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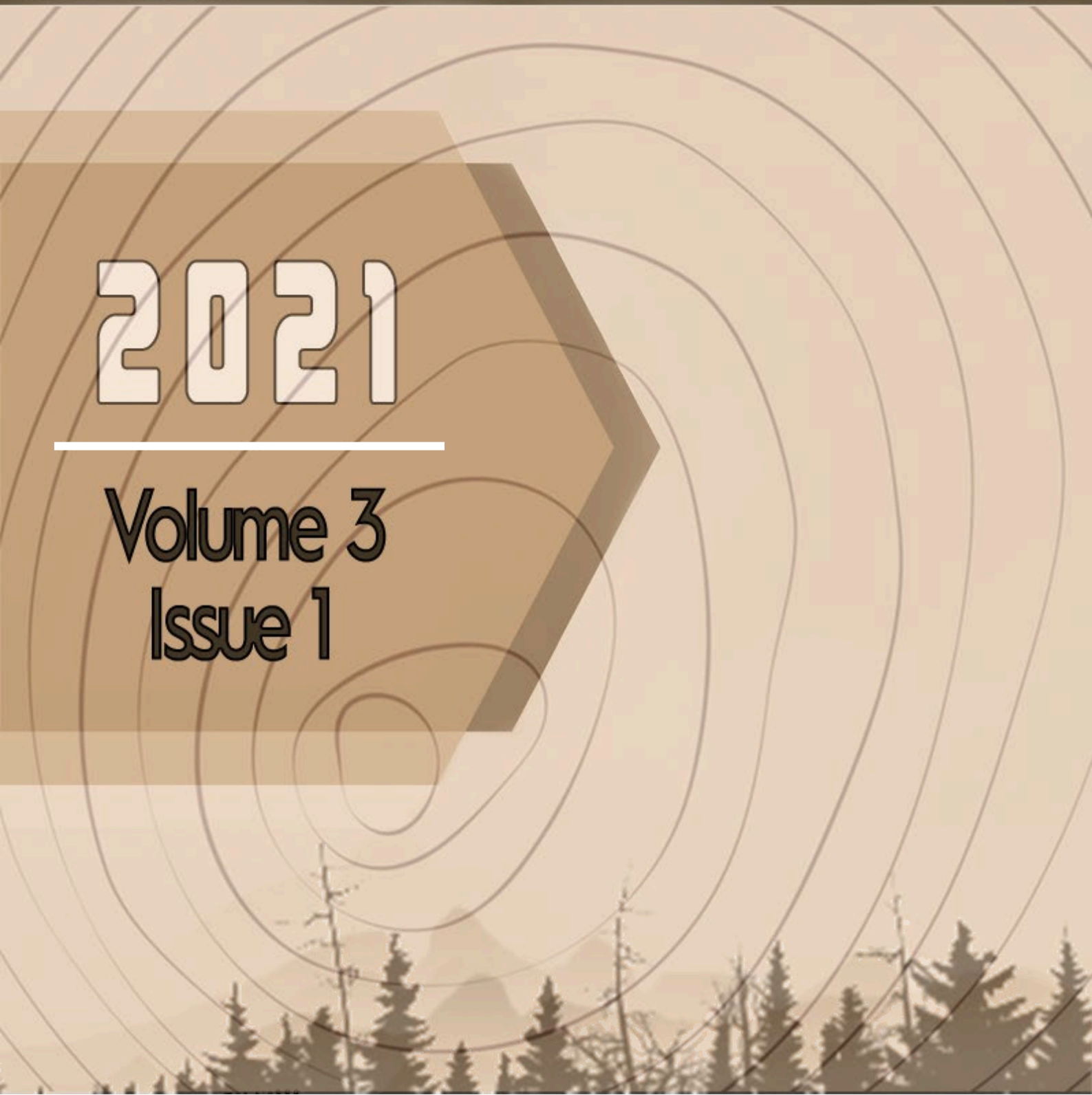
Wood Industry & Engineering

ISSN 2687-6043
e-ISSN 2687-6035



2021

Volume 3
Issue 1

https://dergipark.org.tr/en/pub/wie

Wood Industry and Engineering

ISSN: 2687-6043 **e-ISSN:** 2687-6035

YEAR : 2021 VOLUME : 3 ISSUE : 1

Wood Industry and Engineering (WI&E) is a peer-reviewed international scientific journal and published twice in each year (January-June and July-December). Publication language is English.

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https://dergipark.org.tr/en/pub/wie
http://www.ktu.edu.tr/woodindustry

ISSN: 2687-6043
e-ISSN: 2687-6035

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March 2021, Trabzon, TURKEY

Wood Industry and Engineering

ISSN: 2687-6043 e-ISSN: 2687-6035

https://dergipark.org.tr/en/pub/wie

YEAR : 2021 VOLUME : 3 ISSUE : 1

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Wood Industry and Engineering
International Scientific Journal

ONLINE EDUCATION ON FURNITURE DESIGN FOR HOUSEHOLD PEOPLE DURING LOCKDOWN

Layıka Ney Ece Arıburun Kırca[1]

Citation

Kırca L.N.E.A. Online Education on Furniture Design for Household People During Lockdown. ***Wood Industry and Engineering****. 2021; 3(1): 1-8.*

Abstract

During 2020 Spring academic semester, the majority of the universities in Turkey shifted to fulltime online education due to the Covid-19 pandemic. As a result, theoretical and applied courses in both graduate and undergraduate programs were carried out to an online platform. "Contemporary Furniture Design" was one of the undergraduate elective courses in Istanbul Technical University, Faculty of Architecture. The course started in studio environment with face-to-face interaction and shifted to online education regarding the lockdown regulations.

For the final submission, students were asked to develop a detailed furniture design system for household people during lockdown. Each week a milestone has had to be achieved such as; scenario building and brainstorming ideas for the first week, developing themes and evaluation of initial ideas through sketches, collages, concept/mood boards etc. for the second week and so on. Within this context, this study aims to demonstrate the process and evaluation of designing furniture in an educational setting. The challenges and benefits of online education in applied courses is an additional finding to be discussed in this study.

Keywords
Furniture Design
Furniture Design Education
Lockdown Furniture
Online Design Education
Spatial Design

Paper Type
Research Article

Article History
Received: 02/12/2020
Accepted: 28/12/2020

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ONLINE EDUCATION ON FURNITURE DESIGN FOR HOUSEHOLD PEOPLE DURING LOCKDOWN

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1. Introduction

Furniture, as a product, is embedded with multiple layers of meaning. Besides a function based utilitarian approach, one can think of furniture as a symbolic aspect of life style. Lucie-Smith (2004) describes the meaning of furniture under four headings. In addition to the above mentioned two, furniture can be thought under technological aspects. Moreover, furniture is "purely personal and is a subjective statement of the individual who uses it" (Lucie-Smith, 2004).

Furniture design education is a challenging task. In the Preface to the first edition of "Furniture" published in 1979, Pile states the difficulty of teaching furniture design. Besides the need to have some creative ideas, an instant mental access to a mix information (materials, processes, ergonomics), one must be acquainted with "the history of successful and unsuccessful efforts of all the designers who have struggled with furniture problems over the last four or five thousand years (Pile, 1990)".

Typically designing furniture is an iterative process and the methodology it carries within has not changed much over the years. Pile (1990) states the basic pattern of furniture design process into the following steps: First, the definition of the problem is clarified. A tentative (yet creative) solution to the problem is obtained. Visualization of the tentative proposal can be prepared by sketches, draft models and drawings. Then the critical evaluation and if necessary, re-evaluation of the proposed design is made. After this stage, prototyping is done. Following prototyping minor improvements can be done and subsequently the design is ready for production. This process resembles a clear similarity between well-known "Basic Design Cycle" proposed by Roozenburg and Eekels (1995). The basic design cycle starts with defining the function, followed by analysis, synthesis, simulation, evaluation and finally decision steps take place prior to the approved design.

Many design/engineering schools have been referring to the basic design cycle, as well as the iterative structure of the design process, while teaching design in theory and practice. However, considering the current global arguments in design education it can be foreseen that design education itself is at the edge of an expected change (Meyers and Norman, 2020).

Furniture is an important industry in Turkey. However, recent reports (Furniture Sector Report (2020), Turkish Furniture Assembly Sector Report (2017), Furniture Working Group Report under the Tenth Development Plan (2014-2018), etc.) published by Republic of Turkey Ministry of Trade, The Union of Chambers and Commodity Exchanges of Turkey and (former) Republic of Turkey Ministry of Development have simultaneously mentioned problems in this field related to Design and Production. Among the problems of the industry, the lack of local designers become a considerable disadvantage. Reports base this problem on the inadequate education of architects, interior architects and industrial designers.

Therefore, the situation also remains to be clarified in the context of furniture design education in Turkey. Since Çınar's overview (2005) on furniture design education in Turkey or Curaoğlu's reflections (2008) on furniture design courses in interior architecture education, a considerable improvement in this field hasn't took place. Çınar and Curaoğlu both state that the furniture design education is not sufficient in Turkey in terms of certain aspects regarding quality and quantity (Çınar, 2005; Curaoğlu, 2008). Although design related departments in Turkey have rapidly increased in the last years, furniture design education still remains as a improvable area.

Based on the framework provided above, this paper focuses in a case study which demonstrates the process and evaluation of current furniture design education. The case study is particularly selected in Spring 2020 academic semester due to the first-time coexistence of face to face and online education regarding pandemic regulations. The challenges and benefits of online education in an applied course is an additional finding to be discussed in this study.

2. Process and Methods

Coronavirus (COVID-19) pandemic which surfaced in December 2019 effected the majority of educational institutions globally including the universities in Turkey. Theoretical and applied courses in

both graduate and undergraduate programs were carried out to online platforms during 2020 Spring academic semester. "Contemporary Furniture Design" was one of the undergraduate elective courses held in Istanbul Technical University, Faculty of Architecture, Department of Industrial Design. The course started in studio environment with face-to-face interaction in February 2020 and shifted to online education in April 2020 according to the imperative changes in academic calendar caused by lockdown regulations (Web-1). 24 undergraduate students from Department of Industrial Design and Department of Interior Architecture were enrolled in the course. During the online course weeks (which was carried on for seven weeks: first three weeks as a warm-up design exercise and the remaining four weeks as the final project) four sequential hours of class activity was performed online each week.

For the final submission, which effected the grades in 40%, students were asked to develop a furniture design system for household people during lockdown. This subject was mainly selected because as all students were attending the course online from their homes, they were experiencing the challenges of the situation first handed. Outcomes of the project aimed to ease this unpredicted and therefore unprepared condition for the household. The design process of the project consists warm-up exercise, three stages of design development, and the final submissions (Figure.1).

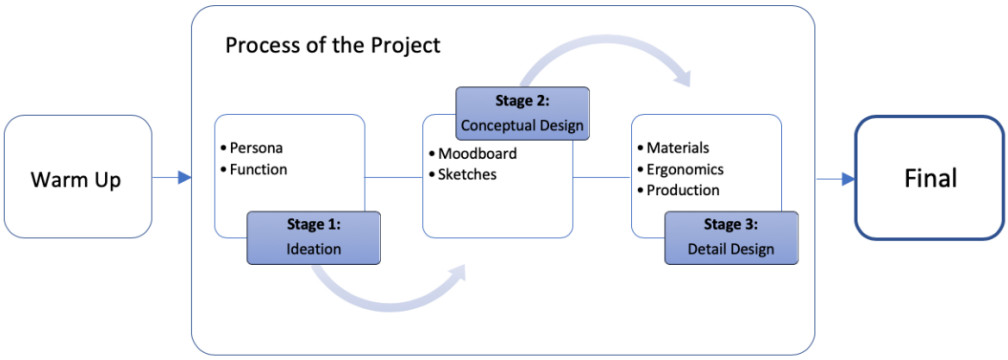


Figure 1: Process of the Furniture Design Project

2.1. Warm-up session

Prior to the project, a two-week design exercise was conducted as a warm-up session. This session aimed to literally warm up the students to each other in an online environment, and to warm up to the furniture design subject. Students were formed into six groups, all distributed randomly in equal quota of four students in each group. During the first lecture formation of the groups were announced. After brief explanation of the exercise students were sent into *break out rooms*, a feature of the online meeting software, where each group could individually discuss their topic. Besides getting familiar with the course terminology and technical infrastructure, the exercise contributed to learn the basic ergonomic dimensions related to furniture. The presentations were made by each group the following week. The groups also had a chance to test their compatibility in working with this exercise. As a result two out of six groups asked for a change in their formation, claiming that they found it difficult to work together. Based on their inquiry eight groups were formed with unequal number of students. The students preferred to continue to the main project this way. The process continued with three design development stages: Ideation, Conceptual Design and Detailed Design.

2.2. Design Development Stages

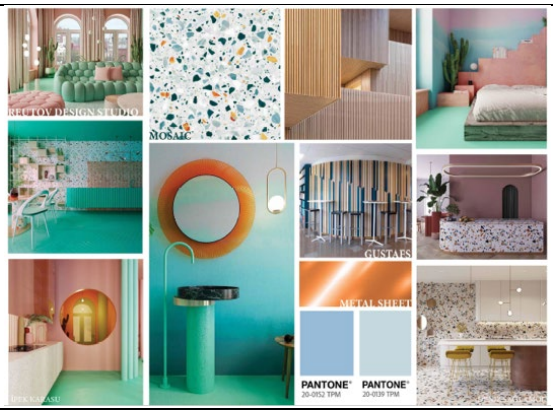
Each week a milestone has had to be achieved such as; scenario building and brainstorming ideas for the first week, developing themes and evaluation of initial ideas through sketches, collages, concept/mood boards etc. for the second week, reviews and further development of detailing, ergonomics, material and manufacturing processes for the third week and so on. Though it was a highly iterative process, it is possible to analyse the design development under three headings: ideation stage (using ethnography and critical design practice methods in order to create a persona, define functions of the furniture), conceptual design stage (brainstorming, sketching, using qualitative research methods [such as surveys] to prepare user requirement lists) and finally detailed design stage (ergonomic issues, material and production details, colours, finishes, etc.). Each group created separate personas and project briefs accordingly (Table 1). Mood/concept boards were used as visual narratives for the project (Table 2). Brainstorming charts, surveys and data analysing, benchmarking in the national/international market, sketching and 3D modelling was among the various methods of design/design research (Figure 2 and Table 3).

Table 1: Personas and project briefs by project groups

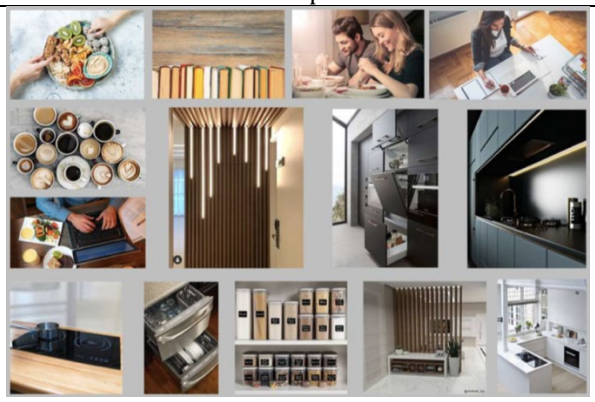
Group #	*Member # (Dept.)*	*Persona*	*Project Brief*
Group 1	4 (ID[a] & IA)[b]	Newlywed couple, living in a small apartment with cat. He is a UI/UX Designer. She is a yoga instructor	Multifunctional furniture system for household people during lockdown
Group 2	2 (ID & IA)	Family with two children, preschool aged. Mother is a youtuber with a food channel	Social area and kitchen interface furniture used for video shooting during lockdown
Group 3	4 (ID)	Pre-teens aged 9-14	The burrow that meets all the needs of pre-teen and surprises them
Group 4	3 (ID)	Young couple, both working as engineers	Dining, working and storage area for two people in lockdown
Group 5	4 (ID)	Young female graphic designer, single, living alone. Does yoga	An experimental furniture system that lets you explore
Group 6	4 (ID)	Young male industrial design student, single, living alone. VR and cats	Think about a wall which gives what you need
Group 7	2 (ID)	Single, middle aged female writer	A multifunctional furniture system for both small houses and people who work from home
Group 8	1 (ID)	Young flatmates, three people living together	Create, purchase and share! Open design approached relaxing, sitting and exercising unit

Table 2: Examples of mood/concept boards

Group 1



Group 2



Group 4

Group 5

[a] ID: Industrial Design
[b] IA: Interior Architecture

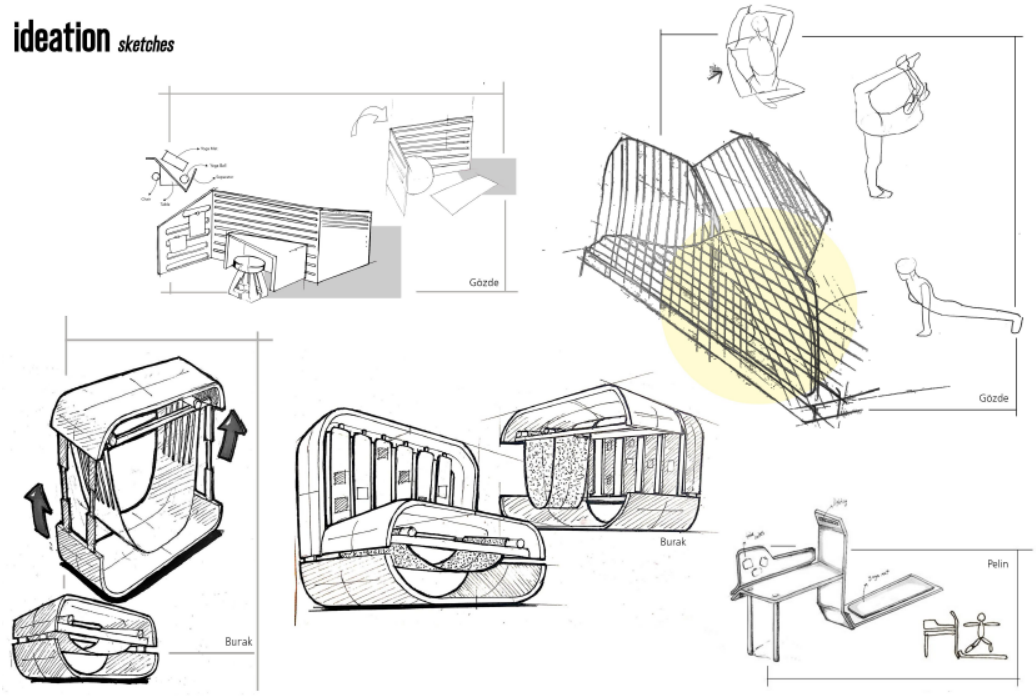
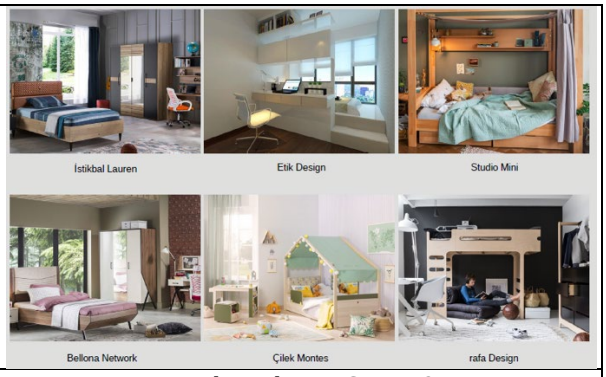
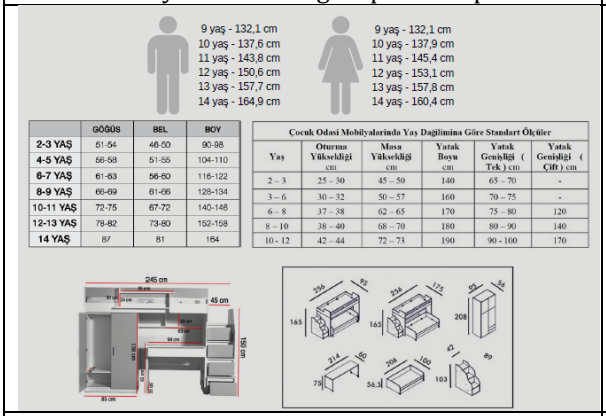
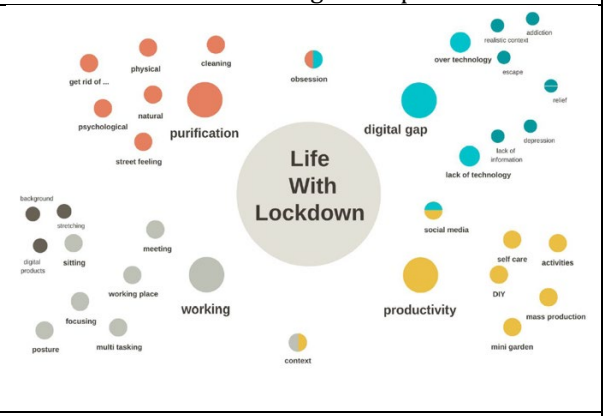


Figure 2: Ideation sketches by Group 5

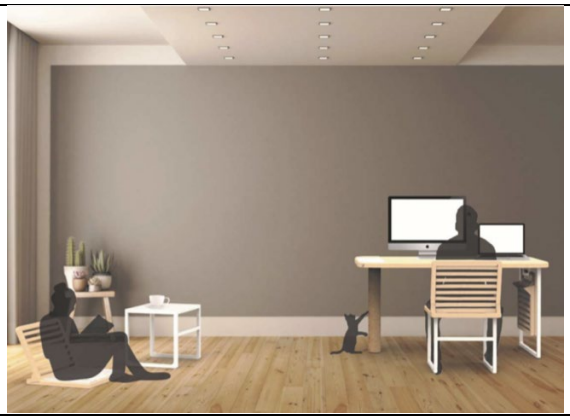
Table 3: Examples of various design /design research methods

	
Surveys with focus groups - Group 3	Benchmarking - Group 3
	
Ergonomics - Group 3	Brainstorming - Group 6

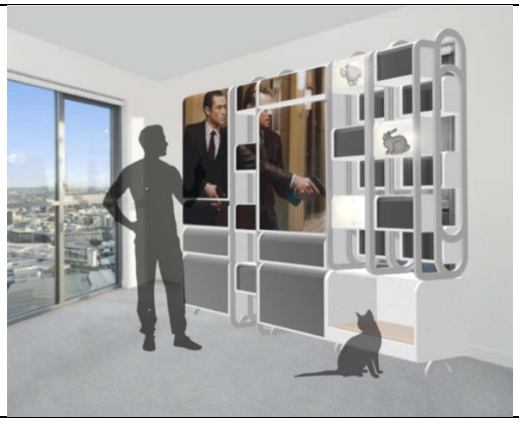
3. Results

The reflections on final submissions made by students express that Coronavirus (COVID-19) pandemic has a perceptive relation with household furniture design. Due to the lockdown regulations amount of time spent at home suddenly increased for all user groups. Multiple users, including members from different age groups, genders and social status were defined as personas by each student group. Each group selected different paths and covered a wide range of user requirements. There were contrasting user profiles in each design scenario submitted: In some cases, lockdown meant increased amount of time spent with children and pets, working from home activities, home schooling, etc. whereas in other cases lockdown had a significant aspect on ones' psychology due to social isolation. Lack of exercise and sunshine was among the challenges of lockdown. It is understandable that the personas students have created for the project was partly an echo of the challenges they faced in their own lives during the process. Therefore, a considerable amount of input of self-experience was delivered into the solutions, whilst using furniture design as a tool to solve the faced design problems. Multifunctional, adaptable, movable furniture systems were highly suggested by students. Aiming to perform more functions with less furniture, Group 1 designed a portable and collapsible working environment that can be positioned according to daylight. Based on the scenario of spending more time in the kitchen during the quarantine period, Group 2 turned the kitchen into a video shooting area when necessary, allowing the food preparation activities to be shared on the internet. Targeting users aged 9-14, defined as pre-teens, Group 3 designed a furniture system with the theme of "room in room" allowing the user to physically isolate during online education sessions or virtually socialize in free times depending on their needs. Group 4 combined the kitchen area with the working area, considering that during lockdown young couples spend most of their time in the kitchen, and the remaining time in online meetings. Kitchen/work environment was introduced as a social hub. Group 5 introduced an experimental furniture system for a single user that aims to turn work, rest and storage into a mindful experience. Group 6 designed a multifunctional furniture system with vertical components of entertainment and work such as VR, online video meeting capabilities etc. Group 7 focused on a rotatable desk for small apartments which saves space while not in use. Lastly, Group 8 offered an open design approach allowing the users to build their own furniture and share it on social media (Table 4).

Table 4: Examples of final submissions

	
Group 1	Group 2
	
Group 3	Group 4

Group 5



Group 6

Group 7

Group 8

4. Conclusion and Discussion

2020 Spring semester was the first-time experience using online platforms for educational purposes since Contemporary Furniture Design course history. As a result, mentioning the reflections of this first-time experience will be appropriate. These reflections on online education in an applied course can be grouped as challenges and benefits.

The first and foremost challenge in online education on furniture design was the "virtuality barrier," which can be explained as the lack of physical and tactile qualities of face-to-face communication. This affected both student-to-student relations as well as instructor-to-student (and vice versa) relations. The highs and lows in an ordinary face to face dialogue, the attention peaks and lows in course flow seemed difficult to adjust for all.

Obviously, the online course is mostly dependant on internet quality and technical aspects of the connected device. It is observed that it became extremely difficult to focus on the course flow, particularly with a bad connection accompanied with hardware incapability (such as low-resolution camera and/or low spec microphone setting. So, the technical capabilities during connection highly affects the overall flow and quality of online course.

However, mentioning the experienced benefits of online education is also essential. As of today, the internet provides fast and clear access to knowledge, including a variety of contents and media formats. By this means it was quite simple to include different media (videos, animations, web pages etc.) impromptu to the course flow, which immediately rise attention to the content.

The fact that lessons were being recorded to cloud-based storage items provided the possibility of re-watching asynchronously. This possibility was particularly beneficial for students who missed the class for any reason, such as poor internet connection, etc. The students have also provided positive feedback on this aspect. Since the class was mostly dependant on studio critics, re-watching the critics provided by the instructor and team members was helpful to understand better.

One other benefit of simulating classroom environment in an online setting was experiencing the "breakout rooms" provided by the software. This setting allowed separate group discussions continue simultaneously as the instructor could join each breakout session. It is possible to say this application was time saving and efficient in conducting group projects.

Overall, considering the evaluation of a first-time experience in online applied courses, it is possible to say it was a fulfilling experience once the mental barrier was overcome. Nevertheless, the tactile qualities of communication still remain necessary in applied courses such as Contemporary Furniture Design.

5. Acknowledgments

The author (instructor) would like to thank all 24 students enrolled in Contemporary Furniture Design course held in Istanbul Technical University, Department of Industrial Design in Spring 2020 semester. Their attendance and valuable participation under unexpected, extraordinary circumstances was mutually beneficial for all. Detailed information about this project can be reached from the project catalogue published on www.tasarim.itu.edu.tr, the ITU Department of Industrial Design website (Web-2).

This research has been presented in 6th International Furniture Congress, held online by Karadeniz Technical University in 2-5 November 2020.

Conflict of Interest Statement

The corresponding author states that there is no conflict of interest.

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Web-2: http://www.tasarim.itu.edu.tr/docs/librariesprovider295/default-document-library/katalog-(revize)c6533a4bceeb6433bf21ff0000f8c30d.pdf?sfvrsn=0, consulted 01 December 2020.

ISSN: 2687-6043
e-ISSN: 2687-6035
https://dergipark.org.tr/en/pub/wie

Volume 3, Issue 1
2021
pp. 9-19

Wood Industry and Engineering
International Scientific Journal

FURNITURE AND ERGONOMICS IN THE RE-USE HISTORIC BUILDING

Okşan Ölmez[1], İnci Versan Alkan[2]

Citation

Ölmez O., Alkan İ.V. Furniture and Ergonomics in The Re-Use Historic Building. ***Wood Industry and Engineering****. 2021; 3(1): 9-19.*

Abstract

One of the procedures for the protection of historic buildings that are dysfunctional is to make the building a usable place for today's needs. The re-use in conservation methods is an approach that enables the building to continue to live while preserving its historical value and to respond to today's needs. Another situation that is as important as preserving the historical structure in the re-using of the historical buildings is that the building can provide the spatial comfort of its new user. Providing this comfort is possible by providing ergonomic requirements in the space.

With this study, the furniture used in the historical space after the re-using was examined in terms of providing the ergonomic conditions, and the questionnaires applied on ergonomics regarding, the user satisfaction with the user of the space were evaluated. The study aims to emphasize the importance of ergonomic decision standards by examining the spatial comfort, which can determine the duration of use of historical buildings, on a furniture scale. For the study; two traditional houses serving as cafes in Edirne province were selected. Taking a survey of 26 questions with the users coming to space and on-site observations were made by photographing space and measuring the furniture. In line with the data obtained, an evaluation was made about whether the furniture in the space is ergonomically suitable or not. A survey was conducted with 50 people in each space and the results were analyzed as a percentage. Survey and on-site observation results were compared. As a result of all the works; it has been observed that ergonomics is partially provided by 65% for cafe 1 and 50% for cafe 2 in the furniture scale in the work areas.

Keywords

Adaptive reuse
Ergonomics
Furniture in the historical building
Survey

Paper Type

Research Article

Article History

Received: 08/12/2020
Accepted: 27/12/2020

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FURNITURE AND ERGONOMICS IN THE RE-USE HISTORIC BUILDING

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1. Introduction

One of the effective methods to preserve the historical buildings, which are our cultural heritage, is to reuse these buildings. At this stage, the choice of the new function and the interior designed with the new function are very important. In the reuse of historical buildings redesigned, the quality of the spatial comfort can determine the lifetime of the space. In this context, a questionnaire was made user's experience of the space and furniture in the space, depending on the new function in the space. With the data obtained from the surveys, it was aimed to investigate the level of spatial comfort, the level of harmony between space and furniture. For this purpose, the measurements of the furniture in the space and the distances between the furniture were measured and compared with the optimum values required to provide the expected needs. Thus, the ergonomics of the space were evaluated in terms of its anthropometric dimension.

The literature regarding this subject has been scanned. Akaydin and Turkyilmaz's (2018) "Ergonomics of Functional Transformed Buildings, Analyzing Uskudar Nevmekan as an Example" contains an example of the study conducted on this subject. In the study of Akaydin and Turkyilmaz, as in this study, observation and a questionnaire regarding the satisfaction with the users were made. And thus, space was examined in the context of ergonomic criteria. As a result of the work Akaydin and Turkyilmaz; indicated that the survey results and the observations coincided, and space met the ergonomic criteria.

In the literature, there are studies prepared to investigate spaces and furniture in terms of meeting ergonomic criteria, but there are not many studies in the context of historical space, furniture, and ergonomics. It was aimed to contribute to the literature with this study.

In the study, two traditional houses that were re-used as cafes in Edirne province were examined. A survey was made with 50 users in each selected building. Evaluations and observations were made in the buildings with the survey results. In short, in this study, the furniture and the relationship between the furniture and space were evaluated according to anthropometric decision standards in terms of their suitability for the necessary actions.

2. Materials and Methods

Questionnaire and on-site observation method were used in this study. The survey applied is a comprehensive survey of 26 questions. Questions were asked on the examination of the anthropometric, physiological, psychological, informatics, and safety dimensions of ergonomics in the space. However, since the anthropometric dimension of furniture and ergonomics was studied in this study, the 7-question part of the questionnaire was taken as the basis. The same questionnaire was applied to the same number of participants in both places. The number of participants is 50 in both places. The number of survey participants was determined based on the work of Akaydin and Turkyilmaz. In Akaydin and Turkyilmaz's studies, 40 people were surveyed. The time to apply for the survey is October 2020. Survey was applied to the users who came to the place at that moment in the work area. Information about the participants in the questionnaire was obtained about how often they use the space and whether they find the space positive in terms of use.

In the survey conducted with the users at space, the following questions were asked about this study. Survey responses and on-site observation were evaluated comparatively.

-How do you find the comfort of the furniture in the space? (comfortable, uncomfortable, neutral)

- What is your opinion about the spaciousness of the place? (spacious, neutral, stuffy)

-What do you think about the occupancy, vacancy rate in the space? (in terms of furniture) (balanced, cramped, neutral)

-Do you find the layout of the furniture compatible with the features of the place where they are located? (positive, neutral, negative)

-Do you think there is harmony between the size of the space and the dimensions of the furniture? (positive, neutral, negative)

-Do you think there is enough furniture according to the size of the space? (positive, neutral, negative)

-Do you think there is harmony between the historical attribute of the place and the furniture in the space? (Positive, neutral, negative)

As a result of the survey, when the ergonomics of both spaces are examined in terms of meeting the anthropometric decision standards, it is seen that some furniture does not provide the optimum boundaries, and some furniture is suitable. In this case, it can be said that spatial comfort cannot be fully provided based on the ergonomic adequacy of the furniture. The on-site observations mainly coincide with the survey results. With observation, it was concluded that spatial comfort could not be fully provided based on the ergonomic adequacy of the furniture.

2.1. Adaptive Reuse and Conservation

Cultural heritage is defined as works created by previous generations and have universal values. Historical buildings are people's cultural heritages that carry the social, cultural, and economic accumulations of past generations to the present. It is only possible to bring to the present day, the knowledge and experience that they had by protecting them. As time passes, people's needs, lifestyle, social, cultural, and economic structures change. This change in needs may require the function of the existing space to change. One of the methods for the protection of historical buildings within the scope of cultural heritage, which serves as a link between the past and the present is to make the building a usable space for today's needs. The reuse in conservation methods is an approach that allows the building to continue to live and respond to today's needs while preserving its historical value. Thanks to the re-use, the spiritual values of the historical building will be transferred to the present day. As an example, we can show the transformation of a historical train station complex into a university campus, the transformation of traditional houses into cafes, offices, museums, and restaurants.

According to Kasli, if the structure in question is a historical structure worth preserving, the meaning of the concept of "re-use" had a different dimension. The re-using of the historical building is the use of the building in a functional sense by allowing the contemporary use of the building with various adaptations, as well as the transfer of the spiritual values it has future generations by preserving the building. In this context, Altınoluk says that it is imperative to make use of our historical-cultural heritages sufficiently and to create a process that can inspire future generations from our experience. In this respect, the structures, the most effective way to make impressive and ultimately educative is to make them "living beings". There is no doubt that this purpose should be to given the structure a functional content, to make it useful for the society, to ensure that the society lives in it and the environment benefits from it (Altinoluk,1998).

In the reused building, the additions should be made in a way that does not cause permanent damage to the structure. The international rule is reversibility. The building should be able to provide the needs developed within the scope of the new function and while doing so, its original structure should not be harmed.

In the re-use of historical buildings, another important situation as preserving the historical building is that the building can provide the spatial comfort of its new user. The changes made in the space with new space equipment elements such as new flooring, new furniture, and lighting elements to be used in the space should be in the quality and appropriate to not throw the historical value of the space into the background. In addition, the new function should provide the spatial comfort of the user and the needs of the new function. Establishing the balance between preservation and renovation is possible by providing the needs of the user within the spatial characteristics, that is, by choosing the appropriate function for space and the space design suitable for the new function.

2.2. Relation of Furniture and Ergonomics in Historical Buildings

Ergonomics is a concept that comes into being with the combination of the word 'ergon', which means work in Greek, and the word 'nomos' which means natural law. Ergonomics means the science of work.

Ergonomics is a science-based discipline that examines designs that will complement people's strengths and abilities and minimize the impact of their limitations, along with the knowledge from science branches such as anatomy, physiology, psychology, engineering, and statistics. The wish of ergonomists and human behavior experts is to develop products, workspaces, or systems that are designed in harmony with people instead of designs that force people to work in an uncomfortable, stressful or dangerous way. What is needed to achieve this goal is to understand the differences in society such as age, height, strength, cognitive ability, cultural expectations, experiences, and goals, and to make designs considering these differences (Web-1).

The purpose of ergonomics is to characterize the designed space according to the user and to perform the function in the healthiest way while the user and the place are in harmony. Decision standards prepared with physiological measurements, performance measurements, psychometric and behavioral observations, and scientific guidelines and resulting from all these studies constitute the content and scope of ergonomics. These ergonomics standards are reached by scientific methods and research which ensures that features such as trust, comfort, functionality, and quality coexist in design.

The necessity of meticulous decision-making and implementation of each change made in the re-use historical places reveals the importance of the concept of ergonomics. The new function selected for the historical space and the interior space renewed in line with it can also determine the duration and quality of the new function and the use of this historical place. In order to ensure user comfort, it is necessary to create an interior by considering the standards of ergonomics. When this comfort is not provided, the user will be uncomfortable and maybe the use of the place will decrease and this will cause the values of the historical place to remain in the background.

If we consider the ergonomic criteria on the basis of space, we can explain it in five dimensions: anthropometric, physiological, psychological, informatics, and safety. Since the relationship between furniture and ergonomics will be examined in this study, the anthropometric dimension of ergonomics is focused on.

2.2.1. Anthropometric Dimension of Ergonomics

Anthropometry is the science that deals with the dimensions of the human body. It is used to create the measurements and dimensions of the accessories according to the body measurements of the human. While determining human body height, gender, age, and the professional field should be taken into consideration. For example, the distance between a man and a woman reaching out on a shelf varies due to their body structures. Other factors affect body size. These are culture, diet, climatic conditions of the region they live in, hereditary characteristics, and health problems (Kucukerman, 1978).

There are two anthropometric dimensions, static and dynamic. Static anthropometry is the measurements taken with the human body, not in motion. In other words, the measurements taken in standing and sitting positions are static anthropometric dimensions. Such as height of eye and elbow and knee, shoulder width. Dynamic anthropometry is the measure taken while the human body is performing a certain action. (Oborne, 1995)

For example; the act of sitting in a stance that people use from past to present to distribute the pressure created by gravity to different parts of the body, to provide their resting needs. In this action, the body weight is lifted from the foot, leg, and back muscles to a certain extent. The surface required to perform the sitting action can be a part of sitting elements with a certain height as well as being the ground plane. The designs that provide and analyze the sitting action are designed and shaped according to the data of the different environments they are in and the purpose of the sitting action in this environment. However, since human beings cannot physiologically change according to the environment, sitting action must provide anthropometric measurements and ergonomic conditions regardless of the environment. (Altiparmakogullari, 2009).

3. Result and Discussions

In this part, two examples of traditional houses adaptive reuse as cafe located in Edirne province are evaluated in terms of the anthropometric dimension of ergonomics in the context of interior furniture (Figure 1).

a b

Figure 1: (a) Café 1; (b) Cafe 2
(Edirne Cultural and Natural Heritage Preservation Regional Board Archive)

In terms of the anthropometric dimension of ergonomics; examinations and evaluations were made on subjects such as the comfort impression of the furniture in the space, the volumetric relationship between the space and the furniture, the suitability of the furniture in the space for the user's access and the impression created by the furniture and space volume on the user's perception.

3.1. Cafe 1 Analysis:

Figure 2: Cafe 1

In the answers received during the interviews with the users, for the question of "How do you find the comfort of the furniture in the space?", the answer of "Comfortable" is the majority. As determined in the building, the dimensions of the furniture used for eating and drinking differ from the optimum limit. It was determined that there were different sizes and designs of furniture in different rooms of the building (Figure 2).

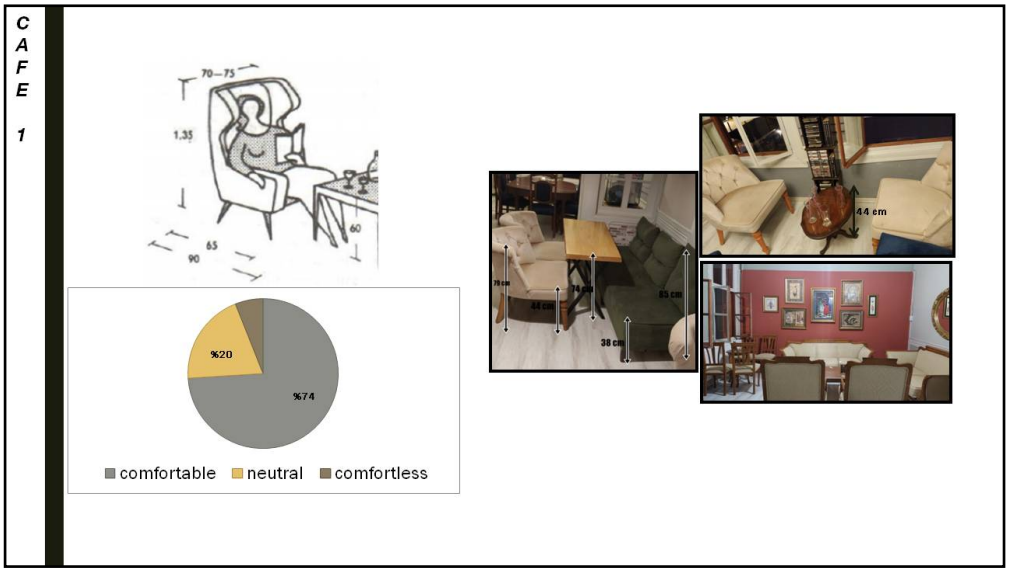

Figure 3: Cafe 1

As determined in the building, the dimensions of the furniture used for drinking coffee, sitting, and resting are different from the optimum limit. It was determined that there were different sizes and designs of furniture in different rooms of the building (Figure 3).

There is a sitting group in another room in the cafe, which consists of rooms. The height of the seating area of the triple sofa is 43 cm, and the height of the reclining part is 86 cm. The height of the double seat is equal to that of the triple seat. The height of the coffee table in the middle is 43 cm. Dimensions of single seats; all seat height; the height of the sitting area was measured as 102 cm and 45 cm.

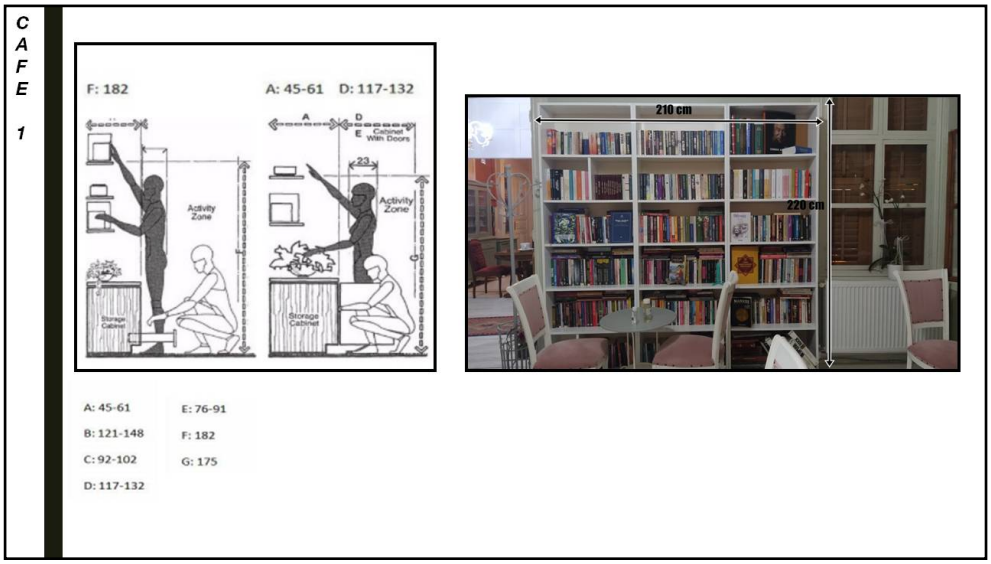

Figure 4: Cafe 1

Considering the average height of the users, every shelf can be accessed in the library units. It has been found ergonomically suitable. However, the table and chair in front of the library prevent access to the library (Figure 4).

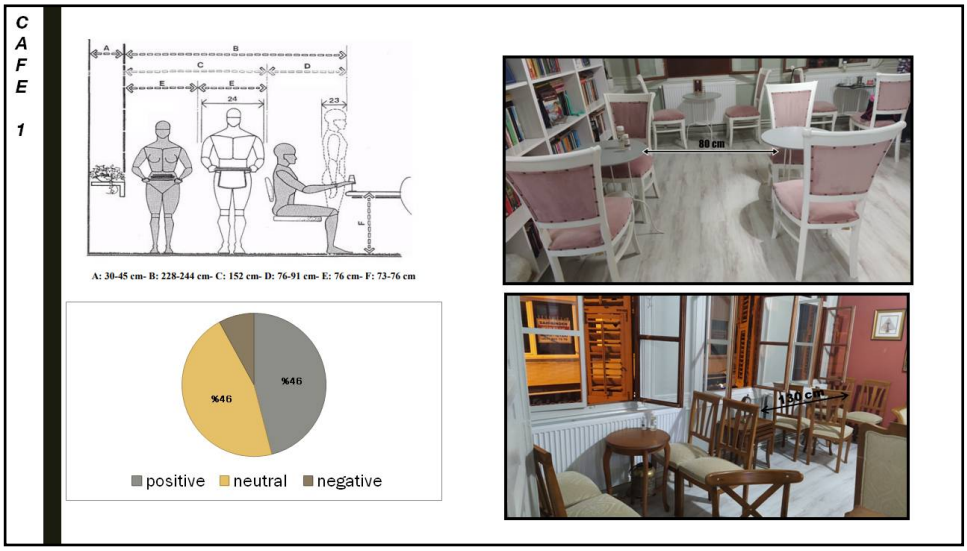

Figure 5: Cafe 1

When the limits of the action area are examined; it has been observed that there are openings between the tables where employees and customers can move freely. In the question about the occupancy-vacancy rate in the space, the furniture in the space was examined in terms of distribution. While 46% of the users found the distribution balanced, at the same rate founded neither balanced nor cramped (Figure 5).

Figure 6: Cafe 1

The building consists of rooms and each room has different types of seating units (Figure 6). Although this situation creates confusion in terms of design, when analyzed based on customer needs; it is a positive feature that seating areas that can be used for different purposes and for different durations have been created.

Figure 7: Cafe 1

When the spaciousness of the place is examined, it has been observed that the customers generally find the place spacious. For the question of "what is your opinion about the spaciousness of the place?", the users answered as 70% spacious and 30% neutral. Although that answer, with on-site observation when compared to the dimensions of the space, it has been observed that the furniture takes up a lot of space and makes the space narrow. Besides, furniture obstructs some transition areas (Figure 7).

3.2. Cafe 2 Analysis

Figure 8: Cafe 2

When we examine the second cafe, we again see that space consists of rooms. It was determined that there were different sizes and designs of furniture in different rooms of the building. Therefore, the comfort level also changes accordingly. When the survey was examined, it was found that 40% of the participants were comfortable for furniture and 8% uncomfortable (Figure 8).

Figure 9: Cafe 2

The building consists of rooms and each room has different types of seating units (Figure 8). Although this situation creates confusion in terms of design, when analyzed based on customer needs; it is a positive feature that seating areas that can be used with different purposes and for different durations (Figure 9).

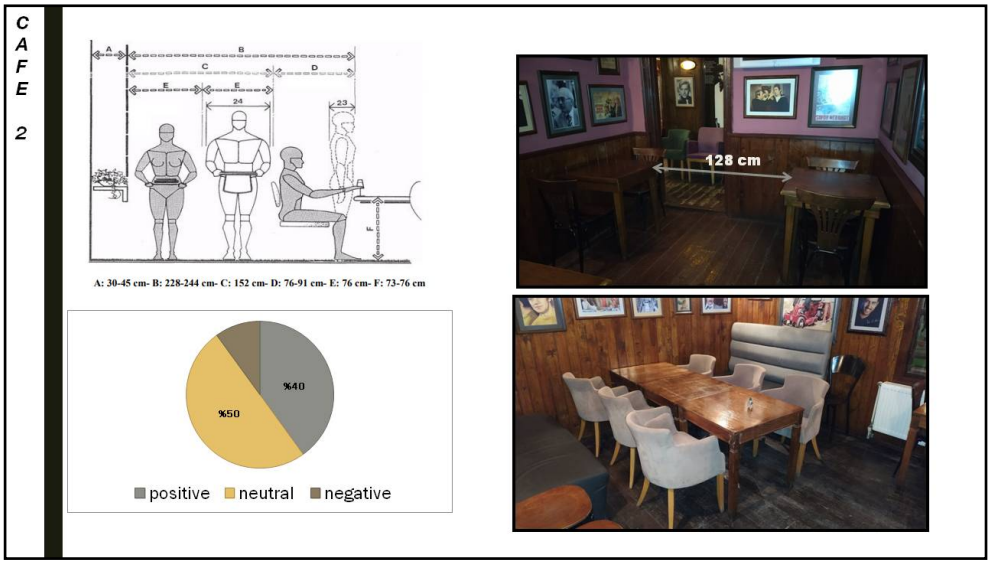

Figure 10: Cafe 2

When the limits of the action area are examined (Figure 10); it has been observed that there are openings between the tables where employees and customers can move freely. In the question about the occupancy-vacancy rate in the space, the furniture in the space was examined in terms of distribution. The users of the space found the space 40% balanced (Figure 10).

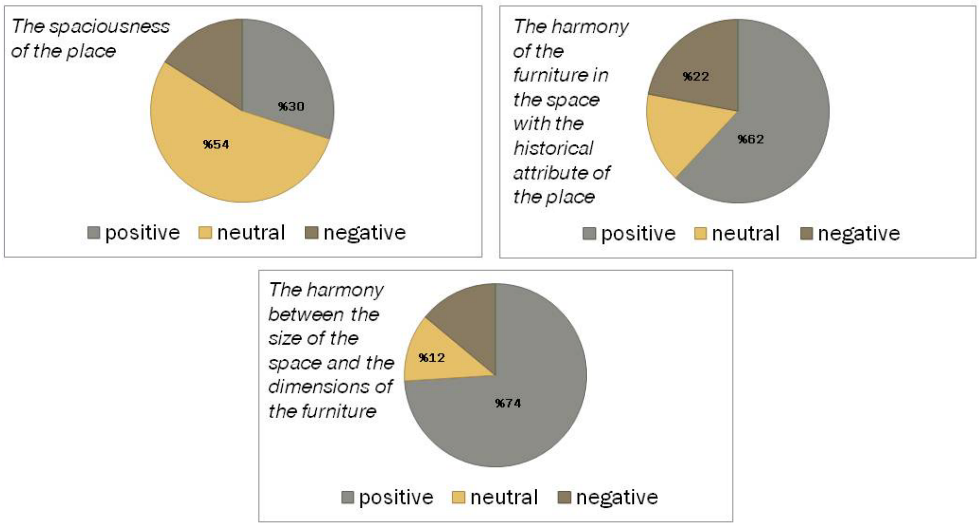

Figure 11: Cafe 2

When the spaciousness of the place is examined, it has been observed that 30% of users find the place is spacious (Figure 11). Whereas; when compared to the dimensions of the space, it has been observed that the furniture takes up a lot of space and makes the space narrow. In addition, it was thought that the furniture creates an irregular appearance as the columns were placed in front of the windows. Space size and furniture dimensions were found 74% compatible with the users (Figure 11). When asked about the harmony between the historical attribute of the space and the furniture, the users evaluated the design 62% positively (Figure 11).

As a similar example written on this subject in the literature, there is the study of Akaydin and Turkyilmaz (2018). Just like the anthropometric dimension of ergonomics part in that study, the furniture in the space was evaluated in this study, and survey and on-site observation has been made. Then the survey results were expressed in percentages. For Nevmekan, whom Akaydin and Turkyilmaz measured as a result of their study; they concluded that it meets the ergonomic criteria at optimum. Space was found 72-80% positive in anthropometric dimension analysis in Akaydin and Turkyilmaz's study. Since the buildings evaluated in this study are different, their comfort levels have also differed. Each structure should be evaluated in its own way.

4. Conclusion

In line with the observations made in the place, the survey study, and interviews with the users, it was tried to obtain data on the ergonomic suitability of the furniture in the selected places.

When the results of the survey conducted with 50 users with different purposes of using the space are evaluated with general percentages; it has been found as 74% comfortable, 6% uncomfortable for 1. Cafe, 40% comfortable, and 8% uncomfortable for 2. Cafe. When the occupancy-vacancy rate in Cafe 1 was examined, it was found as 46% balanced and 8% cramped. In Cafe 2, this ratio is 40% balanced and 10% cramped. Space was found to be 70% spacious and 30% neutral in Cafe 1 and 30% spacious and 16% overwhelming in Cafe 2. The harmony between the historical attribute of the place and the furniture was found as 70% positive and 16% negative in Cafe 1; 62% positive and 22% negative in cafe 2. The harmony between the size of the space and the furniture dimensions was found as 66% positive and 14% negative in cafe 1 ; 74% positive and 14% negative in cafe 2. Taking the average of all these data, cafe 1 is rated 65% positive and cafe 2 is rated 50% positive.

In line with the survey study and the interviews made with the users during this study, the following conclusions were made within the scope of the ergonomic evaluation of the furniture in these reuse buildings.

- Since the different furniture in the place has different comfort values, some users think it has been comfortable, while some find it neither comfortable nor uncomfortable. In general, few people think that it was uncomfortable. Some furniture does not fit with the optimum limits (Figure 2), (Figure 3), (Figure 8), as determined by the measurements.
- The presence of both comfortable and uncomfortable furniture in the place is beneficial for cafes in terms of human circulation in the place.
- Congestion was observed in some rooms in both places. The reason for this congestion is that the furniture in the space takes up more space than the size of the room. The reason for this is that the furniture in the space is more numerous than the size of the space, as observed.
- The presence of furniture in the transition areas in the first space creates confusion in the place and prevents the transition between two rooms.
- The diversity of furniture causes the unity of design language to be not achieved.

As a result of all these evaluations, when looking at the ergonomics of both spaces in terms of providing the anthropometric decision standards, it is seen that the optimum limits are sometimes not provided in places and sometimes they are provided in places. The reason for this is that the space consists of rooms and different sizes, and designs of furniture are used in each room. It is seen that the results of the survey predominantly similar to the observations made.

As a result of all the evaluations made, the importance of ergonomic decision standards was emphasized by examining the spatial comfort, which can determine the duration of the reuse of historical buildings, on the scale of furniture. It was also revealed that these ergonomic decision standards (Neufert, 1983) should be taken into consideration during the design process suitable for the new function.

5. Acknowledgments

This study was presented in IFC 2020 – International Furniture Congress held by Karadeniz Technical University.

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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e-ISSN: 2687-6035
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Volume 3, Issue 1
2021
pp. 20-29

Wood Industry and Engineering
International Scientific Journal

AN INVESTIGATION OF ARTWORKS CONSISTING OF WOOD MATERIAL AND EVALUATION OF THE INVENTORY INFORMATION

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Citation

Ulay G., Yıldırım M. An Investigation of Artworks Consisting of Wood Material and Evaluation of The Inventory Information. ***Wood Industry and Engineering****. 2021; 3(1): 20-29.*

Keywords

Wood product
Wood Identification
Artwork
Inventory

Abstract

Wood, due to its superior properties, has been influenced by cultural and technological developments throughout human history and has found a place in people's life. When the valuable works of art that have been revealed throughout history are examined, it is seen that wood materials are used in many wood products that have survived to the present day. The purpose of this study is to reveal the process of defining the properties of wood artworks and the evaluation of inventory information. In the study, descriptive information about the wooden artworks in the current academic literature and inventory records in the museums where the works are studied were examined. Whether the information given about wooden artworks is based on scientific evidence and data of the works will be discussed. The use of scientific and evidence-based methods in the process of producing reliable information of the works will be discussed. As a result, it is thought that the real values of artworks will be understood and, identification by revealing the properties of wooden artworks with correct and reliable methods and techniques. This process requires interdisciplinary work and collaboration of experts. In this way, it can contribute to providing reliable information to the public who are interested in wooden artworks.

Paper Type

Research Article

Article History

Received: 30/11/2020
Accepted: 21/12/2020

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AN INVESTIGATION OF ARTWORKS CONSISTING OF WOOD MATERIAL AND EVALUATION OF THE INVENTORY INFORMATION

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1. Introduction

One of the most valuable resources that nature offers us is wood material. Due to its characteristics, it has found an important place in people's lives by being affected by cultural and technological developments throughout history (Sanivar, 1978).

Wood, which has been used in the construction of movable or immovable works from ancient times to the present, has been used extensively in many areas due to its ease of processing, its easy and abundant growth due to the climate in some regions. In the formation of the way of society's lives, their beliefs, as well as the environmental conditions they live in, have been determinant. Studies have shown that the societies that use wood materials have taken the tradition and technique of using wood with them in every region they go (Oney,1970).

In the historical process, it is known that the number of wooden artifacts used is quite high. However, the number of cultural assets made of wooden material that can survive today is less than expected. There are two important reasons for this situation. Firstly, wood is the material that is mostly affected by external factors such as climate conditions, harmful microorganisms and moisture, and sometimes by disasters such as a fire. Secondly, the destruction caused by the people damages, sometimes deliberately or unintentionally, and the aging caused by the use of the material from the destruction of wooden artifacts, which have an important place in the cultural heritage (Bozer, 2006).

Artworks made of wood material, which have a long history and a very rich variety of species, are the most valuable documents of cultural existence. Cultural assets created by humanity throughout the ages are constantly transferred to the future in development and change. These products, which were initially made with simple tools to meet human needs, gradually became an art (Arikan, 2009).

Some of the wooden works of art are collected, preserved, and exhibited in museums today. Some valuable wooden works are kept in warehouses according to the classical museology understanding for location, but even though they are kept in warehouses, wooden works are damaged by microorganisms and moisture, and they cannot survive for a long time. Many of the works that are not preserved in museums do not reach today in their original form. The wooden artifacts in the warehouses of the museums should be preserved with contemporary museology methods, their restorations should be done faithfully, and the necessary definitions about the work should be made in detail during the inventory records of the works (Altunbas and Ozdemir, 2012).

This study aims to reveal the identification method based on current and scientific evidence by addressing the methods of defining the type and species characteristics of wood material and the process of evaluating inventory information.

1.1. Definition of wood

The root of the word wood is originated from the plural word of hasebi (khashabiin) in Arabic. It also means "building material, timber cut from the tree to use it in a random production" (Web-1, 2020). It is a natural material formed by gathering the cells that look like wooden thin tubes. Since wood is a material taken from a living organism, its structure and chemical components constitute the properties of the material. Due to its organic structure, defects such as splitting, distortion, and cracking may occur. It is very difficult to examine and define the appearance properties of wood. Physical strength increases in direct proportion to the density of the wood. When the wood material is cut, not all pores die and the material does not lose its water immediately. As the water decreases over time, its volume also shrinks; However, when the dried wood material absorbs moisture again, its volume expands and swells. The deformation of wood with these events is called the work of wood material (swelling and shrink). This change in size is not the same all over the wood material but also varies according to the type of the tree. Therefore, some precautions are taken to eliminate the possible drawbacks that may arise as a result of the work of the wood material. The most important of these measures is to use natural or unnaturally dried wood materials (Hasol, 1997).

1.2. Wooden Artworks Description

Artworks are valuable artifacts that emerged as a result of creativity and mastery (Web-2, 2020). Wooden works have an important place in people's lives in every period. When looking back to the historical process, people have used wood in architecture and household goods, based on needs (Ozen, 1985). The decoration together led to the emergence of the concept of wooden artwork. The data obtained from the excavations show that the art of wood decoration on portable objects has advanced. For example; tables and horse harnesses belonging to Asian funnels excavated in Pazirik and Noin Ula excavations can be given (Ersoy, 1993).

1.3. The Use of Wooden Materials in Artworks Production

Wood has been one of the most widely used materials in human history for the production of artworks (Altun, 2020). The characterization of wood as a work of art is not only related to its usability quality but also its natural aesthetic features such as brightness, color, texture, line (Ors and Keskin, 2008). The structural properties of wood, which is the most important raw material with renewable resources in the world, has enabled it to be used as a versatile material. (Erdin and Bozkurt, 2013).

Mankind has made many items that he uses daily from wooden materials and started to use them for decoration purposes in time. The first examples of wooden decorations that form the expression of different cultures are seen in Central Asia. Since prehistoric times, wood has been a material that shows the continuity of use with its durability, warmth, and texture. Especially the pulpit, mihrab, lectern, sermon lectern, sarcophagus, courtship guard, jewelry box, balustrades, and wood depending on the architecture; it was used in door-window wings, ceiling hubs, columns, and column heads. Wooden artworks, which we come across with various examples, have spectacular examples that reflect the general temperament of the period. To make wooden artworks long-lasting, fiber-free, and hard-textured wood types were generally preferred and different methods were applied to them (Bozer, 2006). Walnut, oak, ebony, cedar, pine, rose, apple, and pear trees were used as wood species (Oney, 1970).

2. Materials and Methods

In the study, descriptive information about wooden works of art in the current academic literature and the inventory records of the museums were examined. The issue of whether the information given about wooden works of art is based on scientific evidence and data was discussed. While recording the wooden works of art in the inventory, it was examined whether the identification methods of the material were made by scientific methods (Figure 1.).

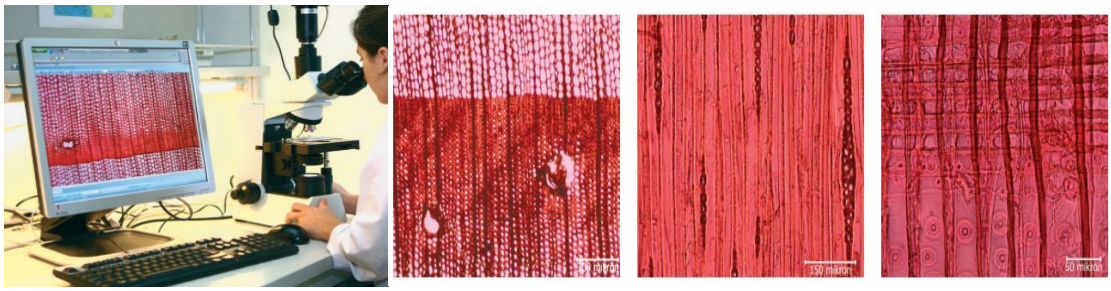

Figure 1: Microscopic examination sections of wood material (Web-5, 2020).

Evaluations were made by presenting the current analysis methods: HLPC (High-Performance Liquid Chromatography) and Figure 2. SEM-EDS (Scanning Electron Microscope and Energy Dispersion X-Ray Diffraction) and the methods used were discussed.

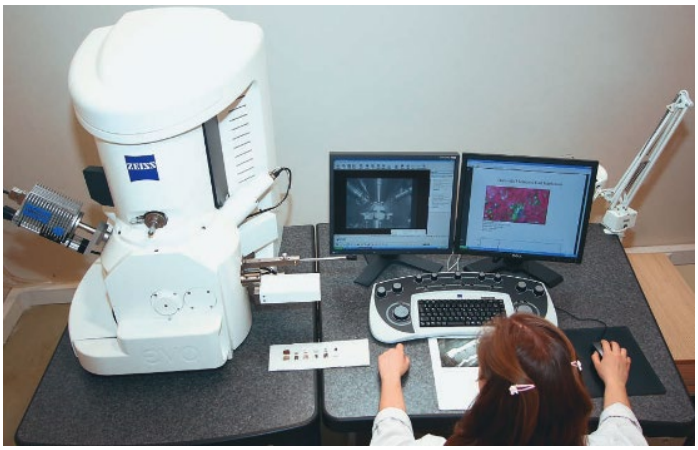

Figure 2: SEM examination sections of wood material (Web-5, 2020).

3. Result and Discussions

In this section, the methods currently used in the identification process of works of art made of wood material have been investigated. The inventory information of the studied artworks in the Turkish literature and the methods used in the creation of these documents are given below.

3.1. The Process of Including Wooden Art Works in the Inventory

Wood has been one of the main materials preferred in daily use and artistic activities throughout the history of humanity in terms of its easy processing, warmth, durability, and aesthetic properties. In the period when wooden works are produced, depending on where they are used by their intended use, when they lose their function, as a movable cultural asset; It can be found in different environmental conditions as a museum display, warehouse or as a building element in architecture (Eskici and Arikan, 2019).

It is a monumental and materials in civil architectural buildings, quality, and content, originality, problems and problem cause KUDEB, which was established to diagnose, provide services throughout in Turkey. The process, which starts with the application made to the KUDEB laboratory for the identification of the wooden work, ends with the sampling within the scope of planning, the preparation of the samples taken and the planning of the necessary analyzes, the analysis and finally the reporting of the results of the relevant analyzes (Web-5, 2020). The workflow is arranged according to the material, and it consists of the stages in Figure 3.

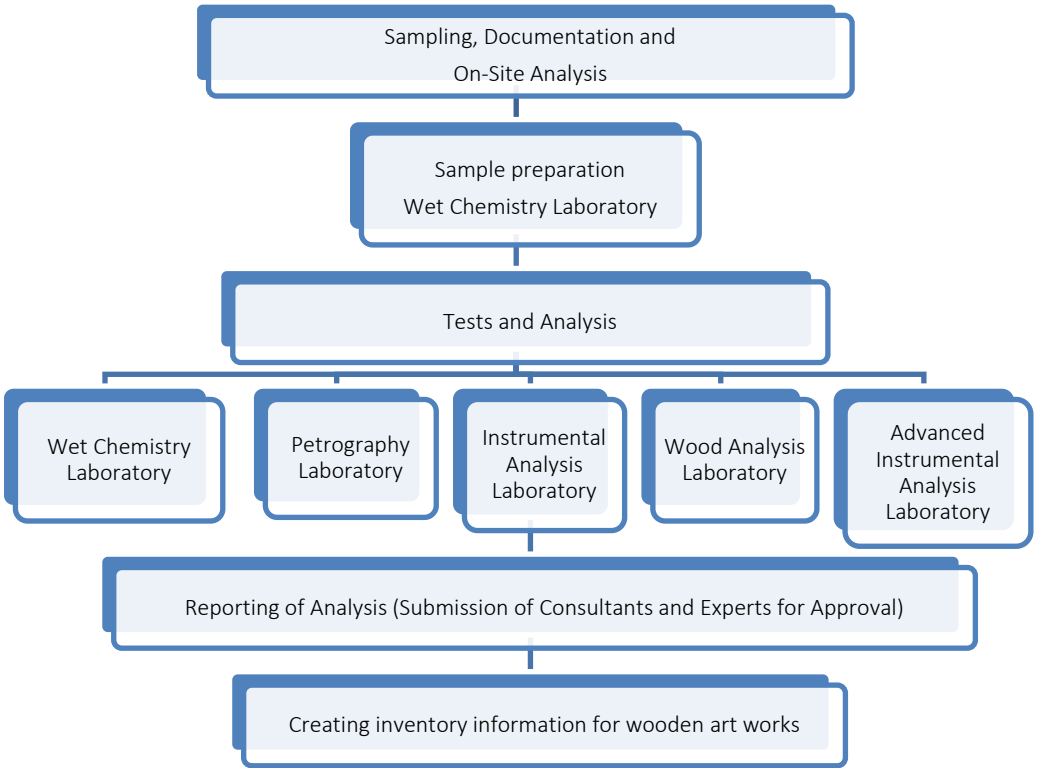

Figure 3: The process of defining the material of a wooden work of art. (Web-5, 2020).

It is aimed to investigate the history of wooden works, which are an element of our culture, and to examine their place and importance in Anatolian geography with scientific research, and present them for the benefit of the scientific world and society. For this purpose, taking the inventory of the works kept in museums and warehouses for many years, analyzing them, and adding them to our culture and society is a responsibility of societies against human history (Yildirim, 2019).

3.2. Classical Methods Used in Creating Inventory Information

It is understood that the wooden works of art brought to the classical museum's function to be collected and preserved in warehouses. In the classical museums, which have the function of preservation, the creation of the inventory information of the wooden artifacts in the warehouses that make up the kitchen of the exhibition areas is done through observation, which is a classical method. For example; In the Inventory Book of the Konya Ince Minaret Stone and Wooden Works Museum (Inventory No: 8, 144, 149, 151, 152, 153, 157, 260), it was written that the material from which the works were made was wood or wood, and the technical characteristics of the material were not included. The type of wood material cannot always be determined by observation. For the wooden artifacts in Sanliurfa Museum (Inventory No: 235, 236, 238, 239, 672, 799, 800, 801, 802, 985, 986, 1135, 1136, 1169, 1322, 1323, 2341, 2342, 2416, 2585) it was stated as the material of which it was made determined by observation (Erdemir 2015; Yildirim, 2019) defined it as Inventory No: 3217 Material of the Work: White Tree (Erdemir, 2015).

Registered in the inventory book of the Turkish Islamic Arts Museum (Inventory No: 3, 5, 6, 10, 12, 74, 78, 116, 127, 130, 145, 147, 191, 195, 196A, 196B, 197,198, 199, 208, 244, 246, 247) defining the raw materials of the works (Uysal, 1991; Bozer 1992; Disoren 1993; Ozkul 2001; Unludil, 2005; Bayrakal 2007; Agyar 2007; Arikan 2009; Pamuk 2010; Taskan 2011; Kurttap 2015; Aktug 2016; Kosif 2017; Akinay 2019; Katildi 2019) and in the determination of material type in studies it has been determined that the traditional method of observation is used. In the inventory document of the wooden work no 1322 given in Figure 4, only pine, walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done. In the inventory document of the wooden work number 1169 given in Figure 5, only the walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done.

Figure 4: Inventory number 1322 (Yildirim, 2019).

Figure 5: Inventory number 1169 (Yildirim, 2019).

In the inventory document of the wooden work number 145 and 244 given in Figures 6 and 7, only the walnut information about the material is included. It is understood from the inventory information that detailed material analysis of the work has not been done.

Figure 6: Inventory number 145 (Akinay, 2019).

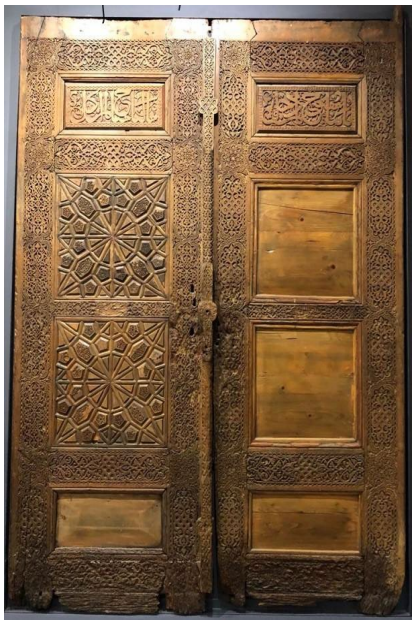

Figure 7: Inventory number 244 (Akinay, 2019).

Kandemir (2010), although the results of the applications vary according to the individual, it does not provide a completely objective evaluation, it is still a method used to provide preliminary information about the material (Kandemir, 2010).

In the inventory document of the wooden works number 119 and 139 given in Figures 8 and 9, only the walnut information about the material is included. Because it is thought that a single type of wood material is not used even when a surface evaluation is made by observation.

Figure 8: Inventory number 119 (Katildi, 2019).

Figure 9. Inventory number 139 (Katildi, 2019).

Kurtisoglu (2015) in his evaluation regarding the material in his study; "it is stated in the sources that it is made of ebony wood, but it is seen that it is a tree species that is lighter than the worn surfaces". he reported (Kurtisoglu, 2015).

It is one of the oldest methods to determine the type and classification of the material without damaging the work. However, the visual evaluation is completely subjective and is evaluated by the analyzer (Icel and Beram, 2016). It has been determined that the descriptions of the type of material from which the works are made are entirely made by observation in all the studies subject to the study. In definitions where traditional methods are used, it is considered that erroneous determinations can be made depending on the knowledge and experience of the person.

3.3. Examination Detection and Documentation Methods

Tree type diagnosis in wooden materials or objects is of great importance in terms of art history. In this context, determining the type of wood used in the production of wooden works that are of interest in art history can explain many issues. The period to which the work belongs, where it was produced, whether it is original, whether it underwent any repairs is very important in terms of art history. Modern methods are used to determine the type of materials that have become antiquities of wooden works that have reached today in laboratories, handicrafts, and architecture.

The academic literature in Turkey; Ph.D. and master thesis, leaflets, catalogs, and books defining the details of the woodworks of art in the inventory information of the works belonging to the museum have been identified which assessed through observation of the conventional method. But some experts have reported that traditional methods are subjective and may differ depending on the person (Icel and Beram, 2016).

The material to be tested or in the group of materials to represent the whole sample needs to be taken. Destructive traditional methods require specific laboratory infrastructure and equipment to perform tests. These methods are also possible to evaluate the material on site does not provide. The disadvantages of traditional destructive testing methods have led to the development of alternative methods, which is a

new method Non-Destructive Testing, the material its integrity and availability in any way defects on the surface and internal structure without damaging and It is defined as determining the status (Icel and Beram, 2016). Development of non-destructive methods, scientifically elasticity in the 20th century and with the development of instrumentation methods in measuring wood properties (Bucur, 2003).

The material type can be determined by preparing transversal, radial, and tangential sections (Figure 1.) and examining them under a polarizing microscope to determine the material type of the samples that can be taken. The analysis of valuable decorative materials, which cannot be taken as a sample in terms of quantity and quality, is only made visually. However, definitions made only by examining physical properties visually may not always give reliable results. HLPC (High-Performance Liquid Chromatography) and SEM-EDS (Scanning Electron Microscope and Energy Dispersion X-Ray Diffraction) analyzes are used in the laboratory environment of wood material (Gulec, 2014; Web-3 2020; Web-4 2020).

Macroscopic structure of the material by analyzing the wood material; Information about anatomical features such as annual rings, self-rays, traces, and physical properties such as color, brightness, and smell are obtained using a stereomicroscope. In the Microscopic Analysis performed under the microscope; the material type of the wooden material can be determined using a polarizing microscope and electron microscope.

Species identification is performed by microscopic examination of the cell order and sequence of wood samples. Identifying the type of wood used in wood materials and determining the reason for biological and physical deterioration caused by insects, fungi, or external factors in its structures by macroscopic and microscopic methods and determines the cleaning and treatment methods. In the Wood Laboratory of the KUDEB institution in the Istanbul metropolitan municipality (IBB), the type of wood material, its preservation status, the degree of deterioration, and protection methods are determined using up-to-date methods. (Web-5, 2020). The tests performed for wood material within the KUDEB laboratory are given in Table 1. Erdem (2007) researched the effects of the “university-industry cooperation, which was conducted in the field of science and technology, on the administrative and financial autonomy and academic freedom of universities.

Table.1: Tests and Analysis Applied to Wooden Building Materials (Web-5, 2020).

Analysis of wood material		
Analyzes	**Purpose**	**Analyzes and Devices**
Physicmechanics	Physical of wood specimens such as porosity, water absorption, density; It is the determination of mechanical properties such as adhesion, compression, tensile, and bending strength.	• Universal Test Device • Adherence Device • Non-Destructive Testing Device
Chemical	If it is in the sample, paint, etc. determination of the type and chemical properties of the coating layers. It is the determination of materials and binders if impregnated.	• Spot Tests • Thin Layer Chromatography • HPLC • SEM - EDX
Microscopic	It is the determination of the species and species by examining the anatomical structure of the wood material and the determination of any deterioration. It is to determine the cause of biological deterioration in wood, cleaning, and treatment methods.	• Texture analysis • Stratigraphy (layer) analysis • Thin Section Preparation Set or Microtome • Biological Microscope • Stereo Microscope • Polarizing Microscope • SEM
All analyzes are made by the experts of the relevant discipline.		

The determination of the type of wood material is done in two stages as macroscopic and microscopic. Macroscopic structure, anatomical features such as annual rings, core rays, traches, which are diagnosed using a stereo microscope, and physical properties such as color, brightness and smell are obtained from the relevant institutions, and inventory information is created based on evidence.

4. Conclusion

Wood art wood species just by visual assessment of the work done in Turkey for nearly all the works done and it was determined that breed identification. Scientific methods and techniques should now be used by determining new approaches in the definition of wooden works of art. In the creation of inventory documents of artifacts in museums, to determine the technological properties of wood materials, they should be examined in detail in the relevant laboratories of universities and research centers, and precise information should be presented by experts with reports according to the evidence and test results. Inventory documents, based on observations made alone, may cause erroneous determinations and may not be sufficient to reflect the true value of the wooden artworks.

Descriptive information about wooden materials belonging to works of art should be created and recorded as a result of tests and analysis with modern test equipment (Table 1). It is considered appropriate to reveal accurate information about artworks passed down from generation to generation, with the cooperation of art historians and woodworking material engineers, and other relevant experts with a multidisciplinary approach.

Besides, there are art historians, architects, restorers, archaeologists, etc., who will examine and study artworks related to wood materials. It is recommended that experts take specialized courses in wood materials science.

As a result, the advancement of science and technology enables to reveal reliable data with modern analysis and test methods in material identification. The possibilities recognized by these methods, known as non-destructive testing methods, should be used to the fullest, and scientific methods and techniques should now replace traditional methods.

5. Acknowledgments

This study was presented in IFC 2020 – 6th International Furniture Congress held by Karadeniz Technical University, Trabzon, Turkey.

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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ISSN: 2687-6043
e-ISSN: 2687-6035
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Volume 3, Issue 1
2021
pp. 30-39

Wood Industry and Engineering
International Scientific Journal

FURNITURE DESIGN AND INTERVAL PRODUCTION IN ART-CRAFT-INDUSTRY

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Citation

Şatır S. Furniture Design and Interval Production in Art-Craft-Industry. ***Wood Industry and Engineering****. 2021; 3(1): 30-39.*

Abstract

The concept of mobility contains the meanings associated with the movement from one place to another. Although furniture, whose history is as old as human cultures, has shown some differences according to the countries. It has achieved an almost equal development in the contemporary sense and covered a distance between art and industrial production by exceeding itself and even its function. With the revival of craft production in terms of production before the industrial revolution, it gains a different dimension. Within these stages, the identity of modern furniture, even being made in small quantities, is differentiated by material and method of production and also based on its functionality in a broader meaning. In the future, the development of their production will be revealed by the semi-mechanization in the skill full production of large or small manufacturers. The report includes the semantic concept of furniture in modern design, primarily a chair, an object of art, craft production based on a functional object and production that responds to the requirements of mass production.

Keywords

Artwork
Craft and mass production
Furniture
Design

Paper Type

Review Article

Article History

Received: 08/12/2020
Accepted: 15/12/2020

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FURNITURE DESIGN AND INTERVAL PRODUCTION IN ART-CRAFT-INDUSTRY

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1. Introduction

In this report, the concept of furniture is considered in a universal way and defined from a universal point of view. This definition refers to the scope of the general definition of design and attempts to reveal the industry's orientation in the field of art, which, on the one hand, is related to the mass production, and on the other, to the esthetics. With these perspectives, design can be defined as: "The human ability to serve our needs and to make our life meaningful, to be able to create and shape our environment, without previously existing in nature" (Heskett, 2002).

"Design is a creative activity the aim of which is to establish the multifaceted qualities of the objects, processes, services and their systems throughout all life cycles. Design the main goal of which is humanizing technology through innovation, is considered as a very important factor in cultural and economic change "

(ICSID=WDO). Things that did not previously exist in the nature are created by human hands. Using his mind, a person produces whatever he considers necessary. Even in the primitive times, man got out of the cave and created shelters from bad weather conditions and wildlife in accordance to the material of that time. He often made and used pieces of furniture to make the bone and muscle structures of his body more comfortable in these shelters. Since the prehistoric times, furniture has been used according to the periods:

"In the First Age (4000 BC - 476 AD) wood, leather, processed wood fibers, ebony in luxury furniture, copper hinges. In the Middle Ages, oak, beech and thin boards; in Renaissance fruit trees and wood veneer; nuts and oaks during the Baroque period; Walnut, oak, rose trees, rosewood in the Rococo Period; cherry, mahogany, ash and birch trees in the New Age; In the Industrial Period chestnut wood, laminated wood, wrought iron, steel, glass; walnut tree in the Art and Craft Period; wood, cast iron, steel, aluminum in the Art Nouveau Period; In the period of Futurism wood, leather, metal, polyurethane foam and plastic; steel pipes, plywood, leather, plastic in the period of Bauhaus Art; lacquered wood in the De Stijl Period (Neoplasticism); in the Art Deco Period, ebony, jacaranda, zebra, calamender, palm, amoranth, amboyna, mahogany, violet, sycamore, ash, rose, maple, eel skin, pony skin, shark skin, processed iron, of pearl; polyurethane foam, plastic, flexible fabric, leather "(Erdem, 2007) materials were used in the Post Modernism Period.

As for the furniture material, the use of wood did not completely disappear with the advent of the concept about ecological esthetics as an environment protector, but rather the use of fast-growing trees was supported. "Materials such as sustainable oak, balsa and pine attract attention. Bamboo is a wood which is easy to recycle is also suitable for furniture"(Yüksel, 2016). In this context, the report examines dozens, hundreds of furniture options, some of them are the most typical for mobile furniture and mainly used in chair and seat concepts.

1.1. Methods

Although the report considers furniture design in many dimensions, it also attempts to highlight the differences in production perspectives, from the most functional to the artistic ones, from the advanced mass-produced to the traditional and semi-industrial ones with very different design features. The article analyzes and interprets the furniture, which was identified as an example through a literature review. Matrix analysis and methods of interpretation are based on the thought of Dilthey(Dilthey, 1999): "The limits of our understanding are always where we reproduce and reconstruct, it's almost like living again ."

2. The Concept of Modern Furniture

Furniture originated from the French "mobile", is associated with the concept of mobility, it is defined as both a direct functional value for a person and the value of spatial equipping. Also, in all living spaces: positive or negative, beautiful or ugly, effective in heat or cold, cute and funny or dull and colorless, etc.it creates a mental image with its perceptual dimension and ensures that space remains in the mind with these objects. The definition that will be essential in the concept of furniture, as in all design concepts, will also be important for mass-production furniture: "Industrial design concept" is defined as follows in

Decree-Law No. 554 on the protection of industrial designs: "Design is the whole or the part of a product, or the external part of the ornament on it, determined by its characteristics, such as line, shape, form, color, material or surface texture"(TPMK Klavuzu). Furniture, which is an important part of the design concept, is a group of objects considered in the context of their relationship with the space. Furniture used to meet the needs of a person in sitting, lying, eating, created from the following materials: stone, wood, metal, plastic, glass, fabric and leather, is a movable object.

To understand the concept of modern furniture, it is important to know approximately the historical background in which it was produced and used. In this context:

"□ Renaissance XIV and XVIII centuries, baroque, rococo and romanticism,

□ XIX century Realism and Symbolism,

□ 20th century Modernism, Cubism, Expressionism, Dada, Fauvism, Art Nouveau, Bauhaus, De Stijl, Art Deco, Pop Art, Futurism, Minimalism, Postmodernism, Installation Art, Performance Art and Video Art,

□ "We also should evaluate 21st century with its relational art, video game art movements"(Sever and Dişkaya, 2019).

In the first half of the 19th century, the start of the Industrial Revolution was the result of the development of a fully functional steam engine invented by James Watt in 1783, which became an environment independent source of energy.

"Furniture manufacturer Michael Thonet provided the opportunity of industrial furniture production in the early period. Since about 1836, he continuously rationalized the process of furniture production, and in 1856 he founded his first furniture manufacturing factory. Finally,instead of carving three-dimensional shapes of the massive wood blocks Thonet curved them with perfective wood techniques. In the growing furniture industry, most of the furniture was made by unskilled factory workers, not trained foremen"(Vegesack, 1997).

The rapid development of the metallurgical industry, which began with the industrial revolution and was an important engine of this revolution, influenced the production of furniture. Cast-iron, bent iron furniture was widely used outside. İn conditions of rapid industrialization, the Arts and Crafts movement, pioneered by William Morris, produced high-quality craft products as an alternative to the mass-produced goods. 19th and 20th. Over the centuries the development of material depended on furniture also accelerated its industrial production as opposed to craft. However, the concept of sustainability that was emerged in the 1970s, global warming due to over industrialization, ozone depletion, turning oceans into plastic landfills, and many other reasons, has led to support of craft production. Although furniture, whose history is as old as human cultures, shows some differences according to the countries. It has achieved an almost equal development in the contemporary sense and has become a distance between art and industrial production by exceeding itself and even its function.

Within these stages, the identity of furniture, even a small number of contemporary art works, based on its functionality also depends on the material and production method and finally, the development of their production by semi-mechanization, either completely or by small-scale producers' opens the door to the future.

3. Furniture With Significant and Production Differences

The items that determine the characteristics of the use of the rooms are furniture. The choice of furniture in accordance with the characteristics of the room and its arrangement within the area define the unique quality of the space and determine its use. Items that are additional elements of furniture are defined as decorative object. "While the pieces of furniture define the use of space, the objects improve the esthetics of the space. The interior decoration is based on the correct choice of object and furniture, taking into consideration individual needs and tastes. Mass production objects are necessary despite their uniformity" (Miró, Coll, Viloria, 2006: 9). In this report, initially the chair is considered both as an artwork of and a functional object, an object of craft production, an object of production corresponding to the style of mass production goes throught the semantic analysis in modern design. In this context:

"Can Furniture Be Art? What is art and when does furniture become art? Furniture at its best combines form and function effortlessly, but just because you sit on a chair, and eat at a table, does that not make it art? Art is an expression of creative skill and imagination; it can tell a story and build an emotional connection. Furniture has the ability to do all these things" (www.artvancouver.net).

The fact that furniture can establish a connection with its user or facts, photographs, stories related to the past in such cases, the ability to establish an emotional connection with the furniture in order to interpret the history of the past, are the qualities that brings furniture closer to art.

3.1. Art Based Furniture

Art, considered as a form of experiment, is contained in the Phenomenology of Perception by Maurice Merleau-Ponty:

"We learn everything that we know from the world around us. Art explores the world in all its manifestations and reflects not only how we see it but also how we react to what we see and what we learn as a result of this vision. The world is the source of all our esthetic, social and political relationships. Art belongs to the world, it is inseparable from it ... Art is a process of discovery through creation, and our ability to explore is often higher than our ability to invent"(White, 2012).

In his research, White defines art as more than just self-expression, information taken from the environment and different other sources helps the artist self-form. He also determines that even imaginary works have sources other than the artist, and that the artist must know their sources. In the preface of Oscar Wilde's book "Portrait of Dorian Gray" White quoted: "Art does not seek profit, if it does it will no longer be art. Sometimes Art plays an impractical role in our lives, but it doesn't mean that it is not very important or necessary.

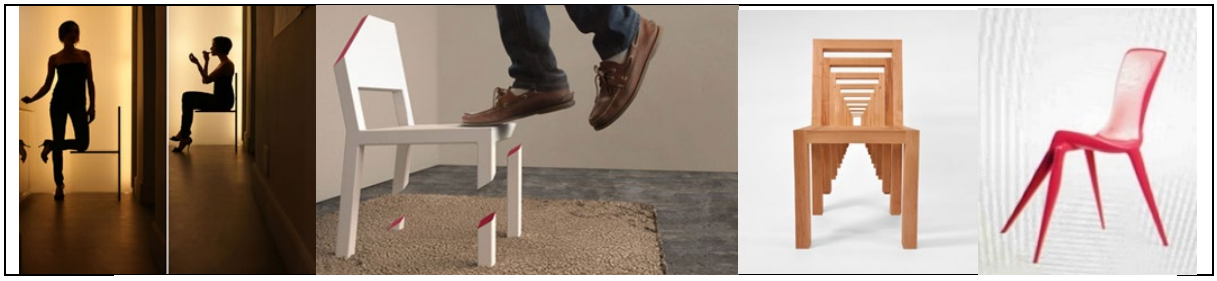

Figure 1: 1a: Davide Conti, The Bloom Chair; 1b: designed by Pool, The Cut Chair; 1c: Ralph Nauta ve Lonneke Gordijn, İnception Chair; 1d: Staight Line Design, Pink Chair (www.boredpanda.com).

The art chairs represented above are the examples that have been designed recently.İn the thought of Oscar Wilde, as in White's one (2012: 11), although art seems to be useless according to Wilde's thought, art is not unnecessary. Because art forms the basis of creative, flexible thinking, and this flexible thinking has enabled the design of chairs that give the impression that they are not used primarily, as in Picture Group 1.

3.2. Furniture Based on Craft Production

In the current guide of the Turkish Language Association, craft is defined as "work requiring experience, skills and craftsmanship together with education, to respond the material needs of people". Craft is a type of manufacturing that requires labor-intensive skill. The area of crafts requiring high skills is based on manual labor; includes apprenticeship - journeyman - mastery; It is an area that deals with the production, repair, maintenance of various objects of use. The concept of craft in the modern sense and in the context of sustainability, as well as in the situation of global warming caused by excessive industrialization, pollution, is becoming increasingly important and began to renew due to the events that harm nature and the environment. This required a revision of production systems and handicraft production. The concept of craft, different from the on of art, has materialistic and useful qualities.

In his work ''Thinking Through Craft'', Adamson (2007) says that fully complementary craft conflicts with contemporary autonomous art. In this context, contemporary art fundamentally confronts to a very strong material specificity; He believes that this was done just for a visual effect. The main part of Adamson's thoughts (Adamson, 2007) is given below:

"Craft in itself is equal to materiality (the extension of matter in space). Basically, craft always involves the usage of the properties of a particular material. It may be wood, it would be metal, clay, paper, plastic, paint, stone - anything - or it would be a combination of multiple materials.

According to Press (Press, 2005), "Craft is regarded as a permanent knowledge demonstrating its power and value ... Crafts should be made from natural materials, preferably colour is beige (beige: is considered a colour of natural materials such as unbleached and natural wool). Craft needs to be made by hand. It needs to be functional. ", on the other hand, Sennett believes that as the skill develops, the ability to sustain increases: "A skill is comes with practice; When modern technology deprives users of repetitive, specific and manual workouts, it is misused. When the head and hand are separated from each other, a a

result we have mental damage"(Sennett, 2009). Below there are some examples of the designers who have experimented with furniture in the craft definition:

Figure 2: 2a: "Trevor Cottelli, 2002; production: Rex Heathcote Furniture, 2006; 2b: Chris Robins, 2006; Cadiz Chair is molded on stainless steel legs with pine laminate from Western Australia and wood veneer material; 2c: Soft sofa, 2003, material: Straw production framed with reed; Manufactured in Cebu Island, Philippines for Idee Co Ltd. Tokyo, Japan; 2d: Design: Marc Newson with Eckerhard Reissig produced Lockheed Living Room furniture with riveted aluminum plates in 1988-89, according to the hand-made version in 1986; Powerhouse Museum collection "(Cochrane, 2007).

Craft production, regardless of the material, brings the product to its origine, and is seen as impersonation of the master's soul and more importantly, it is the product that represents his heart and his skills. Craftsmanship is a highly specialized manufacturing area that requires not only manual labor, but also a lot of patience, as seen from the Soft Sofa or from Lockheed Living Room Furniture, in addition to work of patient and attentive craftsmen- experts such as Eckerhard Reissig. Taking in consideration the origins of the wicker sofa made in the Philippines, it gets clear that artisans tend to be poor workers; Although their skills are highly developed, they work to satisfy the need for food, which means the people who created it may be different.

In a study by Doğan (2012), characteristics of the craftsmanship were defined as follows:

"□ Manual labor prevails in production. Instead of machines, tools are regarded as an auxiliary element in production.

□ Manufacturing takes place in small workshops. The master and the apprentice together produce the objects in the workshop.

□ Traditional education is used in the process of mastering and improving the skills of the student.

□ Products can be made either to order or as a creative work of a master. It also allows him to produce the objects he designs.

□ Even if the general style prevails in the product, it can't be standardized because it is made by hand.

□ Ownership of production belongs to the craft master.

□ The craft master has the right to control the production process.

□ Manufacturing requires high quality. The number of employees is limited. The technology of production is simple.

□ Production and sale are carried out in one place, the relationship with the market is direct.

A sense of rhythm, which reinforces skills, and helps to understand and express spiritual feelings such as looking, seeing, represents the value of a workart. In the craft production, when the hand skill is used to satisfy material needs, this is the right way how to achieve the ideal balance between hand, eye and thought.

Another concept is the concept of handcrafts; this sphere of decoration and its smaller, possibly flexible, direct or indirect use, is a concept developed between art and craft. While handcrafted objects or works are sometimes used for personal or spatial decoration, in other cases they are considered as objects of direct use.

3.3. Furniture Based on Industrial Production

When furniture is considered from industrial production point of view, there can be found a range of completely different production styles that support craft production. In this context, the following examples are important in terms of production differences and call into question some material differences:

Figure 3: 3a: Jasper Marrison, Air-Chair for the Magis Company, 2000; injection molding with gas; 3b: Eye Chair, Interfoam Limited Company, Foam molding method; 3c: Konstantin Grcic, Chair-One for Magis Company, 2001; high pressure metal casting- except iron; 3d: Ulrich Böhme, 1971, Thonet S826 Model, for Thonet Company, Ring rolling method; 3e: Studio Dillon, 1998, Lloyd Loom Nemo chair, kraft paper, metal wire based plastic and wood on computer controlled machines (Thompson, 2011). 3c: Konstantin Grcic, Chair-One source: (www.aram.co.uk).

If we look at industrial furniture in the order of the pictures, the “Air chair” in “3a” is produced by injection molding using gas. Polypropylene (pp) plastic material is injected into a two-pieced mold. But the mold shouldn’t be filled; Polypropylene plastic (pp) is injected into a two-piece mold. But the form is not fully filled; The necessary amount is entered. Because, especially in the bulky parts, it is necessary to direct the molten pp mold to the bottom cavity and walls.

This provides the gas injection pressure. The gas pushes the pp and squeezes it against the mold walls.The thickness can be 3 mm or more. The process takes about three minutes. The mold is cooled along on the conveyor belt. Then the chair is taken out of the mold. The chair weighs 4.5 kg. As the gas pushes the material under internal pressure, the PP material provides a very nice and flat surface on the mold walls. It can be intensively used for a long time.

Secondly, the "Eye Chair" in "3b" is produced by foam molding method. This material is called Liquid Polyurethane Resin (PUR). The softness of a PUR Material or its lack will be determined accordingly on whether the foam cell structure is open or closed. Open cell PUR gives a softer result. İn case of foaming and swelling, the PUR property is calculated again, what ensures the compression of the material towards the walls of the mold and a smooth surface. İn the good mold, this method can be performed (used) 50 times a day. There is a moderate level of speed and cost. Depending on the form and material, the cost of laying can be high. The ‘’eye chair’’ is molded from cold rigid foam with a density of 55 kg / m^3 (3.4 lb / ft3) (torque (rotational motion) for the gravity system in english engineering). There is an internal metal support with legs.

In the third row, Chair-One in 3c was made by high pressure die casting. It is a method of composite casting for metal with other non-ferrous metals. The high pressure pushes the molten metal to all directions and into the mold. Hot liquid metal under high pressure is pushed into the mold cavity by the injection piston. Water cooling channels are important to keep the mold temperature lower than the temperature of the liquid metal in it. The process takes up to several minutes and the mold isn’t opened until the liquid reaching the smallest cavity cools down. The smoothness of the inner walls of the mold leaves no scratches on the chair. However, the paths to the dump are cleared. It took three years to manufacture this chair; İt was anufactured with a fully automatic system.

The "Thonet S826 Model" in "3d" rocking chair’s pipe bending process is an industrial production. On the rotating head, the mandrel (rotary bending) the pipes are bent in the way that large circular curves are formed between the rollers. A clamping clip is used to ensure a wrinkle-free bend. The CNC machine flattens the pipe and starts bending. The seat and backrest are made of molded laminated wood; riveted to the bent pipe. In this production, materials and waste are minimal.

Fifth place is the "Lloyd Loom Nemo Chair" in "3e". Here, the braided wicker material is an leading industrial product because it is woven like a fabric on a loom. Fiber is resistant. As a hard textile, lifting and lowering of the comb bars, feeding the weft mats and forging are important. Each warp thread passes through a hole in the comb. The production is carried out under computer control. It can also be moved by pressing the foot pedal. The blind blade, called the beater, is used to firmly attach each weft mat to the overlapping warp. Here, the warp is made by twisting strips of kraft paper into dense textured fibers. Rattan, willow and bamboo are used as natural materials. In addition, metal, paper, plastic and wood fibers can be used in serial production. The frame to which the woven mat is attached consists of steam-bent wooden rings.

4. Analysis of Art, Craft and Industrial Furniture Production

Furniture intended for seating, with its meaning and production differences, also requires an analysis of the subject. The matrix analysis allows you to take 2 or 3 examples of each of the three furniture groups. The analysis of furniture was carried out according to the following criteria, factory and labor costs, production style and material effect, equipment and mold costs, manufacturer's competence and skills, surface quality, design suitability for production, idea , art production competence , craft production competence, industrial production competence. The interpretations of the analysis of art, craft and industrial furniture in the matrix are given in the section below. The comments are handled in multiple and really comparative between 'A' - 'J'.

Table 1: Analysis of art, craft and industrial furniture and thoughts as interpretation infrastructure

Objects / Criteria							
A- Production and labor costs	Special workshop production. No worker or factory cost .	Depending on the material, it can be a workshop and a factory.	No factory costs. The craftsman produces according to an inner mold or skeleton	No factory costs. The master can work. The designer is different; craftsman is necessary.	Factory, labor cost is high. The first is a long process production, carried out only in the factory	There are factory and labour costs. It can also be produced in a large workshop.	Wicker knitting workshop production. But here there are factory production, workers..
B-Production style and material influence	Workshop production, the artist works alone. The material is massive wood.	The artist is alone; If the leg are steel reinforced, they are wrapped with CTP.	The craftsman produces by hand. An internal skeleton is reinforced. The material is wicker.	Produced by craftsmen. The material is anodized aluminum. Solid foam wood frame.	Pressure metal casting. Non ferrous composite metals. Factory production.	Large diameter pipe bending; rolling ring with mandrel.	Wicker weaving on the machine; warp twisted kraft paper, weft rattan, willow,
C-Machinery, equipment and mold costs	Big machinery equipment, no mold costs. There are hand tools and some small machines.	In fact, a two-piece mold is needed. But it can be produced and painted like a sculpture.	The skeleton is like an inner mold. It is knitted on wicker. No machinery, no equipment.	There is no machine, equipment or mold cost. If desired, the upper and lower bulges of the skeleton can be molded.	In the factory, there is a high pressure mold, equipment machine;	There is a machine and equipment to bend the mandrel or long, large ring between cylinders.	Wicker weaving machine and equipment.No mold is required.
D-The competence and skills of a producer	The artist looked for magic and in the art, by making this chair with one leg	There is no doubt about the competence of the artist, it has an elegant symbol.	The craftsman is very competent. He has exceptional hand-eye skills. The steel skeleton facilitates production.	The designer offered an original design; the craftsman with great skill.produced quite different furniture	The designer's point of view is very different. Production was possible due to factory facilities.	The attention and skills of factory workers are also important.	Skill is unnecessary for wicker weaving machine. Technical knowledge is important. Straw handling requires skills.
E-Surface treatment qualities	The surface has to be processed and cleaned	In workshop production, the upper surface has to be processed..	It is necessary to polish the upper surface in wicker weaving.	Dozens of aluminum anodized parts are cut and riveted according to the surface lines and numbers.	In the product coming out of the high pressure mold, only liquid spouting nozzles are processed.	chrome-plated pipe and laminated wood is treated as paint or veneer	The machine does not require matting, maybe just spray polish
F-Design suitability for production	Design is surprising and suitable for production.	Desire to create artistic elegance. Production in the workshop was compulsory.	Crafting becomes easier with the craft skills.	The design requires a lot of craft skill.	The design forced the factory production. The first production took 3 years.	The design is very suitable for production.	To dress the furniture with wicker weaving requires skills
G-The emergence of the idea; user expectations	accordig to the contemporary furniture idea the artist looks for magic	The artist wanted to reflect some female elegance in the furniture.	İt can use a user's idea with craftsman's one. It may change over time.	Original designer idea; He applied to craft production for a different design	Designer idea; It is possible to produce only by mass production. The user finds it very original.	Thonet idea; The user knows it well. New version with contemporary material.	The user likes the warmth of the wicker material. The idea is general
H- Art production competence	Art production is sufficient from the point of view of art idea; User request is insufficient	The artist designs and produces only what he wants. Doesn't think of the user	Craft production does not seek the idea of art. The idea of usage is more important.	The absence of any art idea in craft production, designer think and design his artwork.	The idea of art is not sought in industrial production. But the designer can look for beauty	Standard furniture like Thonet is already very elegant	The user always likes the wicker, it's very useful.
I- Craft production competence	Artistic expectation is ahead; No craft skills	Artwork is close to hand-making art work. But it doesn't intend to use.	The craft skill is very high. High usage expectation; The good idea is neat- collective, and holistic.	The usage expectation is equivalent to the craft expectation. But the design idea is ahead	The idea of mass production is at the forefront. No need in craft qualification	A well-known furniture; mass production with different contemporary materials. No craft idea	Mass production of wicker is at the forefront. Craft competence exists in upholstery.
J-Industrial production competence	No industry competence is required for art product	Such a work of art can be made by industrial production. But it's optional.	Wicker sofa as a craft product does not require industry competence	No industry skills are required for craft production. Material althought is close to industrial production	A very high level of industry competence is required.İt is very difficult to produce another one	in industry competence; It can also be mixed craft production with semi-machine production.	Industry competence is very important. However, it can also be produced with craft proficiency.

4.1. Art, Craft, Industrial Furniture Analysis

After being covered from different aspects the analysis of furniture requires comments:

A- Commentary: Artist and craftsman have no factory and labor costs. The cost of the workshop is low. Sometimes a worker assistant can work. Industrial production has factory and labor costs.

B - Commentary: Production styles and material properties are sometimes appropriate for both factory production and workshop. However, production requiring high pressure or gas pressure is possible only in the factory.

C - Commentary: Although the cost of machines and equipment is not necessary for arts and crafts, in some cases small machines and equipment are important for this kind of work. Art and usage products can always be adapted to the factory mass production. As it was with the molded production of ,Pink Chair.

D - Commentary: Furniture made by an artist or craftsman requires skill and competence. The worker in the factory also learns how to use the machine in furniture production. No skills required. Maybe woven mat veneer requires skill, it depends on the situation.

E - Commentary: Spray polish is applied to wicker furniture. Top surface treatment is not required for high pressure molded furniture. Other art or craft products also require top surface treatment.

F - Commentary: An art and a design product may present difficulties in production. However, all other designs or crafts are well suited to production.

G - Commentary: User expectations are not important for the artist. He is looking for magic, , or wants to reflect an idea. The master ponders customer orders and examine them taking in considertion the wishes of his clients. In industrial production, the designer evaluates the general user expectations and works on the average value and cost of use.

H - Commentary: Art production in the field of furniture has recently developed in order to make it different. Artist want to put forward their original ideas without considering user expectations. There is no insufficiency in the art production. It is bought by a small number of users.

I - Commentary: Craft production is sufficient according to the user expectations. There is no expectation of magic. However, in some cases it works as if there was some cooperation with industrial production. Like in the example with the wicker weaving machine.

J - Commentary: Industrial production is very efficient in terms of materials and production methods. It responds to a general user when more general forms are produced by mass production. Or it will be expensive, as with the high pressure cast chair. This is not a work of art.

5. Conclusion

Since 4000 BC. people, due to the structure of their bodies, have felt the need to sit.The location and shape, as well as the structure of the seating, varied in different periods of time, and the decorations reflected their features. İt has become meaningful in the modern development by adapting its qualities to the concept of design.

Although the differences in meaning and production of seating furniture have become apparent in recent years, they began to mix and accumulate in each other. For example, while the artistic features seemed uninhabitable, magic was sought in the chair. The fact that the usebility and habitability of the object is ensured was realized. For example, the image of an elegant woman sitting with crossed legs was transferred to a chair; İt is made of plastic, but if it was produced by injection molding it would seem to be the art attributed to industrial production.

For example, For example, a seating furniture was designed by a designer, but manufactured by a craftsman with individual pieces combined. In this case, design and craft get intertwined. And again, an example, wicker knitting, which is originally a craft production, was produced by machine production, as well as by industrial production using a material such as kraft paper. The idea of the craft here was just in upholstery function.

Another chair, entirely designed for industrial production, was created using the high pressure non-ferrous metal production style and took three years. Made a name in the industrial revolution as Thonet, made with rods of chestnut wood and sticks, is completely a craft product,.The hazm-ı taam (for digesting food) seat, in a modern way, was produced entirely with industrial production, the mandrel was produced by the ring rolling method, this is how the craft was transferred to the industry.

All of these art, craft and industrial features of production are now intertwined and grouped into a single whole. We may have the impression that it will continue to be so.

6. Acknowledgments

This study was presented in IFC 2020 - 6st International Furniture Congress held by Karadeniz Technical University, Trabzon, Turkey

Conflict of Interest Statement

The corresponding author states that there is no conflict of interest.

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ISSN: 2687-6043
e-ISSN: 2687-6035
https://dergipark.org.tr/en/pub/wie

Volume 3, Issue 1
2021
pp. 40-45

Wood Industry and Engineering
International Scientific Journal

POTENTIAL USAGE AREAS OF IIOT IN FOREST PRODUCTS INDUSTRY

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Citation

Tuncel S., Candan Z., Laci M. Potential Usage Areas of IIoT in Forest Products Industry. ***Wood Industry and Engineering****. 2021; 3(1): 40-45.*

Abstract

The increasing usage of wood materials in the industry necessitates correct, effective and sustainable use of existing raw material resources. In this context, the concept of Industry 4.0, which includes smart production systems, smart objects, and smart management models, stands out. Industry 4.0 is defined by the concept where human, machinery, robotic control equipment, products and all related objects can communicate with each other; thus, lines are arranged, and eventually they work as a networked system. IoT (Internet of Things) is defined as the communication of all elements/objects within the industry 4.0 system. In the light of current developments, the use of technology in the routine life activities of people is expanding. The most striking example of this is the progress in the telecommunication sector like smartphones. The aim here is not only to ensure verbal communication between people, but also the communication between objects, and objects with people. This creates the system referred as IoT. IIoT (Industrial Internet of Things), also called industrial internet, is the use of IoT in industry/manufacturing. This means that the whole supply chain works in interrelation. In this paper, the definition of IIoT concept and its potential in the forest products industry are examined.

Keywords

IIoT
Internet of Things
Industry 4.0
Forest Products Industry

Paper Type

Review Article

Article History

Received: 08/12/2020
Accepted: 13/12/2020

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POTENTIAL USAGE AREAS OF IIOT IN FOREST PRODUCTS INDUSTRY

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1. IIoT Concept

The Industrial Internet of Things or IIoT is defined as countless devices, machines, computers and people connected by programming tools and data analytics for reflexive business results. IIoT or Industry 4.0 as it is called in the market, utilizes the power of smart machines and constant analytics to make use of the data that vehicles have accumulated in industrial conditions for a long time. Two of the main reasons why IIoT has such an impact on the industry is that smart machines are better at capturing and analyzing data in real time than humans and better at delivering important information such as business decisions from that data accurately and quickly.

Especially with machine-to-machine (M2M) communication, big data, and machine learning, IIoT enables businesses to be more efficient and reliable in their processes. Achieving this effect with connected sensors and actuators, IIoT helps businesses save time and money by contributing to early detection of inefficiencies and problems in businesses and supporting the effort to turn complex data into meaningful-usable information. The most potential usage areas of IIoT are quality control, sustainable applications, supply chain traceability and general supply chain efficiency. In an industrial environment, IIoT is the key component to stages, such as preventive maintenance, advanced field service, energy management and asset tracking.

2. How Does IIoT Work?

The IIoT ecosystem, a network of smart devices connected to build systems that monitor, collect, exchange and analyze data, consists of:

- Smart objects: Objects that can detect, transmit and store information about themselves
- All kinds of data communication infrastructure
- Analytical systems and applications that produce meaningful business information by processing raw data
- People

Edge devices and basic functioning of smart objects; involves transmitting information directly to the data communication infrastructure and converting it into actionable information about how a particular machine part works in this infrastructure. This data would then be able to be utilized to enhance operational cycles, such as preventive maintenance and business processes.

Typical IIoT frameworks require information to be shared over various devices and over numerous networks, from edge gadgets (such as sensors, remote devices, and computers) to the cloud (central computing systems). Huge data volumes can easily overwhelm a network, particularly a network spanning remote operations. In addition, strict security requirements make the system more demanding. To manage increased data volume, performance requirements, security risk and security certificates, interconnected systems require new approaches (Canavan, 2020).

Managing the flow of data in IIoT systems is vital to ensuring that IIoT applications work as designed. Unlike a database which manages past data at rest, the data bus manages data in motion. Bus system makes operations and integration logic easier. Software components communicate through shared and filtered data, rather than trading messages. Applications straightforwardly read and write the value of these privately stored data objects.

2.1. IIoT and IoT Difference

The IoT (Internet of Things) and IIoT (Industrial Internet of Things) are almost the same thing but have very little difference in terms of the scope of their operation (Jeffrey Lee, 2017). IIoT focuses on improving network among devices, saving time, efficiency optimization and other potential advantages,

while IoT can be utilized for industrial, manufacturing and agricultural tasks. It plays a significant role in the daily effect of businesses and their security.

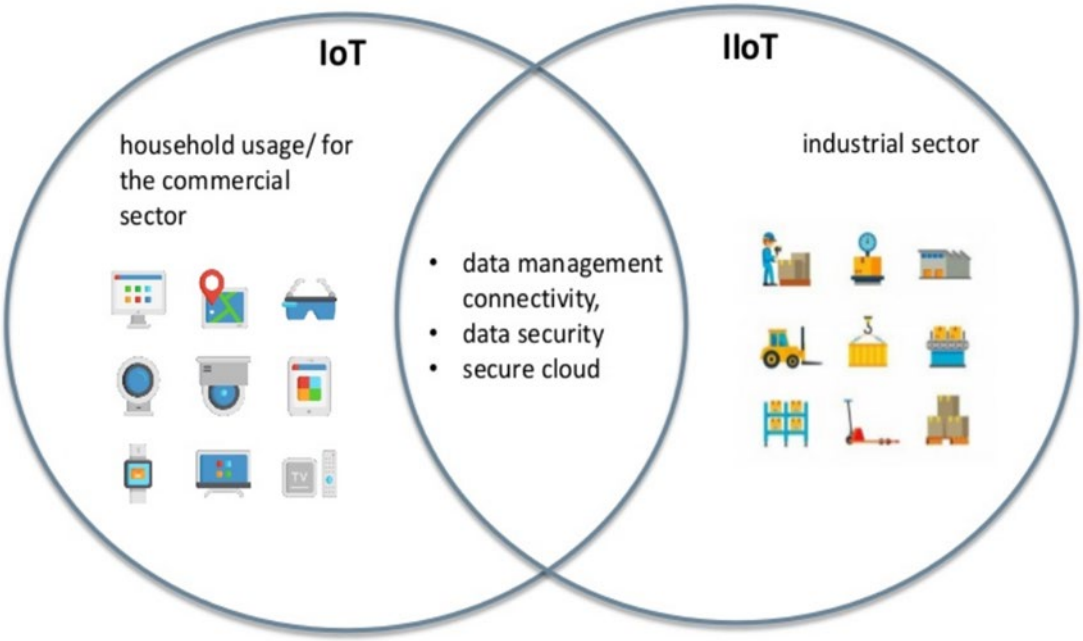

Figure 1: Areas covered by IoT and IIoT. (2019)

The expression "IoT" includes all elements of IIoT as well as consumer use cases such as smart home technologies and wearable gadgets. The focus of IoT it is the "consumer perspective". So, IIoT is a subcategory of IoT. More clearly, IIoT is the use of IoT technologies in the manufacturing and industrial sector. Industrial internet in manufacturing includes machine learning, big data, sensor data usage, automation and machine-to-machine communication technologies. Especially in production, the IIoT eco-system has great potential to create quality control, sustainable and green practices, supply chain management and overall efficiency (Kumar and Iyer, 2019). The basic idea behind IIoT is that smart machines are superior to people at catching and transmitting information precisely. Briefly, IIoT is about making machines more effective and simpler to follow.

3. Industry 4.0

The expression “Industry 4.0” represents the fourth industry revolution. It is perceived as a higher degree of organization and command over supply chains. To be more precise, industry 4.0 is based on the technological concepts of cyber-physical systems and Internet of Things (IoT). Fourth industry revolution happened to guarantee the accessibility of current data progressively by combining all components engaged with the value chain.

Today, from furniture to wood industry every sector and company are operating different. Yet, a common problem is faced. It is the need to access information across processes, products and people simultaneously. Here, Industry 4.0 does not just play the role of investing in technologies and improving tools for manufacturing efficiency—it is about to bring a new concept to the how whole business or company operates and grows (Tuncel et al. 2017; Ocak et al. 2018; Tuncel et al. 2018a; Tuncel et al. 2018b; Tuncel et al. 2019).

4. Use Cases for Industrial IoT

Successful implementations of Industrial Internet or Industrial Internet of Things (IIoT) are the building stones of digital transformation. Most businesses, use IIoT as a method for accomplishing goals by saving time, increase profitability and empower organizations to jump in front of competitors. IIoT is already demonstrating its welfare and flexibility with live deployments in various businesses. Here are the most common IIoT use cases.

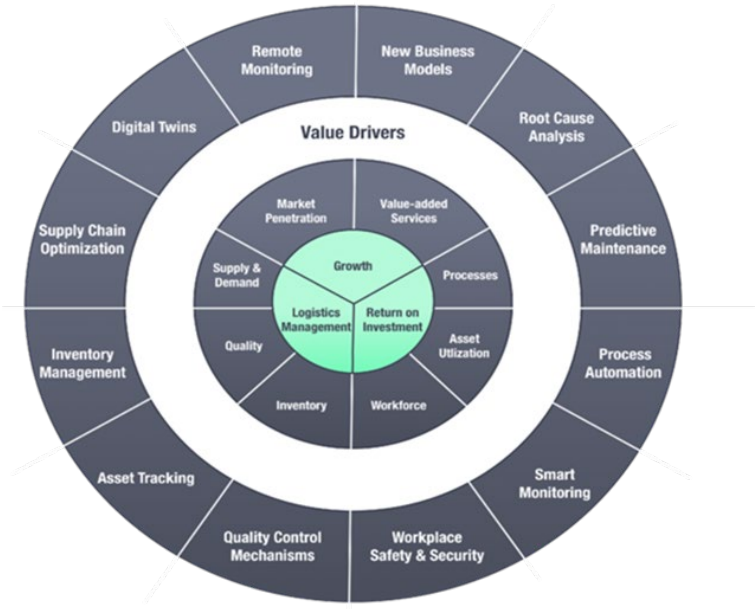

Figure 2: Industrial IoT Use Cases (Doyle, 2020).

Predictive Maintenance: These technologies track all the activities of hardware and increase granular perceivability over all tasks. Producers utilize this review to decrease the chances of system disappointment and hardware degradation. With the utilization of sensors, cameras and data analytics, directors of businesses can know when an equipment will fail before it does.

Smart Metering: Smart meters have gotten a great deal of prominence over the world as of late. Enterprises are recognizing the advantages of smart meters. A smart meter is an internet-capable gadget used for measuring energy, water or natural gas consumption of a building or home (Silicon Labs, 2018). Smart meters additionally give power utilization perceivability right to the meter, so utilities can streamline energy dissemination and make a move-to-move request load.

Simultaneous Asset Tracking: In recent studies it is discovered that an expected $1.9 trillion of monetary worth could be planned by the utilization of IoT gadgets and asset tracking solutions in supply chain and logistics area (Top 5 Industrial IoT Use Cases. 2020). Industrial IoT empowered asset tracking is playing out a more extensive part in the advanced economy than at any other time. The majority of the organizations that have their properties distributed over immense geological areas need to confront a large group of issues that influence their profitability, operational expense, and staffing in addition to other things. The purpose of simultaneous asset tracking is to allow an organization to locate and monitor important assets, ensure quality issues, prevent theft, and maintain stock levels.

Fleet Management: For organizations that depend on transportation as a major aspect of their business, fleet management encourages them to eliminate or limit the dangers related with vehicle venture, improving effectiveness and profitability while reducing generally transportation and staff costs. Shipping services are the best examples of this. They use real-time traffic feeds and efficiency algorithms to convey more packages more efficiently, with less mileage.

4.1. Potential of IIoT Use in Forest Products

Focusing on the provision of inter-machine communication in production facilities, machine learning and the best use of big data, IIoT enables the wide use of IoT in sectoral applications and enables the business to work more efficiently and securely. In fact, IIoT is beyond the work of machines and physical objects connected with IoT over the internet. It refers to the data flow between the software, information technologies, CNC and PLC controls, operational technologies and the networking of all processes. In addition to these, end-to-end data flow and traceability of the supply chain, the monitoring and control of the sub-breakdown of production, logistics and operational functions, and the ability to provide remote access as well as smart sensors bring great ease of use.

The effects of instantaneous data from sensors and other sources on decision processes will be a factor in the enterprise's ability to make accurate and healthy analyzes with the least amount of time, and therefore to work more efficiently. In a manufacturing enterprise, the ability to make cost control by analyzing the financial data coming from the internet or the network as well as the data coming from the

machines and looms instantly, the correct determination of the capacity of the enterprise with all the data on production planning and the most optimum use of the capacity thanks to this accumulated data. Knowing the stops in advance will minimize the lost times and contribute positively to the profitability of the business. In addition, instant tracking of financial fluctuations will be used as an important resource in creating future scenarios.

All of the cost analyzes currently made in many sectors are made with foresight, not in line with net measurements. This creates negative differences compared to the actual cost. Therefore, there is a possibility of loss of business here. By seeing exactly these problems, Tuncel and Candan (2017) is able to calculate the real cost instantly by analyzing all the data obtained from the field and within the enterprise in his study (GE-547285), which was developed for "Smart Cost Analysis" (2017) and whose patent procedures were initiated in the same year. This is one of the concrete results that will be achieved with IIoT. This and similar applications will be very easily applicable not only in the forest products industry but also in all sectors. This study will be used not only in costing but also in many areas such as maintenance planning, line optimizations, and workforce optimizations.

We believe that the technological predisposition of the forest products industry will provide rapid transition in adapting IoT and IIoT applications to businesses. The important thing is for the systematic infrastructure to be designed correctly on an enterprise basis, which will facilitate this transition.

The forest products industry is the 4th largest industry in the economy of Turkey. Under this main roof; furniture industry, wood-based composites industry (plywood, particleboard, MDF, OSB, LVL, sandwich panel, CLT, GLULAM etc.), paper products industry, parquet industry (solid wood parquet, laminate flooring, laminated parquet), joinery industry (door and window production), solid wood industry, wooden packaging industry (pallets, crates etc.), wooden craft industry, wood-based stationery industries (pencil, etc.) take part.

Especially in recent years, due to the widespread use of the Internet, the increase in information technologies, the diversification and complication of production and customer demands, all these sub-sectors have come to the point of using IoT and IIoT technologies. All investments to be made in this regard are not expected to be arbitrary, but to become a necessity for the business to compete in the near future. This investment should not be perceived as equipment and machinery. Since all personnel (engineers, industrial designers, technicians, etc.) working in the factory will be involved in this process, technological investment should be made in human resources..

5. IIoT Challenges

Organizations are profiting by embracing the Industrial Internet of Things (IIoT) advancements. They get better insight, more reliable, dynamic, more efficient, and improved operating. However, those prizes accompany some challenges. In the end, the system is getting more complex and these devices deal with sensitive systems. Below are primary industrial IoT challenges:

• Data Storage&Management: Data storage is a significant challenge for organizations. The information which was put away in past are now utilized for estimations. It is obligatory for organizations to embrace an appropriate arrangement for a safe storage of information before running IIoT in full mode.

Sensors and actuators coordinated with modern gadgets create an great amount of detected data streams with high speed. The detected data is stored in heterogeneous IIoT gadgets. Handling, transmission, accessibility, and capacity of detected data is a difficult errand and require enormous work. To cup with these difficulties, proficient data management models are required (Khan et al., 2020).

• Security on IIoT: There had been various instances of digital attacks before and the effective adoption of IIoT based frameworks by the business clients is influenced by the trust on IIoT systems. IIoT is in its early stages and the greater part of the ongoing researches indicates security and protection as a significant challenge faced by the organizations.

• Actuators and Sensors: General requirements from all edge devices. For example, energy consumption, latency, security, stability from the viewpoint of the industrial user (Gubbia, J., Buyyab, R., Marusic, S., Palaniswami, M., 2013). Pertinence of detected data, particularly that originating from outside the processing plant is vital if it is to be utilized inside an automatic industrial control.

• Economy: A need for an economic case that will obviously demonstrate advantages of presenting new IIoT improvements on sensors and actuators is really important. Moreover, deciding on viable models for paying for the provision to detected data. More examination is additionally needed to help financial appraisals that show up in the commercial area.

6. Acknowledgments

This study was presented in ORENKO 2020 – International Forest Products Congress held by Karadeniz Technical University, Trabzon.

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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ISSN: 2687-6043
e-ISSN: 2687-6035
https://dergipark.org.tr/en/pub/wie

Volume 3, Issue 1
2021
pp. 46-51

Wood Industry and Engineering
International Scientific Journal

A CRITICAL OVERVIEW ON THE UNIVERSITY-INDUSTRIAL COOPERATION PROCESS OPENING WITH FURNITURE PRODUCTION ENTERPRISES

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Citation

Ulay G., Çakıcıer N. A Critical Overview on The University-Industrial Cooperation Process Opening with Furniture Production Enterprises. ***Wood Industry and Engineering****. 2021; 3(1): 46-51.*

Abstract

Turkey's furniture industry, the export potential, employment count, production of value-added products, the ability to branding is important for the country. With the rapid change in the world of science and technology, the developments have eliminated the boundaries between the countries, and as a result of globalization, and the whole world has become a single and big market for everyone. In order to compete in these market conditions, it is very important to gain branding, technology, quality, qualified personnel, R&D and UR-GE success and the ability to produce scientific knowledge and turn it into a product. Within the scope of the study, the collaborations that furniture enterprises can develop with universities that produce scientific knowledge will be discussed. Problems encountered in the process of establishing University-Industry cooperation in the furniture sector will be identified and examined with a critical perspective. The suggestions for the issues, disruptions and new methods to be considered while establishing new collaborations are addressed by addressing the effects and roles of professional representatives in the sector, experts in the field with working experience, managers and academic staff and administrators in the university industry cooperation process.

Keywords

University
Collaboration
Industry
Furniture
Business

Paper Type

Review Article

Article History

Received: 08/12/2020
Accepted: 13/12/2020

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A CRITICAL OVERVIEW ON THE UNIVERSITY-INDUSTRIAL COOPERATION PROCESS OPENING WITH FURNITURE PRODUCTION ENTERPRISES

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1. Introduction

Turkey is one of the leading sectors; imported products that use the most domestic resources in exports the country as one of the least addicted sectors contributes to the economy. Furniture manufacturing sector export potential, employment creation capability, the presence of value-added products, with many features such as branding and to the development of the industry is an important sector in Turkey. In Turkey, university-industry collaboration (UCI), the process is still in the development stage and Furniture Industry located in development in this process. However, cooperation is not considered to be sufficient yet.

The first comprehensive research on the UIC in Turkey, made in 1989 "university-industry relations," says the doctoral thesis. Ensari (1989), Turkey's objectives and strategies, the problems of the industry, were examined by the side of the UIC benefits and relationship process. It also included examples of university-industry cooperation in countries such as Belgium, France, Federal Germany, Italy, Switzerland, England and the USA.Peker et al. (2014) due to some obstacles in university-industry cooperation processes in the UIC process in Turkey desired progress has not been achieved. The obstacles in this process are generally; it is emphasized that it consists of universities, academicians and industry representatives.

Turkish literature, a comprehensive university-industry collaboration to all of the furniture sector in Turkey (UIC) to review the process and are not present a comprehensive survey of the current situation. With this study, university-industry cooperation initiatives in the furniture sector could only be examined through some city-scale researches. Turkey in the furniture industry, university-industry collaboration are needed in research that revealed the current situation.

2. Materials and Methods

Within the scope of the study, the cooperation that furniture companies can develop with universities that produce scientific knowledge will be evaluated through scientific literature and the information obtained through the cooperation platforms shared by the enterprises on the web page. The following different model UIC systems have been examined and evaluated specifically for the furniture sector.

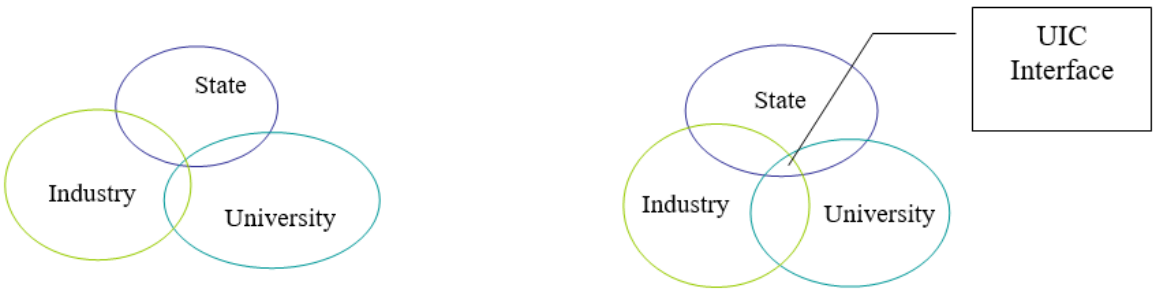

Figure 1: A Triple Helix configuration with negative and positive overlap among the three subsystems (Etzkowitz and Leydesdorff, 1998).

Problems encountered in the process of establishing University-Industry Cooperation (UIC) in the furniture sector will be identified and solutions will be offered by considering the approaches of the parties to the process.

3. Results

3.1. Literature Review of the University and Industry Cooperation in Turkey

Referring to the case of the 1980 university-industry in Turkey relations appeared as the beginning years (Bektas et al., 2009).Today in research on university-industry cooperation process in Turkey mostly contributed to the educational process, students internship and practice facilities, science and technology, business, economics, management science, vocational training, financial management, covered different topics from each other, such as industrial engineering seems to be addressed. Examples of research in these areas are given below.

Peker et al. (2014), as a result of the Analytical Network Process (ANP) application, which was carried out to determine the importance level of the obstacles to University-Industry Cooperation (UIC) for KTU faculty members, said "Not Developing a Collaboration Culture'',"Indifference in Industrialists" and "Bureaucratic Barriers" followed this sub-criterion.

Yardimci and Mufuoglu, (2015), as in a study that reflects the industrialists' view and views on the University & Industry cooperation process, the obstacles related with them and the main problems encountered were revealed and it was aimed to look at the subject from a different perspective

Baysal (2007) discussed in the field of industrial engineering with strategies for an effective university-industry cooperation in industrial design education: A case study on graduation projects.

Bilgili (2008) in the field of public administration in his work titled Technoparks in University-Industry Cooperation: Bursa Ulutek Technology Development Zone Example UIC process with Technoparks is discussed.

Erdem (2007) researched the effects of the "university-industry cooperation, which was conducted in the field of science and technology, on the administrative and financial autonomy and academic freedom of universities.

Araman (2009) examined UIC process problems in terms of technological development in Turkey. It has been reported that with the UIC process, it transforms science into a commodity and scientific production into an activity determined by market needs.

Adiguzel (2016), it has been reported that the cooperation model developed in the last 3 years between Istanbul Commerce University and Istanbul Chamber of Commerce (ITO) is a unique UIC model and has created multiple new interfaces.

Yalcintas et al. (2015), both academics and businessmen, do not get enough information and face problems in the research and development process, as well as in the preparation and management of projects. It is really important to shape it in a multidisciplinary way rather than academicians who produce individual solutions and projects in terms of providing business products and services with high added value in university-industry cooperation.

3.2. Literature Review of the Furniture Industry and University Cooperation Process:

Yildiz and Kaygin (2020), the forest products industry in Bartin province and the university's collaborations took the last 5 years and the suggestions in the scientific study 5 years ago and the qualitative analysis were made. It was emphasized that 85% of the suggestions were realized in the process. It has been reported that there is no audit or monitoring mechanism developed by stakeholders to monitor what the impacts of such studies exist or not, and that the initial UIC studies have been partially moved forward.

Askin et al. (2020) was carried out in order to determine the contribution of the students who graduated from COMÜ Biga Vocational School, Furniture and Decoration Program to the business life of the associate degree education they received within the framework of university-industry cooperation. In line with this purpose, it was determined that their school, profession, post-graduation information and their views on university-industry cooperation were positive.

Gul and Yurekli (2020) investigated the benefits of the 3 + 1 system of the Vocational School within the scope of UIC for Furniture Decoration department students and businesses in Denizli.

Web-1 (2020), by collaborating with companies such as Burotime (Denizli), Istikbal (Kayseri), Cilek Furniture (Kayseri) in the furniture sector of Mimar Sinan University to develop furniture design, the students were provided with application and collaboration opportunities in the field of design.

Altay et al. (2018) stated that they do not have much information about UIC between various furniture companies in Aydin and the university, 57.1% of the companies do not have a joint work with the University and 42.9% of the enterprises are partially informed about UIC process.

Cetin et al. (2017), researched Ink. Co. the UIC training practice implemented between Canakkale-Biga Vocational School, Furniture and Decoration Program and an international company Dogtas Kelebek

Furniture. The on-the-job lesson application training method, which is applied in the panel production line, has been presented with the process and the results were prensented in the introduction and application. The positive effects and results of the process are shared.

Ciritcioglu et al. (2017) stated that, according to the data obtained from 102 furniture enterprises in Kutahya, most of the enterprises do not have information about the opportunities created by the UIC. The lack of communication and the lack of cooperation culture and the low education levels of the employees are among the most important problems in the lack of cooperation between ındustry and university.

Isik et al. (2017) reported that , their contributions to the business and the sector were revealed by conducting a research on customer satisfaction of researchers at the university in a furniture business in Istanbul with a sample UIC model.

Yavuz (2017) reported that university-industry cooperation planned for years is far from the desired level.

Altin (2016) developed the furniture business and UIC process in order to improve the furniture design and production skills of university students in Mugla.

Yildiz (2016) stated in master thesis that the cooperation between the forest products sector in Bartin province and the university industry is at the beginning stage. In the research, the perspectives of the industrialists in the forest products sector and academicians in the university, who are the parties of the process, towards this UIC were revealed and 40 different suggestions were presented.

Ulay (2015) presented an industrial internship model that will contribute to the UIC process by presenting the preparation, process and results in the creation and implementation of the application by including the internship application for the UIC process between the furniture business and educational institutions in Kocaeli.

Ulay (2013), with the protocol signed within the scope of the business UIC, which manufactures yacht furniture, an intern training program was created in cooperation with the university and industry, and a solution was found for the qualified personnel needs of the enterprises at the high school level in Kocaeli.

Korkmaz et al. (2013), stated that that bringing universities and institutions in business life together and making plans for joint work and carrying out various training and organizations in this direction play an active role in university-industry cooperation.

Gurpinar and Barca, (2007), Turkey with companies operating in the furniture and woodworking sector has a weak cooperation between universities. As a result, businesses reported that they could not benefit sufficiently from studies such as R&D, product and technology development offered by universities. Thus, they stay behind their competitors in the world.

4. Discussion

In this study, it was determined that UIC studies of furniture businesses with universities were not at the desired level and most of the existing collaborations were related to student internships and they were generally at a basic level in other subjects. It has been understood that the improving of UIC activities by moving them to an institutional and sustainable level is strategic and very important for the future of the furniture industry in Turkey.

It is thought that furniture enterprises, especially those at the SME scale, do not have sufficient information about UIC processes and need to be informed. It has been reported that businesses are unaware of what kind of benefits they can have from UIC. The lack of a culture of cooperation and the low educational level of employees exist in the sector. The fact that R&D and P&D skills and requirements have not spread to the whole sector is a major factor in the development of UIC.

In terms of universities, communication with businessman, technological infrastructure of universities and interest from industry to university, Technocity or TTOs have not settled yet both for university and industry. The desired results cannot be obtained for reasons such as perceiving it as a load.

Public institutions, Ministry of Industry and Technology, KOSGEB, TUBITAK et al. from the perspective of relevant institutions, R&D supports and incentives for the UIC process and industry have recently increased. However, special solutions for SMEs are still insufficient. In the context of UIC, supports summarize the approach of the public. Public administrators lack sufficient knowledge and experience of UIC.

Employers and Managers are of critical importance for the initial internalization of the UIC process and for raising awareness. Officials in decision-making positions should realize that they need cooperation with universities.

In terms of students; it is very important to ensure university-industry cooperation, to have the opportunity to apply their theoretical knowledge and to prepare for business life during their student years. It also provides a good opportunity to improve physical facilities such as workshops, laboratories and machinery in educational institutions. It may be easier for them to find a job after graduation.

5. Conclusion and Suggestion

- It has been determined that the studies for university-industry cooperation (UIC) in the furniture sector are not sufficient, and more research is required.
- The UIC process can be encouraged by legal to all sectors and legislation should bring obligations to encourage cooperation among them (university, factory, laboratory, education, R&D, P&D, Internship etc.).
- Considering that most of the enterprises in the furniture sector (90% and above) are from SMEs, it should be ensured that these enterprises become aware of university-industry cooperation immediately.

By creating a general awareness in the UIC process, meetings, cooperation platforms among enterprises, universities and vocational schools should be established.

6. Acknowledgments

This study was presented in IFC 2020 - 6st International Furniture Congress held by Karadeniz Technical University, Trabzon, Turkey.

Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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