İstanbul: İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü.
- [22] Ekmekçioğlu, S. (2015, Nisan 24). kişisel görüşme. (E. Tatlısu, Röportaj Yapan)
- [23] Primo, M. A., & Amundson, S. D. (2002). An exploratory study of the effects of supplier relationships on new product development outcomes. Journal of Operations Management, 20, 33-52.
- [24] Gupta, A., & Souder, W. (1998). Key drivers of reduced cycle time. Research Technology Management, 38-43.
- [25] Kessler, E. (2000). Tightening the belt: methods for reducing development costs associated with new product innovation. Journal of Engineering and Technology Management, 17, 59-92.
- [26] Clark, K. (1989). Project Space and Project Performance: The Effect of parts strategy and supplier involvement on product development. Management Science Vol.35, 1247-1263.
- [27] McGinnis, M., & Vallopra, R. (1998). Purchasing and Supplier Involvement: New Product Development and Production/Operations Process Development and Improvement. Tempe: Center for Advanced Purchasing Studies.
- [28] Ragatz, G., Handfield, R., & Scannell, T. (1997). Success factors for integrating suppliers into new product development. Journal of Product Innovation Management, 190-202.
- [29] Wasti, S., & Liker, J. (1999). Collaborating with suppliers in product development: a US and Japan comparative study. IEEE Transactions on Engineering Management, 46(4), 444-460.
- [30] Swink, M. (1999). Threats to new product manufacturability and the effects of development team integration processes. Journal of Operations Management, 17, 691-709.