ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

CRAFT KNOWLEDGE AS A CATALYST IN NEW PRODUCT DEVELOPMENT: COLLABORATIVE WORK OF DESIGNERS AND CRAFTSPEOPLE IN COMPANIES

Ph.D. THESIS

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Department of Industrial Design

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YENİ ÜRÜN GELİŞTİRMEDE BİR KATALİZÖR OLARAK ZANAAT BİLGİSİ: ŞİRKETLERDE TASARIMCILAR VE ZANAATKARLARIN İŞBİRLİĞİ

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To my beloved parents,

FOREWORD

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ABBREVIATIONS

NPD **:** New Product Development

R&D **:** Research and Development

YÜG **:** Yeni Ürün Geliştirme

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CRAFT KNOWLEDGE AS A CATALYST IN NEW PRODUCT DEVELOPMENT: COLLABORATIVE WORK OF DESIGNERS AND CRAFTSPEOPLE IN COMPANIES

SUMMARY

This thesis investigates how the knowledge and skills of craftsmen are evaluated in the new product development (NPD) process in companies through the collaboration between craftsmen and designers. This thesis's primary research question is how craftsmen's knowledge is transferred to product design and new product development. This thesis focuses on the following elements of craftsmanship: First, material and production possibilities are used to define types of craftsmanship. The environmental conditions in which craftsmen work change depending on the materials used. While a glass master or metal master needs a high degree of heat, a master producing leather and shoes work in a different environment. Second, craft is formed with knowledge of the past as well as interact with today's forms of production. Therefore, it is necessary to understand this historical process so that today's forms of industrial production do not break with craftsmanship. The relationship of the master with the industry and the continuation of this relationship makes it necessary to question with whom the master collaborates. The designer is the person who collaborates with the craftsman in the NPD process. The use of the craftsman's knowledge and skills in the companies discussed in this thesis is the result of collaboration with the designer.

Craft production and industrial production seem to be separated in the 21st century. However, in some sectors, it is impossible to fully industrialise. In craft-based or craft-related industries, manufacturing processes are still influenced by craft. Today, there are individual craftspeople, craftsmen as employees working in manufacturing, craftsmen in the industry or craftsmen cooperating with the industry. Even though the industry has automated production systems, it is very important why the industry still needs the knowledge and support of the craftsman. Even in industries that are fully automated, it is useful to cooperate with craftsmen to understand the material behaviour more economically and quickly during the prototyping process. Craft knowledge and experience are also useful in semi-automatic production systems. For instance, this knowledge can be used during the moulding and prototyping process.

Knowledge is the most valuable input and output feature for businesses and industry. Since craft knowledge is tacit knowledge that is transmitted through experience, transforming, and using this knowledge can be valuable and strategically important for companies. According to the craft and NPD literature in the fields of design, crafts, creative industries and management, the transfer of craft knowledge to new products or processes is possible through collaboration.

This research uses a multi-case study method. One of the main reasons for the choice of this method is to understand the similarities and differences between the cases by evaluating each process in detail. In this study, the companies selected as cases are from the glassware, leather and furniture sectors that develop new products and employ or collaborate with craftsmen. In determining the companies, the presence of

industrial designers and craftsmen in the NPD process were taken into consideration. In addition, the employment of industrial designers in the company was used to indicate the value they give to design and NPD.

The data obtained in this study consist of the researcher's observations, field notes, semi-structured in-depth interview records and transcribed texts. The interviews were generally completed in two or three parts spread over different days. Following an in-depth interview during the first visit to the companies, any areas of uncertainty that emerged during the preliminary interview were discussed in more detail in the secondary interviews. The semi-structured in-depth interview questions are presented in the appendices at the end of this report and are divided into the following topics: (1) general information about the company, (2) information about the interviewee, (3) craftsmen's position in the company and the collaboration capabilities of the company, (4) NPD and innovation processes in the company, (5) contribution of craftsmen to NPD, (6) factors that facilitate the contribution of craftsmen and incorporate the views of stakeholders and (7) sectoral assessment and competition.

Through thematic analysis, codes were created and grouped to identity and describe the themes. In the next step, the classified data were associated by comparing and demonstrating similarities. Maxqda, a computer-aided qualitative data analysis tool, was used throughout these analysis processes.

As a result of the interviews, a total of 168 different codes were created. These codes were grouped into seven themes: craftsmen's features, NPD, manufacturing, collaboration with craftsmen, craftsmen's contribution to NPD, knowledge, and management/strategy.

The craftsman's holistic approach to the product, combined with her/his experience in mass production in the sector, enables her/him to identify the problems encountered in the product design and production stages and find solutions to these problems. Prototyping, which is the most fundamental support that the craftsman can provide to the industry, results from this knowledge. The craftsman is also tasked with sharing her/his ideas about making and materials during the product development phase. Craftsmen's contributions to NPD are related to idea development, problem identification and problem solving through their knowledge of materials and construction methods and their contributions during the prototype stage. In both small-scale and large-scale companies, the most important contribution of craftsmen to NPD is making prototypes. A prototype enables the NPD team to discuss, develop and test the producibility of a product based on a three-dimensional object. The prototype made during product design allows the team to see the product in three dimensions and to make changes to it.

In addition to their contribution to prototype creation, craft masters can also offer solutions for problems encountered during product development. In areas where craft knowledge feeds the development of new products, these collaborations occurred in three main ways in this thesis study. In the first type, craftsmen worked as employees within a large-scale company. In the second form, craftsmen supported production and NPD as outside labourers and stakeholders. In the third form, craftsmen established their own enterprise company in which they directly oversaw manufacturing. There are two essential conditions for a company to benefit from craftsmen's knowledge

during the NPD process. First, the collaborating company must have a goal to develop and design new products. Second, the industry must have an ongoing need for craft knowledge and experience that craftsmen can fulfil.

The craftsman supports the existence of craft by presenting his production power as a flexible model for companies that outsource production. In this way, the craftsman gains access to an environment where she/he can sell his products. In addition, craftsmen producing for different companies offer companies an opportunity to measure the trends and pulse of the market.

Although companies do not always see craftsmanship as a factor that creates innovation, they understand the importance of craftsmen in their industry. The craftsman is consulted for her/his specialised knowledge in materials and construction methods in the fields of production and prototyping. This contribution, which allows the craftsman to identify and solve problems with the prototype, is critical for product development. Consequently, to continue collaboration with craftsmen in the future, companies must need or prefer to use craft knowledge. This is possible through factors such as the continuation of the need for tacit knowledge in the relevant sectors, the continuity of the importance of craftsmanship to provide rapid prototyping with real material and the value of handmade products in the market.

YENİ ÜRÜN GELİŞTİRMEDE BİR KATALİZÖR OLARAK ZANAAT BİLGİSİ: ŞİRKETLERDE TASARIMCILAR VE ZANAATKARLARIN İŞBİRLİĞİ

ÖZET

Bu tez, zanaatkarların bilgi ve becerilerinin, zanaatkarların ve tasarımcıların işbirliği yoluyla şirketlerdeki yeni ürün geliştirme (YÜG) sürecinde nasıl değerlendirildiğini araştırmaktadır. Bu tezin ana araştırma sorusu, zanaatkarın bilgisinin ürün tasarımına ve yeni ürün geliştirmeye nasıl aktarıldığıdır. Bu tez, zanaatkarlığın aşağıdaki unsurlarına odaklanmaktadır: Birincisi, malzeme ve üretim olanakları zanaatkarlık türlerini tanımlamak için kullanılmaktadır. Zanaatkarların çalıştığı çevre koşulları, malzeme ölçeğinde değişmektedir. Bir cam veya metal ustasının yüksek derecede ateşe ihtiyacı olurken, deri veya ayakkabı ustası farklı bir ortamda çalışmaktadır. İkincisi, zanaat geçmişin bilgisi ile şekillenmekte ve bugünün üretim biçimleriyle etkileşime girmektedir. Dolayısıyla günümüz endüstriyel üretim biçimlerinin zanaatkarlıktan kopmaması için bu tarihsel süreci iyi anlamak gerekmektedir. Ustanın endüstri ile olan ilişkisi ve bu ilişkinin devamı, ustanın kiminle işbirliği yaptığını sorgulamayı gerekli kılar. Tasarımcı, yeni ürün geliştirme sürecinde zanaatkarla işbirliği yapan kişidir. Bu tezde tartışılan şirketlerde ustaların bilgi ve becerilerinin kullanılması, tasarımcı ile yapılan işbirliğinin sonucudur.

21. yüzyılda zanaat üretimi ve endüstriyel üretim birbirinden ayrılmış görünmektedir. Ancak birtakım sektörlerde tam anlamıyla sanayileşmek imkansızdır. Zanaat temelli veya zanaatla ilgili endüstrilerde, üretim süreçleri hala zanaattan etkilenmektedir. Günümüzde, bireysel zanaatkârlardan, imalatta çalışan işçilerden, sektördeki zanaatkarlardan veya sanayi ile işbirliği yapan ustalardan bahsedebiliriz. Endüstrinin otomatik üretim sistemlerine sahip olmasına rağmen, endüstrinin neden hala zanaatkarın bilgisine ve desteğine ihtiyaç duyduğu konusu çok önemlidir. Endüstride tam otomatik bir sisteme geçilmesine rağmen prototip sürecinde malzeme davranışını daha ekonomik ve hızlı anlamak için usta ile işbirliği yapmak mümkündür. Zanaat bilgi ve deneyiminin kullanımı yarı otomatik üretim sistemlerinde de gerçekleşmektedir. Örneğin bu bilgiyi kalıplama ve prototip sürecinde kullanmak mümkündür.

Bilgi, işletmeler ve endüstri için en değerli girdi ve çıktı özelliğine sahiptir. Zanaat bilgisi örtülü bilgi olduğundan ve deneyim yoluyla aktarıldığından, bu bilgiyi dönüştürme ve kullanma yeteneği şirketler için değerli ve stratejik olarak önemli olabilmektedir. Tasarım, zanaat, yaratıcı endüstriler ve yönetim alanlarındaki zanaat ve yeni ürün geliştirme literatürüne göre, zanaat bilgisinin yeni ürünlere veya süreçlere aktarılması işbirliği ile mümkündür.

Bu araştırmanın yöntemi bir "çoklu vaka çalışması" yöntemidir. Bu yöntemin tercih edilmesinin ana nedenlerinden biri, her süreci detaylı bir şekilde değerlendirerek vakaların farklılıklarını ve benzerliklerini anlamaktır. Bu çalışmada, zanaatkar istihdam eden veya işbirliği gerçekleştiren ve yeni ürün geliştiren züccaciye, saraciye ve mobilya sektörlerinden şirketler örnek olarak seçilmiştir. Öncelikle şirketlerin

belirlenmesinde şirketlerde endüstriyel tasarımcı ve zanaatkar yeni ürün geliştirme sürecinde bulunması dikkate alınmıştır. Ayrıca endüstriyel tasarımcıların şirkette istihdam edilmesi, şirketlerin tasarıma ve yeni ürün geliştirmeye verdikleri değeri göstermektedir.

Bu çalışmada elde edilen veriler, araştırmacının gözlemleri, alan notları, yarı yapılandırılmış derinlemesine görüşme kayıtları ve yazıya dökülmüş metinlerden oluşmaktadır. Bu görüşmeler genellikle farklı günlere yayılmış iki veya üç bölüm halinde tamamlanmıştır. Şirketlere yapılan ilk ziyaret sırasında derinlemesine bir görüşmenin ardından, ilk görüşmelerde ortaya çıkan birkaç belirsiz alan ikinci görüşmede daha ayrıntılı olarak tartışıldı. Bu raporun sonundaki ekler bölümünde sunulacak yarı yapılandırılmış derinlemesine görüşme soruları şu başlıklara ayrılmıştır: (1) şirket hakkında genel bilgiler, (2) görüşülen kişi hakkında bilgiler, (3) zanaatkarlar şirketteki konumu ve şirketin işbirliği kabiliyetleri, (4) yeni ürün geliştirme ve şirketteki inovasyon süreçleri, (5) zanaatkarın yeni ürün gelişimine katkısı (6) zanaatkarın katkısını kolaylaştıran faktörler ve paydaşların görüşleri, 7) sektörel değerlendirme ve rekabet.

Tematik analiz yoluyla, temaları tanımlamak için kodlar oluşturulmuştur ve gruplandırılmıştır. Bir sonraki adımda, sınıflandırılmış veriler ilişkilendirilmiş ve bu ilişkilendirme, benzerlikler karşılaştırılarak ve gösterilerek yapılmıştır. Tüm bu analiz süreçlerinde bilgisayar destekli nitel veri analiz aracı olan Maxqda kullanılmıştır.

Görüşmeler sonucunda toplam 168 farklı kod oluşturulmuştur. Bu kodlar yedi tema altında gruplandırılmıştır: zanaatkar özellikleri, YÜG, üretim, zanaatkarlarla işbirliği, zanaatkarların YÜG'ne katkısı, bilgi ve yönetim / strateji.

Zanaatkarın ürüne yönelik bütüncül yaklaşımı, sektördeki seri üretim tecrübesiyle birleşerek, ürün tasarım ve üretim aşamalarında karşılaşılan sorunları tespit edip bu sorunlara çözüm bulmasını sağlar. Zanaatkarın sektöre en temel desteği olan prototip üretimi bu bilgiden beslenmektedir. Ustadan ayrıca ürün geliştirme aşamasında yapım ve malzemelerle ilgili fikirlerini paylaşması istenir. Zanaatkarların YÜG'ne katkıları, malzemeler ve yapım yöntemleri hakkındaki bilgileri ve prototip aşamasındaki katkıları aracılığıyla fikir geliştirme, problem tanımlama ve problem çözme ile ilgilidir. Hem küçük hem de büyük ölçekli şirketlerde zanaatkarların YÜG'ne en önemli katkısı prototip yapmaktır. Prototip, YÜG ekibinin üç boyutlu bir nesneye dayalı olarak bir ürünün üretile bilirliğini tartışmasına, geliştirmesine ve test etmesine olanak tanır. Ürün tasarımı sırasında yapılan prototip, ekibin ürünü üç boyutlu görmesini ve değişiklik yapmasını sağlar.

Zanaat ustaları, prototip oluşturmaya katkılarının yanı sıra, ürün geliştirme sırasında karşılaşılan sorunlara da çözümler sunabilir. Zanaat bilgisinin yeni ürünlerin geliştirilmesini beslediği alanlarda, bu tez çalışmasında iş birlikleri üç şekilde gerçekleşmiştir. Birinci tipte ustalar, büyük ölçekli bir şirkette çalışan olarak çalışırlar. İkinci biçim, zanaatkarların üretimi ve YÜG'ni dışarıdan bir işçi ve paydaş olarak desteklemesidir. Üçüncü biçim, zanaatkarların üretimi doğrudan denetledikleri kendi girişim şirketlerini kurmalarıdır. Bir şirketin YÜG sürecinde zanaatkar bilgilerinden yararlanabilmesi için iki önemli koşul vardır. İlk olarak, işbirliği yapan şirketin yeni ürünler geliştirme ve tasarlama hedefi olması gerekir. İkincisi, sanayinin zanaat bilgisi ve deneyimine olan ihtiyacının zanaatkarın sektörü beslediği alanlarda devam etmesi gerektiğidir.

Zanaatkar, üretim gücünü fason üretim yapan şirketlere esnek bir model olarak sunarak zanaatın varlığını destekler. Bu sayede zanaatkar, ürünlerini satabileceği bir ortama kavuşur. Ayrıca farklı şirketler için üretim yapan ustalar, şirketlere piyasanın trendlerini ve nabzını ölçme fırsatı sunmaktadır.

Şirketler, zanaatkar bilgisini her zaman inovasyon yaratan bir unsur olarak görmeseler de, zanaatkarların sektörlerindeki önemini anlamışlardır. Usta, üretim ve prototip alanlarında malzeme ve yapım yöntemleri konusunda bilgisine danışılan kişidir. Zanaatkarın prototiple ilgili sorunları tanımlamasına ve çözmesine olanak tanıyan bu katkı, ürün geliştirme için kritik öneme sahiptir. Sonuç olarak, gelecekte zanaatkarlarla işbirliğini sürdürmek için şirketlerin zanaat bilgisine ihtiyaç duyması veya kullanmayı tercih etmesi gerekir. Bu durumun gerçekleşmesi, ilgili sektörlerde örtülü bilgi ihtiyacının devam etmesi, gerçek malzeme ile hızlı prototip yapılabilmesi için zanaatkarlığın öneminin sürekliliği ve el yapımı ürünlerin piyasadaki değeri gibi faktörlerle mümkündür.

1. INTRODUCTION

This thesis focuses on craft knowledge transfer to NPD processes in corporate companies. The employees involved in this transfer and the companies' NPD processes are evaluated to understand this transfer in detail. First, the definition, knowledge and experience of the craftsman in the literature are presented. In addition to these definitions, the transformation of craft production from historical processes to its current situation is revealed. Then, the position and effectiveness of handmade production in industrialised sectors is addressed. The intersection between hand production and industrial production is explored, and the industries that still rely on craft knowledge in product development are identified.

Collaborative studies, which are the most effective way of transferring the craftsman's knowledge and skills to the industry, were the main starting point of this thesis study. Collaborations ranging from one-to-one collaborations to teamwork collaborations in companies are explored. Companies' NPD processes are examined. This thesis investigates how companies accept craft knowledge and skills as inputs for NPD. Examining the concepts of craft, design and innovation within the scope of NPD is a new research area for the industrial design discipline (Coskun Orlandi A.E. and Erkan Y., 2014).

Since craft production is small-volume production, it is generally not considered an essential contribution to the economy (Aparo et al., 2013; McAuley and Fillis, 2005). How ever, in recent years, studies in the literature (e.g., Niedderer et al, 2011; Woolley, 2011; Woolley et al, 2015; Yair et al, 2001) have provided a different perspective to the knowledge of craftsmen. For instance, studies have been conducted on the use of craft knowledge as a strategic tool by companies (Yair et al, 1999) and the transfer of this knowledge (Hogseth, 2013). A critical way of accomplishing this transfer of knowledge is to cooperate through the minds that have the power of tacit knowledge (Cavusgil et al, 2003). For this reason, the human factor is becoming more and more significant in the sectors where tacit knowledge is used.

The transfer of craft knowledge to new products is possible with different-sized collaborations. According to the craft and NPD literature on design, crafts, creative industries and management, the transfer of craft knowledge to new products or processes is possible through collaboration. The first stage of collaboration (with the most significant distance from industrialisation) is craftsmen's and designers' collaborations for handmade production. The second stage is the collaboration between designers and craftsmen in manufacturing systems (see Kaya and Yagiz, 2011; Yair et al, 1999). The third stage (closest to industrialisation) is the collaboration between craftsmen and industrialised corporate companies, where collaboration with the artisan is the most professional in terms of communication and management. It is uncommon for craftsmen to work actively in manufacturing companies using industrialised production methods. However, craftsmen do continue to work actively in the glassware, leather and furniture sectors in Turkey as salaried employees. This thesis focuses on the presence of craftspeople in these sectors and the ways in which craft knowledge supports the product development process.

1.1 Research Questions

This thesis has determined that the craftsman can contribute to the development of new products in leather, glass, and furniture, which are the subject of this thesis, together with pilot studies and literature reviews. In this context, the main research question of this thesis is about understanding how this craft knowledge and experience contributes to product development in these craft-based industries. The main research question of this thesis study is:

How are craftspeople's knowledge and skills transferred to the industry for product development?

Additional research questions were identified to understand craftsmen's contributions to the industry. These research questions were created by following the steps of knowledge input, information processing, and output from the craftsman, industry (manufacturer), and designer.

These questions are as follows:

1. Who is a craftsman? What is craft knowledge? What makes this knowledge unique to organizations? How can this knowledge be used and transferred?

2. How did the industrialization process affect the use of craft knowledge? In which industrialized sectors and at what stage of production does the craftsman work today?

3. With whom do the craftspeople work in cooperation within the company?

4. What are the roles and mutual benefits of stakeholders in designer craftsman collaboration?

5. At what stage and how is the knowledge and skill of the craftsman used in the new product development process?

6. What is the craftsman's most significant contribution to the companies' product development processes?

7.Do companies' internal and external environmental factors affect the transfer of craftspeople's knowledge to NPD? How?

8. How is the contribution of the craftsman managed in companies? Are decisions made to facilitate this contribution?

9. What would be favorable conditions for the craftspeople's contribution to continue in the future?

1.2 Aim and Objectives of Research

This thesis aims to determine the contribution of craft knowledge to NPD in corporate companies. This thesis's primary research focus is how craftsmen's knowledge is transferred to industrial production dynamics. The representation of all objectives of this thesis from the individual to organisational level is given in Table 1.1:

Table 1.1 : Objectives of thesis.

Research Levels	Objectives
Craftsman as Employee	• To define the duties of craftsmen in the companies • To determine who the craftsman coordinates with the most in the company • To discover the craftsman's motivation to work in that company • To investigate the factors that strengthen the craftsman's sharing of knowledge in the company
Teamwork	• To research craftsman's direct or indirect communication methods with people who develop new products in the company • To find out for which purpose and how often the craftsman's knowledge is used in the company
Organisational/ managerial perspective	• To examine the importance of the craftsman in that sector • To research reasons for using craft knowledge in the company • To determine how the company's organisational structure and collaborations affect the transfer of knowledge

1.3 Outline of the Thesis

This thesis consists of eight chapters. In the first chapter research questions, aim, objectives, and structure of the thesis are mentioned.

The second chapter explains the definition of craft and craftsman, the relationship between craft and design, the transformation experienced in the historical process of craftsmanship, industrialization, and craftsmanship, and the characteristics of craft knowledge.

The third chapter includes the types of innovation, the importance of creating innovations for companies, and evaluating industrial design as an innovative element. In addition, the new product development process, the factors affecting the success of this process, knowledge and human factors in new product development are

mentioned. The role and strategic importance of tacit knowledge in new product development are also covered in this section.

The fourth chapter of the thesis reveals why craft knowledge is needed in the industry, the contribution of craft knowledge to the new product development process, and the importance of collaboration for innovation. Studies on design-craftsman collaborations in the literature are mentioned.

In the fifth chapter of the thesis, this thesis study's data collection and analysis methods are explained, and basic information about each company is presented.

In the sixth chapter of the thesis, the codes and themes created from interviews with company employees are presented at company and sector scales. In addition, the most common codes and themes in companies are presented by visualizing their distribution according to company scales.

In the seventh chapter of the thesis, the relationship of craftsmanship with today's industry is discussed. The formation and management of the designer-craftsman collaboration have been evaluated in terms of differences and similarities in companies. At each stage of the new product development process, contributions arising from the designer-craftsman collaboration have been revealed. The factors affecting these contributions were examined and discussed. The designer-craftsman collaboration was evaluated through sample products.

In the eighth chapter, all the contributions presented in the findings and discussion section are summarized in a single table. The importance of the craftsmen’s contribution to new product development is summarized in terms of different stakeholders. In addition, answers to the research questions were presented. The contribution of this thesis to the literature, the limitations of the study, and future studies are stated.

2. CRAFT KNOWLEDGE

This thesis study primarily deals with the concept of craft as a discipline. The characteristics of this discipline and its differences from art and design are revealed. It is also discussed what craftsmanship has been and what periods it has passed through. In particular, the effects of industrialization and the current wave of third-class craftsmanship on the craft are discussed.

2.1 Craft Definition

The economist Schumacher (1989) mentions that humans do not enjoy anything as much as being creative and productive, using both their hands and brain. Following this definition, the craftsman reaches an output by following all of the processes he/she takes into his memory by using his/her hands. Craft is defined as a making experience by hand (Ray, 2009). In evaluating the production scale, Adamson (2010) considered craftsmanship production as a small-scale production with knowledge based on material and skills.

The concept of craft is defined by focusing on the contrast between craft and art. Although this approach is not entirely wrong, when the diversity of crafts, different definitions, and phases of the craft are examined, it may be superficial to explain the craft with such sharp lines. In addition to making these differences and definitions, it would be appropriate to evaluate the characteristics of craft performance, its changes in the process, and its effectiveness in production and material focus.

Bruce Metcalf defines craft with four components: First, hands create the artefact. Second, the craft is a making process through using material and technics. Third, the artefact has a usage. Fourth, the craft has a history of knowledge transfer (Alfoldy, 2007, p. 4).

Within the scope of this thesis, the thesis's focus on the elements of craftsmanship is as follows: First, material and production possibilities are used to define types of craftsmanship. Because of the environmental conditions in which the craftsman works are changing in the material scale. While a glass master or metal master needs a high

degree of fire, a master producing leather and shoes can work in a different environment. Alternatively, there are also types of craftsmanship that can be done from home, such as basket knitting.

Secondly, craft has to be formed with knowledge of the past and interacts with today's forms of production. Therefore, it is necessary to understand both this historical process and the ties that today's forms of industrial production do not break with craftsmen.

The relationship of the master with the industry and the continuation of this relationship makes it necessary to question with whom the master collaborates for production. This situation also leads us to the reason why the craftsman has different collaborations. Of course, the most important of these is the use of artisan knowledge and experience. In order to benefit from the master's knowledge, first of all, it is necessary to examine the master, her/his work, and the environment she/he is in.

2.2 Craftsman

According to Jakob (2013), "crafting is an act of the combination of head and hand and engagement with materials, knowledge, experiences, problem finding and problem-solving, cooperation and collaboration" (p. 129). By relating artisan to design theory, Yair et al. (2001) define craftsmanship as "intelligent making" (pp. 377-378). Press and Cusworth (1997), describing this intelligent making as a whole and describe the components as "formal knowledge, tacit knowledge, physical and mental skill, contextual awareness, innovation and personal creative autonomy" (p. 16). Nevertheless, Hoxie (1920) has long argued that true craftsmanship is much more than this "intelligent making". Hoxie (1920) mentions that craftsmen have the knowledge to help "understand and overcome the constant emerging difficulties arising from variations" (p. 131) under work conditions.

According to Shiner (2012), to review the concept of craft, it is necessary to classify craftsman practices over what the purpose is and how they are made, besides classifying them through the material. When considering craft in this sense, it would be appropriate to examine crafts based on process and practice before separating the craft into discipline categories (textile, wood, metal, glass, ceramics) based on materials (Shiner, 2012, p. 232).

It is essential to work in a workshop for some branches of craftsmanship. The reason is that the materials required for production cannot be used in the home environment, and more tools are needed than the tools used in the home (Figure 2.1).

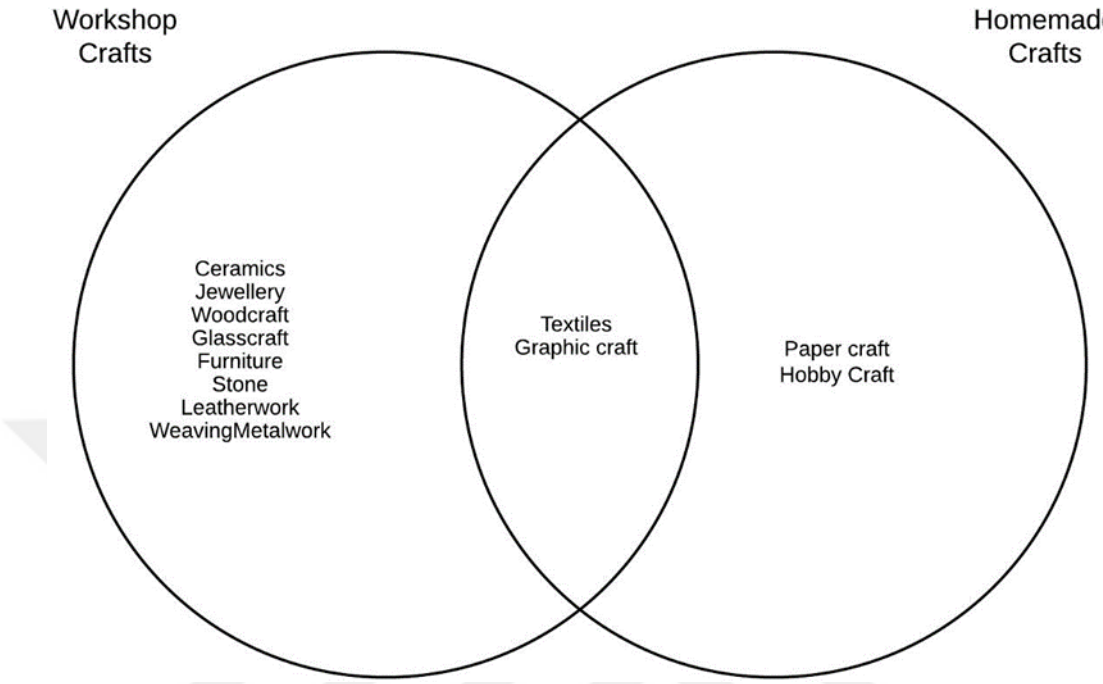


Figure 2.1 : Craft types.

2.3 Craft and Design

Industrialization pushed the craftsman out of the design activity in everyday products and caused the craft to be more associated with art. Besides, the craft's distance from technology and mass production causes it to be perceived as a lower design application. Niedderer and Townsend, 2014). The craft is seen between design and art (Niedderer and Townsend, 2014). One of the most important reasons for this is that while the craft shares its aesthetic concern with art, it shares functionality with design.

The functional contribution of the craft to design comes forward to understand the contribution of craft to NPD from the industry's perspective. Since the aesthetic understanding in industrial design is out of the craftsman's perspective and the craftsman's functional contributions can be more closely associated with the design, the relationship between design and craft is tried to be understood rather than art and craft in this study. According to Shiner (2012), the relation of craft with the design is as important as its relationship with art.

Sennett (2008) states the main difference between designer and craftsman is that while the craftsman ends with a finished, functioning object, the designer does not. Risatti and Trapp (2007) examined the differences between craft and design in terms of product, material, process and prototype. As it is known, while the craftsman produces a unique product by hand, the designer designs industrial productions that provide a large number of identical product outputs. The most important difference at this stage is that the craftsman is both a designer and a producer. On the other hand, while the designer fulfils the design act, production occurs automatically outside herself/ himself. The second issue that Risatti and Trapp (2007) mentions is the material interaction with human. The master has expertise informing the material and knowledge of the material's behaviour, and however, the designer knows the behaviour of the material in production with the machine.

Regarding the process, Risatti and Trapp (2007) mention that the craftsman's conceptualization and form creation parts proceed together, while the form in the conceptualization stage in design may differ from the actual form originating from the material during the construction phase. For the prototype phase, Risatti and Trapp (2007) conveys that the prototype may be the final product for the craftsman, but as a test element for the designer, where he can see the design and production possibilities. Similar to these definitions of Risatti and Trapp (2007), Shiner (2012) also handled the craftsman in the titles of hand-made, material and skill. Although crafts and design have differences, elements such as "sustainability, social responsibility or small-scale production" in the design discipline create intersections with the craft discipline. (Shiner, 2012). For instance, the Bauhaus school integrates crafts with the design is an essential example of creating design thinking processes along with crafts (Gürcüm and Kartal, 2017).

2.4 Role of Historical Processes on Crafts

Historically, the concept of craftsmanship is differentiated both from the country and from a material source. However, before and after industrialization in England in the late 18th century and early 19th century, craft's global influence spread over time. The historical process to be examined within this thesis focuses on transferring the connections and roles that craft discipline has over time. This analysis aims to understand the current meanings of the periods that influenced the craft in history.

In ancient western culture, the craft described as "techne: the art and the theory of making" (Johnson, 2010, p. 675) and “techne was seen as the source of creative tendencies, the formation of new ideas, the place of invention” (Johnson, 2010, p. 677).

In the artisan period, the craftsman carries out the entire process by herself/himself, and the craftsman has complete control and expertise on production tools. There are craft guilds that regulate the apprenticeship system and ensure the protection of craftsmanship.

With industrialization, factories and mass production, while delivering easy, low-cost, and fast products to the ever-growing population in cities, narrowed the work areas of craftsmen in some sectors and workers who made products per piece from their homes. Artisans and craftsmen who lost control of production and believed that they were compromised on quality with mass production started the "Arts and Crafts" movement under the leadership of William Morris. This movement started in England and affected Europe, North America and Japan. Looking at the "Arts and Crafts" movement from the point of craft, principles such as making productions that reflect the material characteristics and following a function of design are the elements that are also proposed for combining art and industry today.

According to Niedderer and Townsend (2014), in the 20th and 21st century, the craft is generally defined by what it is not instead of and what it is (Niedderer and Townsend, 2014). However, nowadays, new forms of production, the digital world, and developing and changing machines and hand tools are why researchers see craftsmanship entirely in the broader umbrella. With this point of view, it is not easy to define craftsmanship's definition through what is not. Instead, it would be better to define craftsmanship with the help of collaborations, changing technologies and new business models.

The craft was influenced by changes in industry, design, design and craft education and academic research on these areas. The most important of these changes was the revolution in the industry. Besides, the studies on design education and knowledge transfer affect the position of the craft. Periods and events summarized in the table below (Table 2.1) in recent history will clear up the concept of craft today and in the future.

Table 2.1 : Critical periods and movements for craft.

Critical Periods and Movements	Details
Before the Industrial Revolution	Mainly, this period was the first artisan period. The craftsman carries out the entire process by himself, and the craftsman has complete control and expertise on production tools. There are craft guilds that regulate the apprenticeship system and ensure the protection of craftsmanship.
Manufacture Period 1550-1775	Manufacture is a form of hand-production based on a division of labour of individual competent workers. It is formed by independent artisans gathering at individual workplaces where they support each other to get the final shape of the product under the control of a single capitalist. In this period, the craftsman has lost his holistic control over the production. Craftsmen do not dominate production tools alone is working under the supervision of their employer. This period is a transitional period for the industrial revolution.
Industrial Revolution 1750-1850	During this period, production was mechanized and done in massive and large quantities. In this production model, where machines are heavily used craftsman is substantially out of the manufacturing system. The craftsman tried to maintain his presence by working in the areas where his knowledge and experience is needed.
The Arts and Crafts Movement	The Arts and Crafts Movement is an act of revitalizing artisans and craftsmen, whose activity is limited to the industrial revolution. This movement is known for its honest handling of the material and its emphasis on simple design.
After the First World War and Bauhaus Movement 1918-1933	After the war, the need for daily use products and furniture has triggered the production in this area. With the production of everyday products, craft gains an opportunity to take part in production again. Through the Bauhaus movement, an educational program was planned to create functional everyday products with craft aesthetic values.
Tacit Knowledge Transfer (Nonaka) 1991	Academic studies have been conducted on tacit knowledge and knowledge transfer in the 1990s. Especially, Nonaka's studies are significant in terms of tacit knowledge and its use in industry for innovation.
Digitalization 1990-today	With digitalization, digital tools are used in prototyping and product development in manufacturing. Although these tools seem tobe an obstacle to the craftsman, some craftsmen use these tools as a means of knowledge sharing and collaboration.
Today	Today, the craftsman responds to unique product models and supports flexible manufacturing systems. Also, while industrialization is accelerating, craft-based industries continue to work with craftsmen.

Each of these historical processes gives us information about the position of the craftsman. Today, the craftsmen who continue production as before the industrial revolution produce personalized products or continue crafting techniques that are not suitable for the manufacture or serial production due to their material. Manufacture production is still active for specific sectors such as leather. A new production method was formed with the industrial revolution, which rivals the Crafts. However, crafts are still active due to flexible production systems, control of products and production methods that are not suitable for mass production and due to consumer attitudes. All of these results are related to the ongoing effects of important events in the industry's history. Recently emerging development of activity areas of craft knowledge and the technologies that will enable craftsmen to create different production models and find new markets allows the artisan to increase the activity area. With all these changes, the craft is returning to western society and is called "the third wave of craft" (Hampton, 2010).

In the future, craftsmen may have the opportunity to have their digitized machines to gain control of the manufacturing again. However, this process can take place step by step from manufacture production to individual entrepreneurship, and today's individualistic way of life may lead to individual manufacturing systems. For this reason, it is significant to support craft and craft-related activities in the future, which are claimed as the basis of third sector growth by some commentators (Press and Cusworth, 1997, p. 19) due to the potential for sustainability, innovation, and added value.

2.5 Industrialization and Craft

In the early days, everyone was trying to produce the products they needed in the historical process. Then, it was seen that some people in society were more skilled in making handmade products. These people who made manual production more skilled stood out from other producers in society. Other people exchanged ingredients such as the food with these products. With the invention of money, they started to buy these products from craftsmen. In this manner, there has been a shift from maker society to skilled craftsmanship (Whitaker, 1967; Doğan, 2013). However, problems such as craftsmen's different price policy practices or not meeting specific ethical standards regarding production emerged at this stage. Therefore, guild organizations have

stepped in to ensure equality and fairness in production and price policies (Yi, 2004). The guilds organized the competition between the masters and provided solidarity. It was not possible for masters not included in the guild to exist in the market. At this stage, the masters were the ones who dominated the entire production process and also had their capital.

The development of trade routes overseas caused craftsmen to leave their places to sell their goods (Tezgel, 2013). This situation affected their production capacity as they could not produce as long as they traveled for trade. For this reason, some craftsmen started to work as merchants in the exchange of goods (Tezgel, 2013).

The masters, who also could sell in advance, now had to share their competencies with traders. This situation broke the link between the craftsmen and the customer who requested the product. Besides, the craftsmen have lost their own decision of how much and what they will produce. The merchant was the person who guided the craftsman's production numbers based on the sales figures. This process is called the "kaufsystem", the purchasing system (Schlumbohm, 1981, pp. 98–99). With the ability to sell over long distances, craftsmen encountered many requests and had to speed up to produce more products. This process revealed production in a manufacturing order before industrialization (Figure 2.2).

"In terms of production style, the manufacture is hardly distinguishable from guild handicrafts, in the narrow sense of the word, except by the use of multiple workers at the same time by the same individual capital." (Marx, 2003, p. 284). The manufacture period is when masters come together in a mastery workshop and are responsible for producing a part of the product and working together (Tezgel, 2013). The purchasing system (kaufsystem) placed the merchant between craftsman and the consumer, and craftsman lost the holistic approach on the production with manufacture period.

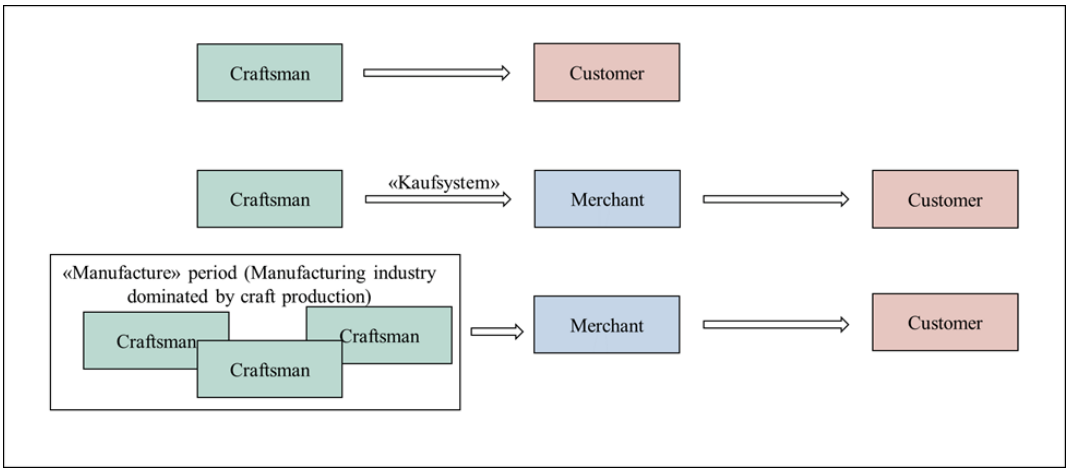


Figure 2.2 : The transformation of craftsmanship before industrialization.

On the other hand, it would not be wrong to define industrialization as the machines' commissioning to provide more massive production. The manufacturing system is a step in the transition to industrialization (Tezgel, 2013). The industrialization has led to its progress by gaining speed by firstly inventing the machines and making inventions such as the steam machine that will operate these machines. In the factories formed by industrialization, masters have now become a worker. The masters working in the factories have wholly lost their control over the product due to increased division of labour and mechanization. Besides, the craftsman, who had the production tool in the manufacturing system, lost his production tool as a worker in the factory system. Also, the craftsman was excluded from the skill of designing in industrial production.

2.6 Craft Knowledge

Craft knowledge is knowledge acquired over many years and gained experience through apprenticeship (Gamble, 2004, p. 190). This practical experience causes tacit knowledge (Polanyi, 1967; Ray, 2009, p. 76; Schön, 1992; Wood et al, 2009, p. 66). This craftsman's knowledge includes using the necessary tools and materials and mastery of the whole making process. As cited previously, this comprehensive knowledge of the craftsman in a broad sense can be described as "intelligent making" (Press and Cusworth, 1997, p. 16; Yair et al, 2001, pp. 377-378), which includes "formal knowledge, tacit knowledge, physical and mental skill, contextual awareness, innovation, and personal creative autonomy" (Press and Cusworth, 1997, p. 16). Understanding the tacit knowledge of the craftsman requires research of a versatile perspective due to the impossibility of generalization of tacit knowledge.

Craft knowledge is stated by "experiential knowledge" (Niedderer and Townsend, 2014, p. 641) and "practice-based knowledge" (Muth et al, 2006, p. 75) words in the literature. This experiential knowledge requires researching and thinking about the learning, using and sharing- teaching this knowledge. According to Nonaka, the transfer of the tacit-to-tacit knowledge is done by "observation, imitation and practice". The person who receives the knowledge as a result of this transfer gains his knowledge. This tacit knowledge of craftsmen contains the knowledge of tools, materials and making. According to Hogseth (2013), a craftsman's capacity to know something includes two terms: "knowing what" and "knowing how"." Knowing what" is related to the craftsman's technical skill and physical acting through making. "Knowing how" contains knowledge and experience related to material selection, using tools, creating a form and choosing the proper making method. By using this tacit experiential knowledge, craftsman brings a product to the market by having a holistic approach from designing to finishing. The craftsman can not only bring a product to the market by using specific tools with his material and production method expertise but also try to understand and overcome the difficulties that arise outside his or her control during the creative process of the artefact (Hoxie, 1920):

> We think of craftsmanship ordinarily as the ability to manipulate the tools and materials of a craft or trade skillfully. But true craftsmanship is much more than this. The essential element in it is not manual skill and dexterity but something stored up in the mind of the worker. This something is partly the intimate knowledge of the character and uses of the tools, materials and processes of the craft which tradition and experience have given the worker. But beyond this, and above this, it is the knowledge which enables him to understand and overcome the constantly arising difficulties that grow out of variations not only in the tools and materials but in the conditions under which the work must be done (Hoxie, 1920, p.131).

Understanding and overcoming these challenges lead us to two conclusions. First, understanding the difficulties gives the craftsman the ability to find problems, and overcoming the difficulties gives the craftsman the ability to solve problems. Secondly, the craftsman, who finds and solves the problem, constantly carries out the production process with a continuous feedback process (Shiner,2012). This continuous

feedback process enables it to move forward by preserving and improving the best method.

3. NEW PRODUCT DEVELOPMENT AND TACIT KNOWLEDGE

In this chapter, the connection between knowledge, which is one of the most critical inputs to create innovation in companies and innovation, is revealed through the sources in the literature. In this thesis, the transfer of craftsman knowledge is questioned within the scope of product innovation. When examining the literature, new product development and craft knowledge keywords and literature searches are limited. By including the concepts of innovation and tacit knowledge, which are thought to be relevant to the subject, the literature scope of the study was expanded, and a literature search was carried out in more than one field. Both management and design literature has been studied in this context. In this way, it is planned to reduce the subject to more conciseness from a wider literature. In this section, the concepts of innovation and new product development will be explained first. Afterward, the importance of knowledge for product development will be mentioned. Finally, the evaluation of tacit knowledge within the scope of new product development will be conveyed.

3.1 Innovation and Its Importance for Companies

Being a pioneer in the market by innovation and being competitive against changing conditions are the elements that provide dynamism and continuity for companies. Companies have two main objectives: to make a profit and ensure continuity. In order to ensure these elements, companies must implement innovations that enable them to be in a state of change and transformation. Drucker (1985) describes innovation as “the effort to create purposeful, focused change in an enterprise’s economic or social potential” (p.96). Schumpeter (1950) defined innovation as encompassing new products, processes, raw materials, management methods and markets. According to OECD (2005) innovation is "the implementation of a new or significantly improved product (goods or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external

relations" (p. 46). The innovation process consists of four phases: "idea generation, selection, development, and launch/diffusion/sales" (Salerno et al, 2015, p. 59).

3.2 Innovation Types

In their simplest form, forms of innovation include innovation related to product, service, or process. Product innovation is the improvement of the existing product or the creation of an entirely new product. Service innovation is to create a format that will be presented with a new perspective in the service industry. Process innovation is the innovation that companies create by renewing the process in production, management, sales or by designing new processes in these areas.

OECD (2005) included more detailed statements in the definitions of innovation. According to the OECD (2005), there are four types of innovation: product, process, marketing, and organisational innovations. Product innovation refers to products that have been improved or designed as a new product from the beginning.

Although OECD (2005) sees the design as part of product innovation, it does not define this design as innovation if the design does not create a significant change in product functionality and intended use. OECD (2005) points to marketing innovation for all other forms of design that do not create a significant change in product functionality and intended use. According to OECD (2005), a marketing innovation is "the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing" (p. 49). Process innovation refers to a significant improvement, especially in production and delivery processes. Finally, an organisational innovation is "the implementation of a new organisational method in the company's business practices, workplace organisation or external relations" (OECD, 2005, p. 51).

3.3 Product Design and Soft Innovation

Innovation provides a measurable economic output, and product design plays an essential role in creating this output. Product design can provide functionality innovation and aesthetics and form innovation and can make a significant contribution to the economy. In the study of Swan et al. (2005), four skills related to product design were obtained: "(1) functional; (2) aesthetics; (3) technological; and (4) quality" (p.

144). OECD (2005) has examined the aesthetic contribution of the design under the title of marketing innovation. However, Stoneman (2010) emphasised that the design activities created especially in creative industries are insufficient to define by marketing innovation as defined by OECD (2005). According to Stoneman (2010), there are innovations in the economy that are not covered by the definition of OECD (2005). For instance, Stoneman (2010) cites a new clothing creation, or a new furniture set design as an example of this situation. According to Stoneman (2010), as a result of all this discussion, design innovations outside functionality and technological innovation can be defined as soft innovation: "Soft innovation is innovation in goods and services that primarily impacts upon aesthetic or intellectual appeal rather than functional performance" (p. 22).

Stoneman (2010) defines soft innovation in two stages: The first is non-functional innovation with aesthetic appeal, and the second is aesthetic innovations that lead to functional product changes. Stoneman (2010) thinks that what OECD (2005) describes as "marketing innovation" itself compares to the second type of definition of soft innovation. However, although it does not bring a functional innovation, it is uncertain where aesthetic innovations stand in terms of innovation. Also, new products do not always create functional, technological or usage differences in the sectors selected for this thesis study. For instance, glasses with different forms in the glass industry can be designed to create aesthetic appeal instead of new functionality. Therefore, in this thesis, innovations in companies will be examined in the context of functional, aesthetic, quality, and technological elements under the title of new product development.

3.4 New Product Development

In today's competitive markets, two essential elements will make companies stand out in this race. These are having a cost advantage in the market and developing a new product. According to Kumar and Phrommathed (2006), creating innovation instead of having a cost advantage is more limitless and contributes to the company's growth. Therefore, it is imperative to continually plan and produce new products in the 21st century to compete in the market. New product development starts with an opportunity in the market and ends with the launch of the new product (Artmann, 2009). Many researchers have revealed the progress of the new product development process. This

process can be broadly described in terms of the stages of "idea generation, idea screening, concept development and testing, marketing strategy, business analysis, product development, test marketing and commercialisation" (Kotler and Keller, 2006, p. 254). Shenhar (2001) states that this linear approach may not be sufficient for all new product development projects. Traditional linear methods can usually help us to understand the NPD dynamics in large companies. However, it can be argued that the new product development process is not linear but it loops back at certain stages (MacGregor et al, 2006).

According to Ulrich and Eppinger (2004, p. 14), the product development process consists of six stages: "planning, concept development, system-level design, detail design, testing and refinement, production ramp-up" (Figure 3.1). The factors affecting new product development and initiating new product development within the company may show changes. For example, one company can design a new product by evaluating an opportunity in the market, while another company can create a new product due to technological developments. Ulrich and Eppinger (2004) list these elements as follow: “market-pull products, technology push products, platform products, process-intensive products, customised products, high-risk products, quick build products and complex systems" (p. 19). In other words, product innovations are classified as market-pull, technology-push and design-driven.

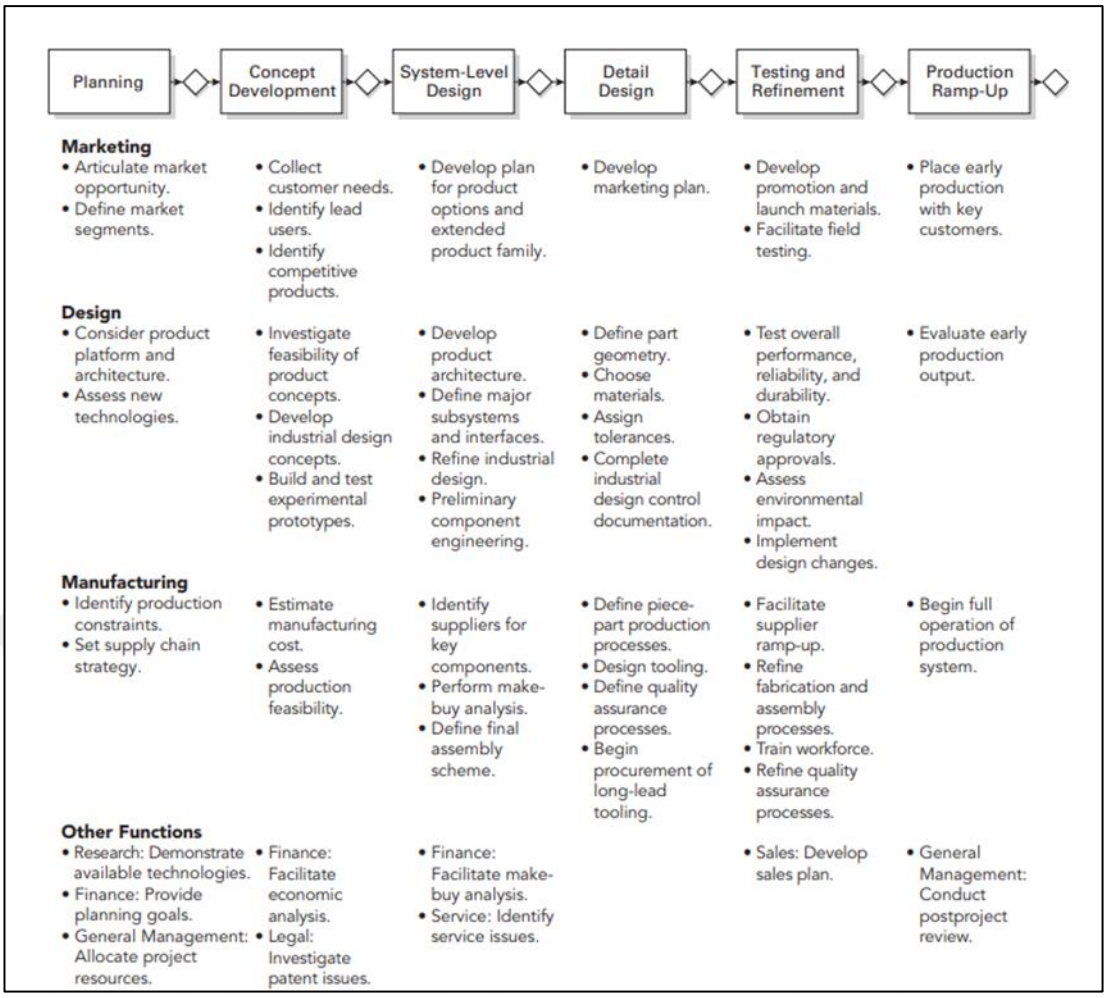


Figure 3.1 : New product development process (Ulrich and Eppinger (2004, p.14).

3.5 Success Factors for New Product Development and Contingency Approach

One of the most important indicators of the success of the new product development process is acceptance in the market and sales figures. However, companies must estimate a product that will be accepted before going to the market. Little (1991) lists the changes that affect new product development as follows: "increased levels of competition, rapidly changing market environments, higher rates of technical obsolescence, shorter product life cycles" (as cited in Griffin, 1997, p. 430). Many factors are significant to be successful in new product development. Connell et al. (2001) list these factors as follows: “(1) executive direction, (2) project team, (3) innovation strategy, (4) internal factors, and (5) external factors” (p. 36). Therefore, the fact of actors, decisions, situations, and management reveals companies' success in developing new products. Although these elements are evaluated separately, they affect each other to a great extent. For instance, it cannot be considered that the

company takes its innovation strategy independently from human resources or internal and external factors. The innovation strategy is based on a specific component such as "process, speed, learning, market, technology, and quantitative" (Lynn and Akgun, 1998, 11). The innovation and NPD strategy determines the competitive conditions in the market and what the companies can do with the instruments they have. When this situation is evaluated with the system approach, companies have inputs; they process and reach the output. However, the contingency approach advocates a situation-specific management and strategy model, focusing on the diversity of each company's dynamics and environmental factors. In this context, it will be appropriate to list certain internal and external factors for companies developing new products. he internal factors of companies can be evaluated on human resources, technology, production capacity and mission-vision scale. External factors affecting companies can be listed as a market, customer, social and cultural conditions, collaborations, competition, legal restrictions, and incentives. The most important of all these elements considered in the contingency approach can be considered an environment, organisational size, and strategy (Donaldson, 2001). In this thesis, inferences are made by focusing on company sizes, company environment, collaboration capacities and new product development strategy in order to evaluate the innovation potential of companies within the framework of the use of craft knowledge.

3.6 Knowledge and People in Developing New Products

Knowledge is the most valuable input and output feature for businesses and industries. In the case of the word "knowledge", information and knowledge words come out of the English language. Revealing the meaning of these two words will lead to a better understanding of the concept of knowledge. Comparing knowledge and information words indicates knowledge word is more than the word "information." When a person learns and uses information, she/he becomes knowledgeable (Chyi Lee and Yang, 2000). Hence, the handling of information as "knowledge" can be explained by its use by an expert.

In the competitive markets of the 21st century, it is necessary to produce new products and continuously offer innovation through these products. Therefore, to realise this, companies give importance to finding and developing the elements that will provide new product development and innovation. The most important source that will provide

innovation is knowledge (Nonaka, 1991; OECD, 2013; Richtnér et al, 2014) and creating knowledge is significant to reach innovation. Innovation is the process of knowledge transformation resulting in new knowledge as well as new products, services and processes, and intellectual property (Penide et al, 2013). Roper et al. (2008) divide the innovation process into three main areas of activity:

1. "The first activity of knowledge sourcing

2. The second one of knowledge transformed into a physical innovation (new product or process)

3.As the innovation of firms becomes a reality, a final stage is dedicated to the exploitation of innovation" (pp. 961-962).

The first two mention the importance of knowledge in the innovation process. It is not only enough to acquire knowledge, but it is also essential to transforming this knowledge. The innovation process is associated with knowledge transfer (Penide et al, 2013). In the scope of transforming and transferring information, I come across matters as knowledge types, knowledge transform methods, and people who will transform this knowledge.

3.7 Types of Knowledge

The management literature gathers knowledge types epistemologically under two headings: tacit and explicit knowledge (Bloodgood and Chilton, 2012; Cavusgil et al, 2003; Gourlay, 2006a; Nonaka, 1994). Explicit knowledge is verbally transmitted, encoded knowledge (Nonaka, 1994; Polanyi, 1967). Explicit knowledge is used and shared through words, numbers and symbols and creates shareable data within individuals. Besides, tacit knowledge cannot be encoded and can be transmitted by experience (Bloodgood and Chilton, 2012; Nonaka, 1994; Polanyi, 1967). Tacit knowledge compromises experiences are difficult to express by words and is shareable by collaborative making (Nonaka and Takeuchi, 1995). Explicit knowledge is more easily accessible knowledge due to being encoded and transmitted easily. However, since tacit knowledge is transmitted through experience and as a source of human experience, it is more difficult to reach, reveal, and evaluate it. Therefore, reaching tacit knowledge and transferring this knowledge to the organisation may be a competitive advantage for companies.

3.8 Tacit Knowledge and New Product Development

It is difficult to code tacit knowledge because it is based on the experience and practice of individual people. Studies have been carried out in the literature, especially on the significance of tacit knowledge for the new product development. (Erichsen et al, 2016; Goffin and Koners, 2011; Gourlay, 2006b; Leonard and Sensiper, 1998b; Liu and Wang, 2011; Mascitelli, 2000; Muñoz et al, 2015; Okuyama, 2017; Richtnér et al, 2014; Sakellariou et al, 2017; Stanica and Peydro, 2016). Leonard and Sensiper (1998b) defines the two most important contributions of tacit knowledge as problem finding and problem-solving. The contribution of tacit knowledge in problem-solving stems from the experience of progress by producing solutions to the problems faced by the person with tacit knowledge while doing the artefact (Simon, 1996). The contribution of tacit knowledge to finding problems is the employee's success who has a holistic approach to frame the problem (Leonard and Sensiper, 1998b).

Tacit knowledge, dependent on one's own experience, should be shared with other employees working in the company in new product development processes and should be learned and used to become organisational knowledge. However, uncovering, sharing, and transforming this non-coded knowledge into organisational knowledge can have various difficulties. In a new product development project, organisational knowledge can be defined as "learned, perceived, experienced and discovered" knowledge by individuals (Erichsen et al, 2016, p. 2). Therefore, people with tacit knowledge can transfer this knowledge in collaboration through mutual learning and knowledge sharing. There are different views in the literature about the use of tacit knowledge for new product development. According to Nonaka et al. (2000), there is a need for an environment and a moderator to create new knowledge through tacit knowledge and using it for new product development (Nonaka et al, 2000). Nonaka and Takeuchi (1995) state the ways of transforming different knowledge into each other with the "SECI" spiral in the companies and summarises the transfer and methods of tacit and explicit information in this environment as follows (Figure 3.1):

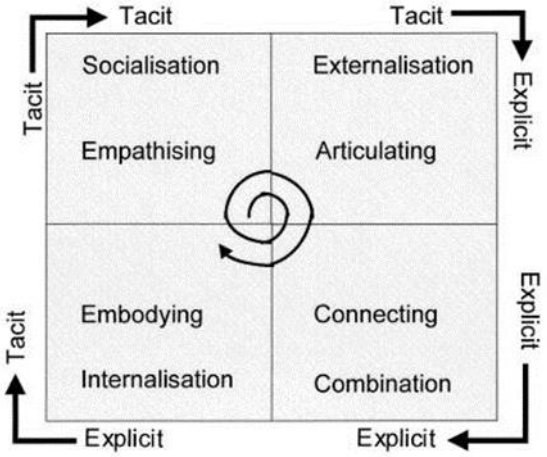


Figure 3.2 : Nonaka's SECI (socialisation, externalisation, combination, internalisation) process (Nonaka et al, 2000, p.12).

According to Nonaka et al. (2000), tacit knowledge can be transformed from tacit-to-tacit knowledge through practice in a team and tacit to explicit knowledge through externalisation through dialogue (Figure 3.1). Nonaka (1994) also argues that knowledge creation, which is essential for innovation, will be realised by transforming tacit knowledge into explicit knowledge. Nonaka et al. (2000) argue that, since the tacit knowledge contains know-how, it should be transformed into explicit knowledge for organisational use in the companies. However, the literature has different opinions regarding the transformation of tacit knowledge into explicit knowledge (Gourlay, 2006a; Ray and Clegg, 2007). According to these authors, tacit knowledge cannot be transformed into explicit knowledge. Opinions on knowledge transfer will be discussed in the next chapter.

In conclusion, it has been seen that a single literature review will not be sufficient to conduct a study on the transfer of craftsman knowledge. On the basis of knowledge, people, and organization, in order to evaluate both the definition of knowledge, the human existence that uses and develops this knowledge, and the organizational structures that manage this knowledge and people, in this study, the concepts of tacit knowledge and innovation related to craft knowledge have been researched from the management literature as well as the design and craft literature.

4. CRAFT KNOWLEDGE, NPD AND COLLABORATION

4.1 Craft Knowledge and Craftspeople in Developing New Products

Craftsmanship is usually achieved through the apprenticeship of master craftsmen (Gamble, 2004). So, craft knowledge is a type of knowledge acquired over many years and gained with experience through apprenticeship (Gamble, 2004, p. 190). This craftsman's knowledge includes using the necessary tools and materials and mastery of the whole making process. This practical experience causes tacit knowledge (Polanyi, 1967; Ray, 2009, p. 76; Schön, 1992; Wood et al, 2009, p. 66). This comprehensive knowledge of the craftsman in a broad sense can be described as "intelligent making" (Press & Cusworth, 1997, p. 16; Yair, Press, and Tomes, 2001, pp. 377-378) which includes “formal knowledge, tacit knowledge, physical and mental skill, contextual awareness, innovation and personal creative autonomy” (Press and Cusworth, 1997, p. 16).

Understanding the tacit knowledge of the craftsman requires research of a versatile perspective due to the impossibility of generalisation of tacit knowledge. By using this tacit knowledge, the craftsman can not only bring a product to the market by using specific tools with his material and production method expertise but also try to understand and overcome the difficulties that arise outside his or her control during the creative process of the artefact (Hoxie, 1920). This thesis includes researching how the craftsman takes part in solving the difficulties that arise during product development. In this way, the contribution of the knowledge and experience of the craftsman, which is considered together with the industrial production conditions, in the new product development process for the relevant sectors in this thesis is evaluated.

4.2 Contribution of Craft Knowledge to NPD and Innovation

In the process of new product development, knowledge is an essential factor in both input and output. As stated previously, innovation is the process of knowledge transformation resulting in new knowledge as well as new products, services and processes, and intellectual property (Penide et al, 2013) and innovation process is associated with knowledge transfer (Penide et al, 2013). This thesis focuses on transferring tacit knowledge in craft-based industries, where craft knowledge is still relevant in new product development and innovation stages. For this reason, the literature on the transfer of craft knowledge to these processes has also been reviewed.

Researchers in both the fields of design (Blundel and Smith, 2013; Gamble, 2004; Muth et al., 2006; Niedderer and Townsend, 2014; Schwalbe, 2010; Yair et al, 2001) and management (e.g., Haldin-Herrgard, 2000; Nonaka, 1991; Ray, 2009) have produced academic studies on craft knowledge and transfer in the literature. In these studies, researchers in the field of design focused on craftsmen's collaborations and craft-making practices, while researchers in management focused more on tacit knowledge transfer and its management.

Bettiol and Micelli (2014), Von Busch (2013), Hogseth (2013), Niedderer et al. (2011) and Yair et al. (1999) have produced substantial research to understand the transfer of craft knowledge and craftsmen's collaboration capabilities. Bettiol and Micelli (2014) analysed collaborations in different-sized companies by examining the role of craftsmen and designers in NPD processes. Collaborations can occur between craftsmen and individual local designers (Duarte Alonso and Bressan, 2014; Rhodes, 2015) as well as between craftsmen and designers in industrial companies in different sectors such as ceramics (Zheng and Nitsche, 2017), textile (Woolley et al, 2015), furniture (Cheatle et al, 2014) and glass (Hankey, 2013).

Additionally, there are different views related to tacit and craft knowledge transfer in the literature. According to Nonaka et al. (2000), tacit knowledge must be externalised to be used within the organisation. Nonaka (1994) explained the importance of externalisation and argued that the process of creating knowledge, as we understand it, is caused by the transformation of tacit knowledge into explicit knowledge. Stanica and Peydro (2016) thought similarly about the externalisation of tacit knowledge. They claimed that if tacit knowledge cannot be translated into explicit knowledge, it may

continue to provide value to the company, but this value will remain at the individual level and cannot be turned into organisational knowledge. In contrast, Niedderer, et al. (2011) stated that craft knowledge – as a type of tacit knowledge – cannot be transformed into another form of knowledge but can be integrated into the organisation by multidisciplinary teams.

The powerfulness of craft knowledge depends on its inability to be imitated because it cannot be verbalised and encoded. These features provide a competitive advantage to the companies which transfer this kind of knowledge to the innovation processes. (Yair et al, 2001). Transfer of craft knowledge needs to be investigated within the company, both within the design groups at the micro-level and at the macro level at the whole organisation environment to understand the potential of craft knowledge.

Researchers have studied on how to efficiently and effectively making this transfer. Mascitelli (2000) recommended that managers who are trying to uncover tacit knowledge should discover their employees' commitment to the innovation or NPD process and improve their internal communication with innovation NPD teams.

Tacit knowledge transfer is an essential contribution to companies' innovation efforts. A meaningful way to realise this knowledge transfer is collaboration through the minds who have the power of tacit knowledge (Cavusgil et al, 2003). As stated before according to Niedderer et al. (2011) craft knowledge as tacit knowledge cannot be transformed into another knowledge but can be integrated into the organisation with multidisciplinary teams. For this reason, in the sectors where tacit knowledge is used, the human factor with this knowledge gains importance. However, it is challenging to manage tacit knowledge because it is analysed in the human mind and can change with human factors (Joia and Lemos, 2010). Craft knowledge can be integrated into design-related management models in multidisciplinary teamwork. Collaborations, now referred to as hybrid combinations that craftsmen are involved in, offer new product opportunities (Blundel and Smith, 2013).

Through collaboration and working with the material, which is the main field of the craft, this "material work becomes a means of investigation, the skill becomes knowledge and making is thinking" (Peer, 2011, pp. 37). With craftsman's material and knowledge experiences, the craftsman has the ability of problem finding and problem-solving through making collaborations (Jakob, 2013), which is a necessary

qualification for idea generation, one of the first steps of NPD (Goffin and Koners, 2011). Then, the craftsman can support decision-making during the prototype stage of NPD by creating artefacts using material expertise and production method knowledge (Yair et al, 1999). The resulting collaborations offer new product opportunities (Blundel and Smith, 2013).

4.3 Transferring Craft Knowledge from the Employee to the Organization

Companies' access to knowledge is generally obtained through the company's employees, which is another significant resource for innovation. At the same time, tacit knowledge is very dependent on the individual worker because the human experience defines this knowledge. However, knowledge related to this experience can be externalised in order to be used within the organisation. As stated before Nonaka (1994) argues that the process of creating knowledge is caused by the transformation of tacit knowledge into explicit knowledge. If this tacit knowledge cannot be translated to explicit knowledge, it may continue to value the company, however it cannot turn into organisational knowledge (Stanica and Peydro, 2016). Besides, Niedderer et al. (2011) state the use and sharing of tacit knowledge can take place in multidisciplinary teams. As stated previously, Mascitelli (2000) recommends managers “crafting a culture of innovation, creating a positive identity for project teams and building an environment for tacit knowledge sharing” (p. 186) to uncover the tacit knowledge.

These suggestions begin with the commitment of the people with tacit knowledge to product development or innovation and making them feel that they are part of the process. After that, tacit knowledge must be shared and revealed within an NPD team. In the third stage, the shared tacit knowledge is expected to generate valuable knowledge that can be used for the organization (Figure 4.1).

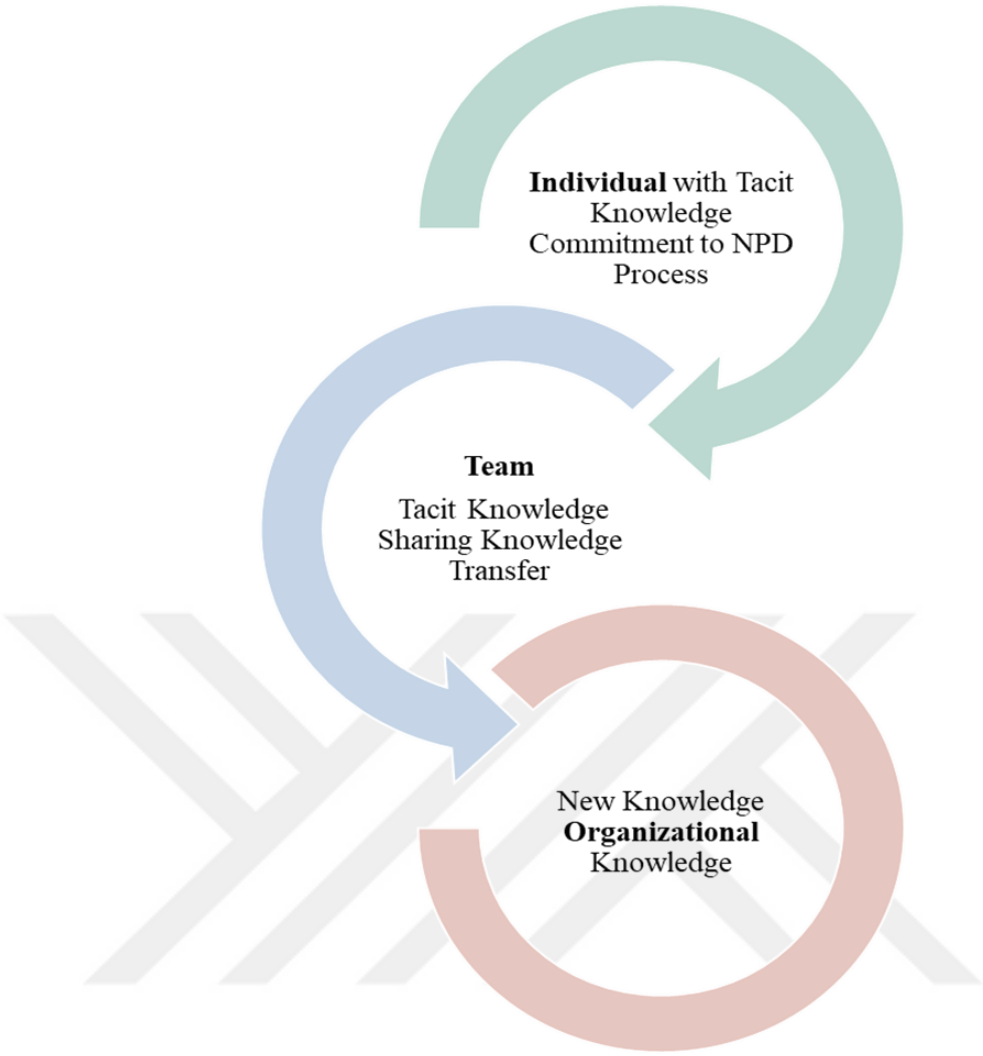


Figure 4.1 : Creating new knowledge through teams (derived from Mascitelli, 2000).

Referring to Figure 4.1, examining the process of sharing tacit knowledge and evaluating it in teamwork to create new knowledge in separate headings will facilitate understanding this process in detail.

4.3.1 Individual-team member

An individual who has tacit knowledge cannot put this knowledge on paper but reveals this knowledge as an experience, performance, and problem-solving that can be shown when called. Polanyi (1967) explains tacit knowledge with these words: "We can know more than we can tell" (p. 4). In other words, tacit knowledge is not about knowing what; it is about knowing how (Grant, 1996; Johnson, 2007; Nonaka et al., 2000).

Tacit knowledge cannot be written or encoded; however, in a community of people, the ones who have this knowledge can become out through observations and the results of their work. One of the main points of these observations is the success of people

with tacit knowledge on problem finding and problem-solving (Leonard and Sensiper, 1998b).

4.3.2 Team- knowledge sharing and transferring environment

As already mentioned, employees with tacit knowledge in companies are an essential source of know-how. However, not every company can sufficiently benefit from this know-how. In order to be able to evaluate this source of know-how in the most useful way, it is necessary to have the human resources and environmental conditions that will firstly understand and transform this knowledge. The most crucial goal of this community of people working in new product development processes is to use this shared and transferred new knowledge to create new products or processes.

When the new product development process is examined, it is seen that the areas where the idea was formed, discussed and transferred during the new product development process are also the areas where the transfer of tacit knowledge is possible. These are the first stage of new product development, the idea generation, and the prototype stages in which the product is tested.

In evaluating the tacit knowledge in the process of new product development, studies in the design and craft literature related to management and knowledge management have been carried out separately and the areas where they coincide remain very limited. The following Table 4.1 is prepared to discuss the intersection points of these two works of literature:

Table 4.1 : NPD process and tacit knowledge transfer.

NPD Process	Initiation Stage	Development Stage	Commercialization Stage
Related Activities	Idea generation Concept generation Problem finding and solving Preparing concept of new product	Product design Prototyping Product use testing Production start-up	Market testing, After-sales support, Marketing mix components
References to NPD and Knowledge Management	Carbonara, N., and Scozzi, B. (2006). Cognitive maps to analyze new product development processes: A case study. Technovation, 26 (11), 1233–1243. Flint, D. J. (2001). Compressing new product success-to-success cycle time: Deep customer value understanding and idea generation. Industrial Marketing Management, 31, 305–315. Howlett, R. J., Gabrys, B., Musial-Gabrys, K., and Roach, J. (Eds.). (2013). Innovation through knowledge transfer. Springer-Verlag. https://doi.org/10.1007/978-3-642-34219-6 Madhavan, R., and Grover, R. (1998). From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management. Journal of Marketing, 62 (4), 1– 12.	Carbonara, N., and Scozzi, B. (2006). Cognitive maps to analyze new product development processes: A case study. Technovation, 26 (11), 1233–1243. Mason, G., and Wagner, K. (1999). Knowledge transfer and innovation in Germany and Britain: Intermediate institution models of knowledge transfer under strain? Industry and Innovation, 6:1, 85-109. Richtnér, A., A˚hlström, P., and Goffin, K. (2014). Squeezing R&D: A study of organizational slack and knowledge creation in NPD, using the SECI model. Journal of Product Innovation Management, 31 (6), 1268–1290. Wu, Q., Luo, X., Slotegraaf, R. J., and Aspara, J. (2015). Sleeping with competitors: the impact of NPD phases on stock market reactions to horizontal collaboration. Journal of the Academy of Marketing Science, 43 (4), 490–511. Ulrich, K. T., & Eppinger, S. D. (2004). Product development process. (3rd ed). Boston: McGraw-Hill/Irwin.	Wu, Q., Luo, X., Slotegraaf, R. J., and Aspara, J. (2015). Sleeping with competitors: the impact of NPD phases on stock market reactions to horizontal collaboration. Journal of the Academy of Marketing Science, 43 (4), 490–511.

Table 4.1 (continued) : NPD process and tacit knowledge transfer.

NPD Process	Initiation Stage	Development Stage	Commercialization Stage
Related Activities with Tacit Knowledge	Idea generation Problem finding- solving	Prototyping	
References to NPD, Tacit Knowledge and Craft Knowledge	Leonard, DorothySensiper, S. (1998a). What is Tacit Knowledge? California Management Review, 40 (3), 112–132. Schwalbe, M. (2010). In Search of Craft. Social Psychology Quarterly, 73 (2), 107–111. Zhang, W., Zhang, Q., and Song, M. (2015). How do Individual-Level Factors Affect the Creative Solution Formation Process of Teams. Creativity and Innovation Management, 24 (3), 508–524.	Valentine, L., Fillis, I., and Follett, G. (2013). An exploratory investigation into the role of a research and development programme on future craft practice. Arts Marketing: An International Journal, 3 (2), 95–116. Yair, K., Press, M., and Tomes, A. (2001). Crafting competitive advantage: crafts knowledge as a strategic resource. Design Studies, 22 (4), 377–394. Yair, K., Tomes, A., Press, M., And, A., and Campus, P. L. (1999). Design through making: crafts knowledge as facilitator to collaborative new product development. Design Studies, 20 (6), 495–515.	

This table (Table 4.1) presents publications in the design, craft and management literature of the use of tacit knowledge and craft knowledge in different new product development processes. Following the Table 4.1, if a company wants to benefit from tacit knowledge, it should first use tacit knowledge at the beginning of the product development steps at the idea generation stages. People with this knowledge should understand the process of product development; their knowledge should be consulted and considered in this process. Thus, these employees have increased their commitment to the new product development team and their work. This situation could lead to new knowledge clusters and new product developments.

People who have this knowledge should develop the product with other members of the NPD team at the beginning of the product development process. However, these rules are not entirely sufficient to transfer and convert tacit knowledge. Because tacit knowledge is transferred through experience, understanding and transfer of this knowledge can be more successful if it involves the process of experience through a physically existing model. This model indicates the prototype as a model used in the testing stages of new product development. The prototyping process facilitates the sharing of knowledge between employees with tacit knowledge and other members of the NPD team through a physical and visual model.

4.4 The need of Craft in Industry

Craft production and industrial production seem to be separated in the 21st century. However, in craft-based or craft-related industries, in terms of making methods manufacturing processes are still influenced by craft. For instance, the leather and glass sectors are already industrialized. However, they either work with an in-house craftsman or carry out collaborations with craftsmen outside the company.

Contrary to common belief, the craftsman's role is complementary to and not in conflict with industrialized production processes (Bettiol and Micelli, 2014).

Woolley (2011) identified craftsmen’s complementary contributions from handmade to fully automatic production throughout the manufacturing process (Figure 4.2). Woolley (2011) claimed that hand-finished, hand-machined, and hand-assembled production methods have the most significant potential for craft and industry collaboration, and these collaborations offer new product opportunities (Blundel and

Smith, 2013). Woolley (2011, p. 26) lists the areas that craftsmen can contribute to the industry in terms of factors such as design, production volume, and cost potential:

DESKILLED ---------- ----- SEMISKILLED ---------- SKILLED						
	MANUFACTURING DOMAIN		CRAFT DOMAIN			
	Fully automated	**hand assembled**	**hand machined**	**hand finished**	**hand produced**	
DESIGN	remote	remote	variable	partially integrated	integral	
PRODUCTION VOLUME	very high	high	high/low	high/low	low	
COST POTENTIAL	very low	low	high/low	high	very high	
OPERATIVE	machine minder and/system controller	assembly line worker	machinist	artisan	craftsperson	
EXAMPLE	one piece injection mouldings	electronic products	quality mass market furniture	quality cutlery	craft objects	
		CRITICAL AREA FOR CRAFT/MANUFACTURE HYBRIDITY				

Figure 4.2 : Mediation, control, and craft influence (Woolley, 2011, p. 26).

Besides, Kettley (2012) argues that collaboration with craftsmen is fundamental for industries to obtain tacit knowledge. The craft can combine the material's knowledge with the aesthetic values and create new possibilities for the consumer culture. Additionally, craftsmanship is a vital resource for modifying and adapting customer needs to products. These possibilities can also support responsible consumption (Press and Cusworth, 1997). Mass customization can also produce products tailored to individual needs and benefit from the expert knowledge of craft for this purpose. One step ahead of it, the Mass Craft idea supports re-evaluating production where high-tech products are supported by low-tech tools used by craftsmen (Bonanni and Parkes, 2010).

In industrialized or semi-industrialized companies, several factors allow the craftsman to work actively in the industry. These are:

- Inability to be separated from handmade production due to the nature of the material: Craft-based sector or craft-related sector
- Late industrialization
- Craftsman protection through past cultures and guilds

• The use of the craft knowledge and experience as an aesthetic value. The fact that the products created with handmade production are personal and labour intensity makes them more valuable.

• Development of flexible and accepted management strategies for the stimulating effects of craft: Applying craft knowledge and experience in semi-automatic production systems occurs.

• To cooperate with the craftsman to understand the material behaviour more economically and quickly during the prototyping process.

Analyzing these factors in more detail is essential to identify industries with a high potential for crafts to support manufacture and design. In order to understand the presence and contribution of the craftspeople in the industry, the environmental conditions in which the craftspeople share and transfer their knowledge and experience should be investigated. Therefore, the collaboration environment and its importance are also examined within the scope of this thesis.

4.5 Collaboration and Meaning for Innovation

There are many definitions of collaboration in the literature. Nunamaker, Romano, and Briggs (2002) explain collaboration as "making a joint cognitive effort toward achieving an agreed-upon goal" (p. 78). Gray (1989) defines collaboration as follows, combining it for problem-solving purposes: "[...] a process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their limited vision of what is possible" (as cited in Gray and Wood, 1991, p. 4).

According to Gray (1985), three main elements are required for collaboration to occur:

- "the act of pulling tangible resources, such as labour, money, or information and/or "appreciations"
- involvement of at least two stakeholders; and
- to solve various problems these stakeholders cannot solve individually" (as cited in Alonso and Bressan, 2014, p. 257).

Labour and knowledge are human-made contributions. Knowledge, as mentioned earlier, is an essential resource for new product development. Nieto and Santamaría

(2010) state that collaboration had a significant impact on product innovation. Innovation is a collective and social activity, and knowledge and experience sharing are at the center of this social activity. Companies can increase teamwork and knowledge transfer by increasing collaboration within the company (Ryoo, 2017).

In the twenty-first century, the economy is based on knowledge, and the importance of knowledge for companies is increasing day by day. Companies support internal collaborations that increase knowledge sharing and production (Bianchini et al., 2012). In-house collaborations enable employees to complete their deficiencies by knowledge sharing with their colleagues in the problems they encounter (Wang et al., 2014). Working together does not just provide knowledge sharing, and it is also a social activity and creates trust and commitment between the collaboration partners (Ahuja, 2000).

Collaboration can also lead to discovering the knowledge of employees within the company (Bianchini et al., 2012). Discovering and sharing this knowledge can save time in new product development processes (Bianchini et al., 2012). In this way, collaborations become a strategic element for companies.

4.6 Designer and Craftsmen Collaboration in Industry

Alonso and Bressan (2014) and Yair et al. (1999) pointed out the importance of collaboration with craftsmen for the industry. Besides, Kettley (2012) claims that craftsmen's knowledge and collaboration to gain this knowledge are core values for the industry. As noted in the previous section, the craftsman can be included in collaborations to benefit from her/his knowledge as an employee. Companies that need craft knowledge can also cooperate with an outside craftsman at the project stage if they do not employ craftsmen.

According to the craft and NPD literature in design, crafts, creative industries, and management, the transfer of craft knowledge to new products or processes is possible through collaboration. In the examples in the literature, it is seen that the collaboration between the craftsman and the designer takes place at different scales. The first type of collaboration (most significant distance from industrialization) is craftsmen’s and designers’ collaborations for handmade production. The second type is the collaboration between designers and craftsmen in manufacturing systems (such as in

the saddlery sectors) (see Kaya and Yagiz [2011] and Yair et al. [1999] for further discussion). The third type of collaboration (closest to industrialization) is the collaboration between craftsmen and industrialized corporate companies, which is the most professional communication and management. These three stages of collaboration differ in how designers communicate with craftsmen, the frequency of this contact, production models, production scale, and NPD processes (Table 4.2).

Table 4.2 : Collaboration types.

Collaboration Types/Properties	**Designer–Craftsman Relationship**	**Production Method and Scale**
Individual designers or craftsmen	One-to-one interaction	Handmade, small-scale
Designers and craftsmen in different manufacturing and production companies	One-to-one interaction	Manufacturing by both machines and hand, small- to mid-scale
Designers and craftsmen in a large-scale company	One-to-one or indirect interaction	Hand assembled or industrialized, large-scale

Many crafts researchers believe that collaboration between producers and craftspeople offers new authenticity, insight, and product design (Yair et al, 1999). For craftsmen with appropriate knowledge and experience, facilitating the adoption of design methodologies following changing manufacturing industries' priorities is a new task (Yair et al, 1999). However, it is crucial to understand how a craft is a collaborative value within the company and which new product development processes will increase this added value (Von Busch, 2013). The craftsman’s contribution to the industry can be measured by how well the craftsman’s knowledge is evaluated and used in the industry. This evaluation and collaboration with craftsmen can be best observed in teams' work (Niedderer et al, 2011) comprised of employees from different departments in the company who transmit their craft knowledge and experience. Craftsmen collaborate mainly with designers in NPD teams. However, craftsmen can be expected to have close relations with the production department and the research and development (R&D) department due to the production-related nature of their

work. The company's environmental conditions, which affect the use of craft knowledge, are also of great importance in evaluating craft knowledge transfer to both the design and production departments.

As already mentioned, the craftsman's knowledge is tacit knowledge learned and transferred through experience. The collaboration of designers with craftsmen does not only mean that they cooperate with traditional handicrafts, and the designer also can experience new design and production methods through crafts (Tung, 2012). This shared knowledge and experience shared by the craftsman and designer have been expressed by Tung (2012, p. 74) in the process of new product development as follows (Figure 4.3):

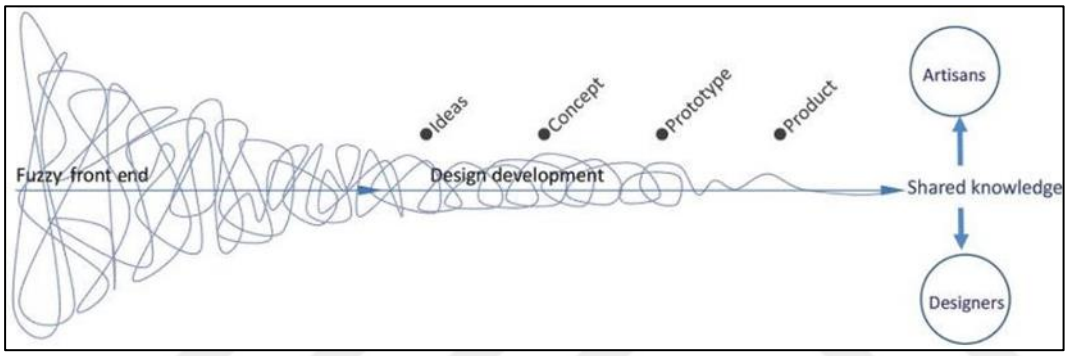


Figure 4.3 : Craft-design collaboration process (Tung, 2012, p. 74).

However, in different cases, the craftsman's contribution can occur at different stages of new product development. To better understand the stage in which the craftsman supports the product development, it is necessary to clarify what characteristics the craftsman supports the development of the new product. For this reason, in this study, it is investigated why the craftsman designer come together and how this collaboration is shaped.

The company's environmental conditions, which affect the use of craft knowledge, are also of great importance in evaluating craft knowledge transfer to both the design and production departments. Therefore, to acquire an in-depth understanding of the role and potential of craft knowledge, the transfer of craft knowledge needs to be investigated both within teams and throughout the whole organizational environment.

In conclusion, to understand the craftsman's contribution to product development and industry; It has been investigated why the craftsman is still needed in the industry, the craftsman's collaboration with the designer to transfer the knowledge and talent needed

from him, and at what stages this collaboration emerges in new product development. For this reason, in this section, publications related to these issues and forms of collaborations between designers and craftspeople were presented.

5. METHODOLOGY AND CASES

This research is exploratory research that would reveal different forms of craft-organization collaboration in different sectors. The environment in which this research was examined included a product development process, either by finding a solution to a problem or by reaching a product with a new idea. The appropriate method for this study should be a method that would allow each organization to be placed on a template by evaluating crafts-organization causality ties. This research method is a "multi-case study" method as a reason for question types and cases approach. One of the main reasons for the choice of this method is to understand the differences and similarities of cases to evaluate each process in detail. As mentioned in the book "Case Study Research" by Yin (2003, p. 9), the case study seeks how and why. Moreover, in this study, the researcher asks questions such as how the craftsman transfers tacit knowledge to product development, how these transfer conditions occur, and why craft knowledge may not be transferred to the industry.

One of the priorities of this research is the determination of the sectors. While making this selection, the existing examples in the international literature were used. Design Council reports in the UK, Nonaka's (1991) studies on knowledge transfer, collaborations with artisans in the Lombardy region of Italy (Bettiol and Micelli, 2014), and studies presented at the "Making Futures" conference (Ferris, 2013) become a guide to identify the sectors of the study. In addition, to identify these sectors, the opinions of academicians working on this subject and the opinions of designers working with craftsmen were evaluated. Subsequently, the presence of craftsmen actively working in these sectors was investigated, and sectors were confirmed. This research was provided by sending e-mails to companies. In selecting companies, criteria such as industrial designer and craftsman employment and transferring craftsman knowledge to industry played an important role. Industrial designers and professional chambers were evaluated as a way of access to companies. The companies planned to be interviewed contacted via LinkedIn, company e-mails,

or telephones; if necessary, preliminary interviews were made, and necessary permissions were obtained. There was not enough interest and return from some companies.

5.1 Data Collection

This thesis follows a qualitative research method in terms of data collection. Qualitative studies are generally exploratory studies to create hypotheses rather than test hypotheses (Corbin and Strauss, 2008, p.25). This study will be an exploratory study to understand the current situation of craftsman knowledge transfer in Turkey.

The data to be obtained in this study consists of the researcher's observations, field notes, semi-structured in-depth interview records, and transcribed texts (Table 5.1). According to Gillham (2000), “it is not easy to understand people's thoughts, behaviours, and emotions before entering their world” (p. 12). Therefore, these interviews are planned to be held face to face, in-depth, and in places where knowledge transfer takes place. The data collection methods to be used during this study are listed as follows:

Table 5.1 : Data collection methods.

Qualitative Data Collection Methods
Observation
Field notes
Semi-structured interviews (with designers, craftsmen, and managers)
Voice recordings and transcribed texts

In the literature, it is recommended to conduct interviews with unstructured or semi-structured questions in case studies. In-depth interviews, understanding of the NPD process, the craftsman's view and contribution to this process, the management staff's view of the craftsman's knowledge and awareness of this knowledge, the designer's view of the craftsman, and the contribution of total craftsman knowledge to that industry are evaluated. With this assessment, the perception of the contribution of craftsman knowledge to the industry at different levels, the experiences of the people and the organization are revealed. For this reason, these interviews are conducted with

the craftsmen, designers, and managers who manage this transfer (Table 5.2). The semi-structured in-depth interview questions to be presented in the appendices section at the end of this report are divided into the following topics:

(1) general information about the company,

(2) information about the interviewee,

(3) craftsmen's position in the company and the collaboration capabilities of the company,

(4) NPD and innovation processes in the company,

(5) contribution of craftsmen to NPD,

(6) factors that facilitate the contribution of craftsmen and incorporate the views of stakeholders

(7) sectoral assessment and competition.

Table 5.2 : Semi-structured Interviews with companies.

Company	Interview	Interviewee	Date
Company A	1. Interview	Designer manager-1, designer manager-2	23.08.2017
	2. Interview	Designer manager-1	05.06.2018
Company B	1. Interview	R&D manager-Designer	26.07.2018
	2. Interview	Design manager	02.08.2018
Company C	1. Interview	Design centre manager	26.09.2018
	2. Interview	R&D Director	31.10.2019
Company D	1. Interview	Industrial designer	18.07.2018
	2. Interview	Industrial designer	05.10.2019
Company E	1. Interview	Founder&designer	22.07.2019
	2. Interview	Founder&designer	10.10.2019
Company F	1. Interview	Owner of the Company, interior architect	21.05.2019
	2. Interview	Workshop Owner-Craftsman	28.11.2019

As a result of the interviews, a general information and research activity are carried out on the companies cover these titles: the sector they are affiliated with, the

manufacturing systems, the hierarchical structure within the company, the departments that carry out new product development, and the products they design. This activity aims to observe and discuss management-related models for strategic use of craft knowledge. Then, focusing on the new product development process, NPD studies carried out with craftsmen are investigated. In this way, this research focuses on the craftsman's works with the people he/she works with in-company (designers, engineers) and his/her communication with them. At this stage, there are familiar works that are narrated in the form of stories. In addition to the interview questions, the researcher's observation and field notes are the selected methods for this project. In particular, observing the craftsman and designer provides objective data for the companies' view of the craftsman. From the craftsman's point of view, these objective observations and subjective in-depth interviews allow for a bi-directional investigation of the craftsman's position in the companies.

5.2 Data Analysis

After the data is collected, the next step is to analyze this data. Corbin and Strauss explain that every study on data analysis must follow its own rules by these words:

"There is no right or wrong about analysis. Nor is there a set of rules or procedures that must be followed" (Corbin and Strauss,2008, p. 71).

The most important part of analyzing case studies is to form a theory from case studies, or at least to analyze what the cases say separately and to find common aspects of the cases. According to Yin (2003), in multiple case study studies, the research questions for each case may change, and this change is about each case's unique authenticity. However, at the same time, similar cases should be analyzed together as a cluster. No matter how few companies are interviewed, companies that provide overlapping research questions may provide comprehensive data.

The qualitative data analysis generally consists of "reduction of data, presentation of the data and revealing the result" (Miles and Huberman, 2015, p.10). Yin (2011) identifies the analysis of the qualitative process in 5 stages. These stages are: "Compiling, disassembling, reassemble, interpreting, concluding" (Yin, 2011, p. 178). Dey (1993) defines qualitative data analysis as a circular process and states that this

analysis should have three steps as "description, classification, and association" (p. 31).

These steps of data analysis can be repeated in some stages (Table 5.3). In the first step, "compiling", the data editing, and description are performed. It is not necessary to collect all of the data for this operation. As data is added, it can be returned to the compiling process. In the second stage, the data is separated by the coding method and more clearly grouped in the disassembling phase. The code is generally a short reminder of a long expression. A code means "an idea, theme, event, dynamic, observation, or statement" (Scott and Garner, 2013, p. 357). According to Corbin and Strauss (2008), this coding phase can also be evaluated as "mining" (p.66) where the researcher has asked him/her about the research, and at the end of these questions, he/she has access to new concepts. In summary, coding helps us see patterns covering a wide range of information (Scott and Garner, 2013, p. 357). In the third stage, the reassembling data stage, the researcher looks at all coding and patterns in the information framework and, as Yin points out, this stage means "playing with the data."

The fourth stage is the interpretation phase of the generated data. At this stage, many questions can be asked to interpret the data. Corbin and Strauss (2008, p.72) classify these questions into four groups. These questions can be seen in table 5.3 together with other analysis steps.

Table 5.3 : Qualitative research-data analysis stages.

Analyzing Steps	**Details**
Compiling	Transcription
Disassembling	Coding
Reassemble	Looking for patterns "Playing with the data" (Yin, 2011, p. 191)
Interpreting	The Use of Questioning (Corbin and Strauss, 2008, p. 72) "First there are sensitizing questions. •What is going on here; that is, issues, problems, concern? •Who is the actor involved? How do they define the situation? •Are their definitions and meanings the same or different? Second, there are theoretical questions. •What is the relationship of one concept to another? •What would happen if…...? •How do events and actions change over time? •What are the larger structural issues here and how do these events play into or affect what I am seeing and hearing? Third, there are the questions that are of a more practical nature. •Which concepts are well developed and which are not? •Where, when, and how do I go next to gather the data for my evolving theory? •How do I reach the saturation point? Fourth, there are the guiding questions" (Corbin and Strauss, 2008, p.72) "Giving your own meaning to your reassembled data and data arrays" (Yin, 2011, p. 207)
Concluding	•"Concluding by calling for new research •Concluding by challenging conventional generalizations and social stereotypes •Concluding with new concepts, theories, and even "discoveries" about human social behavior •Concluding by making substantive (not methodological) propositions •Concluding by generalizing to a broader set of situations" (Yin, 2011, p. 221)
Presenting the Study	"1. Narrative Data About the Participants in a Qualitative Study 1.1 Interspersing Quoted Passages within Selected Paragraphs 1.2 Using Lengthier presentations, covering multiple paragraphs 1.3 Making chapter-long presentations about a study's participants 1.4 Presenting information about different participants, but not focusing on the life story of any of them. 2. Tabular, Graphic and Pictorial Presentations 2.1 Table and Lists 2.2 Graphics and Pictures" (Yin, 2011, p. 241)

Concluding is the finalization of the study. This finalization phase concludes by referring to new research or by creating a new theory. There are five methods proposed for concluding by Yin in table 8. Yin also summarized the Narrative Data and Table, Graphic, and Pictorial elements in table 8 to present this finalized process to other people.

In addition to the studies of Yin (2011), the studies of Miles and Huberman (2015) and Dey (1993) guided the method of this thesis. Taking advantage of these three

qualitative data analysis approaches, the most appropriate analysis ranking for this project is given in the following figure (Figure 5.1):

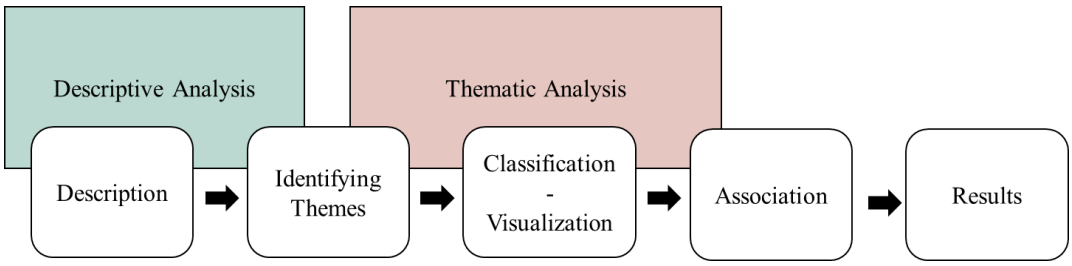


Figure 5.1 : Data analysis flow chart.

The first step, the description stage, includes descriptions of the texts of the records obtained from the interviews. Describing these conversations in a general framework will help to comprehend the whole subject. Through descriptive analysis long texts are described in a general framework and concepts are formulated for thematic analysis. Thus, the texts will be read repeatedly to determine the second stage, which will give an idea of the themes. In the second stage, themes will be determined from the questions generated by the literature review and the interviews. Thematic analysis method is used in determining the themes. Through thematic analysis themes are identified for identifying, analysing, and reporting patterns within the data, providing classification and association to achieve results.

Thematic analysis is a method used to reach the facts in qualitative data and find out the answers to the research questions by analysing them (Boyatzis, 1998; Braun and Clarke, 2006). In the thematic analysis, codes are created to identify the themes, and these codes are grouped to identify themes (Figure 5.2, Figure 5.3).

Figure 5.2 : Codes.

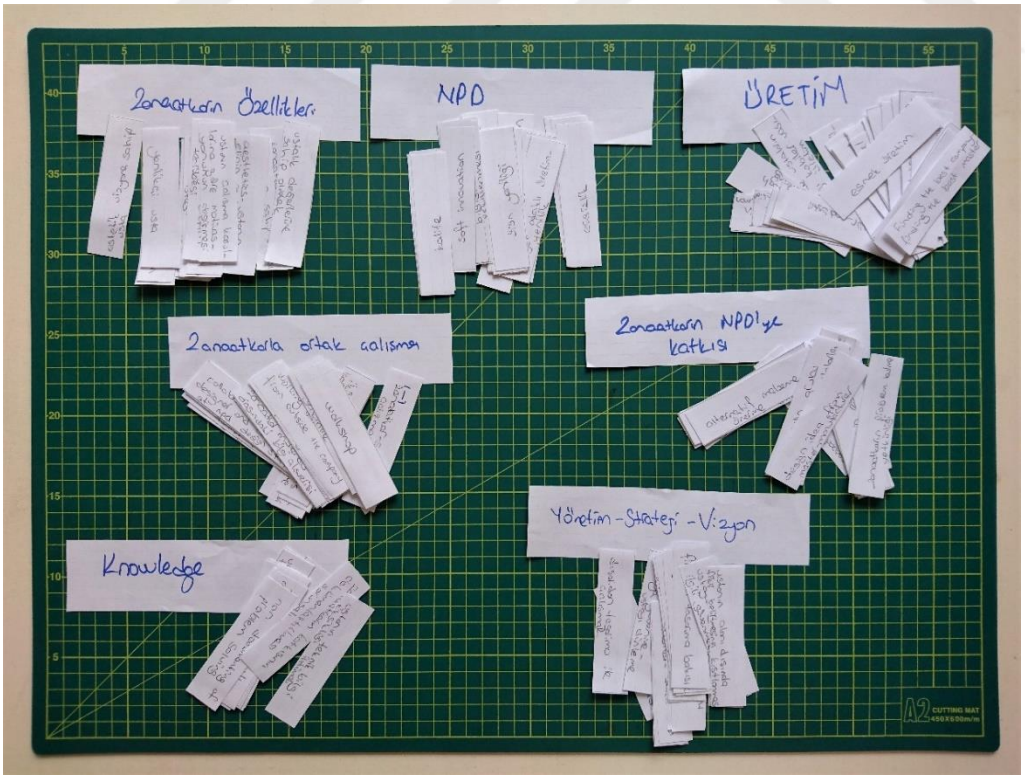


Figure 5.3 : Themes and codes.

Once these themes have been identified, themes that represent the same or similar concepts are classified. Visualization techniques such as tables and graphing are used in this classification. Miles and Huberman (2015) highlighted the importance of visualization in understanding and classifying data since the human mind cannot visualize much data simultaneously. In the next step, the classified data is associated. This association is made by comparison and revealing similarities. Companies in the same sector are compared on a company basis, and sectors are compared on a sectoral basis. Maxqda, a computer-aided qualitative data analysis tool, is also used in all these analysis processes.

5.3 Cases

In this study, the companies are selected from the glassware, leather, and furniture sectors developing new products and employing craftsmen. These interviews were generally completed in two or three parts, spread over different days. Following an in-depth interview during the first visit to the companies, some uncertain areas that emerged in the first interview were discussed in more detail in the second interview.

Table 5.4 : Companies by sector and scale.

	Scale	
Sector	**Large**	**Small to Medium**
Glass	Company A	Company D
Leather	Company B	Company E
Furniture	Company C	Company F

Firstly, in determining the companies, industrial designers and craftsmen in the companies and new product development processes were considered. In addition, the employment of industrial designers in the company indicates the value they give to design and new product development. Before the interviews, the companies were contacted, and information was obtained about working with the designers and craftsmen. This information is primarily effective in the selection of these companies.

In this section, information will first be presented on the companies' fields of activity, their size, and production possibilities. Then, the importance they attach to design and new product development processes will be examined. In addition, there will be information about the craftsmen working in the company or the craftsmen that the company cooperates with.

5.3.1 Company A

The first case of this study is Company A, a glass manufacturer. In Company A stores, decorative products are sold, and a collection of glass, ceramic, porcelain, wood, steel tableware, and kitchenware. Company A produces its products with industrial production techniques but also has a brand of handmade products. Company A, which has production from domestic and international factories, has gathered most of its handmade products in one factory.

For company A, design is essential with its functional and aesthetic added value to the product. New products are designed in every period with professional design processes carried out in the company. The new product development process starts with a brief created in the marketing and product portfolio management departments. The design department creates the concepts of new products. The design department sends them to the factory through the product portfolio management department to prepare technical drawings. After completing the technical drawings, the technicians working in the factory send them back to the designers who control the dimensions suitability for the final design. The product portfolio management department acts as a bridge between the designers and the factory. Craftsmen working in Company A are glass masters working at a factory where the technical drawings are prepared. The craftsmen work in the same place as the technicians who draw the technical drawings of products. The craftsmen intervene in the technical drawings if any production knowledge is required related to their craftsmanship. In addition, Company A collaborates with craftsmen outside of the company for materials such as plastic, concrete, wood, and metal.

5.3.2 Company B

Company B is a shoe manufacturer. The company, which manufactures in the factory system, also has a large workshop that produces prototypes. In the new product development process of the company, R&D departments, designers, especially masters and modelers working in the field of prototypes, take an active role. Company B conducts its new product development through benchmarking. This method is based on following the trendsetters and creating products sold in the domestic market. The most critical step in new product development in this company is the prototyping process. At this stage, a large space of the company is devoted to this work as a

workshop, where craftsmen and pattern makers work together. Since the shoemaking industry is closely linked to handmade production in its historical development, the contribution of the craftsmen in prototype production and mass production is significant in this company. Company B works with in-house craftsmen and collaboration with craftsmen on moulding from outside of the company.

In Company B, while the collaboration of designer and craftsmen is based on individual connections of designer, and the R&D department functions as a bridge and manages the collaboration between the craftsman and the designer. The contribution of the craftsman to the NPD is mainly related to the prediction of the material behavior, and the craftsman shares this prediction with the designer, pattern maker, or R&D worker.

5.3.3 Company C

Company C is a large-sized industrialized furniture company. The company, which initially produces office furniture, has also started producing home furniture in recent years. Industrial designers and interior designers work together in the company. The products are grouped and designed and produced under the responsibility of the product manager. Due to the company's mass production of office furniture and ergonomic standards, innovation is functional-oriented. With the production of home furniture, the aesthetic difference has started to take place as much as functionality among the company's innovation strategy. The knowledge and experience of the masters are used in the company, especially in the prototype stage and in mass production. In addition, the company cooperates with freelance craftspeople outside the company in glassware and decoration products such as ceramics and glass produced within the home furniture field.

5.3.4 Company D

The company produces and sells glass and ceramic products in the glassware sector. Company D produces objects of our daily life such as tea glasses, coffee cups, and dinner sets. All products of Company D are available for sale at shops, sales channels, and websites. The company supplies primary products for ceramic products from a factory abroad. The additional operations applied to these primary products are carried out by companies employing masters in Turkey. The company itself has no production location. However, they work with companies that specialize in different materials for

different forms of production. For instance, if the product is to be made of brass material or brass is used in a part of the product, production takes place in the workshop of the agreed brass producer.

A total of fifteen people works in the company, and two of them are designers. One of these designers is a graphic designer, and the other one is an industrial designer. In the new product development process, the new product idea is highly dependent on the designer's concepts, the market trends and the vision of the company boss, and the company's production networks. If the designed product will be produced with the need for new material, the designer carries out work with the master for some time to decide the final version of the product. No craftsmen are working in the company, and however, the managers of the SMEs that the company cooperates with are craftsmen. If new material is to be used or a new design is emerging, the designer visits these SMEs to see the behaviour and alternatives of the material on site.

5.3.5 Company E

Company E produces handmade bags and wallets with raw leather materials. Company E has a history of reaching high capacities by outsourcing to national and international brands with their industrial production. The company continues to exist by changing its scale and production method. While making high-volume production using industrial production methods, it has moved to the handmade production model by organizing the hand labour of women. The company's founder orders the moulds that will make the drilling and cutting process that will create the patterns of the models he designed. These moulds, made of wood, create holes and directions on the leather and guide women to make and sew it by hand. Company E works with about 150 women to produce approximately 1000-1200 products per month. Women deliver the products to the company's 250 square meter workshop for the final arrangements and polishes. The company creates its products with a pattern that machine cannot produce to be different from other companies. This pattern idea is the owner's design, who is a craftsman. In addition to product design, this company is concerned with the production method design. There are also important factors that increase the quality and life of the company's products. Company E has adopted "vegetable tanned" leathers as the primary material to distinguish itself from other companies. The company also sews with a more durable and waxed thread for sewing, compared to

normal threads. In addition, the zippers of the products are selected from the top-quality zippers of a zipper manufacturer dominating the market.

5.3.6 Company F

Company F is a furniture company whose founders are interior architects. Since the family of one of the company's founders has a woodwork craftsmanship background, the company's roots benefited from the craftsmanship culture, skills, and environment. The company's production is handmade furniture production, and the company works in agreement with twenty five manufacturers for handmade production. These manufacturers have their own workshops, employ masters, and are managed by senior masters. The company's collections include furniture, lighting, and home accessories.

The company conducts new product development processes with both design offices and designers. The company works with several designers. The team that actively carries out the design within the company consists of designers and interior architects. Product concepts designed by teams within the company are given to the master for prototyping. The company has production agreements with crafts workshops. The largest cooperating craft workshop is located in the same building as designers and interior designers. So, the designer has the opportunity to work with the craftsman, designers. Craftsmen and managers make their evaluations on the prototype after the first prototype is formed. The master can guide the designer on the dimensions of the products by using standard 3D programs with the designer.

6. FINDINGS

In this section, the codes are presented in a table to understand what the codes are and the frequency of codes. Then, the codes obtained from the interviews of each company are examined (Table 6.1). In the third stage, the companies' codes in the same sector or organizational structure/production scale are examined comparatively.

Table 6.1 : Distribution of codes by companies, themes, and sectors.

Themes	Sectors and Companies						Total
	Glass		Leather		Furniture		
	A	D	B	E	C	F	
Features of Craftsman	3	7	3	1	9	3	26
NPD	8	5	19	18	12	10	72
Manufacturing	6	9	6	27	5	12	65
Collaboration with Craftsman	13	15	10	1	16	26	81
Contribution of Craftsman to NPD	34	23	20	2	29	18	126
Knowledge	7	1	2	2	12	0	24
Management and Strategy	5	2	7	5	16	15	50
Total	76	62	67	56	99	84	444

As a result of the interviews, a total of 168 different codes were created. These codes were grouped into seven themes: craftsmen’s features, NPD, manufacturing, collaboration with craftsmen, crafts-men’s contribution to NPD, knowledge, and

management/strategy. The codes and themes were created using both the literature and the words that emerged from the interview. The distribution of the coded sections by sectors and company scales is presented in Figure 6.1 and Figure 6.2. For instance, in the glass and furniture sectors, the craftsmen's contribution and collaboration with craftsmen were the two primary thematic groupings, while in the leather sector, manufacturing and the process of NPD were the two primary thematic groupings. In addition to this situation, although there are more codings created on the contribution of the craftsman in large-scale companies, for example, the coding of the relationship between production and craftsman is higher in small and medium-sized companies than in large-scale companies. Understanding the differences in the thematic groups in terms of both sector and scale gives us an idea about which themes were dominant for which company. In a sense, this can be seen as an effort to make qualitative data quantitative to interpret these data from a broad perspective.

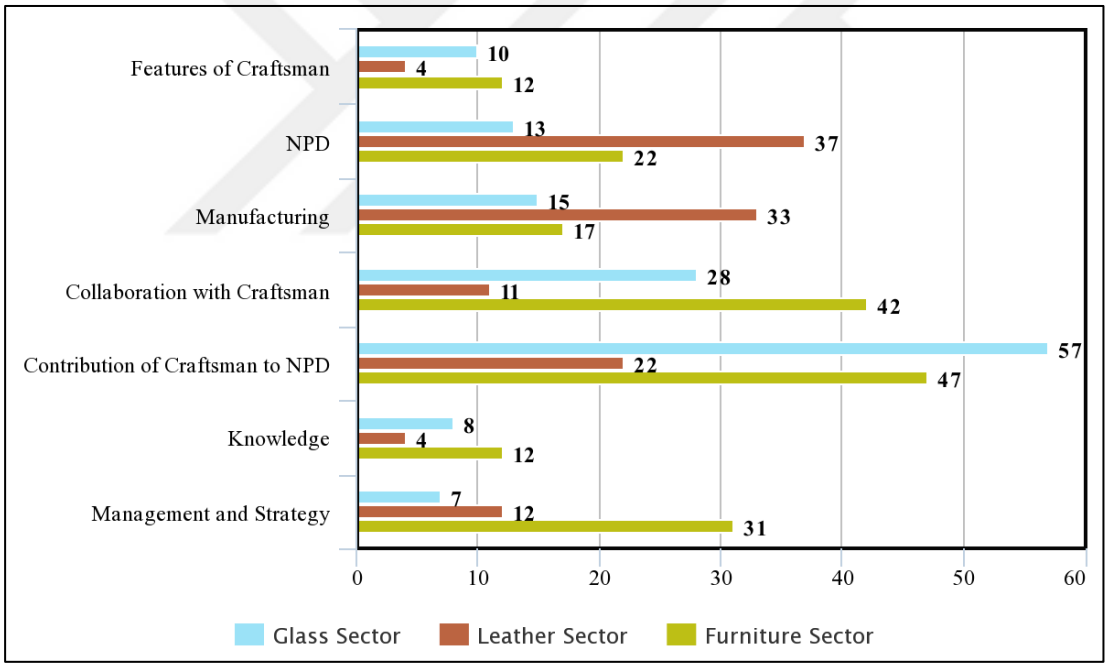


Figure 6.1 : Themes and number of coded parts by sectors.

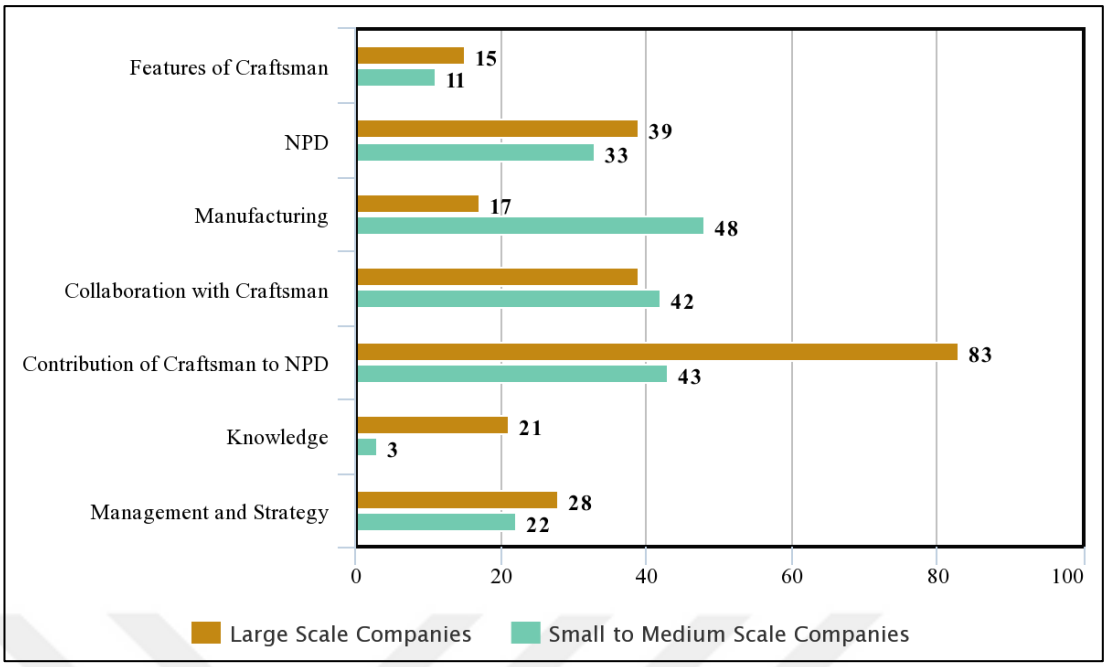


Figure 6.2 : Themes and number of coded parts by company scales.

6.1 Theme 1- Features of Craftsman

This theme was created by taking the interviewees' opinions about the characteristics of the craftsman working in the company. This theme includes features that reflect the knowledge and skills of the craftsman in his/her work. In this section, it is explained how the attitudes of the craftsman towards his profession are perceived in his/her environment. The craftsman must be proficient in his/her work. This competence of the craftsman stems from having a holistic approach to making the product alone. Especially in Company F, Workshop Owner-Craftsman conveys the master's holistic approach with these sentences: “Now, if we start from apprenticeship, the right place is places like us, not factories. In factories, you just screw at work, and you retire. Here you do all the work, you cannot get enough of working” (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In Figure 6.3, numbers show the frequency of repeated code in that companies. The craftsman’s holistic approach to the product was more prominent in Companies D and F than in the other companies. This situation occurs through the craftsman specializing in all products developing processes in small and medium-sized companies and involved in a particular product development stage as prototype production in large-scale companies. In Companies D and F, the masters could reveal their holistic approaches to the NPD process because the masters had the advantage of having total

control over the company's production. Likewise, in Company D, the craftsmen's product-related competencies in both prototyping and production stood out.

A common view in companies is that the craftsman is thought to have a traditionalist point of view based on his routine work. However, in my interviews with companies, I heard that the word innovative is also used when talking about masters (Figure 6.3).

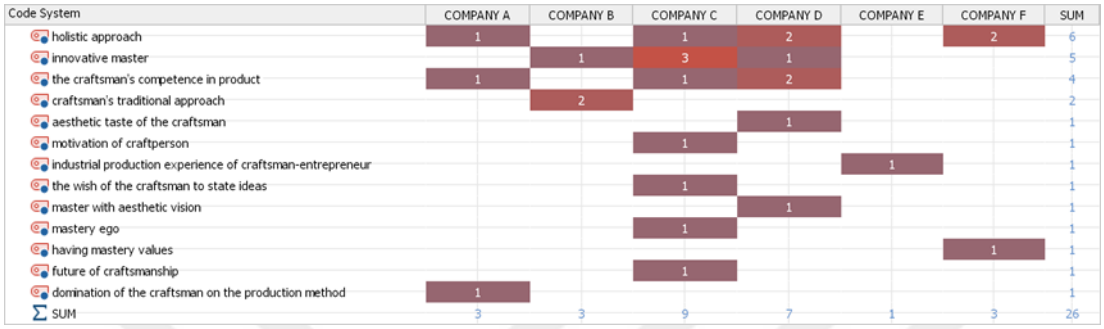


Figure 6.3 : Theme 1-features of craftsman-distribution of codes according to companies.

In Company B, the subject of the craftsman's traditionalist attitude was discussed. One of the critical reasons for this attitude is that the footwear industry (the industry of Company B) continues to use craft-based knowledge. Craftsmen tend to preserve the values that come from their craftsmanship concerning production. The code of having craftsmanship values is associated with Company F's manufacturing with a craft tradition inherited from the founder's family. Within this framework, the craftsman can also transfer the values he gained during his master craftsmanship to the company. The owner of Company F also expresses that they have created the success of their business by protecting their mastery values: "To be a craftsman, I think we need to have some values first, and I can say that he is the strongest part of us" (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

The craftsmen's holistic approach, competence and innovative attitude appeared in at least two sectors (Figure 6.4). The fact that small-scale companies in the glass and furniture sectors carried out production via external craft production centres reveals the craftsmen's mastery of the product (Figure 6.5). The craftsmen's contribution to aesthetics emerged in the fields dominated by the design's prototype process, such as cut glass in the glass sector, and where the master dominates the construction process. Additionally, some of the innovative masters can have a vision especially for aesthetic development:

> For example, in our minds, we can obtain the same pattern, which we say let us do this and that, from two different masters with two different reflections: even according to the depth of the cut, that is, at this point, how the master can do the work, that is, how much he can clear it allows the designer to evaluate his vision in a way. So, the better he works or the more aesthetic vision he (master) has, the more the work of the designer can shine (Industrial Designer, Company D, personal communication, July 18, 2018).

While evaluating the characteristics of craftsmen at different company scales, masters cannot find the opportunity to apply their holistic approach to product development in large-scale companies; on the contrary, they maintain their holistic approach in small-scale production companies. This situation also causes the craftsman to be more competent in large-scale companies by focusing on one product development stage, mainly production. Regarding benefiting from this specialization of the craftsman, it was also evaluated whether the craftsman had innovative features. For instance, in the C furniture company, it was discussed that the craftsman whose knowledge was consulted during prototype and production had innovative ideas (Figure 6.3). The craftsman's competence in the product is also related to the prototype, material knowledge, and mastery of the production method in both large-scale and small-scale companies. Again, the craftsman's effect on aesthetic innovation and craftsmanship values are prominent factors in small-scale companies.

Code System	Glass Sector	Leather Sector	Furniture Sector	SUM
holistic approach	3		3	6
innovative master	1	1	3	5
the craftsman's competence in product	3		1	4
craftsman's traditional approach		2		2
aesthetic taste of the craftsman	1			1
motivation of craftperson			1	1
industrial production experience of craftsman-entrepreneur		1		1
the wish of the craftsman to state ideas			1	1
master with aesthetic vision	1			1
mastery ego			1	1
having mastery values			1	1
future of craftsmanship			1	1
domination of the craftsman on the production method	1			1
SUM	10	4	12	26

Figure 6.4 : Theme 1-features of craftsman-distribution of codes according to sectors.

Whether the craftsman works on a salary within the company or cooperates with the company from outside can affect the master's transfer of his values to the company. For instance, the design centre manager of C furniture company describes the

differences in working with the master who established his own company and the masters working in the company as follows: “That is why, at some points, we work with outside craftsmen, with whom we cannot break up. When you work from outside, there is no problem if you give the money” (Design Centre Manager, Company C, personal communication, September 26, 2018).

Code System	SMEs	Large-Scale Companies	SUM
holistic approach	4	2	6
innovative master	1	4	5
the craftsman's competence in product	2	2	4
craftsman's traditional approach		2	2
aesthetic taste of the craftsman	1		1
motivation of craftperson		1	1
industrial production experience of craftsman-entrepreneur	1		1
the wish of the craftsman to state ideas		1	1
master with aesthetic vision	1		1
mastery ego		1	1
having mastery values	1		1
future of craftsmanship		1	1
domination of the craftsman on the production method		1	1
SUM	11	15	26

Figure 6.5 : Theme 1-features of craftsman-distribution of codes according to company scales.

6.2 Theme 2-New Product Development

The companies' new product development processes have been examined to make the craftsman's contribution more understandable to both researchers and readers in this thesis. Especially in glass and leather sectors, the product's aesthetic value and soft innovation are decisive in design. In the furniture sector, the ergonomic standards and structures of the products formed the main lines of the interviews. Most companies' new product development strategies are shaped according to their competitors and customer demands. Besides, market conditions also shape the new product development processes of the companies. The shoe industry is facing time pressure as it works seasonally. In addition, they create competition on the cost factor since they examine the company that is in a good position in the market and develop products with the benchmarking method. This theme includes subsets of innovation, designer, teamwork, new product development process, and internal and external factors affecting these companies' new product development process.

6.2.1 Elements of innovation

First, the new product development process in the companies is shaped by elements such as differentiating, creating a unique product, aesthetic innovation, soft innovation, personalized product, value-added product, and redesign (Figure 6.6). For instance, the manager of Company F in the furniture industry expresses the impact of differentiation on the market as follows:

> We noticed something there, but it got to a certain point. All boutique hotels started to look like each other. That is when we stepped in. I remember reading this a lot. Everyone buys products from one of the well-known industrial furniture companies, but some hotels wanted to separate from this and wanted to use unique products (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

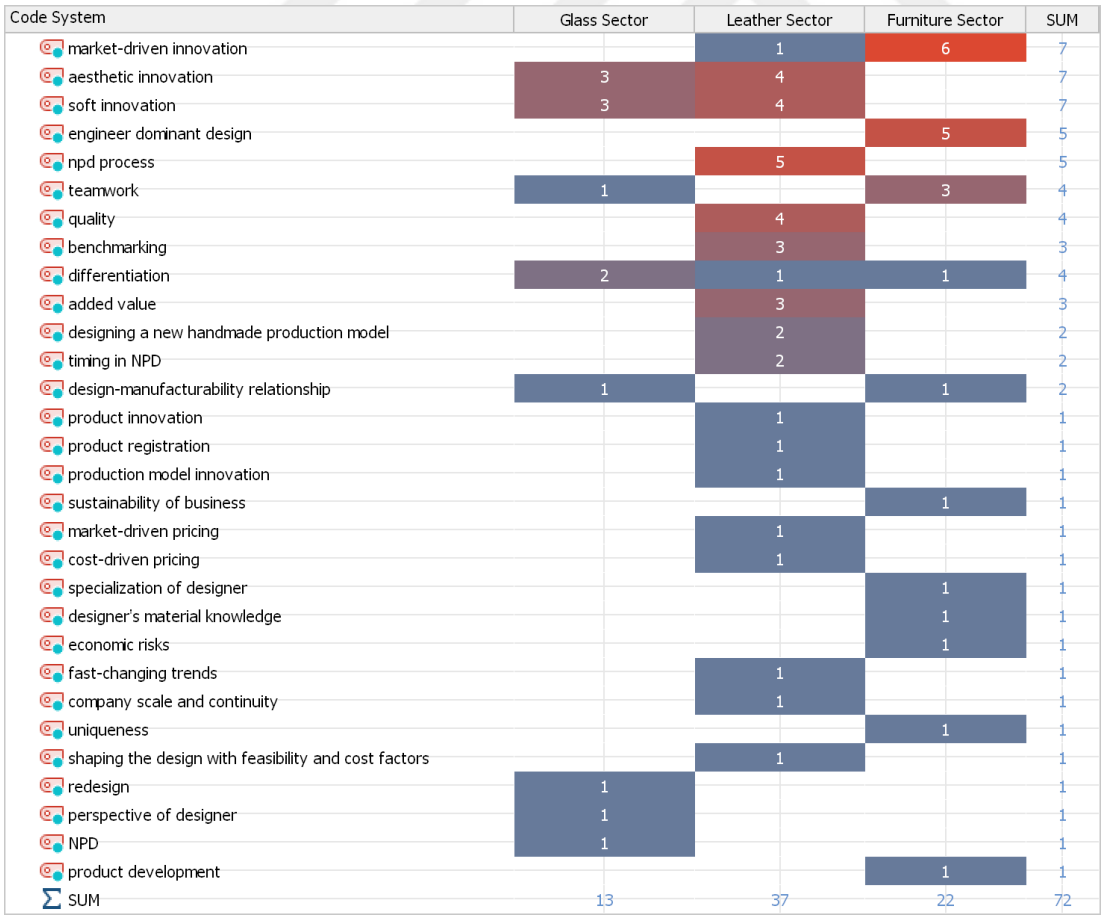
Aesthetic innovation comes to the fore with functional innovation in the glass and leather sectors (Figure 6.7). For instance, the official of the shoe company (Company B) explains this situation as follows: “Exactly. Trend is applied. This is the pattern: For example, colours. Like what happens? Pearl is called fashion. It is used in a pearly way: shiny suede leather, leather with a sheen on it” (Design Manager, Company B, personal communication, August 2, 2018).

Another NPD element is differentiating in the market (Figure 6.6). The founder of the leather company, which makes hand production, ensures the differentiation of the product with quality by emphasizing the quality in the accessories used in the development of new products:

> Look, even this is sewn by hand. So, we bought this snap fastener so that it can be sewn by hand. We bought it like this so that it would be understood that it was handmade and that it was a slightly higher quality expensive snap. Probably a sensitive person who looks at this will understand that the machine cannot do this, right? If you look at this, does a machine do such a thing? (Founder-Designer, Company E, personal communication, July 22, 2019).

Code System	COMPANY A	COMPANY B	COMPANY C	COMPANY D	COMPANY E	COMPANY F	SUM
market-driven innovation		1	4			2	7
aesthetic innovation	2	1		1	3		7
soft innovation	2	1		1	3		7
engineer dominant design			5				5
npd process		5					5
teamwork			2	1		1	4
quality					4		4
benchmarking		3					3
differentiation				2	1	1	4
added value					3		3
designing a new handmade production mod					2		2
timing in NPD		2					2
design-manufacturability relationship	1		1				2
product innovation		1					1
product registration		1					1
production model innovation					1		1
sustainability of business						1	1
market-driven pricing		1					1
cost-driven pricing		1					1
specialization of designer						1	1
designer's material knowledge						1	1
economic risks						1	1
fast-changing trends		1					1
company scale and continuity					1		1
uniqueness						1	1
shaping the design with feasibility and cost		1					1
redesign	1						1
perspective of designer	1						1
NPD	1						1
product development						1	1
SUM	8	19	12	5	18	10	72

Figure 6.6 : Theme 2-NPD-distribution of codes according to companies.



Code System	Glass Sector	Leather Sector	Furniture Sector	SUM
market-driven innovation		1	6	7
aesthetic innovation	3	4		7
soft innovation	3	4		7
engineer dominant design			5	5
npd process		5		5
teamwork	1		3	4
quality		4		4
benchmarking		3		3
differentiation	2	1	1	4
added value		3		3
designing a new handmade production model		2		2
timing in NPD		2		2
design-manufacturability relationship	1		1	2
product innovation		1		1
product registration		1		1
production model innovation		1		1
sustainability of business			1	1
market-driven pricing		1		1
cost-driven pricing		1		1
specialization of designer			1	1
designer's material knowledge			1	1
economic risks			1	1
fast-changing trends		1		1
company scale and continuity		1		1
uniqueness			1	1
shaping the design with feasibility and cost factors		1		1
redesign	1			1
perspective of designer	1			1
NPD	1			1
product development			1	1
SUM	13	37	22	72

Figure 6.7 : Theme 2-NPD-distribution of codes according to sectors.

6.2.2 Design and designer

The most critical factor in developing new products is product design. First, five of the six companies employ industrial designers. The sixth company is also concerned with a new business model, and the founder of that business model is a craftsman. Within the scope of this thesis, the designer's position in the company was evaluated in terms of the new product development process, manufacturing methods, networking possibilities of the company, and the collaboration of the designer and the craftsman. Craftsman and designer collaboration will be evaluated in more detail in Theme 4. First, the designer needs to specialize in a field he/she determines in the early years of his/her career in the industry. As well as sector-specific expertise, we can also talk about material expertise within the sector:

> The designer must focus herself/himself on a certain department once, in my opinion, it is not about designing everything, there is no such thing to design both furniture and a machine here. Or he should determine the subject of designing a place very well in advance. Since he will use most of the materials he will use there, he needs to know them correctly. The designer needs to know very well how these materials will react in hot and cold environments. I do not know how much these are taught in school because I am self-educated (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

Several factors direct and restrict the designer, which stem from the conditions of the company while implementing his/her design. The technical characteristics of the designed product or the production conditions of the company are some of these factors. In a product line where ergonomic standards are stringent, the designer is expected to have more technical knowledge and can work in a design team that usually includes engineers:

> Now let us say you have designed this chair, you have drawn a frame, you will attach a net to the frame. Now, when you put this in front of the engineer, when the man is working with the frame from plastic material, he will say to you, "This section you have drawn here is not suitable for this job, I have to increase the cross section to this extent". The engineer will increase the cross section, work, and finish. Then you will put this to the digital test. When you put it into the

digital test, you will see that the material does not work in that area, you will see that it is in the act of breaking, it will need to be solidified. The thickness will increase a little more, so each time the design takes a different dimension and changes. Therefore, engineers here are people who contribute significantly to that design. Could I explain? (R&D Director, Company C, personal communication, October 31, 2019).

The company's competence in production can also impose an obligation on the designer to work in a particular area:

Now that we produce office furniture (figure 6.8), the design of the product is related to the manufacturability of the product. In other words, when specifying a line, you must determine it according to production. Or in Turkey is determined as follows: The designer has a line and transform his/her ideas into sketches. We come into play in the production part, we say that you need to revise this place in this way. Because this is about our production possibility (Design Centre Manager, Company C, personal communication, September 26, 2018).

Figure 6.8 : Factory, Company C.

6.2.3 Team

The companies carry out their new product development processes with the teams formed by designer-engineer-purchaser-marketer-company founder and product manager. Teamwork is essential in terms of eliminating the problems that may arise regarding the product to be produced or creating innovation:

> The engineer does a lot of static work while implementing what the architect has designed. In those static works, maybe the walls get bigger and smaller. Columns increase or decrease provided that the main design is adhered to. In fact, the engineer does serious work in that job, and then the mastery leg is involved. If this foreman can knead that material correctly, make it into a dough and put it there properly, if his work is able to produce it properly, a really good product will come out. So, we are talking about teamwork. The better the team, the more successful the design will be. The weaker the team, the more unsuccessful the design will be (R&D Director, Company C, personal communication, October 31, 2019).

These teams may not always be formed by a certain number of people coming together in a certain period with a strict management approach. There are also small groups in SMEs that come together when needed and make evaluations and improvements on the product:

> Usually, the designer does not have time or we do not want to call it very much. We make the product: we get it, we prepare the design and the samples. We call the designer at the sample stage. You know, the designer does not come to the workshop while they are being made, so when the samples come out, we invite them, we say “come and see them”, we give comments together (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

Likewise, the new product development team can come together at Company D at the beginning of a project, and it may not be necessary to come together after the production process begins.

6.2.4 NPD process

The companies' NPD processes were examined to make the craftsmen's contributions more understandable to both researchers and readers. Product development processes in companies are dynamic processes starting from developing ideas, creating prototypes, and then continuing with production and post-production returns. In the glass and saddlery sectors especially, the product's aesthetic value and soft innovation were decisive in design. In the furniture sector, developments and designs regarding ergonomics and structure were the main contributions made by craftsmen. Most companies' NPD strategies were shaped according to their competitors and customer demands. Additionally, the market conditions also shaped the NPD processes of the companies. For example, the shoe industry faces time pressure as it produces seasonally. In addition, it must face competition, especially regarding the cost factor, since the companies in this industry apply the benchmarking method, which is a self-positioning method to determine if the company is in a good position in the market.

A designer from the leather sector explains this process with his own experiences as follows:

> First, the footbed of the models I want to make is already clear, I open them, or if there are works in progress, I draw sketches. I draw each model on the mould of the footbed as much as possible in a freehand or computer environment. Even if I am inspired from somewhere else, it could be a bag; it could be something else. Except when you put them together or the information given to you at trend forecasting websites, I draw them what we need to do in the collection. Then I give it downstairs to the workshop. First, the modeler is, of course, very important here. R&D and product management make a start, but this business is passed on to the modeler. After the modeler determines the mould and footpad, a box is prepared, pictures are placed, and drawings are in the box. The modeler takes them and begins to draw. He/she draws it by hand and then transfers it to the computer. If I saw the drawing on my mould at that time, if the first prototype came out from the modeler, then we start making critical. On the product, I say, "Let us shorten one millimetre from here, or we need to make this mould again, which has not had a base mould," we wear it on the feet. We discuss the moulding problems of some of our friends while conducting evaluation meetings. We change them, they are moulded again, and so on. In other words,

> mutual meetings are held, and there can be very special projects. So, you have drawn yourself in everything that is entirely our own. If these are very critical things, they are discussed, and a new project is created. Of course, you are meeting with the master, but in this period, how did it happen now: The package is prepared and left to the responsible employee in the department; that process begins as if he puts it on the production line. When the work is done, and the prototypes arrive, a group goes down to the workshop. This group includes me, the master, and the R&D manager. Let us do it like this; that did not happen; let us change this, let us throw this model elsewhere; many criticisms are being made as if this footpad would be more appropriate. After that, if everything is okay, leaflets are prepared for colouring, colouring is done, and the process begins. The product goes to the cutting room; then it goes to the counter, then all parts are collected, whatever they need and given to the assembly. This is the process (Design Manager, Company B, personal communication, August 2, 2018).

6.2.5 Internal and external factors affecting innovation

Factors such as the sectors of the companies, the scale of the company, the conditions of the market, the production and technology infrastructure of the company, the company's human resource potential, and the economic risks affect the company's new product development potential and efficiency. The new product development processes of the companies have been evaluated within the framework of these factors.

Some trends change rapidly in sectors such as the shoemaking sector and renew every six months. This situation causes the company to design products under time pressure. The designer of Company B expresses how to design products with time pressure with the following sentences:

> There is something called deadline, there is the introduction of goods in time. Would you believe it, it is very important to realize this product more than designing or after creating a product. Because yes you are designing something, you are doing something nice, but it is also very important to put it on the showcase correctly (Design Manager, Company B, personal communication, August 2, 2018).

With the pressure of time, the company must also carry out an effective pricing policy to maintain its market position:

> You know when we are getting hardly from there, when they put a product in front of us suddenly. And this idea is just what a design, this is a very complex structure. This business sold abroad, okay. The designer commented on this a bit, we said okay, the master did it, we said okay. But there is also the tag part, the price part, we have a customer base. If we do not make the price of this product 99 TL, if we try to sell it for 199 TL, this product will go directly to waste, there is no point (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

The new product idea can emerge from within the company, or the demand of the market can shape it. Design centre manager at Company C defines this situation with these words: "As I said, home furniture has dragged us into a very different world for a year. So, we evolved into such a world without rules. Every customer has its own rules" (Design Centre Manager, Company C, personal communication, September 26, 2018).

In addition to all these factors, companies evaluate the opportunities and risks in the market from their perspective. For instance, if F furniture company needs to restrict its production, the company manager summarizes the situation of the company against mass production companies as follows:

> In most of them, there may be carcinogenic substances at work. There comes a time when the whole society is pushed out of there, they have to find something new, and the fact that huge factories are empty for a month means that they will end. But it would not be a problem if we stayed closed for six months, we were standing and leaning on each other. To improve ourselves, we have our designers above, we are intertwined with them, and we apply those things they draw. As long as they do not stop drawing, we are comfortable here (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

6.3 Theme 3- Manufacturing

Within this theme's scope, companies' practices about hand production and industrialization is explained, the networks they create for production, and the craftsman's position in this production network (Figure 6.9, Figure 6.10). First, the companies were chosen for this thesis study benefit from the craftsman's knowledge and workforce. The main differences between companies are the variability of production scales and methods. While some companies design and hand-made manufacture products and full industrialization, some companies benefit more from the added value created by hand-made products.

Especially companies D and F outsource their production to craftsmen (Figure 6.9). Therefore, the link between craftspeople and manufacturing is seen to be more related in small-scale companies than in large-scale companies. The ability of the craftsman to provide flexible production conditions is an element that seen in both large-scale and small-scale companies. Another significant issue, including the transfer of knowledge about production, is the transfer of product idea from hand production to mass production in company A.

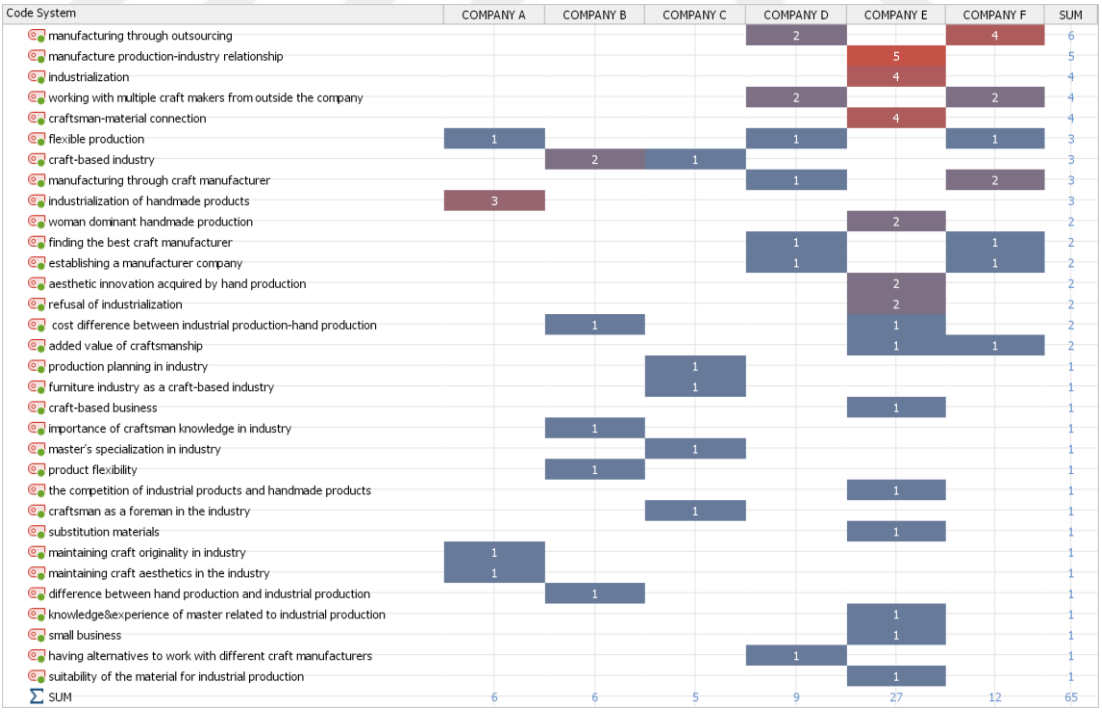


Figure 6.9 : Theme 3-manufacturing-distribution of codes according to companies.

All three sectors benefit from craftsmen in production (Figure 6.10). These sectors receive support for production and prototyping from both internally and externally working craftsmen.

Code System	Glass Sector	Leather Sector	Furniture Sector	SUM
manufacturing through outsourcing	2		4	6
manufacture production-industry relationship		5		5
industrialization		4		4
working with multiple craft makers from outside the company	2		2	4
craftsman-material connection		4		4
flexible production	2		1	3
craft-based industry		2	1	3
manufacturing through craft manufacturer	1		2	3
industrialization of handmade products	3			3
woman dominant handmade production		2		2
finding the best craft manufacturer	1		1	2
establishing a manufacturer company	1		1	2
aesthetic innovation acquired by hand production		2		2
refusal of industrialization		2		2
cost difference between industrial production-hand production		2		2
added value of craftsmanship		1	1	2
production planning in industry			1	1
furniture industry as a craft-based industry			1	1
craft-based business		1		1
importance of craftsman knowledge in industry		1		1
master's specialization in industry			1	1
product flexibility		1		1
the competition of industrial products and handmade products		1		1
craftsman as a foreman in the industry			1	1
substitution materials		1		1
maintaining craft originality in industry	1			1
maintaining craft aesthetics in the industry	1			1
difference between hand production and industrial production		1		1
knowledge&experience of master related to industrial production		1		1
small business		1		1
having alternatives to work with different craft manufacturers	1			1
suitability of the material for industrial production		1		1
SUM	15	33	17	65

Figure 6.10 : Theme 3-manufacturing-distribution of codes according to sectors.

Therefore, companies in this thesis use the craftsman's knowledge in the application of hand-making methods, prototyping, or creating a new product group. Craft and industrial production can be found very intertwined in some companies. However, one of the interviewees trying to make a distinction between these two production models expresses this distinction as follows:

> ... industry is the shortening of the labour time of a continuous product. No matter how much you shorten technically, whatever the labour time is at work with automations and robots. The more you eliminate the waiting times, the more you will have a place in the market. There are no such things in artisan production, no worries. Because it is small in scale. Of course, it tries to value the day of the craft, that is, it tries to produce without wastage. But the things that the craft exaggerates more and more important are perhaps the product's

> distinctiveness, distinctiveness, aesthetics, and its individuality (Founder-Designer, Company E, personal communication, July 22, 2019).

At the same time, the material used in the sector may also require the use of hand-made production within manufacturing:

> If there are shoes with leather, for example, maybe there is such a complete rupture in sports shoes. It is something that now gets very fast with robots and things, maybe it never goes out anymore, completely disconnected from the craft. But as leather is a non-industrial material anyway, since it cannot be cut in layers because one region does not fit the other region, it cannot be processed continuously, so it must always be in contact with something old and manufactory in order to be nourished (Founder-Designer, Company E, personal communication, July 22, 2019).

The interviewee expresses the existence of the master in the shoe sector and the fields he contributed with his knowledge and experience as follows:

> That is when the masters are involved. For example, what am I doing? I struggle until the product is prepared and put it there, but then the job passes to the masters. There are supposed to be masters if this should definitely be the case. Now, there is something very critical: When this shoe-upper paper is reduced to 2 dimensions, whatever leather or artificial, they settle according to the direction. If the shoe-upper starts to flow too much, they call it flowing material. Then they start dividing the upper. For example, imagine that the face of the material is like this. This inside is empty. If there is another layer so that it takes up less space, less material is used, it reduces the cost, they are also placed in it or divided internally. This time, other practices and other cost calculations begin to come into play. But the work is entirely the responsibility of the master. When you look at the collection area, something like that or what is happening there, the designer finishes his summer creation, or he returns to winter. But I am not like that, in terms of design thing here, most of the friends just live through that period. After that, they do not go through the production process. It is to open a base, what is it, what is the material, it is the distribution of this work to the manufacturer (Design Manager, Company B, personal communication, August 2, 2018).

As mentioned initially, companies' blending manual labour with industrial production may impose advantages in companies. For instance, how hand-made or industrial production can contribute to the final form of the product is expressed as follows:

> For example, there are three colours, there is an eva sole in between, and the probability welt is like this. The craftsman has done this one by one handcrafted. But you take this and try to produce in industry. You try to make two colours and 3 colours in one mould with thermo in the same sense. When you take out everything in one piece and offer it to the sole assembly or the part to produce, it will not be the same product. Of course not. Because there is another issue there. It became heavier. Why was it heavy? Because he put it all together and made it out of one piece. In the other, the craftsman does a lot of things to lighten it, puts a thin piece of leather under it, and here puts an eva sole (Design Manager, Company B, personal communication, August 2, 2018).

This example also refers to a flexible production model so that when hand production forms part of the production, a flexible production model emerges, and that production can be intervened at any time. In addition, the fact that manual labour takes place at a stage of production can have an effect to increase the added value of the product. The workshop owner of Company F states this value with these words: “Look at all European countries, look at rich countries, they all pay a different price when the product is handmade” (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In addition, the owner of company E states that the craft will remain as a part of the industry:

> In other words, there are branches of industry in which manufactures will never be cut off from the industry, and they have to be. This relationship must be constantly compared with the artisan and the engineer in the factory, and he must constantly convey what the artisan sees in the small production unit (figure 6.12) and that the other cannot see it in that large-scale production. So somehow, current has to pass through. They should meet so that they can get what they cannot see from there. There is also aesthetics in this business, of course. Perhaps in the industrial process, there may be aesthetic blinding when saying fast production cheap production or something. The small production puts it on the

table, inverts it and loves its product. His highly sensitive state must also flow to the industry. Let us say the sensitivity of the thing there, I get it now (Founder-Designer, Company E, personal communication, July 22, 2019).

Figure 6.11 : Workshop, Company E.

Companies employ craftsmen within the company, and they can collaborate with masters from outside the company to get support for production or prototyping. Even some companies do not have any production possibilities of their own, and they can realize all their productions with the companies established by craftsmen. Owner of the Company F states, “Our company does not have one square meter production

facility" (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

The owner of the workshop producing for the Company F gives the following information about the companies producing for the Company F:

> Handan Temeltaş: The Manager of the company said they have close to twenty master connections. Are you the biggest of these workshops?
>
> -Yes, as a woodworking workshop (Figure 6.13). (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).
>
> Handan Temeltaş: What kind of workshop are the others?
>
> - They are also a wood workshop, except here, as furniture, we are 3, one 3 or 4 chairs and armchairs, there are 3 upholsterers, there are 3 metalsmiths, there are lighting workers, brassfounders, etc. or actually we are a crowded group (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

Figure 6.12 : Workshop, Company F.

> I can say we work with between five and ten companies. There are companies that we have started to work with, and companies that we have changed. There are certain companies that do this work. But now, for example, we have both decoration and metalwork, we have coating works, we have cutting and sandblasting works. For example, this glass mouth, which we call rim, is rimmed in a special company. We only go to one company for the production of handles which is a small company. The masters there pour the things into moulds, the handles, the team, they combine it with a laser, they give it to us, they draw rims

> in the mouth and give it back. We found a new company. This company produces packaging and works on glass packaging. That company will support us for the customer project. We can say ten, that is, we work with ten companies comfortably (Industrial Designer, Company D, personal communication, July 18, 2018).

Outsourcing to craft production provides flexible production to companies and the opportunity to find and work with the best performer. In addition, companies can negotiate with new manufacturers for newly created product groups:

> Let us say that we will go into brass material for a while, here are certain table objects and decoration objects made of brass. We are also comfortable about the product, so we bring it, we do it, if it does not work, you can get it out of sale after a year. We are very comfortable, so this is the advantage of working with different masters. For example, you produce thirty with one master and we look at the sales of thirty ones. If the sales are good, another thirthy is ordered and another fifty is ordered and the market is measured on a trial basis. So it is a bit like that in the decors, of course, not thity, fifty, but two hundred fifty sets are coming, five hundred sets are coming, and it continues depending on the situation (Industrial Designer, Company D, personal communication, July 18, 2018).

Some of these companies can also offer a capital contribution in order to lead the formation of new production companies. For instance, Company D opened a joint production line in a company that it co-financed with the main glass company due to some economic balances.

The hybrid application of handcrafting with industrial production can positively affect the competitive conditions of the product output in the market and ensure that the handmade production knowledge and industrial production knowledge are mutually fed from each other within the company:

> In other words, being aware of the artisanal thing and the industry can create synergy. If it creates synergy, it has a meaning. In other words, if you sew something made with industrial processes by hand as a sewing machine does, let me say something very clear, instead of harvester, you will put people with sickles into the crop field. It has no meaning. Is there? Could you sell more

> expensive cake made from that flour? We cut it by hand and then took it to the mill. When we say that we grind it in a mill with a special water or something, is it worth it? This is the critical thing. If it adds value to it, if it alters it, if it gives it strength, if it enhances its aesthetics, then the value of that artisan touch backwards comes out when it is produced on an industrial platform. It's a matter of seeing the trace of the artist's artistic collaboration in the industrial output (Founder-Designer, Company E, personal communication, July 22, 2019).

One of the most critical features of craft knowledge transferred to industrial production is the contribution of aesthetic innovation:

> The originality of a craftsman is not lost in glass design. Due to our factory in which we carry out handmade production, we already have many projects that started as hand-made and later became an industrial product. Our design manager will explain this better through design projects. We can only talk about the interpretation of this originality according to the industrial conditions. It is ensured that the designer's original designs are produced in larger lots, cheaper and in more suitable weights. In this case too, you must compromise very little on design. But this is never in the form of giving up the originality of the design and turning it into a flat product. It is in a way that carries traces of the originality of the design. Because, if this originality is the main thing, it is tried to be preserved as much as possible (Designer Manager-2, Company A, personal communication, August 23, 2017).

6.4 Theme 4- Collaboration with Craftsman

The way to benefit from the craftsman's knowledge is to obtain this implicit knowledge through collaboration. Collaboration with craftsmen is one of the essential themes of this thesis. The codes of this theme have been collected in four subsets. The craftsman's work, the working environment, new product development process, reason of collaboration, how this work is carried out, and the attitude of the company management in the joint work with the craftsman is discussed (Figure 6.14). First of all, the person working with the craftsman in the company can be the designer, engineer, technician, R&D manager, or product manager. Within the scope of this thesis, designer-craftsman collaboration has been emphasized, especially since product design is in question.

The best way to benefit from craftsmen's knowledge was to obtain this implicit knowledge through cooperation with the craftsmen. In addition to the companies' internal craftsmen, it is also possible to work together with craftsmen outside the company. Working with craftsmen from outside the company was a common feature in all companies except Company E (Figure 6.14). In Companies A, B and D, it is possible to work together with the craftsman by experiencing. In these companies, the craftsmen saved the company time during the design creation by sharing their knowledge of the material and production method with the designer. Working with craftsmen one-on-one was seen more in Companies B, D and F than in the other companies. In Company B, the prototype workshop was located in the same building as the designers, while in Company F, the masters' workshop and the designers were in the same building. In these two companies, it was easier for the designers and craftsmen to consult with each other and work together as needed because they shared the same physical environment. Company A expressed the opinion that the master cannot create innovation alone, and his knowledge can only be transferred to new products under the designer's leadership. Thus, the designer took a leadership position.

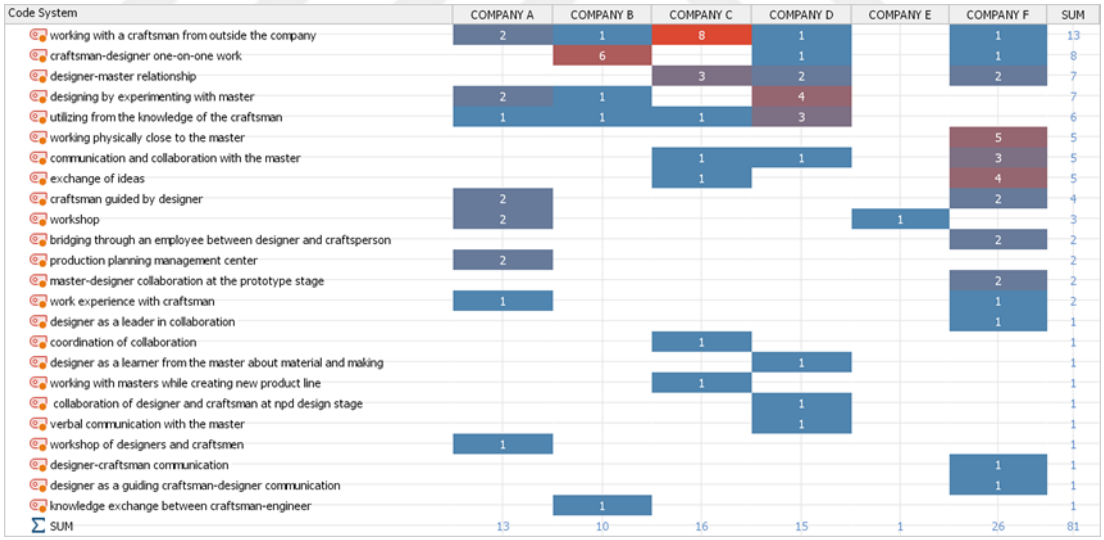


Figure 6.13 : Theme 4-collaboration with craftsman-distribution of codes according to companies.

In all three sectors, cooperation is carried out with craftsmen outside the company. In the glass sector, external craft support was sought for prototyping and production (Figure 6.15).While other companies receive support from outside craftsmen in prototype and production, Company A received support from a woodworker for a product incorporating wood in addition to its primary production material, glass.

Working closely with craftsmen was observed most often in the leather and furniture sectors. For small-scale companies, one-on-one work between designers and craftsmen was mostly encountered in the furniture and glass sectors. In contrast, in large-scale leather and glass companies, there were departments that oversaw this collaboration. Product management or research and development (R&D) departments provided communication between the craftsman and the designer. In these companies, the designer could also communicate and collaborate with the master on her/his initiative. However, some companies viewed this cooperation with suspicion, as it was felt that by working with the master, the designer was not innovative enough. Others felt that the traditional perspective of the craftsman should not influence the designer. Generally, in all the companies, it was expected that the designer should guide the craftsman and obtain the needed information skilfully while maintaining his creativity. Additionally, in the leather sector, it was emphasised that communication with the master was critical to the designer's development in the material and construction techniques during the early years of his career.

Code System	Glass Sector	Leather Sector	Furniture Sector	SUM
working with a craftsman from outside the company	3	1	9	13
craftsman-designer one-on-one work	1	6	1	8
designer-master relationship	2		5	7
designing by experimenting with master	6	1		7
utilizing from the knowledge of the craftsman	4	1	1	6
working physically close to the master			5	5
communication and collaboration with the master	1		4	5
exchange of ideas			5	5
craftsman guided by designer	2		2	4
workshop	2	1		3
bridging through an employee between designer and craftsperson			2	2
production planning management center	2			2
master-designer collaboration at the prototype stage			2	2
work experience with craftsman	1		1	2
designer as a leader in collaboration			1	1
coordination of collaboration			1	1
designer as a learner from the master about material and making	1			1
working with masters while creating new product line			1	1
collaboration of designer and craftsman at npd design stage	1			1
verbal communication with the master	1			1
workshop of designers and craftsmen	1			1
designer-craftsman communication			1	1
designer as a guiding craftsman-designer communication			1	1
knowledge exchange between craftsman-engineer		1		1
SUM	28	11	42	81

Figure 6.14 : Theme 4-collaboration with craftsman-distribution of codes according to sectors.

The R&D director of Company C expresses the importance of the designer's learning from the craftsman, especially in the first years of his career, to get to know the sector: "In the first years of the profession, until the thirties and forties, designers have to work

hard with craftsmen. There is such a requirement. Because they have to learn many things they do not know from those masters" (R&D Director, Company C, personal communication, October 31, 2019).

Collaboration with the craftsman usually occurs where the master is, and it can be inside or outside the company. However, if the exchange of knowledge cannot be provided in the same environment, knowledge can be received from a far. At Company F, a furniture company, the designer meets the master at certain stages of the prototype: "We talk with the master here and when the sample comes out, the designer comes, but the designer comes at every stage of the product, not the final sample" (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

In addition, the designer in the furniture industry can visit the master in his workshop to get the suggestion of the master related to the product:

> The radius on the back is too much, you need to revise it in this way. By the way, it is actually the moulder itself that gives the final form of the design. Because we pour a design into a mould drawing, process it as wood and take it away at CNC. The moulder master says that "this part of the product cannot come out of the mould, the depth of it is too much here, it can cause you such trouble like this" (Design Centre Manager, Company C, personal communication, September 26, 2018).

In the glass company, there was a workshop where the designers benefited from the knowledge of the master. This workshop caused the designers to work more closely with the master:

> Handan TEMELTAŞ: Craftsmen and masters complain that they do not have apprentices: they tell as "we don't have apprentices, we don't know what will happen in fifty years or thirty years from now".
>
> In fact, it came to my mind that we had one master here a long time ago when this place was not in this state. He had a small workshop. Sometimes we would ask him if we could cut and mow something. Our master was able to make glass sandblasting, glass cutting. He could do small-scale decoration works, colouring maybe. In fact, he was quite advanced, he was doing the drilling and screwing alone. He was there somewhere, and he had a small workshop near where we are. We used to stop by him every two weeks to consult him. Sometimes we

> would take our products to see what happens if we cut your mouth a little bit crooked, how it happens when you cut it with a wavy cut. He also added his own thoughts and was very active with us. Actually, we had that type of work a long time ago, but our relationship did not last long. The workshop was closed when he retired (Designer Manager-1, Company A, personal communication, August 23, 2017).

Another essential element of this collaboration is why this collaboration is needed and at what stage of this collaboration occurs in the new product development process. In companies working with masters from outside of the company, while the designer works on the product idea or prototype, he can visit the master in his workshop to carry out the product development process:

> We started to work with a new coppersmith, brass, and steel producer. They are doing business in many companies. I met with them a month ago and came to their office twice, now we have ordered something new. I will follow these products which are produced by this producer. Because it is a new company. But if a routine comes into play, for example, with the company we work with in the Bazaar, we settled the products. After that, I have not seen the master for about six months. Products are coming. In other words, after the product design is finished and its development is over, I do not meet with the manufacturer. Because there is a team that follows the production (Industrial Designer, Company D, personal communication, July 18, 2018).

Like the glass sector, the furniture sector also needs the craftsman's knowledge when developing a new product group. Some of the critical reasons for collaborating with the master are that the master is easy to access, and there is no need for procedures for this collaboration:

> If you make the bottom of the glass in this way, it will not sit on the plate, you have to feed it as follows. Thanks to them (masters), glasses have come to this point. This was not a process that we, for example, could advance ourselves. Because they are movements that we are very foreign and repeat a lot in daily life, but in fact, we could not notice their return in terms of design. We progressed there completely with the masters (Design Centre Manager, Company C, personal communication, September 26, 2018).

The most crucial reason for consultation with the craftsman is that the craftsman has the know-how of materials and production techniques accumulated over many years. For instance, the R&D Director of C company emphasizes that in order to apply tow technology in furniture, it is necessary to have knowledge of this method or to work with someone who has this knowledge.

Through collaborations between designers and craftsmen, the designer has the opportunity to develop himself/herself and develop products. For instance, it is considered essential for the designer to be in the workshop where the craftsmen work and to see the prototype and production process in the shoe industry:

> Sometimes we tell the designer to come workshop area to learn. You know this process, the designer has to swallow a little dust, so that he/she can learn the job and understand the work. Because the more the designer is new and does not know the job, the harder our job becomes (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

The reasons for collaborating with the master can be summarized as developing the product idea, making prototypes, designing by experimenting together, taking revisions for the designed product, and taking part in all stages of the product. For instance, the company in the field of furniture expresses that they collaborate with the master during the product development with the following words:

> We work with the masters we work with them from here. For example, there was a coffee table project recently, mostly about solid wood products. For example, our solid wood leg was not very developed here. When solid chairs are made, we work with masters and workshops from outside. While developing products, we develop together with them. After that, for example, you exchange a lot of ideas. Because true craftsmanship starts with the skeleton, namely the skeleton: the chair frame. In the production of solid wood frames, craftsmanship is required, that is, there will be technical knowledge, as well as craftsmanship. So the man will know well how to shape that tree, then it is done. For example, we had a coffee table production, we sent it to him. You definitely draw a project again, you do something, and he creates a prototype for you by adding his own comments (R&D Director, Company C, personal communication, October 31, 2019).

In the vast majority of companies, collaboration with the craftsman occurs during the product's prototyping. In some of these companies, the prototype of the product is created with the help of masters working outside the company:

> We have a master outside our company. He is dealing with woodworking and doing it handmade, he does not have much automation. For example, we did not want classic wooden joints at the stage where these legs were to be built. We said that we will use it as a desk furniture in the office. He said let me make a 45-degree frame in that classic wooden work and tie the furniture legs to it. We did not want it that way, we wanted to pass pipes. Half a pipe goes into them. He worked these by hand, but for example, the angle the foot should be, the distance between the two legs, and these were made by his own methods by working on the prototype. The person who makes polyurethane moulds is also in another city, we have a master there we cooperate with (Design Centre Manager, Company C, personal communication, September 26, 2018).

> If necessary, we go to the factory to the master. For example, sometimes the master can talk hypothetically about the mould. The master says, "it's a difficult product, I have to try it". The opposite picture comes to us, but the opposite picture comes at random. So, the master simply says: “We try to produce this, but only in this way”. We are preparing the opposite picture. Information comes from the moulding workshop with a note like “we will try, we will see”. If you want to see it, if you want to be with the master, if some changes need to be done there, you sit side by side with the master. Designers do it in this way. Our foreign designers are also going to factory to work with masters. I have also gone. There the craftsman cuts, trims, folds, and reaps the glass beside the designer. As a designer, we look at how close he is to the original design idea. It can also be this: The master can accidentally do something better, brings it together (Designer Manager-1, Company A, personal communication, June 5, 2018).

> We have one sample made, that sample is made by the craftsman, and it is put in front of us. If we can, if we have time, we also go to the producer between the manufacturing of samples. Because the manufacturer is always doing wrong, or we have drawn it wrong. Usually, the right product comes out not the first time,

but the third time on average (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

We also get support from masters for something: For example, in the decorative products we have in our minds, the men (masters) produce the flower patterns that can be placed on the edges of the products from the reference photographs we have (Industrial Designer, Company D, personal communication, October 5, 2019).

Handan TEMELTAŞ: There are masters working in the company. For example, you have made a personal cooperation with the metal master from outside the company. But does the company cooperate with an outside master when needed? For example, with a master who does not work within the company?

We have a plastic master and metalworker who do not work within the company but work constantly. For example, we have a concrete master, when there is something fixed about concrete, we go directly to him. They are contracted workers, of course, people with annual agreements. If he says he cannot get out of it, we'll make a smaller prototype, but if his conditions are different, he doesn't have the time or technology doesn't allow, or if it's a very different product that we want to make, we look for someone else. I get expertise in small scale projects (Designer Manager-1, Company A, personal communication, August 23, 2017).

In addition to collaborating with the master in the prototype stage of NPD, sometimes incomplete design concepts can also be outputs of this collaboration developed with the prototypes created by the master and the designer:

Cutting glass is something very different. In other words, even though it looks very simple on it, you can see what kind of visual the glass will create when it is cut, only by experimenting, some patterns can create reflections that we can never imagine, for example (Industrial Designer, Company D, personal communication, July 18, 2018).

Apart from the collaborations mentioned above, designer and master collaboration can progress in product development, and this situation develops with the dynamics unique to that sector. The design manager in the shoemaking sector expresses this process as follows:

> The master we work with is active in every step of our shoe group from the birth of the shoe. He cannot tolerate slipping even an inch in that shoe outcrop. He says: “it should be like this”. If I did something new, for example, there was something classic, I added a lot of things on it at the first point. It was a straight thing; I gave it a name. We have done work to strengthen the brand. Suddenly the business went elsewhere. They said it would not stick or there would be a problem. I said no such thing would happen. After that, there were a lot of pads came to the outcrop. I thought we do not need that many pads, I think we should make a slightly larger pad, we cut them with a knife so we can fix them all. He said yes, we can but it would be a problem. Previously, they prepared different pads for each shoe sole for such things. Big cost, a lot of stuff. We changed it into two colours. And it was very nice when I created the texture and stuff. We dropped all the previous ones and started to continue like this again (Design Manager, Company B, personal communication, August 2, 2018).

As mentioned at the beginning, it is possible to be in collaboration with craftsman for developing ideas, as well as taking revisions after the product design is completed or in the mould stage:

> The radius on the back is too much, you need to revise it in this way. By the way, it is actually the moulder itself that gives the final form of the design. Because we pour a design into a mould drawing, process it as wood and take it away at CNC. He says that this cannot get out of the mould here, the depth of it has been too much here, it can cause you such trouble like this (Design Centre Manager, Company C, personal communication, September 26, 2018).

> One of our craftsmen gave our revisions. We made coffee cups. He said that, for example, the angle of the coffee cup is too much to hold, it has too much capacity to distance from the nose. For example, we have never even checked it, how much it takes, how much it does not. Then it was the same team's design of a glass cup (Design Centre Manager, Company C, personal communication, September 26, 2018).

The collaborative relationship between designer and craftsman does not always go smoothly. During the collaboration, these two parties may not agree and may advocate different opinions regarding the product.

The reason for these conflicts emerging is that one of the parties insists on an area that they do not know: It may be that these conflicts arise because the designer or craftsman who collaborated has a persistent attitude towards something that he does not have much expertise in:

> It is very difficult to manage, once there, you break things there, that is, the moment you break the harmony between the designer, foreman and sub-production staff, the moment you say "no, I don't want it that way, you will do it like that, brother" If you are not experienced, you may be insisting on the wrong thing. We come across this a lot. This then breaks that thing anyway, it breaks that balance there, and the job is to put the design into practice by struggling. The job gets hard then (R&D Director, Company C, personal communication, October 31, 2019).

A craftsman who is a manufacturer in the furniture industry states that he can make biased decisions while working with the designer, and how he handles this situation is as follows:

> They take our opinions into account, and sometimes we can be mistaken, so what they say can also turn out to be true. Even if something we say will not happen, we are still doing it. So, we see that we were also wrong. It is about experience. We can say that it will not work on a subject that we have not experienced, but then we realize it is happening (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In addition to these issues, company executives have expressed their opinions about how to work with the craftsman. Companies also implement projects to make this collaboration more efficient. In these collaborative studies, companies state that the leading person should be the designer:

> The designer will come up with an idea, maybe something came to the mind of the craftsman and he will say something like "One day I made something out of glass for someone and it looked like this, but it was hanging from the air," and I will come up with an idea for a second, then I will say something. But these are tough possibilities (Designer Manager-1, Company A, personal communication, June 5, 2018).
>
> Handan TEMELTAŞ: Yes.

> They are mostly wrong. Because I do not think it is possible for someone else to understand the work of a designer from the perspective of a designer. Their way of thinking is not very close. When you give a product to a master, he develops it, makes it. You always must force it. In other words, you should not hope that he will create something new or create something from yourself and approach the idea in your mind. Most of the time, you are forcing him to get his ideas out. You will throw an idea; the master will answer it. He will say something about this idea, even if it is absurd or something else. You must take that idea again and collect it and turn it into a design (Designer Manager-1, Company A, personal communication, June 5, 2018).

The owner of Company F, when asked what would happen in case of incompatibility in the collaboration of designers and craftsmen, explained that they did not experience such a problem because the designer guides this collaboration: "So, there can be no incompatibility between them (master and the designer) , the designer guides" (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019). Sometimes, to carry out this collaboration efficiently, there may be a department that provides communication between the designer and the craftsman:

> Handan TEMELTAŞ: With whom do the design departments work in coordination? Production?
>
> We are naturally intertwined with production. For example, let us say they have a glass project. They say we want to make a 300-cc glass 200 cc. Even if it is a flat conical product, it must pass our approval. Because the mould maker does not look from the perspective of the designer, there is a margin of error. Sometimes you change the ratio and increase proportionally. But there will be other problems. Not everyone can see it. We have had a lot of these mistakes. Sometimes they do it and send it directly to everyone. Then they see that there is a problem. We explain the reason and they must contact us again. That is why we are always in the middle. Maybe in a middle point, everyone's work comes to us and goes from us. We are the connection point to production planning department (PPD). In fact, the contact with the factories is as follows: For example, the project is coming, the demand is coming. We design. But if we need to talk to the factory, we do. Then, if I need it, I get some advance information. I design and send the project to PPD again. PPD sends it to the

> factory for the opposite picture. This time the middle point is actually PPD. We do not have a direct connection with the factory. We do not have an official correspondence link (Designer Manager-1, Company A, personal communication, June 5, 2018).

6.5 Theme 5- Contribution of Craftsman to NPD

This theme section is the essential theme of this thesis study. Within the scope of this theme, how the craftsman contributed to NPD, feedback from the craftsman to the industry, and opinions about this contribution will be shared. Until this stage of the thesis, the contribution of the craftsman to aesthetic innovation has been mentioned. The contributions of the craftsman to aesthetic innovation and functional innovation with examples from the opinions of employees and managers of the relevant companies will be discussed.

This theme isessential for evaluating the craftsmen's contribution to NPD from the idea development stage to production. Craftsmen's most important contribution is through material knowledge and production knowledge and experience (Figure 6.16). This knowledge is applied most often during the prototype construction and production stages. Additionally, when the designer and the craftsman create prototypes, this collaboration often feed the designer's future designs. Likewise, the designer refers to the craftsman's knowledge and experience regarding the compatibility of material and construction methods for the product concept. In addition to the idea and concept stages, craftsmen use their knowledge of material behaviour to inform designers about issues that may occur during the prototyping, testing and production stages, such as suggesting a more suitable upholstery fabric or material for the product form. When addressing these problems, craftsmen could also suggest a material that would have the same performance at a more affordable cost, as occurred in Company B. For Company B, the cost element is one of its competitive factors. Thus, the strategy of cost-effective materials is spread to every employee in the company. In Companies A and D (glass industry), including craftsmen in the prototyping process cut time and costs from the NPD process.

Code System	COMPANY A	COMPANY B	COMPANY C	COMPANY D	COMPANY E	COMPANY F	SUM
the contribution of the craftsman in the prototype stage	3	3	5	2		4	17
the craftsman's contribution to idea development	7		2	4		2	15
craftsman's contribution to NPD through production method	6	2		3			11
master's suggestion about the product	3	1	3	1		3	11
contribution of craftsman to product development	3		4	2		1	10
transfer of craftsman's material behavior knowledge in NPD	1	2	1			3	7
the craftsman as a problem solver in new product development	1	3	2			1	7
the contribution of the craftsman through material knowledge	1		1	2		2	6
the craftsman's problem-finding competence	1	2	2				5
contribution of the craftsman to product structure			3	1			4
problem-solving skill of master through material knowledge		3				1	4
design arising out of fault in prototyping	3						3
contribution of craftsman related to moulding			3				3
new molding proposal from the manufacturer and its application				2			2
feedback from craftsman to industry					2		2
problem-solving contribution of the craftsman about production		2					2
rapid prototyping by hand production	1			1			2
master involved in every step of the production process		1					1
alternative material suggestion						1	1
design idea from master-manufacturer				1			1
the craftsman's contribution about ergonomics			1				1
Increasing design efficiency with the skill of the master				1			1
the master's contribution to design				1			1
problem-solving contribution of the master related to moulding		1					1
following trends with the master producing to various customers				1			1
the craftsman's contribution to aesthetic innovation			1				1
the aesthetic contribution of hand production	1						1
master's suggestion on feasibility	1						1
the contribution of the craftsman in saving time in production			1				1
the competence of the craftsman in production				1			1
contribution of the craftsman to the usability of the product	1						1
craftsman's contribution to functional innovation	1						1
SUM	34	20	29	23	2	18	126

Figure 6.15 : Theme 5-contribution of craftsman to NPD -distribution of codes according to companies.

Besides, the craftsman workshop has a strong command of the market and trends, as it gives support to Company D and other companies in production from outside. During the collaboration with the designer and craftsman at Company D, the company receives information from the craftsman about the market's latest trends. This situation shows that the craftsman can also inform companies in the field of market research. As seen with Company D, craftsmen could have a separate production workplace and work with many companies independently. The craftsman, who had mastered the spinning production method, collaborated with the designer during the prototyping process. Since this method includes an experimental approach, products that failed during the prototyping process informed the designer about product development. In other words, experiences and faulty attempts during the collaboration between the craftsman and the designer could trigger new ideas.

The craftsman’s contribution to the product may be related to aesthetics, usability or ergonomics. The aesthetic contribution reflects the form of the product and often occurs due to hand production. The craftsman could contribute to usability by combining the material’s structure with the appropriate production method. For example, the craftsman’s application of a sandblasting method at Company A allowed a carafe to flow without dripping. At Company C, the craftsmen guided the company

through its transition from office furniture to home furniture and kitchen equipment by providing measurement standards. The company also improved its relationships with the manufacturers working in the area.

As a result of the collaborative work between craftsmen and the designers, the contribution to developing ideas was most often observed in the glass sector, while the contribution to creating prototypes was primarily observed in the furniture sector. In all industries, it was observed that the craftsmen transferred their material and production knowledge primarily through prototyping and consulting (Figure 6.17). The prototyping process with the craftsmen involved both the experimental/conceptual prototype and the final prototype.

Code System	Glass Sector	Leather Sector	Furniture Sector	SUM
the contribution of the craftsman in the prototype stage	5	3	9	17
the craftsman's contribution to idea development	11		4	15
craftsman's contribution to NPD through production method	9	2		11
master's suggestion about the product	4	1	6	11
contribution of craftsman to product development	5		5	10
transfer of craftsman's material behavior knowledge in NPD	1	2	4	7
the craftsman as a problem solver in new product development	1	3	3	7
the contribution of the craftsman through material knowledge	3		3	6
the craftsman's problem-finding competence	1	2	2	5
contribution of the craftsman to product structure	1		3	4
problem-solving skill of master through material knowledge		3	1	4
design arising out of fault in prototyping	3			3
contribution of craftsman related to moulding			3	3
new molding proposal from the manufacturer and its application	2			2
feedback from craftsman to industry		2		2
problem-solving contribution of the craftsman about production		2		2
rapid prototyping by hand production	2			2
master involved in every step of the production process		1		1
alternative material suggestion			1	1
design idea from master-manufacturer	1			1
the craftsman's contribution about ergonomics			1	1
Increasing design efficiency with the skill of the master	1			1
the master's contribution to design	1			1
problem-solving contribution of the master related to moulding		1		1
following trends with the master producing to various customers	1			1
the craftsman's contribution to aesthetic innovation			1	1
the aesthetic contribution of hand production	1			1
master's suggestion on feasibility	1			1
the contribution of the craftsman in saving time in production			1	1
the competence of the craftsman in production	1			1
contribution of the craftsman to the usability of the product	1			1
craftsman's contribution to functional innovation	1			1
Σ SUM	57	22	47	126

Figure 6.16 : Theme 5-contribution of craftsman to NPD -distribution of codes according to sectors.

In all sectors, the craftsman's ability to discover and solve problems with a product was a vital contribution. For instance, a craftsman in the shoemaking sector identified that a specific material could become folded and deformed during production and suggested a suitable alternative material for this product. In the furniture sector, the

manufacturer noted that the furniture to be produced might cause problems during the installation stages and suggested modular production. A craftsman in the glass sector noted that the colour red could not be applied due to tolerance during production and that the colour blue should be used instead.

The design chief of Company A from the glass industry explains how the company benefited from the aesthetic contribution of the craftsmen as follows:

> Handan TEMELTAŞ: At that time, there was the statement that some handmade products in factory are adapted to the industry when they are in high demand, which we mentioned as number two. You found it very ambitious later. Then I will look at it in factory later.
>
> Yes, I can only say it this way. Here is the example (he gets up and brings the sample, a sample jug) (Figure 6.11). Now this is a handmade product. Normally, of course, they do this even more freely. You can see that the handle is pressed against the product and pulled and glued. But this one seems a bit more automatic, but it is made by hand. A master took that handle and glued it here. Here is one, if not a super example. A handmade product. This glass form comes, and it sticks, and it is very industrial, so it looks very industrial. We are wondering if we can turn it into such an aesthetic product. Sometimes it can be very noticeable to take it out of this mould like this or to make the bottom thick. But there is a problem in automatic production. You can easily produce by hand. At this stage, hand production can contribute to the realization of the product. The bottom of the design is hollow, starts at the top and is very thick. It is not a problem to produce it in hand production. For example, if you will produce a whiskey glass with this method, it looks very nice (Designer Manager-1, Company A, personal communication, June 5, 2018).

Figure 6.17 : Jug, Company A.

Even though company C in the furniture sector has industrial production, it explains that the craftsman will continue to exist in the sector with its aesthetic contribution to the new product development:

> The activity of the master never ends. In other words, he will not be missing in any period. Human beings will be involved and exist somewhere in the industry. I do not think of anything else. In other words, no matter how much you become mechanized, no matter how much you put these works into automation, the human will definitely exist somewhere at some point in that work. Let us assume that today the automotive industry or the white goods industry has adapted to industry 4.0, let us say that there are facilities that produce with robots and so on. Most of them are, anyway, the master enters it in some way. For example, let me give you an example from Germany, I met a friend from Germany during a fair visit, the man is a foreman in the mould department of Mercedes, so no matter how much you put it in automation, you will need a foreman in the mould

> department. Could I explain? I do not think it will disappear completely, and if you are dealing with an aesthetic product, craftsmanship is definitely coming for this job, since the furniture sector existed, art and craftsmanship is in this business (R&D Director, Company C, personal communication, October 31, 2019).

Besides the contribution of the craftsman to aesthetic innovation on the product, he/she can also contribute to functional innovation of the product. Again, the design chief from the glass company explains how the master solves the usability problem encountered in a decanter design and production with these words:

> They could not do it in the world, nobody could. The customer went to a few places, and they could not produce it. The trouble is: How do we make this product? Of course, this has a try before. The mould shape is the same here, it is produced in the same way. This is not a problem, actually the problem is: Now we make it to be cut, somehow you fill the wine. Your glass is here (under the opening to pour from the decanter) when you start pouring, but if you put another glass there (on the base of the carafe) it would be good. Because the liquid flowed from two places. We recorded and sent a video to explain this problem. We mentioned that if there is no protrusion or beak, the liquid inside goes down as it is. The form is a suitable form. If I do it very quickly, I will say if I can solve the problem, but it does not disappear. We sent it. I have seen nearly a dozen examples of this. I saw different forms. Ten separate moulds were made. First, the craftsmen in hand-made thinks to create the proper form: How do I get this glass out of this thing so thin? How do we empty the middle? How will that glass flow? Which are smaller problems. How do we make this beak? After all, we produced this. The masters grinded these places very well, they worked hard. They even used a special solution on its surface for fluidity here. Eventually it started flowing smoothly (Figure 6.18) (Designer Manager-1, Company A, personal communication, June 5, 2018).

Figure 6.18 : Carafe of Company A.

After mentioning the contributions of the craftsman to innovation, before describing which stages of product development he/she supports with examples, it is necessary to mention the problem finding and problem-solving ability of the craftsman related to product development because it is vital to be able to see the problems encountered in new product development and to find solutions for them.

The craftsman's ability to identify and solve problems often relates to material behaviour, moulding, and manufacturing. For instance, a craftsman working in the relevant sector can identify the problem with the product and make suggestions about the material:

Things are a little different in handmade and automatic production there. But what we understand from the craftsman is the master, right? (Designer Manager-1, Company A, personal communication, June 5, 2018).

Handan TEMELTAŞ: Yes, master.

We do not really mean the man standing at the machine, do we? (Designer Manager-1, Company A, personal communication, June 5, 2018).

Handan TEMELTAŞ: No.

- The issue there is already moulding and design. Let me tell you about a project we transferred to the factory, I am not interested in the factory side, but I know more or less the order there. The design is sent, and the opposite picture is requested. But if there is a difference in the opposite picture, the person there is already talking about what the master said. An employee of the mould department says that this handle cannot be bent from here to here or that the red colour inside cannot merge with this white / transparent, it will explode, its tolerances are different. So, he says "please draw the handle blue or make it thinner". "According to this situation, we made a drawing for you and evaluate the opposite picture accordingly," they say (Designer Manager-1, Company A, personal communication, June 5, 2018).

Now every material has a bearing force according to where it is used, there is a self-bearing force, these need to be calculated. But to look naive, sometimes they can be used too thin or too thick, we intervene here to weigh the weight, we say "this is wrong, if you use such a large tree, it will crack and freeze. The large tree leaves a certain amount of moisture in it". But there are many things in this business such as if it shrinks and dries to a certain extent, it will be a dried tree and it will not lose its bearing. We say them one by one; we adjust on it and the product comes out (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In addition to problem-solving ability related to material behaviour, the craftsman may also indicate that an additional material should be placed on the product. Likewise, he can discover a production problem: "There, our master is like a safety insurance. He says no, you need to make an addition here, he calls the modeler" (Design Manager, Company B, personal communication, August 2, 2018).

> They also interfere with the case of the furniture, for example we make the structure, but he (craftsman) says: “look, I furnished it, I am dealing with such a problem”. That seam needs to be pushed or pulled from there to make it fit better. They are involved in such decisions. I do not even say that they are involved, we are included in them. It is already something they have done (Design Centre Manager, Company C, personal communication, September 26, 2018).

There are also masters in the furniture and shoemaking sectors that solve the problems that arise during the moulding phase of the product:

> The radius on the back is too much, you need to revise it in this way. By the way, it is actually the moulder itself that gives the final form of the design. Because we pour a design into a mould drawing, process it as wood and take it away at CNC. He says that this cannot get out of the mould here, the depth of it has been too much here, it can cause you such trouble like this (Design Centre Manager, Company C, personal communication, September 26, 2018).

> When dressing up feet, there are some details. He (craftsman) says:” It cannot be. There is a problem with this shoe mould, we need to change it”. I say: “Okay, master, what should we do?”. He says “we need to feed that backside. There is a problem in the waist part, we need to fix it, if we do not correct the mould, this will not turn out to be good”. “Okay”, I say, we go to the mould workshop, we fix it at the mould workshop. We come again; the master gives his criticism again. If there is no problem anyway, it adjusts the system itself. The master follows from beginning to end (Design Manager, Company B, personal communication, August 2, 2018).

After citing the craftsman's problem-finding and problem-solving skills, the stages in which the craftsman contributed to the NPD process are mentioned. The craftsman contributes to the development of new products in idea development, prototyping, and production stages. The craftsman supports this process if he/she is consulted during the idea development phase in developing new products:

> Handan TEMELTAŞ: Is the craftsman involved at the point of creating projects?

> No, it is possible that I asked the master even at the beginning. I am even doing a design this time. There, for example, I must ask the master directly. I made a couple of "sketches" from the beginning, but before I started drawing in three

> dimensions, I must ask the master at this stage if you can do this. Because it can be a waste of labour. If the master tells me, “We can do it”, I will continue. I am going to talk about it today (Designer Manager-1, Company A, personal communication, June 5, 2018).

Sometimes the craftsman can not only state his ideas but also prototype his proposed product idea and express his opinion on the prototype:

> For example, we worked on the decor of this design, our graphic designer worked, and it was produced. But if I am not mistaken, this decor is completely the decor that our manufacturer recommended, we did not make this decor ... For example, this is the application of a decor to glass that I designed, but we have just applied it, for example, we designed it in colour at that time, and then we decided to apply it to glass for something else, such a decor for example, I think this also came from the manufacturer. We liked it, yes. We said we can do it in the same way, these are always with the decor from the manufacturer (Industrial Designer, Company D, personal communication, October 5, 2019).

In fact, products developed with the craftsman's idea can be awarded successfully:

> There is an example of a centrifugal casting glass plate. We received an award with this project. The person who started this product and made some improvements to its pattern is the master at the factory (Designer Manager-1, Company A, personal communication, August 23, 2017).
>
> Handan TEMELTAŞ: Yes, this is a very good example.
>
> They worked in partnership with the designer. Only the designer designed the form. One of our team has finished developing the patterns inspired by a fabric. Our designer also added a small interpretation to it. He also took care of its form. But the master transferred his own experience to the mould in that product. Because the centrifugal casting method is not like normal moulding as follows: The glass falls exactly into a mould and the centrifuge spreads into the mould in a rotating manner. In this case, the glass is jumping off. Here, it is the height, depth and multiplicity of the engravings that determine the speed of the glass. This is a complete master knowledge. There is no rule that the product will come out without spin as soon as I draw it. It is absolutely necessary to intervene. The

> centrifugal casting method is just such a method (Designer Manager-1, Company A, personal communication, August 23, 2017).

In the furniture industry, the craftsman also has support for product development. The designer may refer to the knowledge of the master when designing the product, especially in matters such as material knowledge, production knowledge, and material selection:

> The craftsman who manufactures the product says, "Let's not use dart seam there, let's do something different like this, it would be better if we did this, or it would be better if we made a wick, or it would be better if we did it. When the craftsman proposes them, if you allow the application, different products may come out from time to time. Even if the design does not differ completely, it may differ within the product, sometimes very correct decisions are made (R&D Director, Company C, personal communication, October 31, 2019).

> Foremen and craftsmen are involved in the area where fifty percent of those engineers' work. They also contribute a lot, so here is how to get it upholstered, to how that thing gets attached to the armrest. In fact, everyone puts an opinion on the product. Actually, the worker in the company also does this: "We connect it like this, but if we connect it like this, we produce it more easily". This gives you feedback from a productive point of view. All of these constitute the integrity of that design (R&D Director, Company C, personal communication, October 31, 2019).

One of the essential stages of new product development is the prototyping stage. Because the prototype enables the discussion of the new product on a 3D object, on the other hand, it enables the product's production to be tested. The support of the craftsman can be used in prototype production, especially in small projects:

> We have a plastic master and metalworker who do not work within the company but work constantly. For example, we have a concrete master, when there is something fixed about concrete, we go directly to him. They are contracted workers, of course, people with annual agreements. If he says he cannot get out of it, we'll make a smaller prototype, but if his conditions are different, he doesn't have the time or technology doesn't allow, or if it's a very different product that

> we want to make, we look for someone else. I get expertise in small scale projects (Designer Manager-1, Company A, personal communication, August 23, 2017).

The company's prototyping process with the craftsman may realize after the product's design is completed or while the product design is in progress. The prototype made during product design is preferred both to see the product in three dimensions and to shape it with the changes that the craftsman can add or suggest: “When we built the first prototypes, for example, he hand-crafted ceramic moulds, for example, he handcrafted ceramic moulds from wood, he (master) gave us a lot of directions there” (Design Centre Manager, Company C, personal communication, September 26, 2018).

In some companies, after the product design is completed, the process of creating a prototype with the craftsman begins:

> Again, the preliminary works create preliminary sketches, like what will the surface be, which upholstery foam we should use here and so on. Until this stage, we actually do not have much communication with the craftsman or the master. Whenever we need to communicate with the craftsman or the craftsman, after the product reaches the prototype stage or when the prototype is made. We actually share information with the masters or operators who produce these prototypes we work there (R&D Director, Company C, personal communication, October 31, 2019).

The master owner of the furniture company analyzes the prototype process from his perspective as follows:

> They (designers) draw things, make them 3-dimensional. In other words, if the only reason they make it three-dimensional is that they can see, two dimensions are enough for us. After that, we buy it and produce exactly the same with the right materials or the materials they want. When there is a problem or something, we share it together because not every drawn thing can be made of every material, we make the necessary warnings for it, they correct it if there is a need for correction and then production is started (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

There may be an idea about the product that will emerge in creating a prototype in the furniture industry, however, in the glass industry, the prototype or production method can give unpredictable results:

> Cutting glass is something very different. In other words, even though it looks very simple on it, you can see what kind of visual the glass will create when it is cut, only by experimenting, some patterns can create reflections that we can never imagine, for example (Industrial Designer, Company D, personal communication, July 18, 2018).

6.6 Theme 6- Knowledge

It was not easy to receive information about the transfer of craft knowledge to NPD processes at the beginning of the interviews with designers and managers. The sample cases mentioned during the interviews informed the researcher about this knowledge transfer and how it takes place. Company A has both industrial production facilities and handmade production facilities and transitions its knowledge sharing between these two production modes. For instance, the handmade production department supports prototype production that could not be realised in the mass production department. In another example, because a handmade product was in demand in the market, the same design suitable for industrial production was produced and sold. In other words, the production of a few parts made by hand was used as a guide for measuring the market demand.

Another remarkable point in company A is that the communication between the craftsman and the designer is carried out through the product planning department. In Company A, communication between the craftsman and the designer was carried out through the product planning department (Figure 6.19). Since the company's factory was located outside the city, designers and masters did not always have the opportunity to work together. Although there had once been a glass workshop located in the same building as the company's designers, the glass workshop was closed after the master retired. The designer interviewed mentioned that he could contact the master, when necessary, but he had to go to the factory for one-on-one work. The designer at Company A thus was allowed to take the initiative to work with masters outside the company.

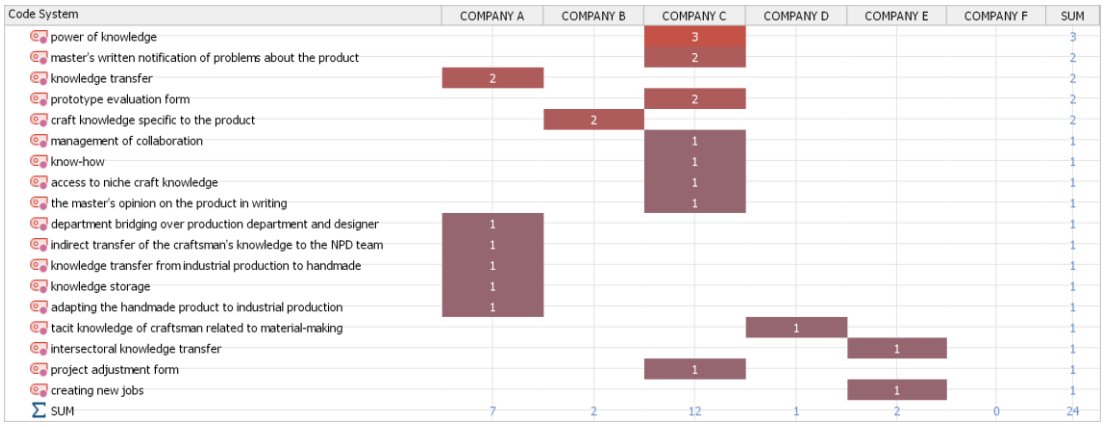
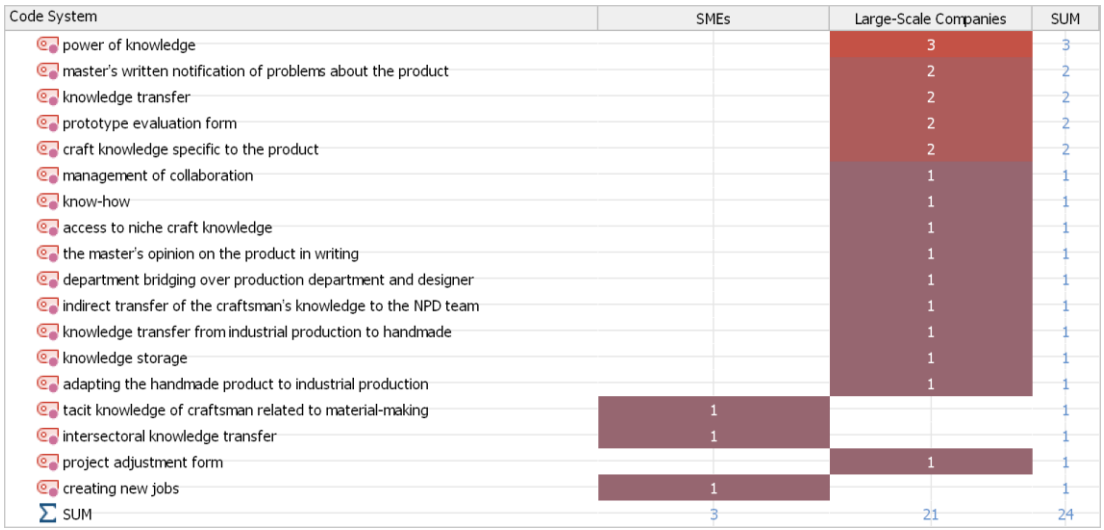


Figure 6.19 : Theme 6-knowledge -distribution of codes according to companies.

In Company B, it is investigated whether the master could transfer the problem-finding and -solving ability from one product to another. The head of the R&D department mentioned that a problem solution for women's shoes might not work for men's shoes. Additionally, the company's product development processes were seasonal, creating time pressures. For these reasons, no effort was made to develop a system of knowledge transfer. However, if the same master was involved in the development of the prototypes of two different shoes, it is possible that the knowledge could be reused.

Company C collected ideas from masters with material and assembly knowledge while collaborating with craftsmen during both the prototype and assembly phases. The management team, which prepared the prototype evaluation form and the project arrangement form, collected the problems experienced by the employees during the prototype phase and the assembly phase and suggestions for improving the project, a process the company referred to as the suggestion system. The mode of production and use of modular products in this sector facilitated the reuse of the knowledge obtained from craftsmen (Figure 6.20).



Code System	SMEs	Large-Scale Companies	SUM
power of knowledge		3	3
master's written notification of problems about the product		2	2
knowledge transfer		2	2
prototype evaluation form		2	2
craft knowledge specific to the product		2	2
management of collaboration		1	1
know-how		1	1
access to niche craft knowledge		1	1
the master's opinion on the product in writing		1	1
department bridging over production department and designer		1	1
indirect transfer of the craftsman's knowledge to the NPD team		1	1
knowledge transfer from industrial production to handmade		1	1
knowledge storage		1	1
adapting the handmade product to industrial production		1	1
tacit knowledge of craftsman related to material-making	1		1
intersectoral knowledge transfer	1		1
project adjustment form		1	1
creating new jobs	1		1
SUM	3	21	24

Figure 6.20 : Theme 6-knowledge -distribution of codes according to company scales.

In Company E, a manager with a craftsmanship background managed a factory with industrial production for many years before downsizing the company and returning to handicraft workmanship. This company's manager prepared production templates using cutting technology to make his leather bag moulds (Figure 6.21). The manager's knowledge of craftsmanship was turned into a new production model and a new craftsmanship model.

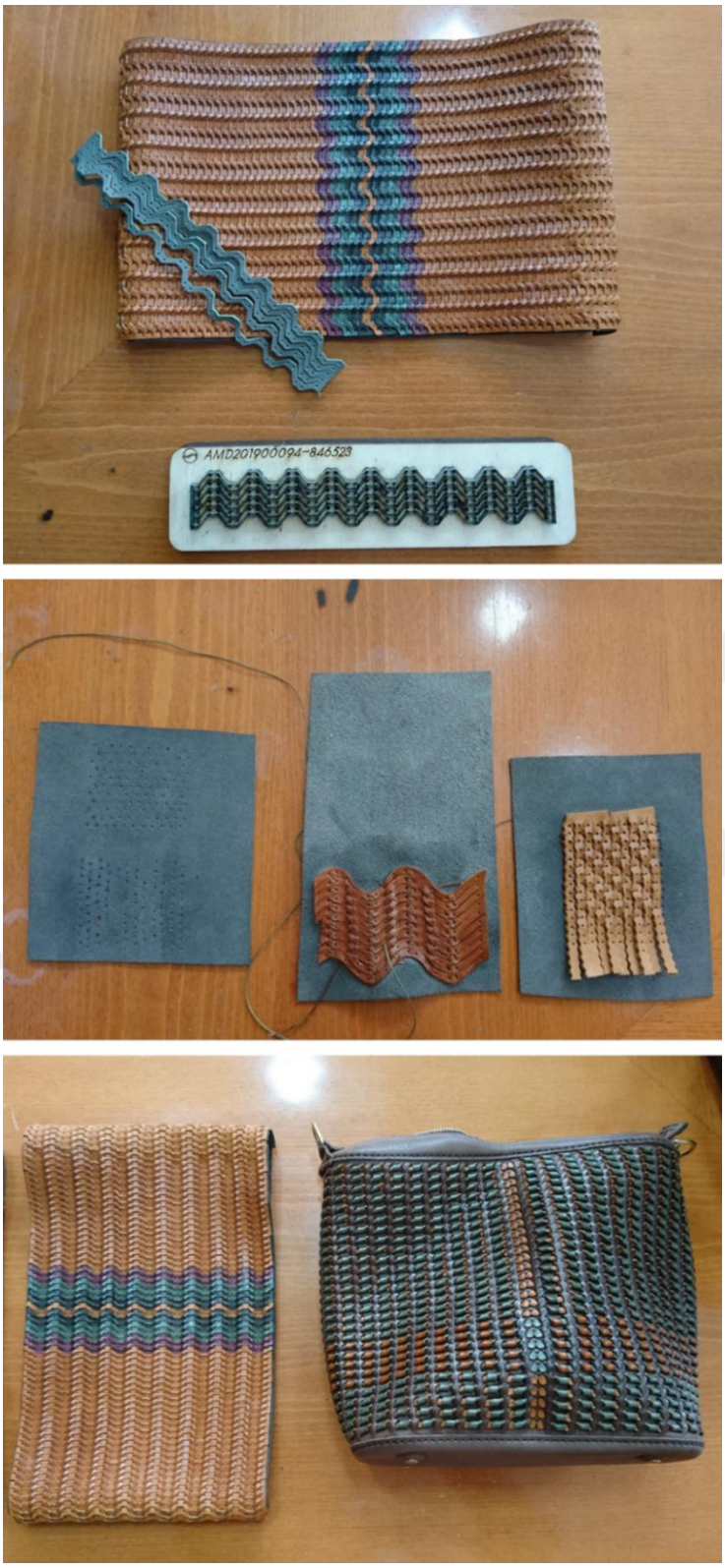


Figure 6.21 : Mould, pattern of handmade bags and final product, Company E.

In this theme, many knowledge sharing and management issues are expressed more in large-scale companies than SMEs. The first reason for this is the low number of employees in small-scale companies and establishing a close relationship with the

craftsman. In large-scale companies, information is stored due to the high number of employees, a large number of products, and the lack of opportunity to work one-on-one with the master.

This theme explains the significance of the knowledge provided by the craftsman, the transfer of this knowledge, and how this transfer is managed. The companies discussed in this thesis study are in craft-based sectors and benefit from the craftsman's knowledge.

6.6.1 The power of knowledge for the industry

In the furniture sector, the importance of being in collaboration with employees who are knowledgeable about rare production methods is mentioned as follows:

> The situatiıon you will need a craftsman is this: Let us say you are going to make a piece of furniture with tow technology, tow technology has not been used in this sector for many years. But if you want to make a classic product with tow, then you really need a craftsman. Otherwise, you will learn and read. Actually, there are a lot of books about it and so on. Know-how is all of them. Could I explain? Then either you will have it, or you will work with someone who has it (R&D Director, Company C, personal communication, October 31, 2019).

6.6.2 Knowledge transfer

Company A, which carries out both industrial and craft production in the glass industry, solved a problem encountered in mass production with the knowledge and skills of mould masters working in hand production:

> Handan TEMELTAŞ: Well, in connection with that, I want to ask the following: Information transfer between groups in your company is done for new product development. For example, you noticed something while working with the master, but you say that this can actually be useful for another group. It is an extreme example, but is such a situation happening?
>
> I can give an example as follows: The hand-made group of our company received a request from a foreign customer. As a "Homekit", it was mentioned about the system that allows people to buy empty packaging and create their own acidic beverage at home by means of a device. For this purpose, a glass package was requested. Our group that received the request, naturally, handled the request in

> the format of handmade, since there was no group that made the packaging design. However, at this point, after a few trials, they reached us when they had problems with the volume and head parts of the product. The problem was an area that we often experienced, as it was one of the requirements of my glass packaging design. We shared our experiences with them, the problem was solved. This may be the most obvious example of information sharing between groups (Designer Manager-2, Company A, personal communication, August 23, 2017).

This example can be defined as a kind of transfer of master crafts knowledge to the industry. In the same company, it is also possible for the master to transfer his knowledge and skills to industrial production with minor external interventions to the machine:

> Handan TEMELTAŞ: Actually, in my thesis, I focus on the craftsman's material knowledge and making knowledge. The craftsman transfers these two more to the product. While transferring these two, he sometimes designs but may not be aware of what he is doing.
>
> Of course! For example, there are things that the craftsmen open doors to us. In fact, in automatic production, there are minor interventions on the machine from outside. So, there is no problem in saying this as everybody knows. They are doing something to improve a manufactured machine. Those interventions are sometimes due to their efforts to create something new. The master says, “I am making a product with blowing method and I will make a beak. How am I going to do that? "for example. “If I make a beak, there will be constant blowing. I do it with outside intervention,” he says. This is a method used in the world. There is a system where they make that work on the machine as if a master were coming and doing a click there. It turns around on the machine, comes and plugs something there. So, there is someone who intervenes as if there is a master there (Designer Manager-1, Company A, personal communication, June 5, 2018).

6.6.3 Management of knowledge transfer

Knowledge transfer and knowledge storage in companies are also examined within the scope of this theme. Tacit knowledge is transmitted through experience and cannot be coded. However, the transfer of this knowledge when physical conditions do not allow it can occur in other ways. I have seen that the communication between the craftsman and the designer is carried out through a bridge department in our companies in both the shoe industry and the glass industry. For instance, company A, masters are located in different cities, has a production planning department that provides communication between the craftsman and the designer.

Company C, which is a furniture company, collects the ideas of the masters about the products in writing and analyzes them:

> The people who apply it in the company, the people who see the problem there while applying the product, will definitely suggest you that it can be produced better or that you can produce it faster. We call this the suggestion system. In any case, everyone in the factory can make suggestions on the product, even on the production technique or the management of the factory. Without this participation, you will not be able to develop the industry anyway, and the craftsmen always make suggestions on the product (R&D Director, Company C, personal communication, October 31, 2019).

> Here, if there are complaints about production in the product, there are project changing forms coming from production department, and so on. Product manager inspects them, corrects them, then implements the nonconformity forms, if any, and transfers them to the system. He is the owner of the product (R&D Director, Company C, personal communication, October 31, 2019).

> After the interviews are made, the first prototype is actually produced after the master has expressed his opinion. During this first prototype production, we see how correct and how wrong the techniques we apply are. Then we have a prototype evaluation form. This prototype evaluation form, the producers in production, here are metal production, wood production, upholstered production, then marketing, sales, product management, R&D design department and management company management, they each have their own fields, they fill these fields. They fill in these fields and express their opinions. In other words,

> they freely convey their opinions about the product (R&D Director, Company C, personal communication, October 31, 2019).
>
> So, there is no such thing as keeping knowledge individually by the person working with us. Once the man finds a problem, he has to edit a non-conformity form for it. He has to write it on to the form of nonconformity, or these are not very inaccessible things. Or, you have a lot of know-how, I mean, you have books and things about them. In other words, what the man said is here, in fact, the man tells you that "when I put double pressure stitches, we have to put the tape under it, in order not to tear". This master has learned this, he says it deliberately, but open this book, this information is also in the book (R&D Director, Company C, personal communication, October 31, 2019).

6.6.4 Assessments about attitudes of employees

There are also attitudes of the employees regarding knowledge sharing. For instance, the craftsman who avoided sharing their knowledge in the glass industry with various motivations were mentioned:

> Although it used to be a group that was reticent about knowledge sharing and refrained from sharing its experiences with the next generation, this is no longer the case today. This issue has been eliminated by our institution both through trainings and by spreading the "importance of knowledge sharing" to the corporate culture. Our Design Centre is the starting point of the entire design process and is always in contact with all units where the design will be processed during the process. Sharing knowledge and experience is therefore important (Designer Manager-2, Company A, personal communication, August 23, 2017).

In the furniture industry, if the technical knowledge of the master is not sufficient, it may be restricted to share his knowledge: “There are technical issues and if the master does not have enough technical knowledge in that subject, we will restrict the craftsman in technical matters” (R&D Director, Company C, personal communication, October 31, 2019).

In the shoe sector, since the problem-solving skill of the master mentioned in the previous themes can lead to different results in each product, each solution becomes specific to the related product:

Who did this job? Our sports shoes department did. We made the male model, we experienced this problem and solved it. If we want a female version of the same model, if the person who solved is there, he solves the problem with me. I say, "We have already had this problem here, we will do the same, you should have a meeting with that master. We had such a problem here, we solved it like this. We can also have the same problem here. Talk to him without encountering this problem, get this information from him" (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

Handan TEMELTAŞ: Is this information ever written down?

No (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

Let me just say this, let me go a little deeper here again. We made five different colours using that material. There was black, white, green, yellow in that material. Black gave another reaction, white gave another reaction, yellow gave another reaction, let me say so. We had to gain different experiences even within the product itself (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

Handan TEMELTAŞ: I understand.

Even if it is written, you know, wrong information. When you will apply from now on (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

6.7 Theme7-Management and Strategy

This theme deals with companies' influence on regulatory management behaviours and strategies when working with craftsmen (Figure 6.22). Craftsmen's knowledge and experience create added value for the companies, regardless of whether the company used hand production only or a mixture of industrial and handicraft production. I examined this situation in terms of material knowledge, prototype making and experimental work. In most companies, product managers were responsible for product development, and there was one person at the head of each product group.

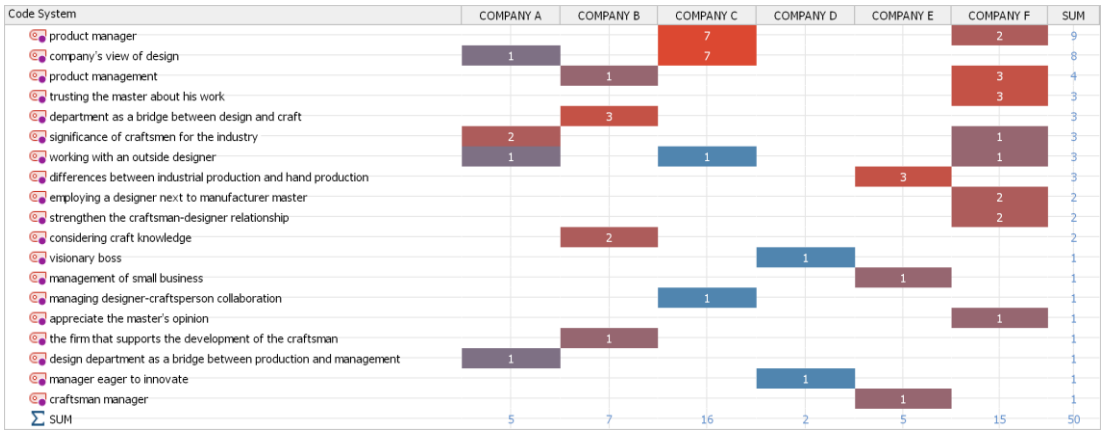


Figure 6.22 : Theme 7-management and strategy-distribution of codes according to companies.

As mentioned before, Companies A and B had a product planning or R&D department that directed the relationship between craftsmen and designers. As large-scale companies, there were specific reasons for having these departments manage this relationship. An industrial designer and head of the R&D department at Company B mentioned the necessity of a hierarchy to manage the knowledge and experience shared between the designer and the craftsman during collaboration. Having an industrial designer at the head of the unit that directs this communication was seen as a positive from the company's design perspective. At Company F, the founder employed an industrial designer alongside master manufacturers to strengthen the collaboration between the craftsman and the designer and to facilitate procedures and communication. The industrial designer prepared reports by conveying and explaining the designs of other designers to the master. He also gained experience while working with the craftsman. Whether the company was large or small, the collaboration between the craftsman and the designer often involved a facilitator or department that followed specific procedures for clear communication.

This last theme will focus on the value of the craftsman in the company and how the company's management evaluates the communication and collaboration with the craftsman. This theme will be examined based on presenting the situation, examples of attitudes and behaviours.

6.7.1 Situation

6.7.1.1 Significance of craftsman for the sector

Above all, the work of the craftsman is respected in sectors where the knowledge of the craftsman is used:

> So, for example, the master tells you that this product should not be like this. He says: “yes, it is wrong, we need to fix it”. Mutually, what is the problem? This is right here if it lies in my mind. But I especially listen to the master. Because he has great experience (Design Manager, Company B, personal communication, August 2, 2018).

Additionally, the owner of Company F answered the question of how much you take into account what the craftsman said: We consider it 100%, I do not know how much we will apply it, but we consider it 100% (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

The company's past affiliation with craftsmanship also influences the company's value placed on craftsmanship. The founder of Company F, which comes from a family with craftsmanship roots in the furniture sector, expresses the value he gives to the craftsmen he works with:

> First of all, my brother, my little brother who was trained by my father, working with a master like him, working with a master like X master, working with a master called Y master, working with a master Z, working with a man like A master, all of these are very valuable people. I mean, you cannot train those people if you are studying at a university today (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

In addition to respecting and valuing the master about his work, trusting his work and being able to entrust the process was another element I encountered in this process. The design manager of Company B states the importance of the master in the process with these words: “There, our master is like a safety insurance. He says: “no, you need to add something to this”, then he calls the modeler” (Design Manager, Company B, personal communication, August 2, 2018).

Company F workshop owner mentions that the trust between the designer and the craftsman develops over time as a result of collaborative work:

> That trust issue is something that develops over time, that is, the business of mutual trust, especially the designer's trust to the manufacturer, because the masters can often evade in a difficult design. But after the issue of trust emerges, they do not have such trouble working here with us and they trust us (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In addition, in company F, the craftsman can take on the role of facilitating the decision of the designer by giving information on the material:

> Handan Temeltaş: Did you solve the disassembly there? As masters, did you say this should be disassembled and gave information to designers, did they redesign it?
>
> No, we solved it, we said that we are doing this, and they accepted it, because the process was a little short there, because it will take a while to draw and so on, we showed them here on the materials. They said okay and we did it accordingly, so it was not drawn as a revised project again, but they knew what to come out of here, we knew what to do, so it continued (Figure 6.23) (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

Figure 6.23 : Modular furniture at workshop of Company F.

6.7.2 Attitudes

After the statements expressing the importance of the craftsman for the companies, the management perspective on the company's collaboration with the craftsman was examined.

6.7.2.1 Company’s view on design and designer-craftsman collaboration

The design perspectives of the companies included in this thesis are different. In the furniture company that produces office furniture, where ergonomic standards are intense, engineers also work actively in design. Therefore, it is expected from the designer to have more technical knowledge in this sector:

> We are still from the production side, and I am a forest industry engineer. I always give the same example. The design we made sells well but does not receive awards. This is our difference because we design products that can enter direct production smoothly and quickly, because we know. For example, when a manufacturer sees our design, he directly approves it because the cost is very low, even if he sells it or not, it is profitable. But for example, it takes a very serious process to make an industrial designer friend's drawing ready for production because it is necessary to make the designer happy too (Design Centre Manager, Company C, personal communication, September 26, 2018).

> We cannot reveal a product just by taking a pencil and drawing two sketches at work. There is no such thing, such a technique, could I explain? You just imagine, then you sit down and talk to the manufacturer or the engineer and the engineer puts your feet down and says, "My brother, that's not what happens with this product. So, you drew it, but it just doesn't stay in the air." (R&D Director, Company C, personal communication, October 31, 2019).

> I think the designer should have the production knowledge, actually a good engineer should have a good knowledge of craftsmanship. If you have this and you have access to this knowledge, you create much more valuable designs that are more grounded. So, this is the part we called mastery (R&D Director, Company C, personal communication, October 31, 2019).

It is seen necessary for the designer to improve his/her production knowledge together with the masters in the first years of his/her career in the furniture sector: “In the first

years of the profession, until the thirties and forties, designers have to work hard with craftsmen. There is such a requirement. Because they have to learn many things they do not know from those masters" (R&D Director, Company C, personal communication, October 31, 2019).

The communication between the craftsman and the designer about knowledge sharing in companies is supported by the management. In addition, together with the view that the craftsman is not competent in creating innovation, it is also mentioned that the designer should create innovation by using the knowledge he obtains from the craftsman:

> I do not think it is possible for someone else to understand the work of a designer from the perspective of a designer. Their way of thinking is not very close. When you give a product to a master, he develops it, makes it. You always must force it. In other words, you should not hope that he will create something new or create something from yourself and approach the idea in your mind. Most of the time, you are forcing him to get his ideas out. You will throw an idea; the master will answer it. He will say something about this idea, even if it is absurd or something else. You must take that idea again and collect it and turn it into a design (Designer Manager-1, Company A, personal communication, June 5, 2018).

6.7.3 Behaviour

After presenting data on status and attitude, the companies have some behaviours to use, develop and support the craftsman's knowledge. For instance, it is an essential step in the shoemaking industry to take a foreperson to China and include her on production-related trips:

> Here they have been in a room for years and they make inferences in shoes with reverse engineering. In this way, they develop themselves and develop by solving the problems they experience or they can improve something by talking among themselves, but of course this is enough for us. What is it done? Here, we took our master in the sports section below to China for the first time last season. These works are also done there. You know, it is done better than us. Let her come and see how they are made, how they are better, what are better than us

and what they do differently (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

6.7.3.1 Organizational change

Company F, which has all of its production made by contracted masters, has placed an industrial designer next to its leading manufacturer in order to carry out a healthier communication between masters and designers:

> I place the industrial designers who are curious about the business, besides our producers, we made one, it really had a hundred percent reflections. Now, we want to combine university graduates, new generation such young people with those masters and make their workshop stronger, create workshops that plan, make production planning, make financial planning, and keep the flows in the excel table. You know, we still have men who come with notebook paper. We say you will print forms and write on the form (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

The owner-craftsman of the company where this designer is placed expresses his views about the designer as follows:

> Now our brother (designer) is looking at the projects coming from the designers first, we check some of the necessary work at the joints and so on, and we check them together at first. He is one of us in the workshop here, and one of them (designers). It is a bridge right in between. He understands the top (management) very well, and here he tells us what the top actually wants. Because he started to learn about the works done in the workshop, and it will be even better. As he learns, confidence in the master will increase, everyone will be sure. The manager is sure of us, but the designer is a much more timid bird, they do something frightened as if when you do it will fly away. The designer may wonder if what I am dreaming about will be done here or not, where they will prune. They have fears that our pare project to the bone. At least this does not happen, but if it happened somewhere else, they would really pare it to the bone (Workshop Owner-Craftsman, Company F, personal communication, November 28, 2019).

In addition to employing an employee to strengthen communication with the craftsman, companies have bridging departments (R&D department or product

planning department) that provide communication between the designer and the craftsman. The R&D manager of Company B states that the R&D department acts as a bridge between the design and the craftsman: “Here is the designer, the R&D department employee is in between designer and master. Consider the designer here, if the masters are here, we are the link between them” (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

The R&D manager of Company C states that the R&D department acts as a bridge between the designer and the craftsman: “Therefore, the product manager may go and discuss this with the master or I talk directly with master. In general, designers coming from outside do not negotiate too much with the craftsmen and foremen in our production” (R&D Director, Company C, personal communication, October 31, 2019).

> We have a product manager who is responsible for everything about the product ... She has an assistant, we have a department called product management, that person does feasibility and makes cost analysis of the product. She takes out the product variations, wants them to file if there are any variations from the designer, then gives them to the manufacturer after he filed them. Then when it comes to prices, she gets them into the price list, actually the product manager is at the heart of the business (Company Owner-Interior Architect, Company F, personal communication, May 21, 2019).

The shoemaking industry employee expresses the reason for this bridge department as follows:

> Here, after the design comes out, I withdraw or we withdraw. When you give it directly to the master, that design has its requirements: it needs materials, it needs a base. Here are all the components that make up the shoe. Because what will the master do? I mean, a sheet of paper, a sheet came, but you have nothing, material does not exist. There is no inner mould to draw it, there are a lot of things that make up the math inside the shoe that he will do. None of them exist. If there is nothing, the master cannot do anything. We also provide them. We get that information from the design department, which materials, which soles, how we take them, we give them to the masters. They are starting to build a shoe with

them (R&D Manager- Designer, Company B, personal communication, July 26, 2018).

Organization changes, restrictions, and supports are made by middle-level or higher managers. However, in companies such as Company D that produce with craftsmen, establishing connections with craftsmen and following up new product ideas through production networks are carried out with a more individual perspective.

> Once the boss is a visionary boss, he actually decides what to do and what kind of product segment he wants to produce. So, for example, I would not want to get into the copper business very much, but he is very enthusiastic. In other words, he has such a tendency to produce brass and so on, candle holders are more towards decoration like this. In other words, he wants to move a little more towards decoration work than porcelain glass and kitchen. He decides on the product groups, he says, "I want to enter this product group. Product designs begin after a few meetings with some reference companies over the products we like (Industrial Designer, Company D, personal communication, July 18, 2018).

Likewise, the owner of E company, who put forward a new production model based on his craftsmanship experiences, is also a manager who combines the knowledge of craftsmanship with his entrepreneurial vision:

> Of course, you came across such a person who started this job as a hobby. While I was studying in the business administration, I was wandering around as an enthusiast in the Grand Bazaar, I had a chat with a boot master there. The production was done by hand. I picked up the leather there, sewed it while helping. Then it was such a business that developed by making myself belts, making shoes, making products to my friends, and then selling them. I also have a 26-month adventure as a craftsman there in the past ... (Founder-Designer, Company E, personal communication, July 22, 2019).

6.8 Distribution of Codes and Themes in Companies

In Company A, the craftsman's contribution to NPD was the main theme (Figure 6.24). In this company, the contributions of the craftsman to developing prototypes and ideas were the prominent codes (Figure 6.25). This contribution occurred in production

methods dominated by the craftsman, such as the spinning plate method. The designer and the craftsman collaborated by creating new design ideas from faulty prototypes.

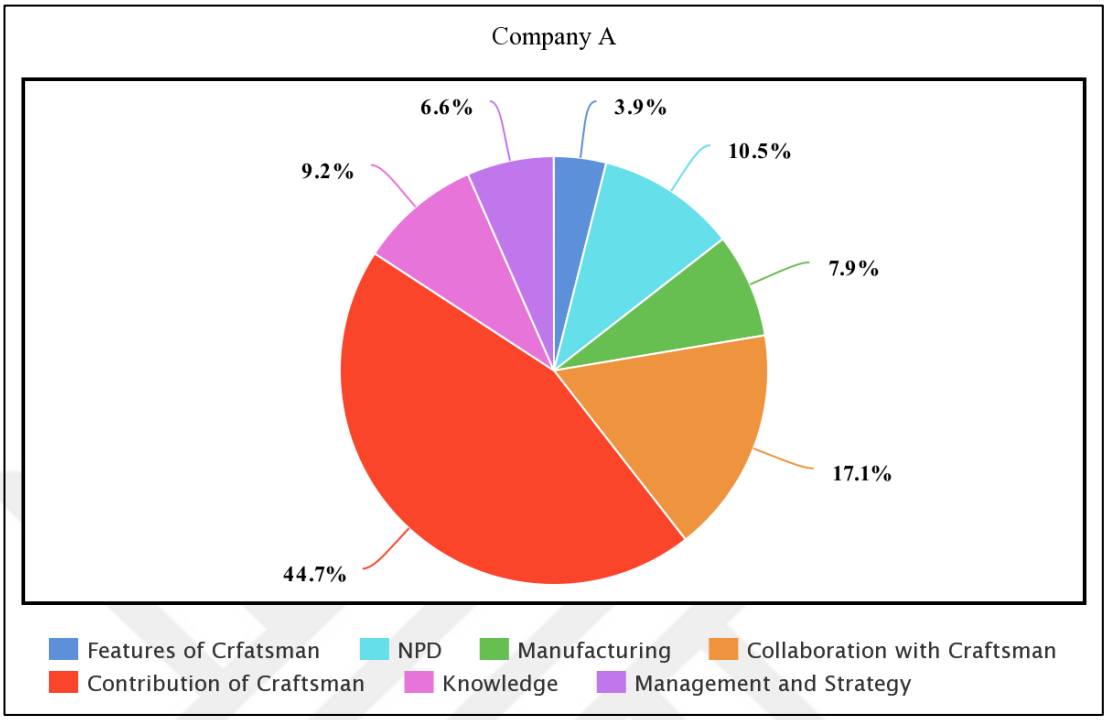


Figure 6.24 : Distribution of themes in Company A.

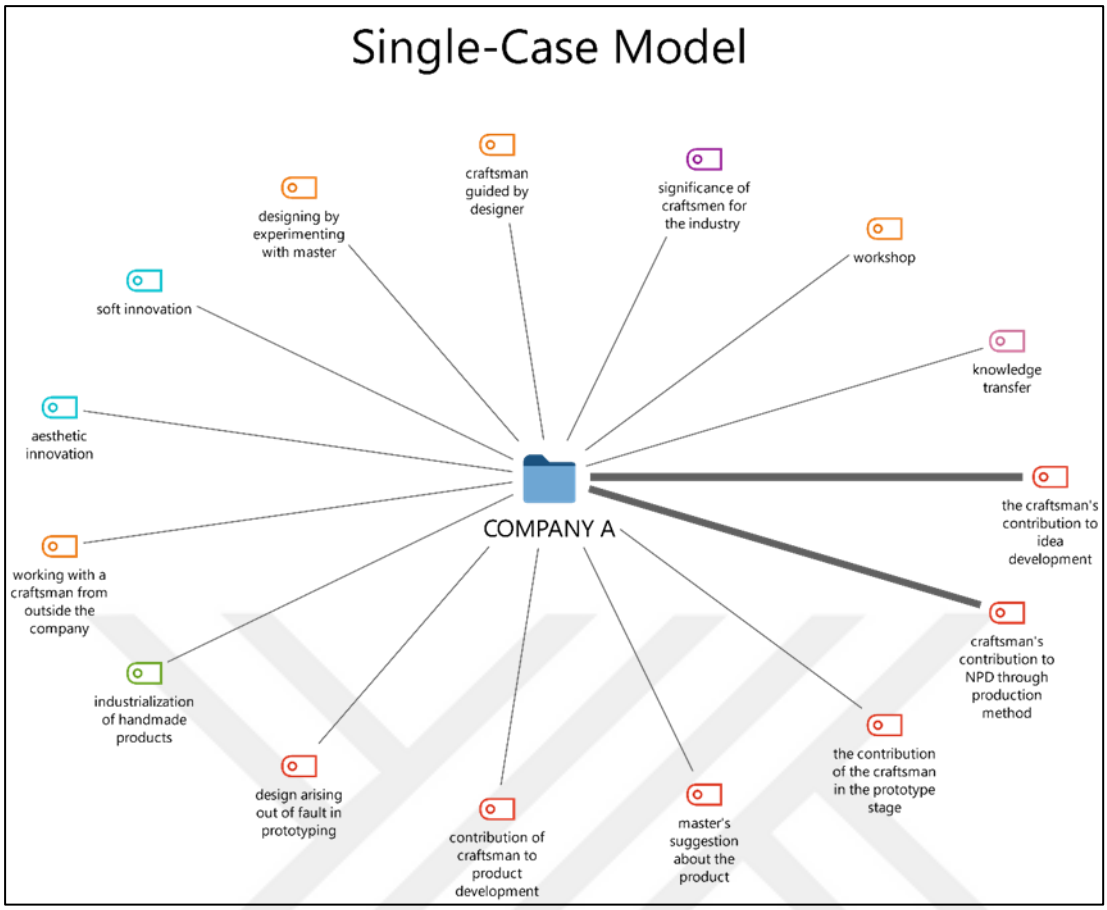


Figure 6.25 : Distribution of codes in Company A according to their frequency.

Company B was a large-scale footwear company. The themes featured in this company were relatively homogeneously distributed (Figure 6.26). The craftsman's contribution was based on transferring material knowledge and dominance of the prototype stage (Figure 6.27). In addition to these contributions, the craftsman's skill helped with identifying and solving problems during the prototype stage. This situation was possible due to the dominance of craft-based prototype production within the company.

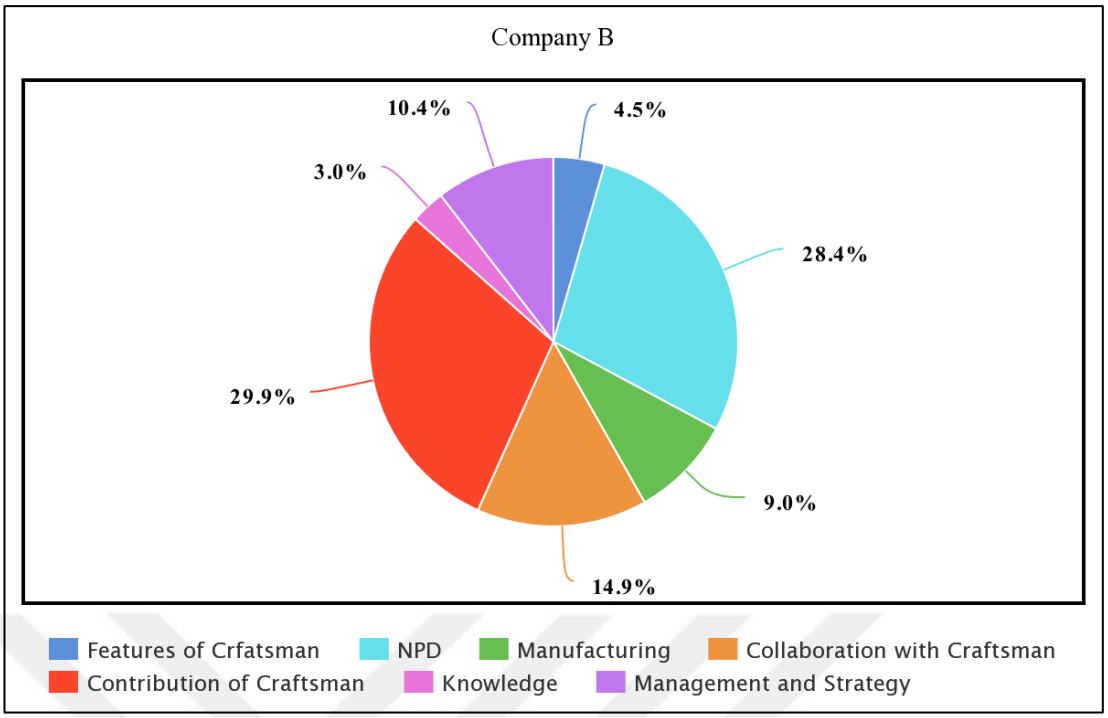


Figure 6.26 : Distribution of themes in Company B.

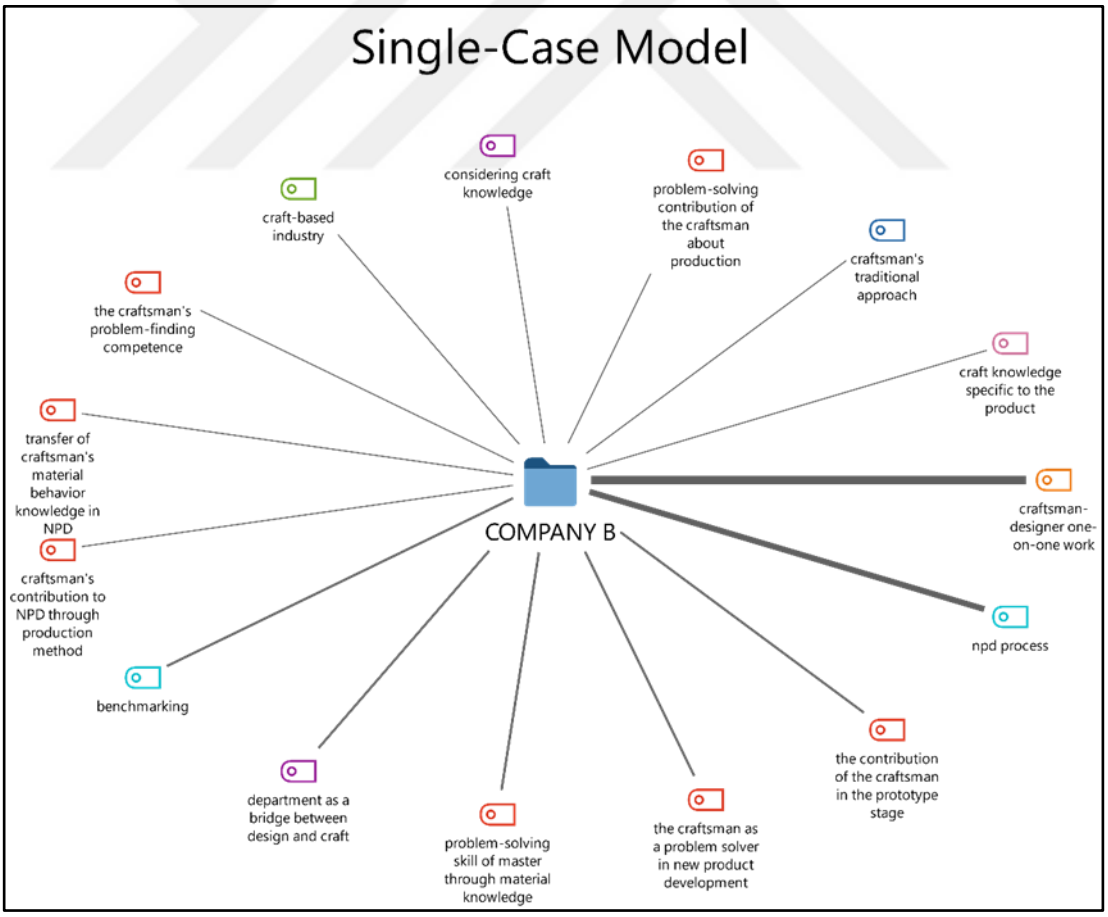


Figure 6.27 : Distribution of codes in Company B according to their frequency.

The themes featured in company C were relatively homogeneously distributed (Figure 6.28). In Company C's NPD processes, most collaborations occurred with masters working outside the company. There was also a collection of written recommendations from craftsmen working within the company. As a reflection of the company's engineering-dominant design approach, there was a great effort to document the knowledge shared (Figure 6.29).

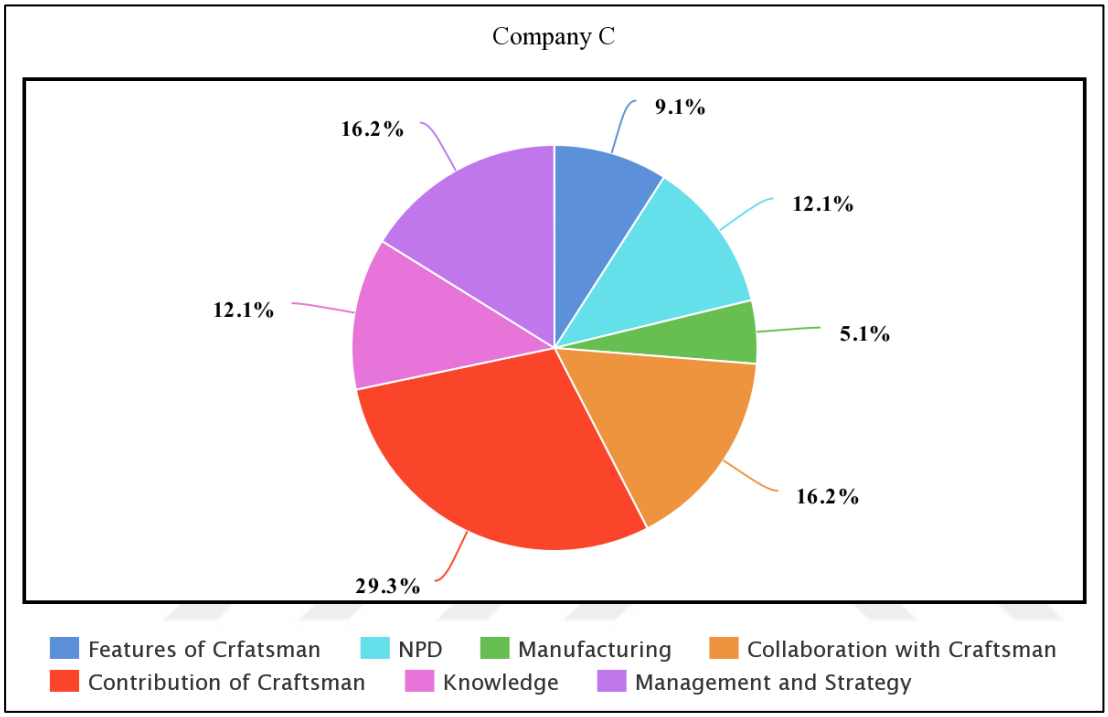


Figure 6.28 : Distribution of themes in Company C.

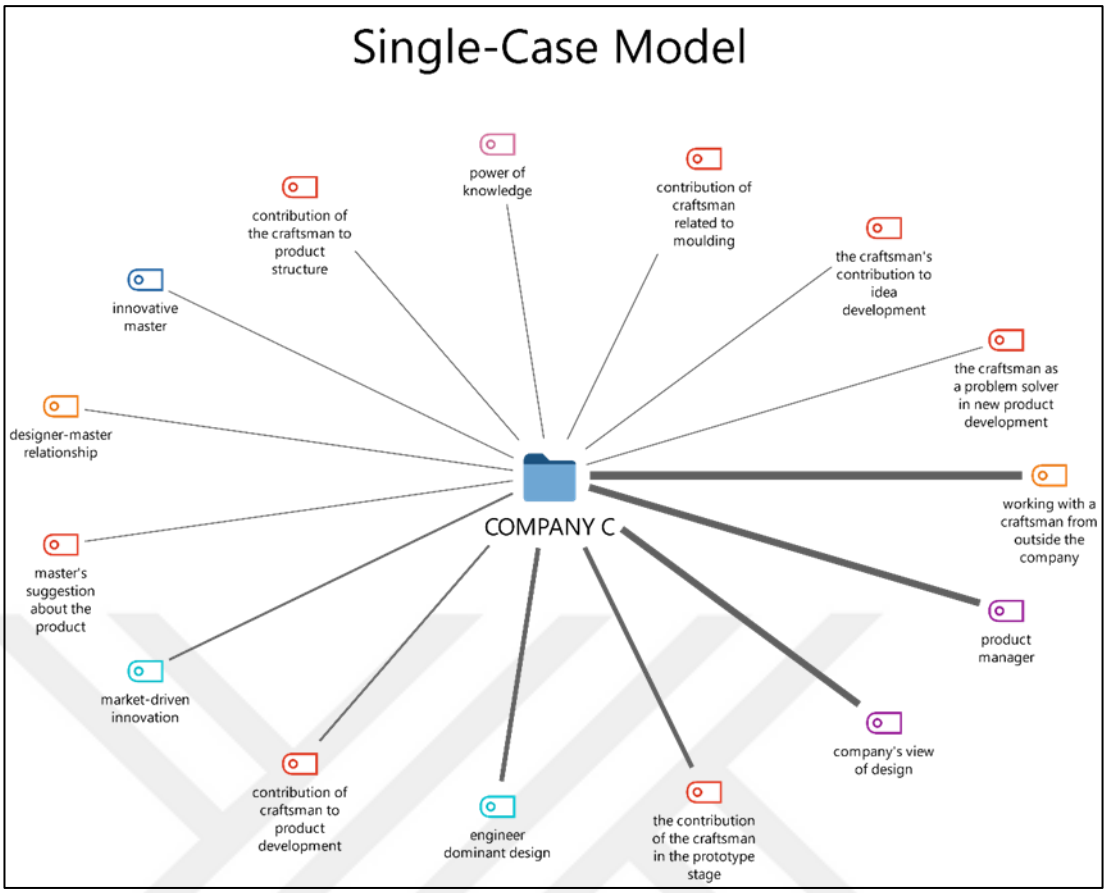


Figure 6.29 : Distribution of codes in Company C according to their frequency.

In Company D, the theme “contribution of craftsman” is the main theme that the interview includes (Figure 6.30). The craftsman’s competence in materials and production methods was utilised in the experimental work with the designer during the prototype process (Figure 6.31). There was a collaborative environment in which the craftsman could demonstrate this holistic approach.

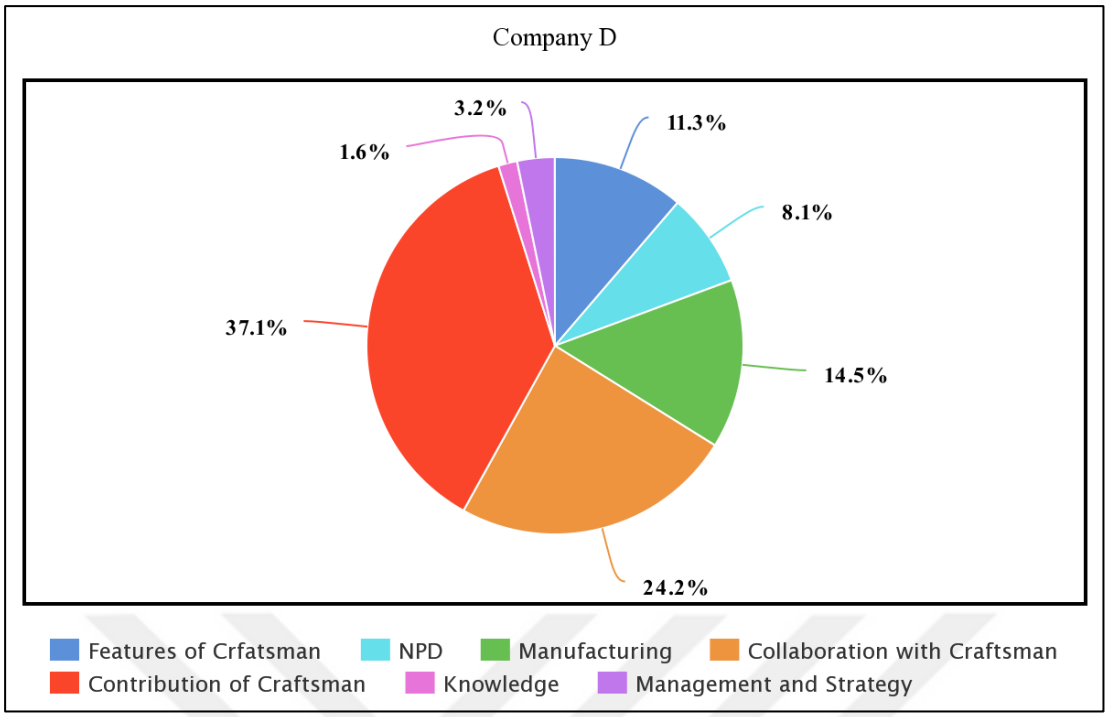


Figure 6.30 : Distribution of themes in Company D.

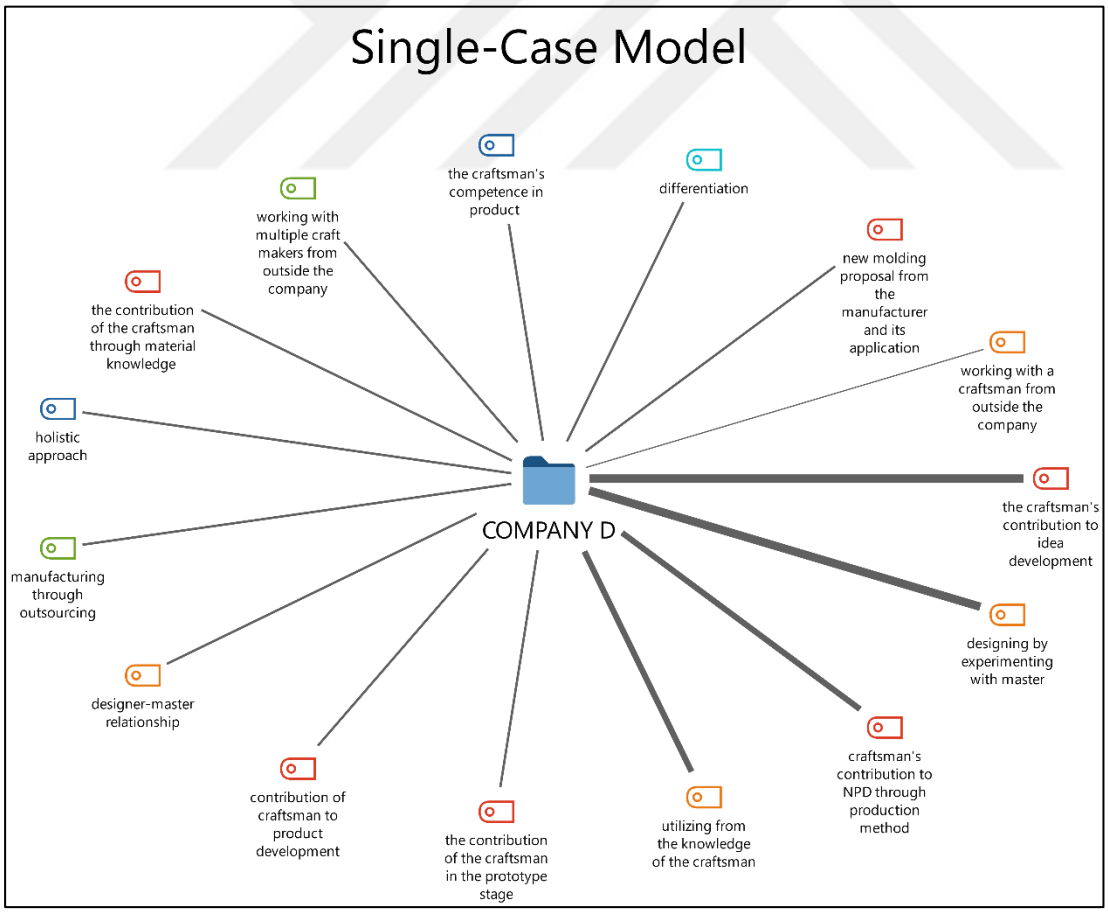


Figure 6.31 : Distribution of codes in Company D according to their frequency.

The manager of Company E was a craftsman, and the company had its own production model. So the manufacturing theme was the main theme in the interviews (Figure 6.32). The codes were used to explain the production and product innovation resulting from this production model. Themes such as the added value of this method, the rejection of industrial production and the aesthetic design of handicraft products were mentioned (Figure 6.33).

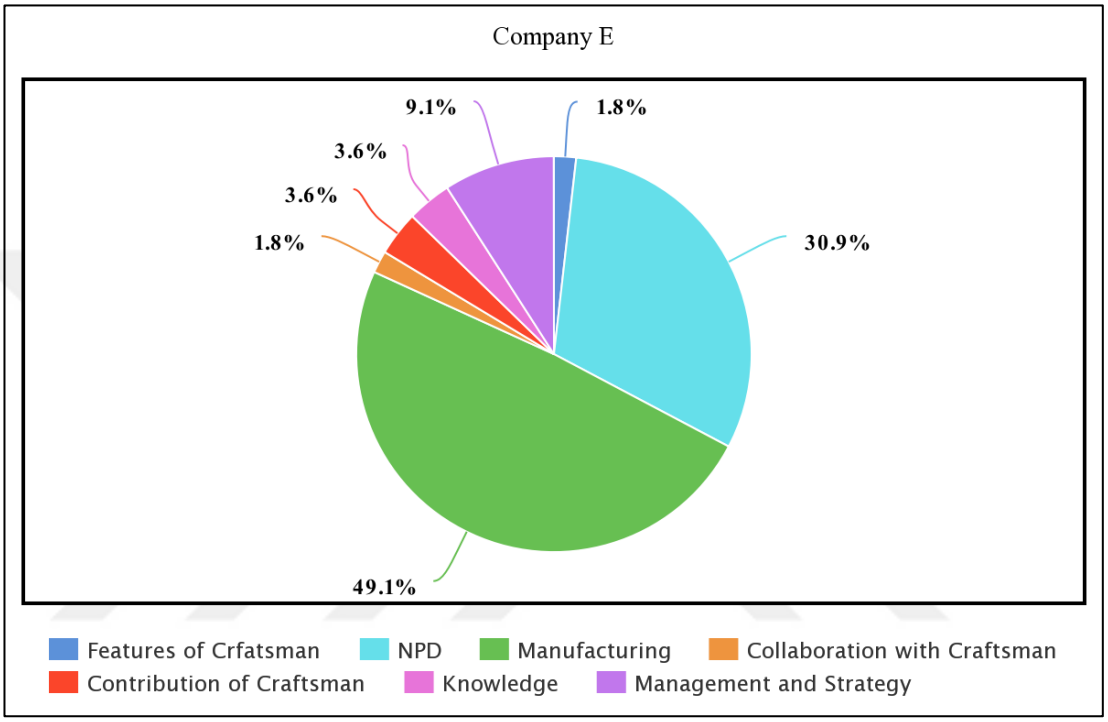


Figure 6.32 : Distribution of themes in Company E.

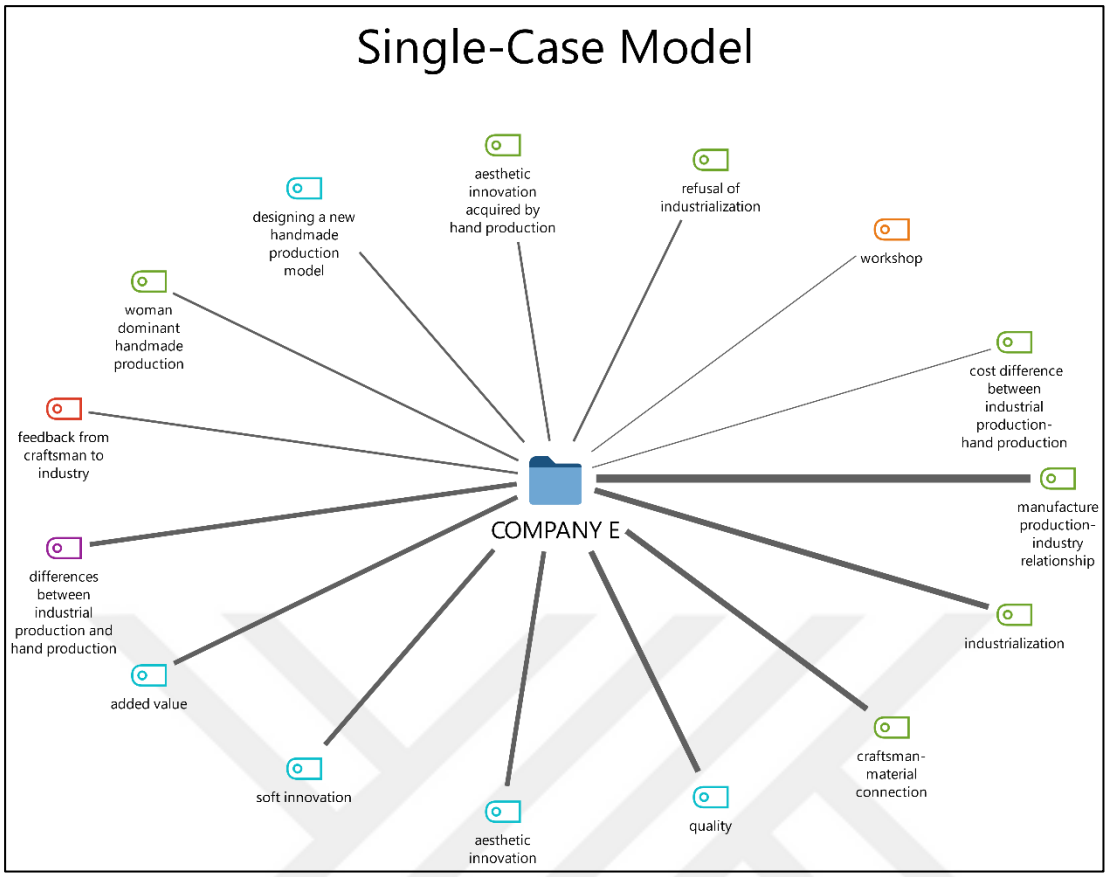


Figure 6.33 : Distribution of codes in Company E according to their frequency.

In Company F, collaboration with craftsman and contribution of craftsman are the main two themes in the distribution of themes (Figure 6.34). Physical proximity to the craftsman in Company F was the main factor determining its relationship with the craftsman. In particular, the knowledge conveyed during the prototype process and the craftsman's suggestions on the best materials were practical benefits gained from collaboration with the craftsman (Figure 6.35).

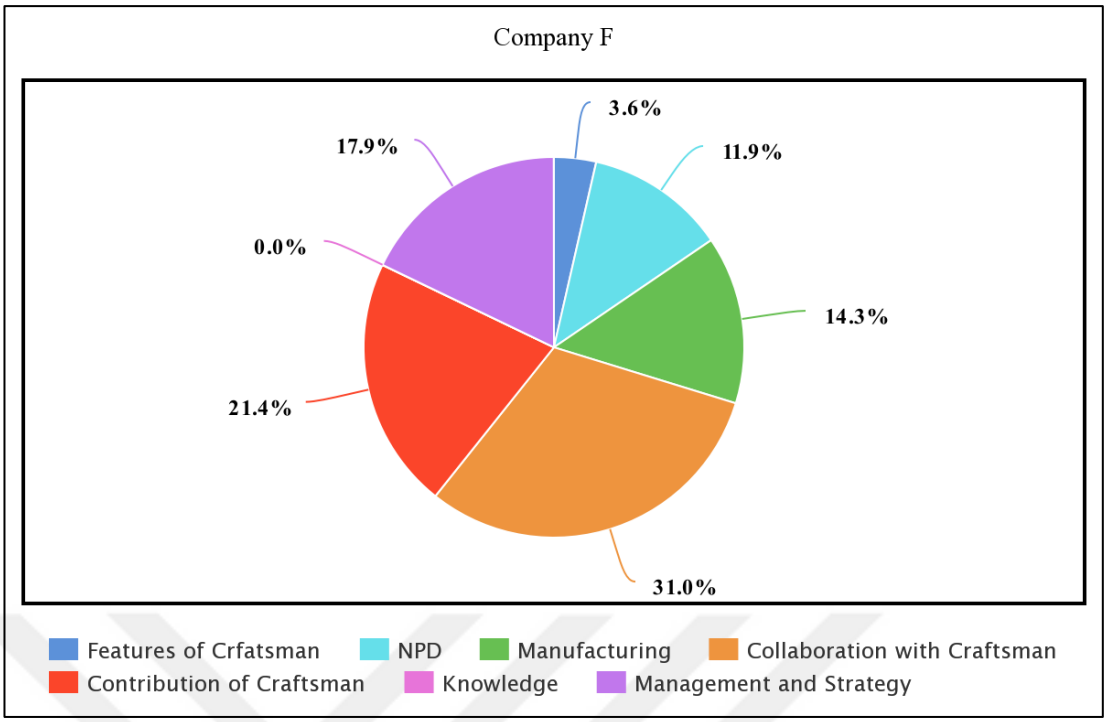


Figure 6.34 : Distribution of themes in Company F.

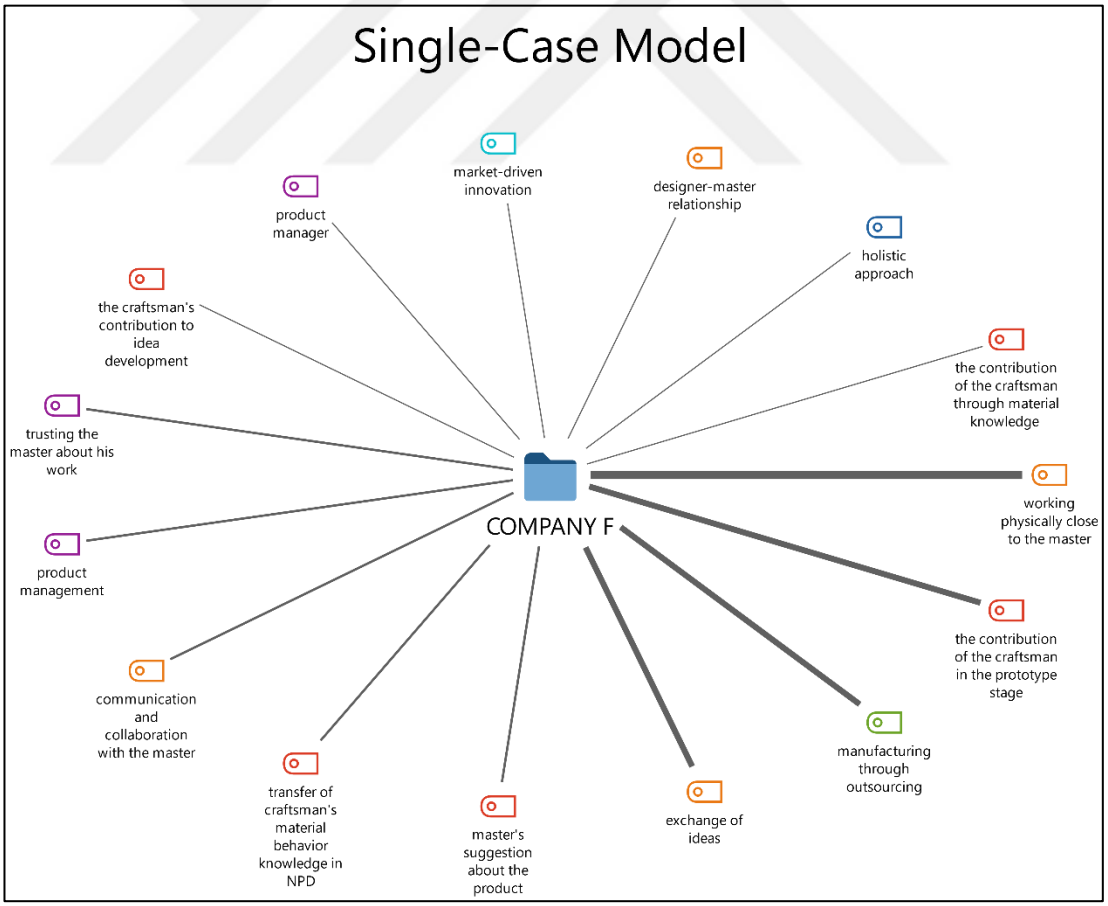


Figure 6.35 : Distribution of codes in Company F according to their frequency.

Examining the distribution of themes during the semi-structured interviews was used as an indicator for which themes were more prevalent. These graphs can be evaluated as a snapshot of the subject scope of the interviews.

In the interviews with E company, different from other companies, production was emphasized. This is because the manager of this company was a craftsman who had established a business model for craft production.

Designer–craftsman collaboration was the major theme in the interviews with Company F because of the close working environment shared between the masters and designers.

NPD was mentioned in every company. Company F stood out in the theme of management and strategy can be counted as the founder of the company has control and effort to develop some strategies to benefit from the craftsman's knowledge.

The themes of production and collaborative work were discussed more than other themes in the interviews with small-scale companies (Figure 6.36). For the large-scale companies, the interviews focused more on NPD and knowledge transfer from the craftsman’s contribution (Figure 6.37).

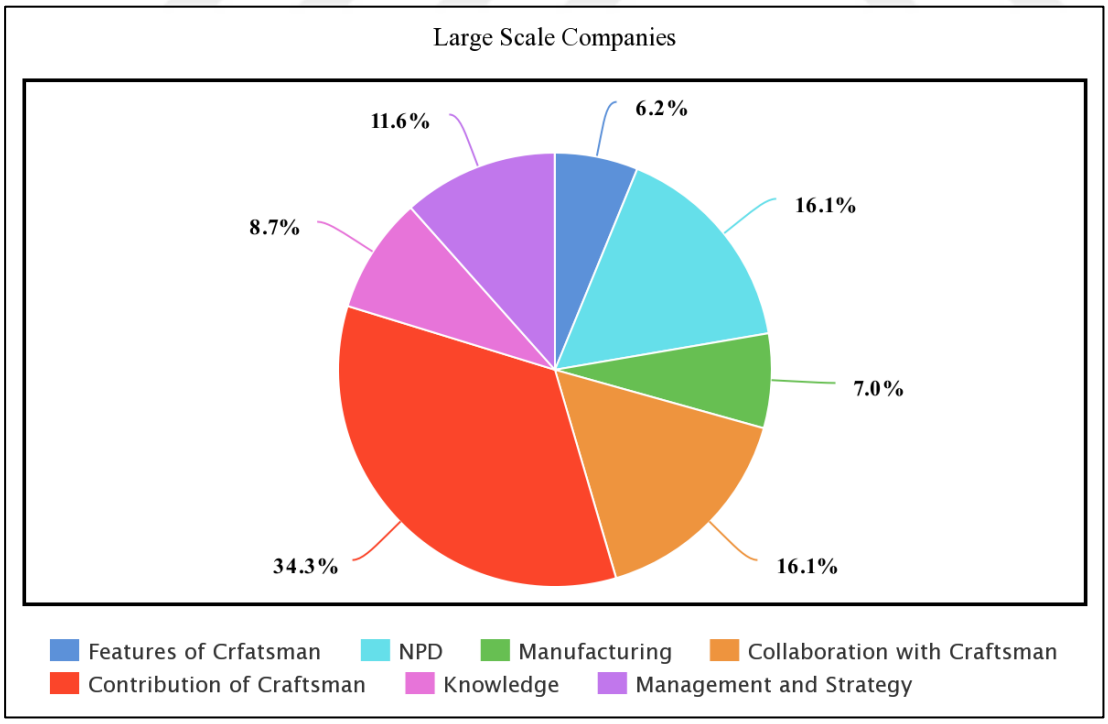


Figure 6.36 : Distribution of themes in large scale companies.

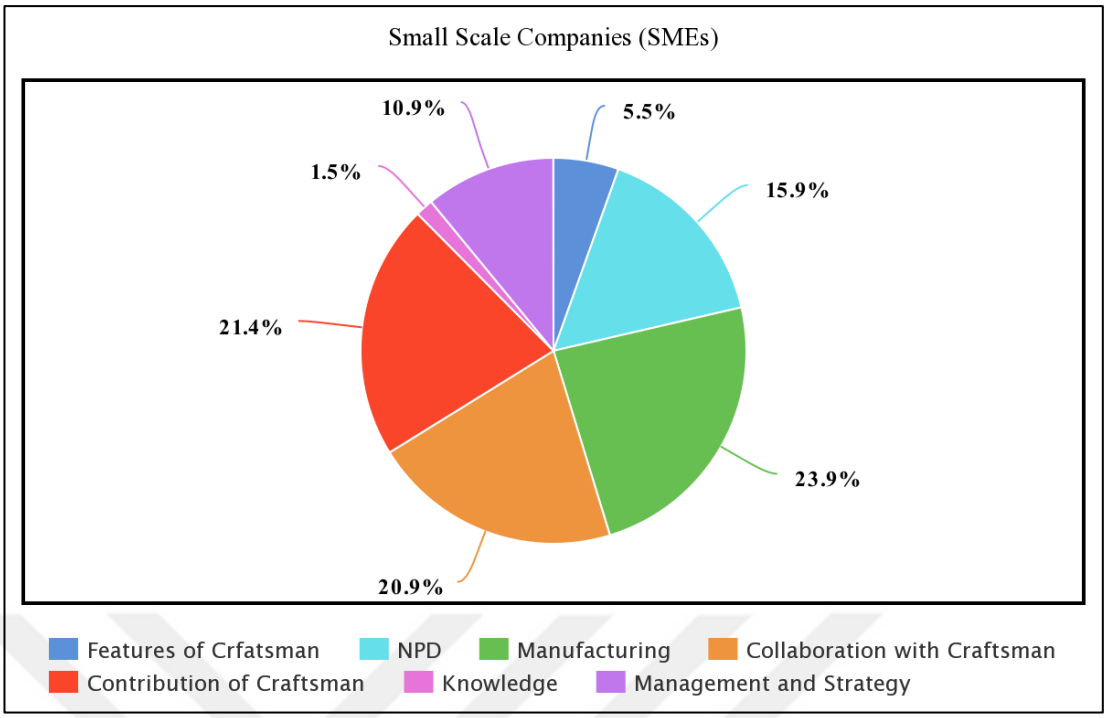


Figure 6.37 : Distribution of themes in small scale companies.

7. DISCUSSION

A comprehensive analysis of the information is derived from the findings. Each of the themes contained much information in itself; each company's unique contingency and familiar aspects required a multi-directional analysis process to interpret these data. For this reason, the researcher followed a ranking scheme to discuss the collected data in the most efficient way. In the findings chapter the distribution of the themes obtained by companies, sectors and company scales is examined. This review provides an impression of the distribution of the themes within the companies and sectors in general terms. Then, focusing on the codes, more detailed information regarding the themes is revealed. These findings present the similarities and differences between companies in terms of evaluating craftsmen's knowledge and experience. Finally, the distribution of the codes in the companies and sectors is presented.

The analyses offer a perspective on the companies and sectors in terms of codes and themes. As a result, the internal conditions of each company and the craftsmen contribution in each company are related to different parts of the NPD process. Therefore, in this thesis, the NPD process serves as a template for analysing and discussing the data. In the NPD processes of companies presented in appendix C, the craftsman's knowledge and experience are accepted as input and the product as output. Based on this process, the contingency of the companies is understood, and comparisons are made.

7.1 Industrialisation and Existence of Craftsmanship and New Forms of Craftsmanship

This thesis study investigates the position and efficiency of the craftsman in NPD. While the effectiveness of craftsmanship has decreased over time due to industrialisation, craftsmen have continued their activities in some sectors, and it seems likely that they will continue to do so. Numerous craftsmen have mastered product design, marketing and sales processes in addition to the pre-industrialisation

production process. Some craftsmen who have transferred the responsibility of marketing and selling products to traders have had to create their product designs according to market demands.

With industrialization, craftsmen working in production turned from craftsmen to workers, lost their holistic approach, and became responsible for a specific part of the work. Such position changes of the craftsman are not processes that occur and are completed in every sector. Besides, the craftsman in every industry did not experience these changes and transformations, and it is not possible to say that every industry was industrialized entirely by getting rid of craftsmanship. Especially in the sectors subject to this thesis (glass, furniture, leather), the craftsman's activity continues at individual stages or in some companies to undertake production. The primary aim of this thesis study is to reveal the scope and differences in this transition. Craftsmen's power is influenced by the materials used in the sector, the production method, the scale of the company and the company's management decisions.

First, the link between material and craftsmanship keeps craftsmen active in the production process. For instance, since leather materials need to be processed in a specific manner, this process needs to be overseen by a person, even if a machine is used. Likewise, craftsmen's production activities continue to be needed if a specific production method is required for the material to be processed. For instance, even though semi-industrialisation has been achieved in the glass industry's spinning production model, the presence of the master is still needed. Some craftsmen may demonstrate a holistic mastery of the entire process related to the product as they did throughout history. This was observed in Company E, where the craftsman started a business as an entrepreneur. The craftsman responsible for the production method in this company is involved in the design, production, marketing and sales processes.

In other companies, craftsmen's knowledge and experience were used in the idea development, concept creation, prototype making and production stages. Greater cooperation was observed in small-scale companies because the craftsman had closer communication with the designers. However, the effectiveness of the craftsman is out of the question in the marketing and sales stages. However, regardless of the company size, the craftsman's effectiveness in that sector increases when the physical distance between the craftsman and designer decreases. On the other hand, the approximation of physical distance is also created to benefit from craft activity. For instance,

craftsmen played an active role in the prototype-making process in (the large-scale) Company B. The reason for this dynamic role is that the shoemaking industry is craft based. Therefore, the prototype workshop was located in the same building as the company's R&D and design teams. For Companies D and F, in contrast, there was no on-site production; all the products were outsourced to enterprises run by craftsmen. One of the most important reasons for these companies to prefer outsourcing production is their production scale. On the other hand, being connected with many different manufacturers offers these companies the advantage of a flexible production model. The flexible production provided by the craft also ensures the continuity of craftsman's activity. Besides, this flexible production method can enable companies to cope with economic risks more efficiently by making decisions faster than large companies. In light of these factors, it can be predicted that craftsmen's presence in the relevant sectors will continue in the future. However, changes in material and production methods, which can take many years to spread across the industry, can undermine craftsmen's effectiveness. At the same time, the preference for products produced entirely by hand means that craftsmen will continue to be needed both as masters working in the field of prototypes in the sector but also as entrepreneurs who establish their own businesses utilising hand production. In other words, the future existence of craftsmanship will be shaped by the materials available, consumer demands and technology.

7.2 Collaboration Design and Management

The craftsman's knowledge acquired over many years can be passed on verbally to the collaborator, such as by indicating the suitability of a material for the product. Specific reasons for the need for craftsmen's knowledge and experience were mentioned in the previous section. In this section, the formation and management of this cooperation is examined. Companies can employ craftsmen internally as well as cooperate with masters from outside the company. Collaboration between companies and craftsmen is possible regardless of the company scale. Large-scale Companies A, B and C employed craftsmen within their organisations (Figure 7.1, Figure 7.2, Figure 7.3). Simultaneously, they collaborated with craftsmen from outside the company when carrying out smaller production projects or when they needed mastery knowledge of a material that they did not normally use.

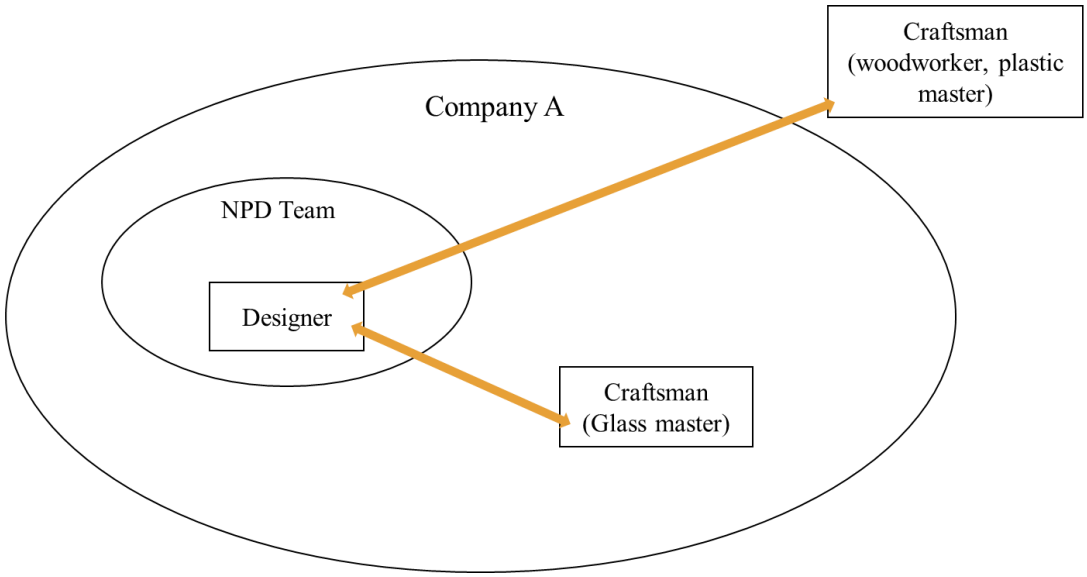


Figure 7.1 : Designer and craftsman collaboration in NPD at Company A.

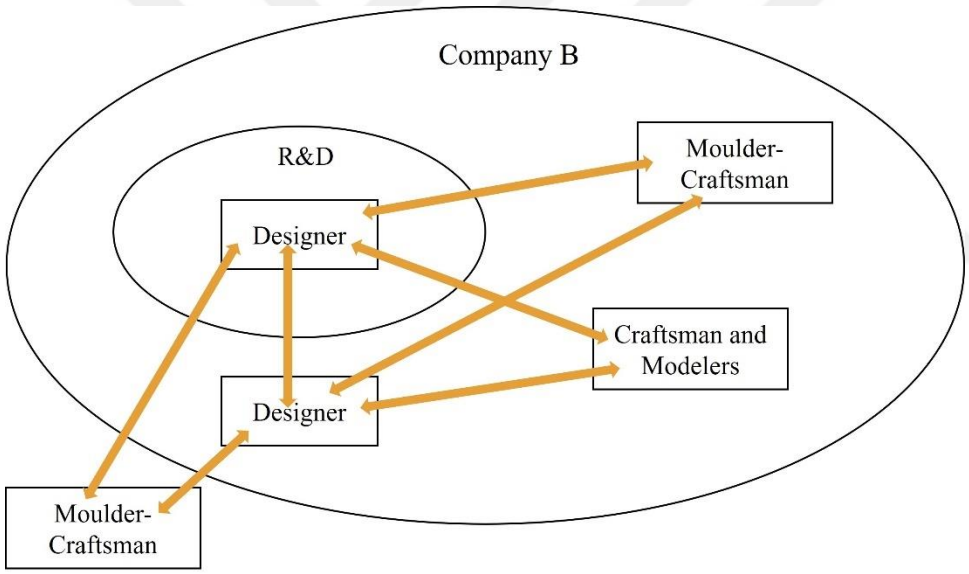


Figure 7.2 : Designer and craftsman collaboration in NPD at Company B.

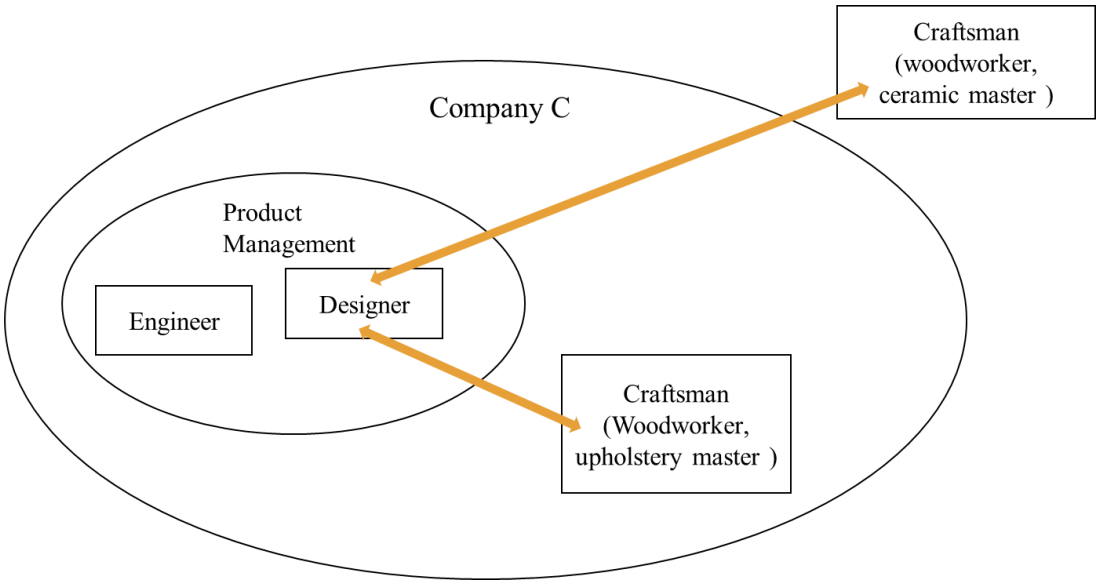


Figure 7.3 : Designer and craftsman collaboration in NPD at Company C.

In Companies D and F, the entire production process was carried out with the collaboration of craftsmen (Figure 7.4, Figure 7.6). Neither of these companies had their own production areas. Company D made its products in cooperation and agreement with masters working in the glass field, and Company F manufactured its productions in the furniture field. In company E, the production is done by women outside the company and the final assembly is done by the craftsmen within the company (Figure 7.5). In addition to industrial production, handicraft production was also carried out in the factory in Company A.

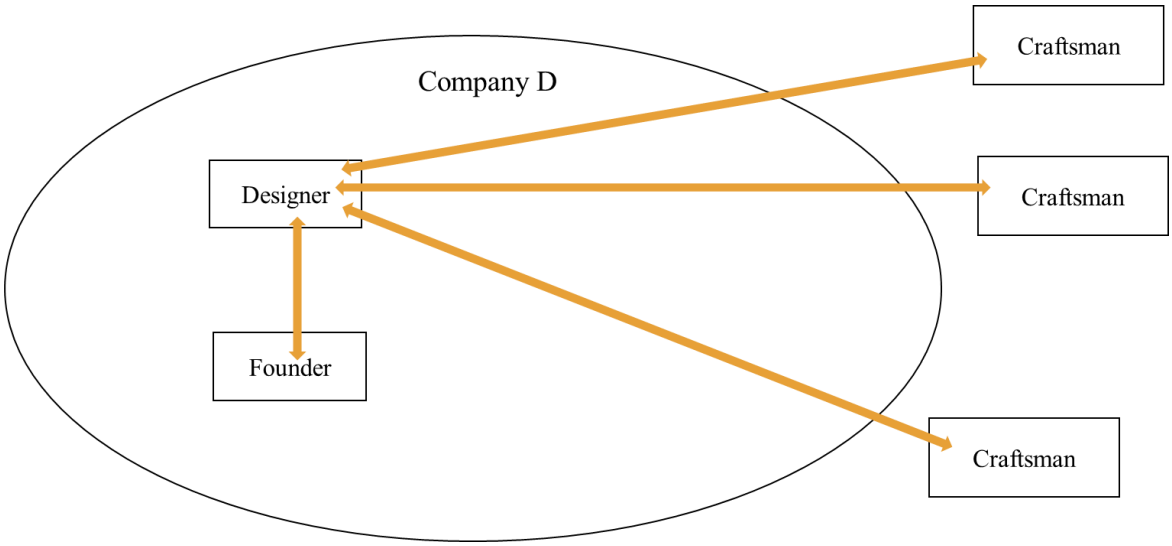


Figure 7.4 : Designer and craftsman collaboration in NPD at Company D.

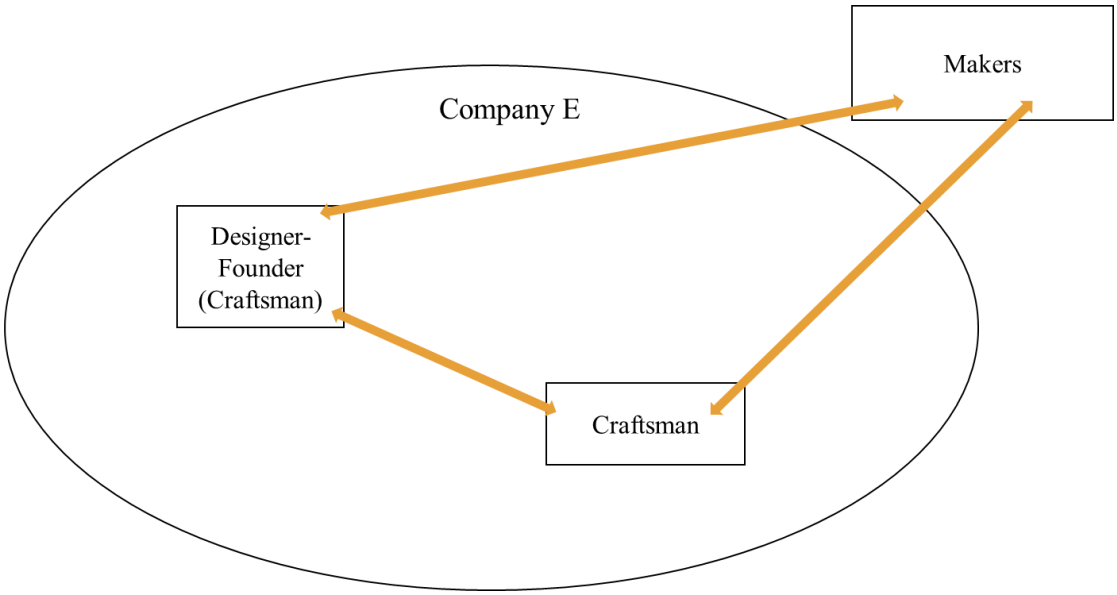


Figure 7.5 : Designer and craftsman collaboration in NPD at Company E.

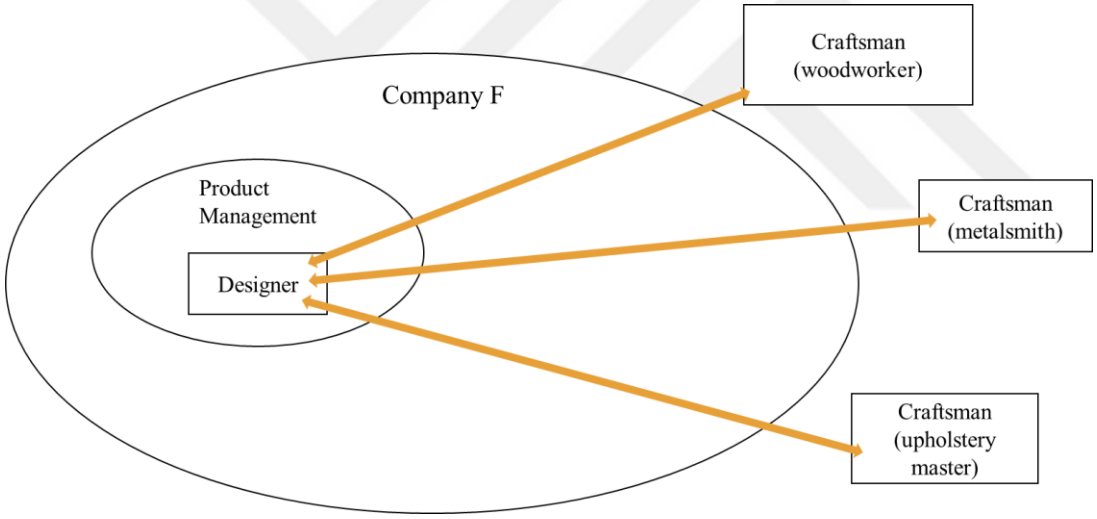


Figure 7.6 : Designer and craftsman collaboration in NPD at Company F.

Each company had different reasons and formations for working with the master. These are described in Table 7.1:

Table 7.1 : Companies' manufacturing methods and collaboration status.

Companies	Scale of the Company	Industrial Production	Hand-making	Craftsman Employment	Collaboration with craftsman outside the company	Reason for Collaboration from outside
A	Large-scaled	Yes	Yes	Yes	Yes	Different Material
B	Large-scaled	Yes	No	Yes	Yes	Different Product Group / Moulding
C	Large-scaled	Yes	No	Yes	Yes	Different material / Different product group
D	SMEs	No	Yes	No	Yes	Production
E	SMEs	No	Yes	Yes	No	No
F	SMEs	No	Yes	No	Yes	Production

Craftsmen often collaborated or shared knowledge with a designer, engineer or product manager. These people were responsible for the company's NPD, and sometimes they were also the owner of the company. The scale of the company was essential in determining who was involved in this collaboration.

The main emphasis in this thesis is the collaboration between the designer and the craftsman. However, in some companies (such as B and C), engineers working in the company also worked effectively with craftsmen. These collaborations were also considered to be within the scope of this study.

Craftsmen and designers met both individually on their own initiative and/or through a bridging department established within the company. This intermediate department was the R&D or product planning department in large-scale companies. Having such a bridging department in large-scale companies created a controlled structure for planning and managing the NPD process and information sharing. The forms of collaboration and existence of bridging departments in the companies are presented in Table 7.2.

Table 7.2 : Collaboration with craftsmen in and outside the company.

Companies	Collaboration in the Company	Bridging Department	Collaboration Outside the Company
A	Yes	Yes	Yes
B	Yes	Yes	Yes
C	Yes	Yes	Yes
D	No	No	Yes
E	No	No	No
F	No	No	Yes

In addition, the employee at the head of the bridge department in Company B was an industrial designer. In this case, because the relationship between the designer and the craftsman was overseen by the designer, this ensured that the ideas and prototypes that came out of this collaboration were evaluated from a design perspective. At the same time, this situation reflects the company's point of view on design.

The collaboration between the craftsman and designer usually occurred in two main ways. Firstly, the designer needs the craftsman's knowledge to resolve a question mark in his mind regarding the product development process of the craft. Second, while working on the prototype at the concept stage, the craftsman notified the designer of any problems or additional arrangements he encountered.

The fact that the craftsman and the designer were in the same building was advantageous because it enabled the designer to work with the craftsman whenever necessary to address questions about the product. While the designer and craftsman did not share the same working environment in Company D, they also often came together to develop products, as it was the craft workshop that handled production.

Some of the company managers interviewed think that designers should work with masters in the first years to obtain detailed information about materials and production. This collaboration enables the designer to learn the information he/she needs and to compare it with the information he/she has learned through education.

The designer could evaluate alternative materials for the product's form, and the master could give feedback on the materials. The master could also indicate the unsuitability of some design materials. In large-scale companies, the bridge department became the decision maker in such cases. In small scale companies, it was more common to trust and rely on the master's knowledge. However, in some cases, if the designer insisted on selecting materials, the master would continue making

prototypes with the relevant material. For appropriate collaboration, employees had to have an open mind. Additionally, the craftsman's and the designer's communication and collaboration improved as they got to know each other and gain common working experience.

7.3 Contribution of Craftsmen's Knowledge and Experience to Product Development through the NPD Process

In this section, the classification of the contribution of craftsmen to product development through the NPD process and the factors that influence and guide these contributions are discussed. According to Ulrich and Eppinger (2004, 14), the product development process consists of six phases: 'planning, concept development, system-level design, detail design, testing and refinement, [and] production ramp-up'. This section is structured under the following main headings:

- Differentiation in Market and Market Research
- Ideation/Idea Generation
- Concept Development/Experimental Prototypes
- Business Analysis
- Detail Design/Product Development/Prototyping
- Testing
- Moulding/Production
- Factors Affecting and Directing the Contribution

7.3.1 Differentiation in market and market research

Although industrial products are an undeniable part of our lives, a large consumer group in the market demands handmade products. This situation may allow some companies to gain a share of the market for handmade products. Company F was well-known for its handmade production, and its main competitor was a well-known industrially produced furniture retailer. Company A also had a significant share of the market for handmade glass products, with a history of both handmade and industrial production. Company E also has a special place in the market due to its products made entirely by hand with quality materials (Figure 7.7):

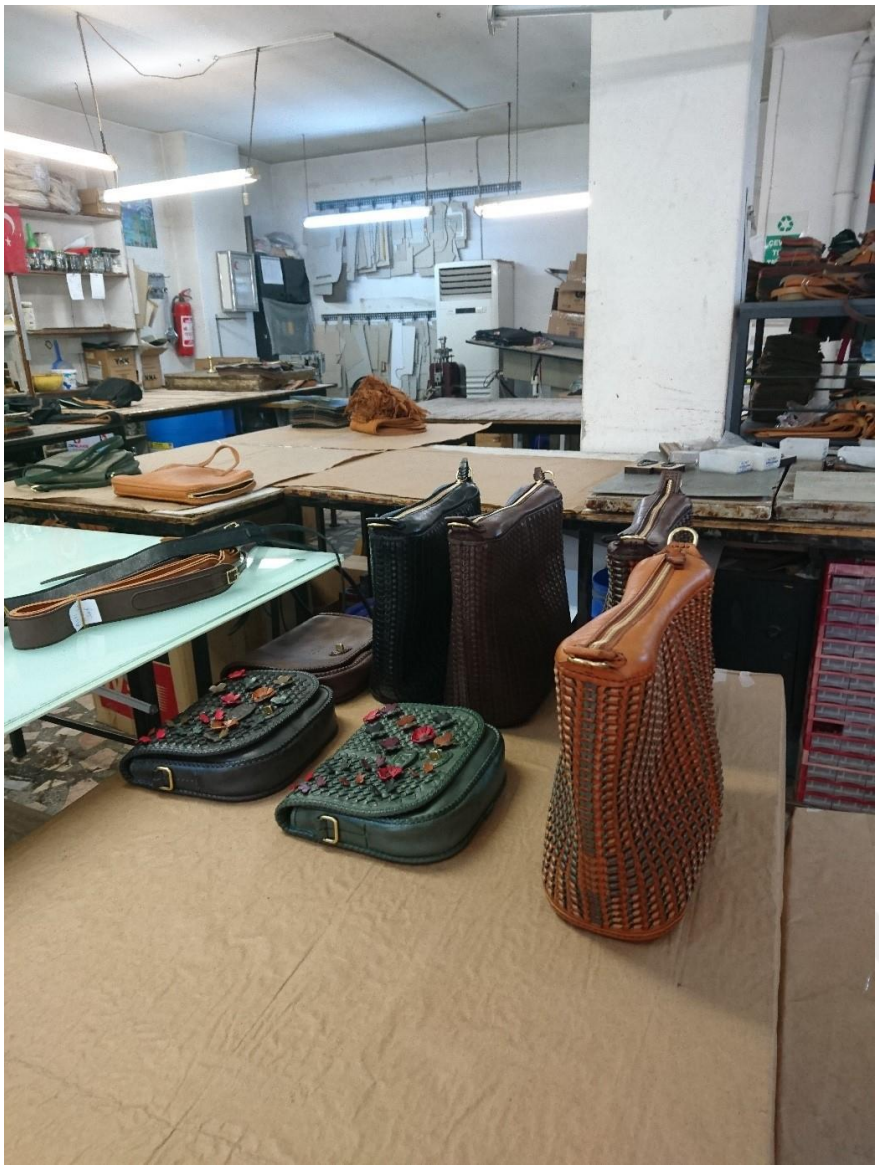


Figure 7.7 : Workshop and products, Company E.

Craftsmen also could have a secondary contribution to the market, as occurred in Company D. Company D learns about which products are trending in the market through its connections with craft workshops. The masters in these workshops have connections with numerous companies and thus have extensive knowledge of the products that sell best in the market.

7.3.2 Ideation/ idea generation

Collaboration with craftsmen mostly occurred at the prototype stage, where knowledge and skills related to materials and production methods were transferred. However, sometimes the designer consulted the craftsman about material behaviour and suitable materials to develop the product ideas. Also, depending on the production method, the

design idea's formation could go hand-in-hand with prototype making, for instance, in centrifugal glass production or cut glass making. In this case, new product ideas could arise through the craftsman's and designer's prototyping collaboration.

As seen in Table 7.3, codes and themes related to the product idea creation and development stages are listed. While developing the product idea in both small-scale and large-scale companies, the craftsman supported this process with his knowledge and experience.

Table 7.3 : Distribution of related codes and companies in the idea generation/idea development/screening stage of the new product development process.

Idea Generation/Idea Development/Screening		
Themes	**Codes**	**Company**
NPD	fast-changing trends	B
	cost-driven pricing	B
	market-driven pricing	B
	market-driven innovation	C,F
	soft innovation	E
	aesthetic innovation	E
Manufacturing	cost difference between industrial production-hand production	E
	craft-based business	E
Collaboration with Craftsman	workshop of designers and craftsmen	A
	working with a craftsman from outside the company	C
	exchange of ideas	C
	communication and collaboration with the master	C
Contribution of Craftsman	the craftsman's contribution to idea development	A,C,D,F
	master's suggestion about the product	A,F
	craftsman's contribution to NPD through production method	B
	contribution of the craftsman to product structure	C
	the contribution of the craftsman in the prototype stage	D
	following trends with the master producing to various customers	D
	design idea from master-manufacturer	D
	the contribution of the craftsman through material knowledge	F
	transfer of craftsman's material behavior knowledge in NPD	F
Management and Strategy	differences between industrial production and hand production	E

The NPD elements that affected the product idea were fast-changing trends, companies' product price policies and innovation strategies. In addition, cost differences at the production stage could also shape the product's idea generation.

Collaboration with the craftsman is very important in the product idea development stage of the new product development process, and this collaboration usually takes place between the designer and the craftsman. The craftsman's contribution to the product idea occurs in several forms. As seen in Company D, the craft companies which the company cooperated with could provide information to the company about the trends in the market.

The contribution of the craftsman to the product idea emerges through collaboration with the designer and through sharing material, structural and production method knowledge. These exchanges could occur in the form of conscious consultation for information or by the designer and craftsman spontaneously coming up with a new product idea while working on prototypes.

7.3.3 Concept development/experimental prototypes

After the product idea is created, the product concept and experimental prototypes are created. At this stage, as in product idea development, the company's innovation strategy and cost issues can be decisive (Table 7.4).

Table 7.4 : Distribution of related codes and companies in the concept development/experimental prototype stage of the new product development process.

Concept Development/Experimental Prototypes		
Themes	**Codes**	**Company**
NPD	soft innovation	A, B, D
	aesthetic innovation	A, B, D
	market-driven innovation	B
	shaping the design with feasibility and cost factors	B
	differentiation	D, F
	added value	E
	teamwork	F
	designer's material knowledge	F
Manufacturing	industrialization of handmade products	A
	craftsman-material connection	E
	aesthetic innovation acquired by hand production	E
	the competition of industrial products and handmade products	E
Collaboration with Craftsman	working with a craftsman from outside the company	A,C,D
	workshop	A
	designing by experimenting with master	A
	craftsman guided by designer	A, F
	work experience with craftsman	A, F
	knowledge exchange between craftsman-engineer	B
	craftsman-designer one-on-one work	B,D, F
	designing by experimenting with master	D
	verbal communication with the master	D
	designer as a learner from the master about material and making	D
	exchange of ideas	F
	working physically close to the master	F
	designer as a leader in collaboration	F
	designer as a guiding craftsman-designer communication	F
	master-designer collaboration at the prototype stage	F

Table 7.4 (continued) : Distribution of related codes and companies in the concept development/experimental prototype stage of the new product development process.

Concept Development/Experimental Prototypes		
Themes	**Codes**	**Company**
Contribution of Craftsman	the contribution of the craftsman in the prototype stage	A, C, D
	the craftsman's contribution to idea development	A, C, D, F
	master's suggestion about the product	A, D, F
	the craftsman as a problem solver in new product development	A,C
	design arising out of fault in prototyping	A
	rapid prototyping by hand production	A
	master's suggestion on feasibility	A
	the contribution of the craftsman through material knowledge	A,C, D
	the aesthetic contribution of hand production	A
	the craftsman's problem-finding competence	B, C
	problem-solving skill of master through material knowledge	B, F
	master's suggestion about the product	C
	transfer of craftsman's material behavior knowledge in NPD	C, F
	contribution of craftsman related to moulding	C
	the craftsman's contribution to aesthetic innovation	C
	craftsman's contribution to NPD through production method	D
	contribution of the craftsman to product structure	D
	rapid prototyping by hand production	D
	alternative material suggestion	F
Knowledge	knowledge transfer	A
	adapting the handmade product to industrial production	A
	indirect transfer of the craftsman's knowledge to the NPD team	A
	prototype evaluation form	C
	master's written notification of problems about the product	C

Material knowledge and teamwork came to the fore during the creation of experimental prototypes. During this phase, the designer worked in collaboration with

an internal or external craftsman. In most of the companies, I see external work with craftsmen. In fact, in Companies D and F, the entire production process was outsourced.

Being close to the master, knowledge of materials, experiences of the craftsman, communication between the craftsman and designer and the designer acting as the guide were the relevant codes of the collaboration theme during this process. The most important contribution of the craftsman in concept creation and experimental prototype creation, which is seen as common in companies, is to be a problem solver in this process, to be able to identify problems and to do them with knowledge of materials and production methods.

Craftsmen's knowledge was also transferred via the collaboration between the craftsman and the designer during the concept creation and experimental prototype stages. In Company A, which used both handmade and industrial production, the method for connecting a handle to a handmade product was transferred to industrial production. In Company C, a written record was kept of the problems found and solutions presented by the craftsman.

7.3.4 Business analysis/ system level design

During the investigation of the contribution of craftsmen, few relevant codes were detected for the business analysis part of the NPD process (Table 7.5). The reason for this is that the cooperation with the craftsmen often took place in the sub-departments of the business hierarchies and had indirect effects on the management departments.

Table 7.5 : Distribution of related codes and companies in the business analysis/system-level design stage of the NPD process.

System Level Design/Business Analysis		
Themes	**Codes**	**Company**
NPD	company scale and continuity	E
Manufacturing	finding the best craft manufacturer	D, F
Collaboration with Craftsman	working with masters while creating new product line	C
Contribution of Craftsman	the contribution of the craftsman in saving time in production	C
Knowledge	project adjustment form	C
	intersectoral knowledge transfer	E

Since the manager of Company E was also a craftsman, he had planned the scale of the company in terms of business analysis in accordance with the conditions of hand

production. Companies D and F had to find the best manufacturer to consult for business analysis decisions since they worked with external manufacturers and did not have their own production areas. Company C, a furniture company, entered the field of home furniture and created a new product range in cooperation with a craftsman with expertise in the production of home kitchenware.

7.3.5 Detail design/product development/prototyping

The product development and prototyping phase is the stage in which the product is closest to finalisation. Following this, the product is evaluated by creating a prototype. At this stage, factors such as manufacturability, timing and quality are important (Table 7.6).

Table 7.6 : Distribution of related codes and companies in the detail design/product development/prototyping stage of the new product development process.

Detail Design/Product Development/Prototyping		
Themes	**Codes**	**Company**
NPD	redesign	A
	benchmarking	B
	timing in NPD	B
	design-manufacturability relationship	C
	engineer dominant design	C
	designing a new handmade production model	E
	quality	E
	uniqueness	F
Manufacturing	maintaining craft aesthetics in the industry	A
	maintaining craft originality in industry	A
	product flexibility	B
	working with multiple craft makers from outside the company	F
Collaboration with Craftsman	working with a craftsman from outside the company	B,C,D
	designing by experimenting with master	B
	craftsman-designer one-on-one work	B
	collaboration of designer and craftsman at npd design stage	D
	utilizing from the knowledge of the craftsman	D
	craftsman guided by designer	F
	designer as a guiding craftsman-designer communication	F
	master-designer collaboration at the prototype stage	F

Table 7.6 (continued) : Distribution of related codes and companies in the detail design/product development/prototyping stage of the new product development process.

Detail Design/Product Development/Prototyping		
Themes	**Codes**	**Company**
Contribution of Craftsman	the contribution of the craftsman in the prototype stage	A,B,C,D, F
	the craftsman as a problem solver in new product development	A,B,C, F
	transfer of craftsman's material behavior knowledge in NPD	A,B
	the craftsman's problem-finding competence	A,C
	contribution of the craftsman to the usability of the product	A
	craftsman's contribution to functional innovation	A
	the aesthetic contribution of hand production	A
	contribution of craftsman to product development	A,C, D
	the contribution of the craftsman through material knowledge	B
	problem-solving skill of master through material knowledge	B
	contribution of the craftsman to product structure	C
	contribution of craftsman related to moulding	C
	the craftsman's contribution to ergonomics	C
	craftsman's contribution to NPD through production method	D
	the master's contribution to design	D
	Increasing design efficiency with the skill of the master	D
	the craftsman's contribution to idea development	F
	master's suggestion about the product	F
	contribution of craftsman to product development	F

At this stage, which is connected with the production stage, the preservation of craft aesthetics and the product's flexibility are evaluated. Cooperation with craftsmen at this stage to create prototypes is especially important for companies that outsource their production.

Since Companies D and F work with external craftsmen, there is a great deal of cooperation between the designer and the craftsman during the prototype stage. The designer directs the cooperation, while craftsmen who have mastery of the materials and production method provide information to the designer.

Both small-scale and large-scale companies benefit from the knowledge and experience of the craftsman during the prototyping stage. At this stage, the craftsman may use his knowledge and skill to identify and solve issues related to the product. For

example, in the design of the carafe in Company A, the craftsman ensured the usability of the product via a sanding method that improved flow. This example also demonstrates the artisan's functional contribution to product development as well as their aesthetic contribution.

Company C decided to produce home furniture as well as office furniture and thus started to work with upholstery masters. At this stage, the masters were consulted on the furniture's structure. In addition, company C also benefitted from the masters' experience in the field of moulding.

7.3.6 Testing

One of the areas where the contribution of the craftsman was not seen much was the testing phase. However, the knowledge and skills of the craftsman continued to be used during the testing phase, especially in companies with small-scale production and in large-scale companies where production or prototypes were made using a production method dominated by the craftsman. For example, the contributions of the upholstery masters in Company C regarding the product structure or the contributions of the masters in the shoe industry to the material knowledge and testing were mentioned for this stage.

Table 7.7 : Distribution of related codes and companies in the testing stage of the new product development process.

Trials, Testing, Refinement		
Themes	**Codes**	**Company**
Collaboration with Craftsman	utilizing from the knowledge of the craftsman	B
Contribution of Craftsman	master's suggestion about the product	A,B, C
	the craftsman as a problem solver in new product development	A,C
	the contribution of the craftsman through material knowledge	B
	contribution of the craftsman to product structure	C
	craftsman's contribution to NPD through production method	D
Knowledge	the master's opinion on the product in writing	C

7.3.7 Moulding/production

The following codes convey the contribution of the craftsmen during the moulding and production stages of NPD (Table 7.8).

Table 7.8 : Distribution of related codes and companies in the moulding/production stage of the new product development process.

Moulding/Production		
Themes	**Codes**	**Company**
Features of Craftsman	domination of the craftsman on the production method	A
NPD	design-manufacturability relationship	A
	differentiation	D
	production model innovation	E
	quality	E
	sustainability of business	F
Manufacturing	flexible production	A, D,F
	difference between hand production and industrial production	B
	craftsman as a foreman in the industry	C
	master's specialization in industry	C
	manufacturing through outsourcing	D,F
	manufacturing through craft manufacturer	D, F
	establishing a manufacturer company	D, F
	having alternatives to work with different craft manufacturers	D
	working with multiple craft makers from outside the company	D, F
	refusal of industrialization	E
	woman dominant handmade production	E
	knowledge&experience of master related to industrial production	E
	manufacture production-industry relationship	E
	small business	E
Collaboration with Craftsman	utilizing from the knowledge of the craftsman	A,C
	working with a craftsman from outside the company	B,C,D,F
Contribution of Craftsman	craftsman's contribution to NPD through production method	A,D
	problem-solving contribution of the master related to moulding	B
	master involved in every step of the production process	B
	problem-solving contribution of the craftsman about production	B
	contribution of the craftsman to product structure	C
	new molding proposal from the manufacturer and its application	D
	the competence of the craftsman in production	D

Hand-made production refers to the production of small quantities compared to industrial production. Although this is seen as a negative factor in terms of scale, a small amount of production makes it easier to make quick decisions and make rapid changes in the market. This ability provides companies with opportunities for straightforward adaptation to different situations. For instance, Company D, which operated in the glass sector, could quickly switch focus to another product if one product group did not sell well in the market.

Craftsmen's contributions to production are shaped by being a manufacturer or making a prototype. For Company B, various shoe samples were made to determine the best balance of comfort, flexibility and weight by stacking different materials in layers while making the shoe prototype. Hand-made prototype samples provide flexibility in production.

Production in Companies D and F was provided by external craft SMEs. The possibility of working with different craft masters offered a flexible production model for these companies. In addition, these two companies carried out their production with craftsmen outside the company make capital support on establishing the company that can provide production services.

Many masters working with Company B during the prototype stage also had mass production experience. If products returned to the prototype stage due to problems experienced during the production stage, the masters' production experience allowed them to better understand and solve the problems.

Company A produced both handmade and industrially made glass products. In this company, the amount of products made by hand was lower than those made via automatic production. If a handmade product sold well, the company would attempt to transition it to automatic production if possible. This situation allowed the company to measure the demand of the market with its small-scale handmade products.

Also in Company A, a craftsman was responsible for manual intervention in the machine manufacturing process to create a form detail that industrial conditions could not. This led to the creation of a hybrid production formed by the combination of manual and automatic production.

When Company C, a furniture company, switched from office furniture to home furniture, it entered the field of ceramic kitchenware, which it had not previously

produced. At this stage, the company, which is entirely foreign to this field, has continued this process with the masters working in this product group. This cooperation provided the company with easy access to the master, affordable prices, and flexible production conditions for a small number of products. As a result of this production support, the company was able to specialise in a new product group.

7.4 Factors Affecting and Directing the Contribution

Several factors influence or direct craftsmen's contributions. These factors can be shaped by the craftsman's attitude, the co-worker's attitude, the changes in the sector, and the strategies of the company. First, the way the company cooperates with the craftsman is significant. The hired craftsman should have a fixed salary. However, a different wage policy may be set for the craftsmen who are consulted from outside the company.

The motivations of the master may differ. In some companies, the master is seen as a traditionalist, while others can be innovative. The designer in Company A felt that the masters were traditionalists and should be guided by the designer. The designer working in Company B mentioned the existence of innovative masters as well as traditionalist masters.

Employees' attitudes, such as being open to collaboration and willing to share information, are also useful for creating an environment in which the craftsman can contribute. Additionally, the product's form, production and innovation direct the craftsman's contribution.

The product's material and production method can ensure the craftsman's existence in the industry. It is unthinkable to carry out leather processing methods, cut glass production or centrifugal glass production without a craftsman. At the same time, the scale of production guides the craftsman's contribution to product development. The craftsman is generally in charge of all production in small-scale companies and is generally responsible for the prototype process in large-scale companies. However, in the large-scale Company A, which utilised both handmade and industrialised production, the craftsman supported the company in both production and prototyping.

The companies investigated in this thesis study followed different strategies for innovation. A company's innovation strategy can progress in a design-driven, cost-

driven or market-driven direction. In Company B, which designs products using benchmarking and market demands, the craftsman's contribution is related to prototyping and material behaviour. Company D conducts NPD process that is shaped by the demands of the market. The external craftsmen with whom Company D collaborated supported the company's prototyping and production. Simultaneously, these craft workshops were advantageous in determining which products were in demand in the market since they produced for other companies and were in contact with other handmade craft workshops. These craft manufacturers thus shared information on the market trends with Company D. This interaction was not a one-way interaction but a complementary and cyclical interaction.

7.5 Cases

The case studies that embodied the contribution of craftsmen are listed in Table 7.9. These cases, which consisted of product creation, production models or knowledge transfer, are examined in terms of their input, process, output, how the knowledge was used and shared and the importance of the knowledge for the company. In each of these cases, the craftsman's knowledge input and/or designer–craftsman collaboration created an essential and valuable output for the companies.

Table 7.9 : Cases of companies.

Company	Case	Input	Process	Output	Knowledge	Value for the company
A	Decanter	Handmade skill, grinding application	Masters solved the problem regarding the product's flow function	Product Product Functionality	Tacit and Explicit	A handmade product with a high selling price
A	Transfer of handmade product to mass production	Handmade production	Transferring the handmade product with a good sales graphic in the market to mass production	Increasing sales volume Creating and following market trends	Tacit to Explicit	Increasing sales volume
A	Centrifugal casting method plate	Craft knowledge	The work of the master (who has knowledge of the production method) and the designer	Design Product Prototype	Tacit to Tacit	Creating a design from error Creativity

Table 7.9 (continued) : Cases of companies.

Company	Case	Input	Process	Output	Knowledge	Value for the company
B	Shoe pads	Craft knowledge	Craftsman and designer reducing costs on the pads of the shoes	Product	Tacit to Explicit	Cost reduced
C	Contribution of the master for home furnishing and household appliances	Craft Knowledge	Collaboration of designer and master in a new field of the company	Product Ergonomic Information	Explicit Knowledge	A low-cost facilitating and guiding contribution to creating a new product range
C	Furniture leg production	Hand production and moulding	Craftsman supported creation of a polyurethane mould for the production of office furniture legs	Product, Collaborations		Producing furniture legs at the desired angle
D	Tray case	Craft knowledge, material knowledge of craftsman	The craftsman of the manufacturing company proposes a floral motif for the tray and the designer applies it, collaborative work	Product, A new material and mode of production for the company, Following trends	Socialisation (tacit knowledge sharing)	A new product on the market
E	Production Model	Craftsman's knowledge, creativity, knowledge transfer from different sectors	Craftsman entrepreneur designing a new production model	High quality handmade products	Tacit to explicit, explicit to explicit	Handmade high-quality products, hard to copy
F	Modular Furniture	Craft Knowledge	Craftsman's idea and implementation for making furniture modular	Product		Reducing storage and transportation costs, solving the placement problem

In Company A, an issue regarding liquid not flowing properly in a carafe was overcome by the designer–craftsman effort. After solving this functional problem, which the craftsman overcame with a grinding method, the product was able to go to production. In this case, it has become a unique design with a high selling price.

Another case in Company A was the transfer of a successful product from hand production to mass production. Here, the handmade product was used to gauge reaction and demand in the market. The handmade product, which had a good sales graphic, was then made suitable for mass production while preserving its aesthetic values. This transfer was done via a flexible production model and the use of both handmade and industrial production facilities. Here, the product was transferred to industrial production by converting tacit knowledge to explicit knowledge.

As a third case, the craftsman contributed to Company A's product via introduction of the spin plate method. In the spinning plate method, molten glass is poured onto a spinning platter, allowing it to spread thinly and evenly and take the pattern of the mould beneath it. Although this method of construction is semi-industrialised, it requires the intervention of a craftsman. The product designed by the designer is produced to the extent that this method allows. Even at this stage, the craftsman and designer can discover new patterns while creating prototypes. In this case, the output can be a design, product, or prototype. Knowledge transfer here occurred in the form of sharing tacit knowledge.

The same function was provided by reducing the number of pads used in a shoe group in Company B, a shoe manufacturer. With the contribution of the master, the cost was reduced while providing the same level of comfort.

In Company C, a facilitation step was used to reduce the cost with the craftsman's knowledge. Company C, a manufacturer of office furniture, started production in kitchen products with its transition to the home furniture market. As it had not produced these types of products before, the company cooperated with a master in this field. In this way, it gained access to knowledge at a low cost to facilitate its entry into the market.

Company C, which wanted to differentiate itself in the market, worked with a polyurethane moulder and a master to produce office furniture legs at the desired angle. These legs were finished by hand. Here, with the contribution of the master to the production, differentiation was achieved in the product and the market.

In some cases, external production led to greater collaboration between the designer and the craftsman than for other companies. In Company D, which outsourced all of its production, the master used different materials in the design of a tray. His material

knowledge contributed to a new product being introduced to the market. In this collaboration, tacit knowledge was shared through socialisation.

Company E is a company that produces handmade leather bags and wallets. The founder of the company, who designs the production model and the product design, has many years of craftsmanship experience. He planned to create high-quality handmade production products by working with different sectors during the moulding stages of the products.

In Company F, the products were produced modularly to reduce transportation costs and allow it to get through the doors of the building. This idea was realised because of the collaboration of designers and craftsmen. In this way, storage and transportation costs were reduced, and the issue of getting the product into the building was solved.

8. CONCLUSION

After discussion, it should be noted that not all of the craftsmen suddenly disappeared with industrialization. In today's current situation, there are individual craftspeople, employees working in manufacturing production methods, craftsmen in the industry, or craftsmen cooperating with the industry. The issue of why the industry still needs the knowledge and support of the craftsman is essential, although the industry produces automated production systems. The reasons for this situation are listed as follows:

- The fact that the products created with handmade production are personal and labour intensity makes them more valuable. In this case, it ensures that the sales of handmade products continue in the market.
- Although it is passed to a fully automated system, it is possible to cooperate with the craftsman to understand the material behaviour more economically and quickly during the prototyping process.
- The application of artisan knowledge and experience in semi-automatic production systems occurs. For instance, it is possible to use this information during the moulding and prototyping process, especially in the leather industry.

This thesis determined the contribution of craft knowledge to NPD. The primary research focus of this thesis is how craftsmen's knowledge is transferred to the dynamics of industrial production. For this purpose, craftsmen's knowledge and skills and the transformations of the craft during the industrialisation process were examined. Craft knowledge is transmitted through collaborative work since it is tacit knowledge that can only be learned through experience. Therefore, collaborations with craftsmen in connection with product development were investigated. The literature review on collaboration revealed the sectors in which craftsmen are influential. Craftsmen maintain their existence in these industries through companies that rely on craft knowledge or materials that can already be processed by craftsmen (e.g., glass, leather

and wood). In the companies included in this thesis, craftsmen were employed primarily during the prototype and production stages.

Craftsmen, who once had control over production, design and sales, have lost this power with industrialisation. Today, craftsmen employed within companies work as employees whose contribution to the product is not at the forefront but who make the expected contribution.

Nowadays, craftsmen's knowledge and skills are transferred to the development of new products through collaboration with companies. This collaboration can take place between the designer and the craftsman within the company or between the designer and an external craftsman. In addition to sharing knowledge about the material and manufacturability of the product, the designer and craftsman can work together during the prototype stage. In the collaborative work between the designer and the craftsman, the craftsman makes an important contribution by finding issues and consulting on how to solve problems.

Figure 8.1 presents contribution of craftsman to NPD and industry through collaboration with designer. Craftsmen's holistic approach to the product, combined with their experiences in mass production in the sector, enables them to identify problems that may be encountered in the product design and production stages and to find solutions to these problems. In Company E, this holistic approach enabled the craftsman, as an entrepreneur, to plan a new method for craft production. The craftsmen's knowledge of materials and production methods are the most important skills for finding and solving problems. Prototyping, which is the most fundamental support that craftsmen can provide to the industry, results from this knowledge. Craftsmen are also asked to share their ideas about making and materials during the product development process.

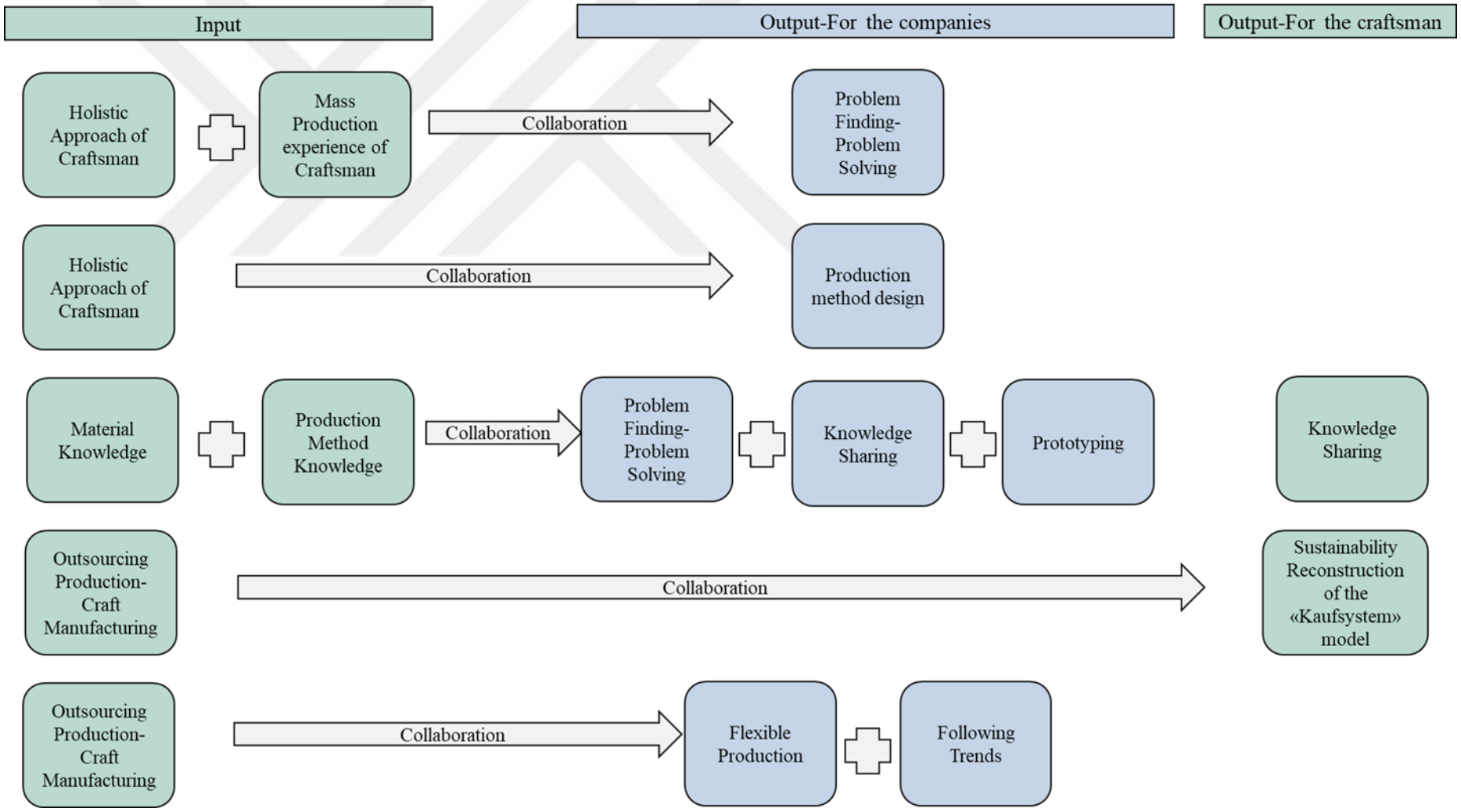


Figure 8.1 : Contribution of craftsman to NPD and industry through collaboration with designer.

Craftsmen present their production power as a flexible production model; companies that outsource this production support the continued existence of the craft. This situation enables craftsmen to establish relationships with companies in the same way that they established relationships with merchants in the pre-industrialised manufacturing period. In this way, craftsmen gain an environment in which they can sell their products. Independent craftsmen producing for different companies can share market trends with these companies. In conclusion, craftsmen not only offer handmade products to companies, but also contribute to the development of new products, through sharing material and production methods knowledge that can affect the functional properties of the product.

Although companies understand the importance of craftsmen in their sectors, they often do not consider them as an element that creates innovation. Craftsmen are consulted for their specialised knowledge in materials and construction methods in the fields of production and prototyping. This contribution is critical for product development because it often results in craftsmen finding and solving problems. The ability of the craftsmen to find and solve problems in new product development, and the contribution of material and production knowledge in this process, have a catalytic effect by making this process more efficient and sometimes faster. The most important factor that made craftsmen's knowledge unique in the interviewed companies was their contribution to the manufacturability of the product. Manufacturability is critical for product design, planning and launch.

The factors affecting craftsmen's contributions to NPD are the craftsmen's own characteristics, the teamwork environment, communication elements and managerial decisions. In some companies, the master is seen as a traditionalist, while others are viewed as innovators. Primarily, craftsmen and those who collaborate with them should be open to knowledge sharing. While this factor is a requirement for salaried craftsmen in the company, it is expected that an external craftsman and the company will reach a mutual agreement for each project. Creating an environment suitable for teamwork in the company and planning its progress efficiently can be factors that increase craftsmen's contributions. Creating an environment suitable for teamwork in the company and planning its progress efficiently are the factors that increase craftsmen's contributions.

Collaboration management, knowledge management, human resource management and investment management can be used to manage craftsmen's contributions. Creating a hierarchy and establishing a bridge between the designer and the craftsman is an example of a model for the management of collaboration, while the craftsman's evaluation of the product's assembly or prototype in writing is an example of knowledge management. Employing a designer alongside the craftsman is an example of human resource management and providing capital to a company to support their production can be considered investment management.

Companies have different behaviours and management strategies for knowledge management. Since small-scale companies work with a small number of designers and human resources, knowledge processing processes are carried out faster and with fewer steps. In large-scale companies, however, two separate behaviours emerge in this regard. First, in knowledge sharing, repetitive situations are ignored in favour of focusing on knowledge that is unique to that product. Here, it should be taken into consideration that the shoe product, which is effective in this decision, has a high connection with craftsmanship and the company has very high number of design trials in a production season. The second example is the written record of the masters' opinions on the product and prototype in a large-scale furniture company. The factors that shape the behaviour in this company are that the management of the company is focused on engineering and the modular office furniture contains similar parts in every product, although the design changes, so there is a possibility to transfer the acquired knowledge to another product.

These strategies depended on the companies' scale, production conditions and NPD processes. For instance, the formation of a bridging department between craftsman and designer collaboration is due to the management of new product development by the R&D and product planning departments within those companies. In addition, the fact that these companies are large-scaled, and the designers and masters are not in the same environment are seen as reasons of companies to manage communication of these people through a department. On the other hand, this strategy is monitored to ensure the control of every stage of new product development by the management. In a small-scale furniture company (Company F), there is a designer as a bridge worker instead of the bridge department. Here, a designer provides the collaboration between designers and masters. This example expresses both the acceleration of new product

development on a small scale and the facilitation of communication through the designer.

The fact that a small-scale glass company is an investor in the establishment of a hand-made glass company enables it to have a say in a company that can produce for itself. This situation could be considered a management strategy by eliminating the danger of external producers copying the design.

Factors such as the financial possibilities of the company, human resources capacity and the size of the company also influenced the selection of the appropriate strategies. Having an open knowledge sharing environment within the company and defining the NPD process can highlight the role of the craftsman. The objective evaluation and use of the master's knowledge by other employees are extremely important for the sustainability of this knowledge sharing. In addition, the market demand for handmade products is an external factor ensuring the continuation of the craftsman's trade. Continuing to use the materials processed by the craftsman and the production method he/she has mastered is another factor that preserves the craft's existence in the sector. In the questioning of the future existence of the craftsman, maintaining the title of material expertise, adapting himself to new materials can be considered as a protective step.

8.1 Contribution to Knowledge

This study tried to integrate the use of tacit knowledge and its transformation within the company for innovation mentioned in the management literature and the transfer of knowledge and experience of craftsman to product design by collaborative studies in craft and design literature.

In the literature, the transfer of craftsmen's knowledge to NPD has mostly been studied in terms of one-on-one collaborations but not at the company scale. Therefore, it was clear that extensive research is needed on the contribution of craftsmen to the development of new products in the industry. In this study, the forms of collaboration with craftsmen were evaluated in different sized companies and different sectors. The transfer of craft knowledge to the product was evaluated at different scales, from collaboration between individual craftsmen and designers to collaboration between a workshop owner craftsman and another company.

Craftsmen’s contributions to products at different stages of the NPD process were revealed. Additionally, craftsmen’s contributions to both the aesthetics of the product and its functionality were examined.

8.2 Limitations of Research and Further Research

First, the researcher originally planned to meet with more companies within the scope of this study. However, interviews with some planned companies could not be done due to their negative responses. Further research can be carried with more companies in number.

Secondly, the craftsmen’s contributions to the product could be better understood by observing the company throughout the NPD process. However, much more time would be needed for such a study. Although the researcher could spare this time, the companies could not allocate such a long period of time for a researcher in their working order. In a future study, a product development process should be observed from start to finish, and the contribution of the craftsman within the company should be examined in more detail with more examples. Thus, in addition to participants’ statements, more observations should be made, and additional information should be collected.

In addition, during the pilot interviews, some companies indicated that they had started using digital technologies. In this regard, craftsmen’s interactions with digital production and prototyping tools in the industry may be examined in future research.

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APPENDICES

APPENDIX A: Semi-structured interview questions

APPENDIX B: Ethical approval of the research

APPENDIX C: Distribution of codes in the NPD process of companies

APPENDIX D: Themes, codes, and explanations

APPENDIX A: Semi-structured interview questions

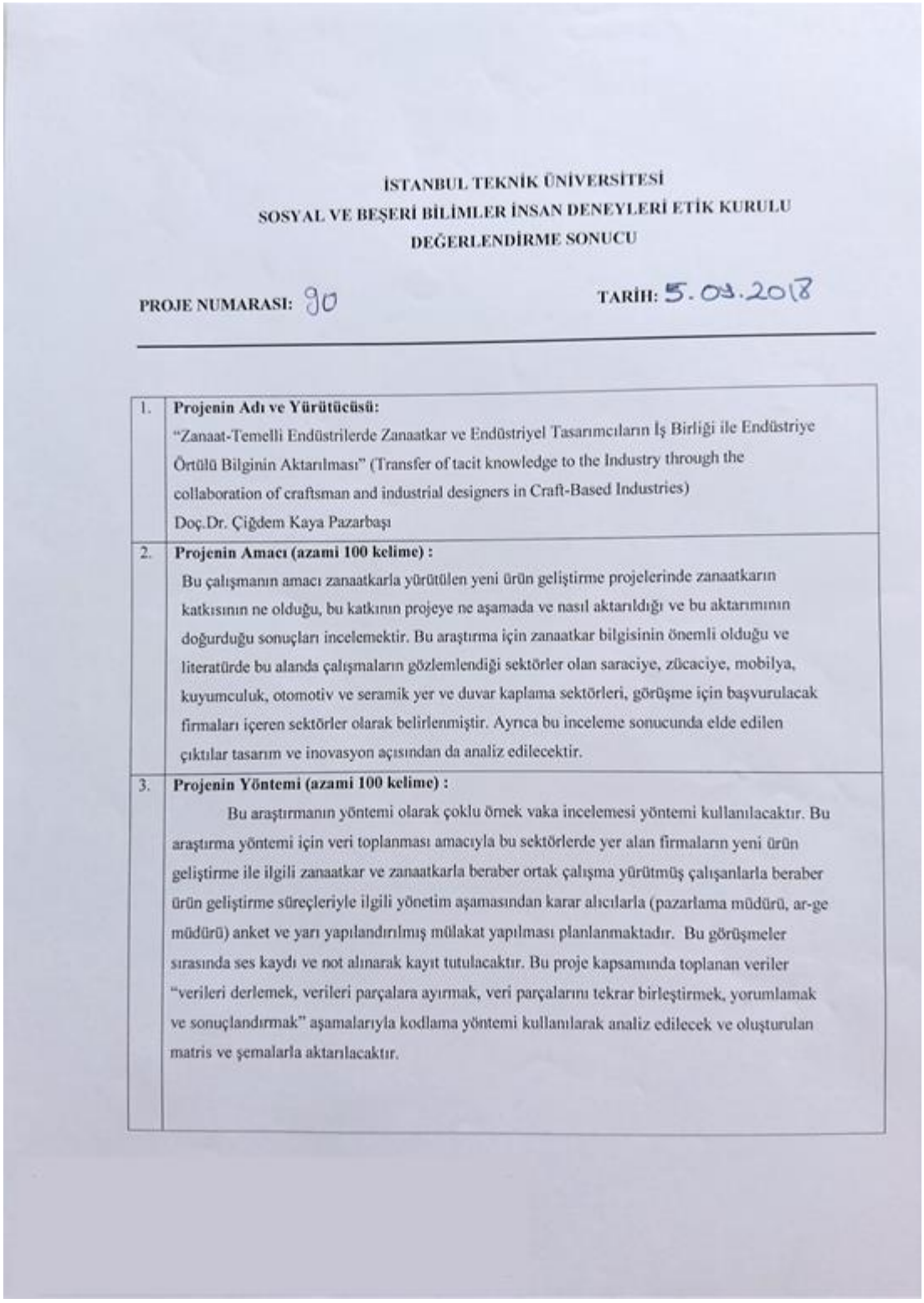
Table A.1 : Semi-structured interview questions.

Question Groups	Questions
Information About the Person Interviewed	1. What is your role in the company? 2. How many years have you been working in this company? 3. What is your area of expertise? 4. Which department do you work in this company?
New Product Development and Innovation Processes in the Company	5. Who (which departments) conducts the new product development process in the company? 6. How is new product development planned in the company? What is your role in this process? 7. How many new products have been developed in the last five years? 8. How effective is product design in the new product development process? 9. Is craftsman knowledge used in the new product development process? 10. At what stage of NPD and for what reason is craft knowledge applied? 11. Is there any support from an outside craftsman during the new product development process? (At the prototype, moulding, or final product stage).
Collaboration with craftsman	12. What is the importance of the craftspeople for that sector? 13. How many craftspeople work in the company? 14. At what stage of production do the craftsmen work in the company? 15. With which employees does the craftsperson collaborate the most? 16. Can another employee do the work of the craftsperson in the company? 17. Is the craftsperson's work considered as innovative?
Questions asked to reveal the products that the craftsman contributed	18. How does the craftsman knowledge and experience contribute to the company? 19. How often in the company do you use the knowledge or experience of the craftsman? 20. Can you share with me the examples that come to your mind from the works you carried out with the craftsmen in the company?

Table A.1 (continued) : Semi-structured interview questions.

Question Groups	Questions
Questions to Examine Case Studies and Understand the Contribution of the Craftsman	Questions about sample products 21. Who did the craftsman work with on this project? 22. How was the craftsman's contribution/knowledge transfer in the case study/project? 23. Was the craftsman involved in the project from the beginning or when her/his knowledge was needed? 24. At what stages did the craft knowledge transfer take place? (design, production, prototype) 25. In this collaborative effort, was the craftsman's contribution planned or developed during the process? 26. Has the innovation that emerged with this knowledge transfer been repeated or caused another innovation? 27. What are the machines/tools/technology used by the craftsman to facilitate this knowledge transfer? 28. How often and to what extent does new product development occur in the company with the contribution of the craftsman? 29. Do you think there is a difference between the products that the craftsman contributes and the products that does not? 30. What are the shortcomings you see during this project? 31. What did you learn during the collaborative work? What has this process done for you? What benefits did it provide? 32. What kind of experience did this sample project provide for your future projects?
Questions about Outcome of Cases	33. What is the output of the project? 34. How is the output protected? 35. Is the output of the project trying to be reproduced? Is the product range being expanded? 36. Did you encounter the output you hoped/anticipated at the beginning of the collaboration? 37. Could this output be achieved without a craftsman? What is the unique contribution/effect that the craftsman adds? 38. Did the transfer of artisanal knowledge help the company gain a competitive advantage over other companies in this case study?
Factors that Facilitate and Complicate the Contribution of the Craftsman, Opinions of the Stakeholders	39. How free is the craftsman to innovate and participate in innovation? Is such an environment provided by the company? 40. What are the factors that support the transfer of knowledge of the craftsman in the collaborative working process? 41. Are there any constraints to the transfer of knowledge of the craftsman in the collaborative work process? 42. What would be your suggestions to the person you work with for the development of such projects?

APPENDIX B: Ethical approval of the research.



İSTANBUL TEKNİK ÜNİVERSİTESİ
SOSYAL VE BEŞERİ BİLİMLER İNSAN DENEYLERİ ETİK KURULU
DEĞERLENDİRME SONUCU

PROJE NUMARASI: 90 TARİH: 5.03.2018

1.	**Projenin Adı ve Yürütücüsü:** "Zanaat-Temelli Endüstrilerde Zanaatkar ve Endüstriyel Tasarımcıların İş Birliği ile Endüstriye Örtülü Bilginin Aktarılması" (Transfer of tacit knowledge to the Industry through the collaboration of craftsman and industrial designers in Craft-Based Industries) Doç.Dr. Çiğdem Kaya Pazarbaşı
2.	**Projenin Amacı (azami 100 kelime) :** Bu çalışmanın amacı zanaatkarla yürütülen yeni ürün geliştirme projelerinde zanaatkarın katkısının ne olduğu, bu katkının projeye ne aşamada ve nasıl aktarıldığı ve bu aktarımının doğurduğu sonuçları incelemektir. Bu araştırma için zanaatkar bilgisinin önemli olduğu ve literatürde bu alanda çalışmaların gözlemlendiği sektörler olan saraciye, zücaciye, mobilya, kuyumculuk, otomotiv ve seramik yer ve duvar kaplama sektörleri, görüşme için başvurulacak firmaları içeren sektörler olarak belirlenmiştir. Ayrıca bu inceleme sonucunda elde edilen çıktılar tasarım ve inovasyon açısından da analiz edilecektir.
3.	**Projenin Yöntemi (azami 100 kelime) :** Bu araştırmanın yöntemi olarak çoklu örnek vaka incelemesi yöntemi kullanılacaktır. Bu araştırma yöntemi için veri toplanması amacıyla bu sektörlerde yer alan firmaların yeni ürün geliştirme ile ilgili zanaatkar ve zanaatkarla beraber ortak çalışma yürütmüş çalışanlarla beraber ürün geliştirme süreçleriyle ilgili yönetim aşamasından karar alıcılarla (pazarlama müdürü, ar-ge müdürü) anket ve yarı yapılandırılmış mülakat yapılması planlanmaktadır. Bu görüşmeler sırasında ses kaydı ve not alınarak kayıt tutulacaktır. Bu proje kapsamında toplanan veriler "verileri derlemek, verileri parçalara ayırmak, veri parçalarını tekrar birleştirmek, yorumlamak ve sonuçlandırmak" aşamalarıyla kodlama yöntemi kullanılarak analiz edilecek ve oluşturulan matris ve şemalarla aktarılacaktır.

Figure B.1 : Ethical approval of the research.

☒ Proje değerlendirilmiş ve etik açıdan uygun BULUNMUŞTUR.

☐ Proje değerlendirilmiş ve etik açıdan uygun BULUNMAMIŞTIR.

Projenin Adı ve Yürütücüsü: "Zanaat-Temelli Endüstrilerde Zanaatkar ve Endüstriyel Tasarımcıların İş Birliği ile Endüstriye Örtülü Bilginin Aktarılması" (Transfer of tacit knowledge to the Industry through the collaboration of craftsman and industrial designers in Craft-Based Industries)

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Figure B.1 (continued) : Ethical approval of the research.

APPENDIX C: Distribution of Codes in the New Product Development Process of Companies

Table C.1 : Distribution of codes in the NPD process of Company A.

NPD PROCESS-COMPANY A							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
Material Knowledge Handmade making methods Collaboration Environment Designers' guidance for collaboration Having handmade and industrial manufacturing facilities together ●design department as a bridge between production and management ●significance of craftsmen for the industry ●the craftsman's competence in product ●company's view of design ●perspective of designer ●holistic approach	●the craftsman's contribution to idea development ●master's suggestion about the product ●workshop of designers and craftsmen	●the contribution of the craftsman in the prototype stage ●the craftsman's contribution to idea development ●working with a craftsman from outside the company ●master's suggestion about the product ●workshop ●soft innovation ●aesthetic innovation ●designing by experimenting with master ●the craftsman as a problem solver in new product development ●design arising out of fault in prototyping ●industrialization of handmade products ●craftsman guided by designer ●rapid prototyping by hand production ●work experience with craftsman ●knowledge transfer ●master's suggestion on feasibility ●adapting the handmade product to industrial production ●indirect transfer of the craftsman's knowledge to the NPD team ●the contribution of the craftsman through material knowledge ●the aesthetic contribution of hand production		●the contribution of the craftsman in the prototype stage ●the craftsman as a problem solver in new product development ●transfer of craftsman's material behaviour knowledge in NPD ●the craftsman's problem-finding competence ●contribution of the craftsman to the usability of the product ●craftsman's contribution to functional innovation ●the aesthetic contribution of hand production ●maintaining craft aesthetics in the industry ●maintaining craft originality in industry ●contribution of craftsman to product development ●redesign	●master's suggestion about the product ●the craftsman as a problem solver in new product development	●design-manufacturability relationship ●craftsman's contribution to NPD through production method ●flexible production ●domination of the craftsman on the production method ●utilizing from the knowledge of the craftsman	Products Knowledge Transfer ●knowledge transfer from industrial production to handmade

Table C.2 : Distribution of codes in the NPD process of Company B.

NPD PROCESS-COMPANY B							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
●craftsman's traditional approach ●department as a bridge between design and craft ●the firm that supports the development of the craftsman ●craft-based industry ●importance of craftsman knowledge in industry	●craftsman's contribution to NPD through production method ●fast-changing trends ●cost-driven pricing ●market-driven pricing	●the craftsman's problem-finding competence ●problem-solving skill of master through material knowledge ●soft innovation ●aesthetic innovation ●market-driven innovation ●shaping the design with feasibility and cost factors ●knowledge exchange between craftsman-engineer ●craftsman-designer one-on-one work		●the contribution of the craftsman in the prototype stage ●working with a craftsman from outside the company ●the contribution of the craftsman through material knowledge ●designing by experimenting with master ●the craftsman as a problem solver in new product development ●transfer of craftsman's material behavior knowledge in NPD ●benchmarking ●timing in NPD ●problem-solving skill of master through material knowledge ●product flexibility ●craftsman-designer one-on-one work	●master's suggestion about the product ●the contribution of the craftsman through material knowledge ●utilizing from the knowledge of the craftsman	●working with a craftsman from outside the company ●problem-solving contribution of the master related to moulding ●master involved in every step of the production process ●difference between hand production and industrial production ●master involved in every step of the production process ●problem-solving contribution of the craftsman about production	Products

Table C.3 : Distribution of codes in the NPD process of Company C.

NPD PROCESS-COMPANY C							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
•company's view of design •engineer dominant design •the craftsman's competence in product •innovative master •power of knowledge •craft-based industry •holistic approach •know-how	•the craftsman's contribution to idea development •working with a craftsman from outside the company •contribution of the craftsman to product structure •exchange of ideas •market-driven innovation •communication and collaboration with the master	•the contribution of the craftsman in the prototype stage •the craftsman's contribution to idea development •working with a craftsman from outside the company •master's suggestion about the product •the contribution of the craftsman through material knowledge •the craftsman as a problem solver in new product development •transfer of craftsman's material behaviour knowledge in NPD •the craftsman's problem-finding competence •contribution of craftsman related to moulding •prototype evaluation form •master's written notification of problems about the product •the craftsman's contribution to aesthetic innovation	•the contribution of the craftsman in saving time in production •working with masters while creating new product line •project adjustment form	•the contribution of the craftsman in the prototype stage •working with a craftsman from outside the company •the craftsman as a problem solver in new product development •the craftsman's problem-finding competence •contribution of the craftsman to product structure •contribution of craftsman related to moulding •contribution of craftsman related to moulding •the craftsman's contribution to ergonomics •design-manufacturability relationship •contribution of craftsman to product development •engineer dominant design	•master's suggestion about the product •the craftsman as a problem solver in new product development •contribution of the craftsman to product structure •the master's opinion on the product in writing	•working with a craftsman from outside the company •contribution of the craftsman to product structure •craftsman as a foreman in the industry •master's specialization in industry •utilizing from the knowledge of the craftsman	•power of knowledge •know-how Products

Table C.4 : Distribution of codes in the NPD process of Company D.

NPD PROCESS-COMPANY D							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
●visionary boss ●manager eager to innovate ●innovative master ●the craftsman's competence in product ●tacit knowledge of craftsman related to material-making ●holistic approach	●the contribution of the craftsman in the prototype stage ●the craftsman's contribution to idea development ●following trends with the master producing to various customers ●design idea from master-manufacturer	●the contribution of the craftsman in the prototype stage ●the craftsman's contribution to idea development ●working with a craftsman from outside the company ●craftsman's contribution to NPD through production method ●master's suggestion about the product ●the contribution of the craftsman through material knowledge ●soft innovation ●aesthetic innovation ●designing by experimenting with master ●contribution of the craftsman to product structure ●differentiation ●rapid prototyping by hand production ●verbal communication with the master ●designer as a learner from the master about material and making ●craftsman-designer one-on-one work	●finding the best craft manufacturer	●the contribution of the craftsman in the prototype stage ●working with a craftsman from outside the company ●craftsman's contribution to NPD through production method ●collaboration of designer and craftsman at npd design stage ●the master's contribution to design ●increasing design efficiency with the skill of the master ●utilizing from the knowledge of the craftsman ●contribution of craftsman to product development	●craftsman's contribution to NPD through production method	●working with a craftsman from outside the company ●craftsman's contribution to NPD through production method ●manufacturing through outsourcing ●differentiation ●flexible production ●manufacturing through craft manufacturer ●new moulding proposal from the manufacturer and its application ●the competence of the craftsman in production ●establishing a manufacturer company ●having alternatives to work with different craft manufacturers ●working with multiple craft makers from outside the company	Products Following trends through craftsmen

Table C.5 : Distribution of codes in the NPD process of Company E.

NPD PROCESS-COMPANY E							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
•differences between industrial production and hand production •creating new jobs •small business •added value of craftsmanship •industrial production experience of craftsman-entrepreneur •craftsman manager	•soft innovation •aesthetic innovation •differences between industrial production and hand production •cost difference between industrial production-hand production •craft-based business	•craftsman-material connection •added value •aesthetic innovation acquired by hand production •the competition of industrial products and handmade products	•intersectoral knowledge transfer •company scale and continuity	•designing a new handmade production model •quality		•refusal of industrialization •woman dominant handmade production •knowledge&experience of master related to industrial production •production model innovation •manufacture production-industry relationship •small business •quality	•creating new jobs •designing a new handmade production model

Table C.6 : Distribution of codes in the NPD process of Company F.

NPD PROCESS-COMPANY F							
Input	**Idea Generation/Idea Development/Screening**	**Concept Development/Experimental Prototypes**	**System Level Design/Business Analysis**	**Detail Design/Product Development/Prototyping**	**Trials, Testing, Refinement**	**Moulding/Production**	**Output**
●having mastery values ●market-driven innovation ●holistic approach	●the craftsman's contribution to idea development ●master's suggestion about the product ●the contribution of the craftsman through material knowledge ●transfer of craftsman's material behavior knowledge in NPD ●market-driven innovation	●the craftsman's contribution to idea development ●master's suggestion about the product ●transfer of craftsman's material behavior knowledge in NPD ●exchange of ideas ●working physically close to the master ●problem-solving skill of master through material knowledge ●differentiation ●craftsman guided by designer ●designer as a leader in collaboration work experience with craftsman ●designer as a guiding craftsman-designer communication ●master-designer collaboration at the prototype stage ●alternative material suggestion ●teamwork ●designer's material knowledge ●craftsman-designer one-on-one work	●finding the best craft manufacturer	●the contribution of the craftsman in the prototype stage ●the craftsman's contribution to idea development ●master's suggestion about the product ●the craftsman as a problem solver in new product development ●craftsman guided by designer ●designer as a guiding craftsman-designer communication ●master-designer collaboration at the prototype stage ●uniqueness ●working with multiple craft makers from outside the company ●contribution of craftsman to product development		●working with a craftsman from outside the company ●manufacturing through outsourcing ●flexible production ●manufacturing through craft manufacturer ●establishing a manufacturer company ●sustainability of business ●working with multiple craft makers from outside the company	●employing a designer next to manufacturer master ●bridging through an employee between designer and craftsperson ●added value of craftsmanship ●employing a designer next to manufacturer master

APPENDIX D: Themes, codes, and explanations.

Table D.1 : Theme 1- Features of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	holistic approach	6	Having mastery of the whole process regarding the product made by the craftsman
●	innovative master	5	The master who follows the innovations as well as his traditionalist attitude
●	the craftsman's competence in product	4	Knowledge and experience of the craftsman in making the product
●	craftsman's traditional approach	2	The traditional attitude of the craftsman due to years of doing his work with the same methods
●	aesthetic taste of the craftsman	1	The positive effect of the aesthetic vision and experience of the master on the product design
●	having mastery values	1	Business with mastery values
●	domination of the craftsman on the production method	1	Master's sole mastery of a mode of production involved in hand-made production
●	industrial production experience of craftsman-entrepreneur	1	Designing a new model for hand production with knowledge gained in industrial production
●	the wish of the craftsman to state ideas	1	The master's willingness to express his opinion about the product
●	mastery ego	1	The master's self as a result of his knowledge and skill

Table D.1 (continued) : Theme 1- Features of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	master with aesthetic vision	1	The master who is aware of the aesthetic contribution of the product he produces
●	future of craftsmanship	1	The position of the craftsman in production when it comes to the production forms of the future and new materials
●	motivation of craftsperson	1	The motivation of the craftsman while contributing to the product

Table D.2 : Theme 2- New product development- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	soft innovation	7	Aesthetic innovation beyond functional innovation
●	aesthetic innovation	7	Aesthetic innovation beyond functional innovation
●	market-driven innovation	7	The form of innovation in which the demand for innovation comes from the market
●	npd process	5	Work, collaborations, and steps during new product development
●	engineer dominant design	5	The fact that the engineer is as effective as the designer in design

Table D.2 (continued) : Theme 2- New product development- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	quality	4	product quality
●	teamwork	4	Working together of people from different disciplines during the product development
●	added value	3	Value added to a product through processing, added to a service by labor.
●	differentiation	4	To design a product that is functionally and aesthetically different from other products on the market
●	benchmarking	3	Examining the business techniques of other businesses with successful performance, comparing them with their own techniques and applying the information obtained from this comparison in their own business
●	timing in NPD	2	Planning new product development time for a product
●	design-manufacturability relationship	2	Progress of the designed product within the company's manufacturability possibilities
●	designing a new handmade production model	2	Designing a production model that differs from existing production models
●	uniqueness	1	To be unique by differentiating from other similar products in the market

Table D.2 (continued) : Theme 2- New product development- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	market-driven pricing	1	Setting a product price on terms that can compete with other products in the market
●	product development	1	All of the design and development activities carried out to bring a new product to the market.
●	cost-driven pricing	1	Determining a price strategy by considering the cost
●	company scale and continuity	1	The size of the company and its long-term strategies regarding this situation
●	redesign	1	Designing new products by improving existing products
●	fast-changing trends	1	The rapidly changing tastes and purchasing behaviors of customers in the market
●	NPD	1	NPD process
●	product innovation	1	Product-based innovation studies
●	economic risks	1	Adverse economic conditions that will harm market activities or affect sales volume
●	product registration	1	Necessary applications for the registration of the product belonging to the company

Table D.2 (continued) : Theme 2- New product development- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	product registration	1	Necessary applications for the registration of the product belonging to the company
●	shaping the design with feasibility and cost factors	1	Product design shaped by factors such as manufacturability and cost
●	production model innovation	1	Creating a hand-made production model in which craftsman-entrepreneur designs the production pattern by means of moulds
●	perspective of designer	1	Designer's perspective on craftsman- designer collaboration
●	sustainability of business	1	The ability of the current business model to continue in the future conditions or to survive by transforming
●	designer's material knowledge	1	The designer's knowledge of the processing and properties of the material used in the sector she/he works in
●	specialization of designer	1	The designer's specialization in any industry after graduation

Table D.3 : Theme 3- Manufacturing- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	manufacturing through outsourcing	6	The company outsources its production to a contracted manufacturer
●	manufacture production-industry relationship	5	The position and shaping of the production conditions in the industry
●	working with multiple craft makers from outside the company	4	Working with more than one craftsman outside the company during the product development process
●	craftsman-material connection	4	The bond of the craftsman with the material she/he is working with and the characteristics of this material shaping the craftsmanship
●	industrialization	4	Making production facilities suitable for mass production
●	manufacturing through craft manufacturer	3	Carry out production in a small business owned by a craftsman
●	craft-based industry	3	Industry where craftsman knowledge and skills are used
●	flexible production	3	The ability to switch rapidly from the manufacture of one product to another
●	industrialization of handmade products	3	Adaptation of handmade products to industrial production by protecting the aesthetic value of handmade products at the maximum level.
●	finding the best craft manufacturer	2	An effort to find and work with the best craftsmen outside the company
●	woman dominant handmade production	2	Work of women workers in production
●	aesthetic innovation acquired by hand production	2	The prominence of aesthetic elements in innovation with handmade

Table D.3 (continued) : Theme 3- Manufacturing- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	establishing a manufacturer company	2	Making a capital investment for a company that will make the production
●	cost difference between industrial production-hand production	2	Difference in cost per piece when a product is handcrafted, or mass produced
●	added value of craftsmanship	2	The added value (uniqueness, quality) that the craftsmanship input adds to the product
●	refusal of industrialization	2	Adopting a small-scale strategy and abandoning mass production
●	craft-based business	1	Business where craftsman knowledge and skills are used
●	maintaining craft aesthetics in the industry	1	To preserve the aesthetic elements fed by craftsmanship in industrial production
●	knowledge&experience of master related to industrial production	1	Craftsman with experience working in mass production
●	having alternatives to work with different craft manufacturers	1	The fact that there are more than one company that undertakes the production of the company and the company can choose among them
●	the competition of industrial products and handmade products	1	Competition of handmade and mass-produced products that can be equivalent in the market
●	production planning in industry	1	The planning process that includes the scale and methods of production in industry

Table D.3 (continued) : Theme 3- Manufacturing- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	product flexibility	1	The ability to adapt to a future change in a product design
●	small business	1	Small sized business (SMEs)
●	furniture industry as a craft-based industry	1	Continued use of the craftsmanship knowledge and skills applicable to the furniture industry
●	importance of craftsman knowledge in industry	1	Using the craft knowledge and skills used in the industry with awareness of their contribution to the industry
●	difference between hand production and industrial production	1	Differences between handmade and industrial production in terms of factors such as production, material, selling price
●	suitability of the material for industrial production	1	Material in forms that can be processed, stored, and supplied in mass production
●	master's specialization in industry	1	The master is responsible for a specific part of the production, not the entire production process in the industry
●	craftsman as a foreman in the industry	1	The craftsman becoming a technician by specializing in a certain field in the industry
●	substitution materials	1	Materials that can be used instead of one in production, the craftsman's suggestion of these materials
●	maintaining craft originality in industry	1	To work to preserve the features of the product, which the craftsman has made unique with its handmade production, in mass production

Table D.4 : Theme 4- Collaboration with craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	working with a craftsman from outside the company	13	Collaboration of the designer in the company with an independent craftsman from outside the company in the product development process
●	craftsman-designer one-on-one work	8	One-on-one work of craftsman and designer without another guide
●	designing by experimenting with master	7	Especially in the product idea creation and prototype process, the designer and craftsman make experimental studies and improve the product
●	designer-master relationship	7	The attitudes and behaviors of the designer and the craftsman during their cooperation work
●	utilizing from the knowledge of the craftsman	6	Using or transforming the craftsman's knowledge through collaboration in the new product development process
●	communication and collaboration with the master	5	Forms of communication and collaboration used in the collaborative work between the designer and the craftsman
●	working physically close to the master	5	The designer or engineer collaborating with the craftsman is in the same building as the craftsman or is within short reach
●	exchange of ideas	5	Mutual exchange of ideas and evaluations during the cooperation work
●	craftsman guided by designer	4	The person who directs the product design in collaboration with the craftsman designer is the designer
●	workshop	3	The area where the craftsman works and the activities where cooperation with the craftsman is experienced

Table D.4 (continued) : Theme 4- Collaboration with craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	master-designer collaboration at the prototype stage	2	Collaboration of craftsman and designer to produce prototypes and sharing ideas
●	work experience with craftsman	2	The experience of the craftsman in different companies
●	production planning management center	2	The department responsible for product planning, which can also act as a bridge between the craftsman and the designer
●	bridging through an employee between designer and craftsperson	2	An employee who manages the connection of the collaborative work between the designer and the craftsman
●	designer as a leader in collaboration	1	The designer being the person who manages the designer and craftsman collaboration
●	coordination of collaboration	1	Coordinating the cooperation between the craftsman and the designer by the management departments of the company
●	designer-craftsman communication	1	Communication between designer and craftsman that leads to establishing or maintaining collaboration
●	designer as a guiding craftsman-designer communication	1	Designer's direction of communication leading to establishing or maintaining collaboration
●	knowledge exchange between craftsman-engineer	1	Cooperation and knowledge sharing between engineers and craftsmen

Table D.4 (continued) : Theme 4- Collaboration with craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanations
●	designer as a learner from the master about material and making	1	Especially the information that newly graduated designers learned about materials and construction methods as a result of cooperation with the craftsman
●	verbal communication with the master	1	Unwritten form of communication with the craftsman during product development
●	working with masters while creating new product line	1	The company's use of craft knowledge and skill when creating a new product line
●	workshop of designers and craftsmen	1	Craftsmen and designers come together for a product group or an exhibition to make experimental works.
●	collaboration of designer and craftsman at npd design stage	1	The designer's use of the craftsman's knowledge and cooperation during the product design phase

Table D.5 : Theme 5- Contribution of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	the contribution of the craftsman in the prototype stage	17	Craftsman making a prototype of the product or supporting the prototype of the product
●	the craftsman's contribution to idea development	15	Contribution of the craftsman to the product by sharing his knowledge about the material and production method during product idea development
●	master's suggestion about the product	11	The craftsman sharing his knowledge and experience when asked for his opinion at any of the product's development stages
●	craftsman's contribution to NPD through production method	11	Contribution to the prototype or production through the production method in which the craftsman is an expert
●	contribution of craftsman to product development	10	The contribution of the craftsman to the product with his knowledge and skills during the product development stage of NPD
●	transfer of craftsman's material behavior knowledge in NPD	7	Using the craftsman's knowledge of material behavior during new product development
●	the craftsman as a problem solver in new product development	7	Overcoming a problem that arises at the prototype or production stage of the product in the new product development process with the knowledge of the craftsman
●	the contribution of the craftsman through material knowledge	6	Craftsman supporting product development using material knowledge
●	the craftsman's problem-finding competence	5	The master's voicing a problem arising from material or production during product development

Table D.5 (continued) : Theme 5- Contribution of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	contribution of the craftsman to product structure	4	The craftsman's suggestions about the structure of the product at the prototype or production stage and the craftsman's contribution to the product by using his knowledge and skills
●	problem-solving skill of master through material knowledge	4	Elimination of the problem caused by the material during the production phase by applying methods such as substitute material or joining cutting methods with the suggestion of the craftsman.
●	design arising out of fault in prototyping	3	The emergence of a new product idea from a manufacturing defect in the collaboration of the craftsman and designer at the prototype stage
●	contribution of craftsman related to moulding	3	The craftsman's undertaking the molding process or supporting the product development with his knowledge and skill in this process
●	new molding proposal from the manufacturer and its application	2	Making a proposal to the company about the molding method to be applied to the product by the master who produces on behalf of the company and the implementation of this suggestion
●	rapid prototyping by hand production	2	Working with the master to create a rapid prototype of the product
●	feedback from craftsman to industry	2	Benefiting from the knowledge of the craftsman during the adaptation of a product produced in handicraft to industrial production
●	problem-solving contribution of the craftsman about production	2	The product returns to the prototype stage due to a problem that arises during the production phase and the master's contribution to solving the problem with his material knowledge

Table D.5 (continued) : Theme 5- Contribution of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	contribution of the craftsman to the usability of the product	1	Solving a functional problem with the knowledge and skills of the master in the product
●	craftsman's contribution to functional innovation	1	Using the craftsman's knowledge to innovate in the functionality of the product
●	master's suggestion on feasibility	1	The craftsman's opinion on the manufacturability of the product
●	Increasing design efficiency with the skill of the master	1	Facilitating the realization of the products designed by the designer by using the knowledge of craftsmanship during the production phase
●	following trends with the master producing to various customers	1	To have information about the trends of the market by working with the master who produces for different companies in the market
●	the master's contribution to design	1	The master's revealing her/ his knowledge and skills that will affect the design in cooperation with the designer and the designer's reflection of these knowledge and skills on his product
●	the craftsman's contribution to aesthetic innovation	1	Using the knowledge and skills of the craftsman to create the aesthetic innovation/differentiation of the product
●	the contribution of the craftsman in saving time in production	1	Shortening of the new product development process due to the master's contribution in material selection and prototype stages
●	master involved in every step of the production process	1	The master's control of the product throughout the production process (prototype, production, and testing phase) and receiving the master's suggestions

Table D.5 (continued) : Theme 5- Contribution of craftsman- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	design idea from master-manufacturer	1	Suggestion of product ideas within the framework of material, production method or molding by the master who produces for the company from outside
●	the craftsman's contribution about ergonomics	1	The master provides information to the company about the product ergonomics that he has mastered
●	the aesthetic contribution of hand production	1	The contribution of handcraft to the aesthetic novelty and uniqueness of the product
●	problem-solving contribution of the master related to moulding	1	Solving a problem that occurs during the molding phase of the product by a master working in this field.
●	alternative material suggestion	1	The master's suggestion for a material that causes problems in production or for a more cost-effective material selection
●	the competence of the craftsman in production	1	The continuation of the craftsman's effectiveness in production, since the industry is a craft-based industry or the company's production in an artisanal field that has mastered production

Table D.6 : Theme 6- Knowledge- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	power of knowledge	3	The benefit of having knowledge in product development and competitive conditions in the market
●	master's written notification of problems about the product	2	Keeping in writing the problems that arise during the use of materials or the production of the product
●	knowledge transfer	2	Transformation of craft knowledge into different departments or different forms of information so that it can be turned into appropriate use within the company
●	craft knowledge specific to the product	2	Craft knowledge used only in one product or in a product group, not generalizing, due to the material of that product
●	prototype evaluation form	2	The form in which the prototype of the product is evaluated by the craftsman in the furniture industry and the opinions are collected in writing
●	project adjustment form	1	The form in which the opinions of the craftsmen about a new project, especially about materials, assembly and production, are obtained
●	the master's opinion on the product in writing	1	Keeping, filing and re-evaluating the opinions of the master about the product in writing
●	tacit knowledge of craftsman related to material-making	1	The master's tacit knowledge of the material and method of making
●	knowledge transfer from industrial production to handmade	1	Providing information about a product used in mass production to handicrafts in both handmade and mass production companies

Table D.6 (continued) : Theme 6- Knowledge- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	intersectoral knowledge transfer	1	Benefiting from a different sector in mould making for the production model in company E
●	access to niche craft knowledge	1	The company employs or has access to a craftsman with a niche knowledge of the craft
●	creating new jobs	1	New business areas created by collaboration with craftsmen
●	indirect transfer of the craftsman's knowledge to the NPD team	1	The case where the craftsman is not part of the product development team, but his opinion is asked through the designer
●	knowledge storage	1	Storage of craft information for later use
●	department bridging over production department and designer	1	Being a department that provides information flow between the production department where the craftsman works and the designer
●	management of collaboration	1	Managing and developing collaboration between designer and craftsman
●	know-how	1	Practical knowledge or skill; expertise of craftsman
●	adapting the handmade product to industrial production	1	Trying to transfer a handmade product, which is popular and has a good sales volume, to mass production by trying to preserve its aesthetic novelty

Table D.7 : Theme 7- Management and Strategy- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	product manager	9	The person who is at the top of a product development in companies and is responsible for the product
●	company's view of design	8	Design perspective, designer employment in the company's new product development
●	product management	4	Planning, executing, and evaluating the product development process
●	trusting the master about his work	3	Valuing the knowledge of the craftsman and trusting the craftsman by evaluating his previous experience
●	significance of craftsmen for the industry	3	The use and benefits of the master's knowledge and skills in that industry
●	working with an outside designer	3	Developing products with an external designer or design studio
●	department as a bridge between design and craft	3	Coordinating the cooperation between the craftsman and the designer by an in-between department
●	differences between industrial production and hand production	3	Management differences arising from the scale difference of industrial production and industrial production.
●	strengthen the craftsman-designer relationship	2	Increasing the collaboration of craftsmen and designers
●	employing a designer next to manufacturer master	2	Employing a designer for craft manufacturer so that the craftsman can communicate with the company and establish a connection with the design department.
●	considering craft knowledge	2	Be aware of the importance of craftsman knowledge for the company
●	managing designer-craftsperson collaboration	1	Managing, planning, and sometimes limiting craft-designer collaboration

Table D.7 (continued) : Theme 7- Management and strategy- Codes and explanations.

Colour	Code	Number of coded text (all documents)	Explanation
●	craftsman manager	1	The person who manages or establishes the company has craft knowledge
●	the firm that supports the development of the craftsman	1	Making improvements that will increase the knowledge or experience of the craftsmen and taking them to foreign fairs
●	appreciate the master's opinion	1	Consideration, evaluation, and implementation of the ideas presented by the master about the product
●	design department as a bridge between production and management	1	The design department is a bridge between production and management, especially for transferring the knowledge of the craftsman.
●	manager eager to innovate	1	Manager who pursues innovation opportunities in the market and provides the plans to realize them
●	visionary boss	1	The boss who makes accurate predictions about the products that will exist and develop in the market in the future and creates his plans accordingly
●	management of small business	1	Management of small-scale companies with flexible production systems and forms of cooperation, where quick decisions can be implemented

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