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A CASE STUDY OF UNIVERSITY-INDUSTRY COOPERATION

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Abstract

The goal of this study was to analyze the situation of the cooperation between University and Industry in Düzce, Turkey. Target population of the study was the firms that related only woodworking industry. There were 242 firms according to the registry of Düzce Chamber of Industry and Commerce. But some of them were only the end product seller instead of manufacturer or supplier. Because of this reason, population of this study was determined as 154 firms. And this was the only constraint of the study. 91 of 154 firms were surveyed by the face to face method with 41-question survey. According to the results it can be said that Industry knows very little about opportunities and has little concern with cooperation. Also, miscommunication may be the one of the main reason of weak cooperation. In this regard, Technology Faculties are able to strengthen this weak cooperation due to its on-site education syllabus.

Keywords: University-Industry Cooperation, Woodworking Industry, Furniture Industry, Technology Faculty.

ÜNİVERSİTE-SANAYİ İŞBİRLİĞİ

Özet

Bu çalışmanın amacı, Düzce'de üniversite sanayi işbirliğinin durumunu analiz etmektir. Bu çalışma kapsamında yalnızca ağaçişleri-mobilya endüstrisinde faaliyet gösteren firmalar hedef kitle olarak belirlenmiştir. Düzce Ticaret ve Sanayi Odası kayıtlarına göre 242 firma bu alanda faaliyet göstermektedir. Fakat bunlardan bazıları üretici ya da tedarikçi değil sadece nihai ürün satıcısıdır. Bu nedenle bu çalışmanın nihai popülasyonu 154 olarak belirlenmiştir. Bu husus çalışmanın yegâne kısıtı olarak düşünülebilir. 154 firmanın 97'si ile 41 sorudan oluşan bir anket kullanılarak yüz yüze görüşme tekniği ile gerçekleştirilmiştir. Çalışma sonuçlarına göre endüstrinin fırsatlar hakkında çok az şey bildiği ya da neredeyse farkında olmadığı ve işbirliği ile ilgili çok duyarlı olmadıkları söylenebilir. İletişimsizlik ya da iletişim eksikliği bu zayıf işbirliğinin ana sebeplerinden biri olabilir. Bu doğrultuda, Teknoloji Fakültelerinin işyerinde eğitim müfredatı sayesinde bu zayıf işbirliğini güçlendirebilecektir.

Anahtar Kelimeler: Üniversite-Sanayi işbirliği, Ağaç İşleri Endüstrisi, Mobilya Sanayisi, Teknoloji Fakültesi.

1 Introduction

Cooperation (collaboration) is a situation in which someone acts together to do something. This cooperation can be established between at least two partners for group action to achieve a common purpose. Partners can be natural person or legal identity such as university, hospital, enterprise and etc. In either case there should be a management that organizes the partners for an efficient group action. Manner of rule is the key factor that affects this cooperation success too. Consequently parties must arrange well this key factor before beginning the action. In general cooperation bases on a project either funded by public enterprises or own funds. Both, projects must contribute all the partners. Contribution may be differing according to the goal and scope definitions of the partners. For example providing pecuniary resources, intellectual property, commercial product, scientific publication and etc. are some of these goals. In terms of university intellectual property and scientific publication may be of top priority but of course developing innovative commercial products, new materials or business knowledge are research interests too. But, Industry, a distinct chain or group of businesses which serve specific products or service, especially focuses on growth and profitability. University-Industry cooperation is not a new matter and has been studied for decades. But lots of things changes rapidly not only with the technological development but also region to region. Also, industry and university changes too; their needs, knowledge, market, competition conditions, teaching way and etc. According to Zhang et al., scientific and technical advancement as a power source, social need as a market driving force and market competition as an external pressure are the external morals and the technical innovation mechanism of China's wood processing enterprises results in the industry-university cooperation [1].

But according to Congqin and Changhong, enterprises are incomparable advantageous about converting scientific and technological acquisition into products, keeping up with market demand while universities are important for new knowledge and ideas by having the most valuable human and technical resources [2]. According to Lööf and Broström, technology and knowledge distribution has an outstanding role in the literature on technological change, creative thinking and growth [3]. And also role of universities has been remarked much more. Zheng et al., stated that University-industry cooperation established through some organization such as enterprises, universities and research institutes in order to achieve their value objective. But majority of academic knowledge is neither distributed decently with corporates nor served their practical necessity [4]. In the some related literature this problem was stated as follow; "Despite extensive

evidence for the importance of partnering between university and industry, many scholars emphasize that our knowledge on the interaction between university and industry still is limited and unambiguous when it comes to issues such as systematic data analysis and the economic consequences associated with knowledge diffusion" [5-7]. That's why it's difficult to form cooperation between these partners.

In early days, support structure for innovation by providing trained persons, research results and knowledge to university was the role of the universities but nowadays university is not only an education institution but also combined economic productivity centers [8]. While scientific knowledge means an economic enterprise and formation, distribution, and usage of this knowledge by industry become more than an issue, role of the university maybe the most significant to achieve this knowledge transfer and goal [9]. Also, Shuilong stated that cooperation between Industry-university is important for national innovation system [10]. Harhoff expressed that scientific personnel in the firms is essential for technology intensive entry [11]. That's why about 60% research projects, collaborated with university and industry, funded in U.S. by the Advanced Technology Program [12]. Governments are an indivisible part of this collaboration between industry and university. And according to Etzkowitz, collaboration between university-industry-government means Triple helix. And entrepreneurial university takes an important role to broadening academic knowledge to the partners [8]. While firms upscale their technological infrastructure, they're getting closer to the academia and profiting this knowledge. And, governments, as a ruler and public entrepreneur, fund the projects and maintain order.

According to Zhangbao and Yicai, University-industry cooperation can be classified into four; personnel training, research and development, production and operation and subject complex [13]. But Yanyan et al., classified it according to the perspective of the subject role, such as government leading mode, enterprise leading mode, universities or research institutes leading mode, and common leading mode [14].

As the late 1970s, significance of university-industry collaboration has increased [15]. Exercised policies to encourage keep up university-industry cooperation from the 1980's [16]. And need of this collaboration has been extensively highlighted in recent times [17]. And according to Chang, and Chu, there are lots of studies in various fields that expressed relationship between theory and practice [18]. From this point of view, aim of this study was to examine this relationship between woodworking industry and university in Düzce city of Turkey.

2 Materials and Methods

In this study, only one partner, industry side, surveyed to examine collaboration level between university and industry.

Also governmental side in this collaboration neglected in this study and this maybe limitation of the survey. Woodworking industry is an essential industry in Düzce city and that's why surveyed with this study. Also, Woodworking Industrial and Forest Industrial Engineering Departments in Düzce University justified the decision.

At first woodworking or furniture manufacturing firms have been identified by registry list of Düzce Chamber of Industry and Commerce. Inclusion criteria of this study have been determined as manufacturing companies. But, some of these firms were only seller and that's why excluded for survey.

Consequently total of 242 firms were identified, 154 of them provided inclusion criteria. The space of subject group calculated with following equality [19];

$$n = \frac{z^2 . N . p . q}{(N . d^2 + z^2 . p . q)} \qquad (1)$$

Where;

z : Standard errors (1.96 for 5% Confidence Interval)

N : Statistical population size

p : Probability of desired feature existence on the population (99%)

$q=1-p$: Probability of desired feature absence on the population (1%)

d : Sampling error – lot tolerance percent defective (taken as 0.02)

n : Sample size

With using formula 1, sampling size of this study was determined as 58. To improve reliability, study was conducted with 91 firms. Study has been performed with firm owners, managers or staffs who have the ability to represent the firm.

Obtained quantitative and qualitative data analyzed by IBM SPSS 21 (Statistical Package for the Social Sciences) software and visualized by tables. There were limited literature on this issue and therefore results discussed with a limited knowledge. At the end of the study a framework of benefits and obstacles summarized according to the results and suggestions were given as a conclusion.

3 Results and Discussion

3.1. Descriptive Data of Participants

This study was performed within wood working industry which is engaged in manufacturing field in Düzce province.

In order to understand industry properties and sectoral structure, some descriptive questions were asked to firm via questionnaire form. This survey also serves the purpose of determining the status of cooperation between universities and enterprises in this sector. Some of descriptive features and general ideas about companies are given in Table 1.

Scale of the firm is the one of the key factors that influencing the propensity of firms on collaborating with researches organizations such as universities and other education institutions [20-23].

Table 1. General preferences of companies

Company Characteristics Scale	N	%	Company Characteristics Operating Period	N	%	Company Characteristics Legal Structure	N	%
Micro (<10 Employees)	37	40.7	1-10 Years	22	24.2	Private	30	33
Small (<50 Employees)	35	38.5	11-20 Years	22	24.2	Limited Liability	44	48.4
Medium (<250 Employees)	12	13.2	21-30 Years	20	22	Joint Stock	16	17.5
Large (>250 Employees)	1	1.1	>31 Years	17	18.7	Un defined	1	1.1
Un defined	6	6.5	Un defined	10	10.9	**Production Type**		
R&D Department			**R&D Budget**			Job shop production	42	46.1
Available	17	18.7	Available	12	13.2	Mass production	17	18.7
Unavailable	73	80.2	Unavailable	76	83.5	Mixed production	31	34.1
Un defined	1	1.1	Un defined	3	3.3	Un defined	1	1.1
Total	**91**	**100**	**Total**	**91**	**100**	**Total**	**91**	**100**

The companies' scale information which are the subject of this study was seen in Table 1, almost 40.7% of the companies were micro scale which has less than 10 employees, 51.7% percent were small & medium scale (between 50 to 250 employees) and only 1.1% were large scale (>250 employees) companies. This result showed that woodworking companies in Düzce province consisted of generally small & medium scale companies. According to Veugelers and Cassiman, cooperation level between industry-university may be related to industry structure. If the share of SMEs (Small and Medium Sized) that are focused on non-science activities and have limited R&D portfolio is high in the structure then cooperation level should be low [24]. Furthermore according to face to face interview most of them are family companies. In the business literature, generally family business may bring some difficulties or impediment. For example, when managerial decisions are influenced by feelings about and responsibilities toward relatives in the business, when nepotism exerts a negative influence, and when a company is run more to honor a family tradition than for its own needs and purposes, there is likely to be trouble [25]. Some of the scholars give useful advice for solving these problems related with family business management. These researches mostly emphasize that requirement of turning over family member management to professional management or providing distinctive hierarchical structure [25-27].

According to the study results, those companies' operating periods' percentages were found 1-10 or 11-20 years 24.2%, 21-30 years %22 and more than 31 years %18.7. This result shows that those companies have highly experienced. In this study, companies' legal structures were divided into 3 main groups (private, limited liability and joint stock). The study results revealed that private companies were 33%, limited liability companies were 48.4% and joint stock companies were 17.5%.

Like the other industries, woodworking industry also performs their production type according to amount or properties of consumers' demand. In small amount or desired unique designed products need job shop production system. In order to reduce of production costs, mass production system is required, but this system is not suitable for variety in product. Therefore mixed production system is generally preferred by fashion oriented industries like textile and furniture. As a result of this study, almost half of the companies (46.1%) performs job shop production, 34.1% mixed production and only 18.7% mass production system (Table 1).

Lyon et al., stated that change is unavoidable and industry has to lean on research [28]. In order to improve market share and perform many activities; innovations and proper research and development (R&D) investments is essential [29].

Investing in R&D studies has a major role relationship with collaborative R&D projects. Also legal status of the firms may influence the cooperation. To understand the R & D conditions of the companies, two questions were asked to them. First one was availability of R&D department and second was R&D budget of the company. As seen in Table 1, majority of these companies don't have R&D department (80.2%). Only 17 companies (18.7%) has been established R&D department and reserved some budget for this purpose. But, solely 12 from the 17 companies have the budget for R&D.

According to East Marmara Development Agency's report, Düzce province has around 239,000,000 TL investments in woodworking and forestry industry. Furthermore, these companies achieved 22,320,000 $ export revenue in 2012 [30]. Accordingly, forestry and wood product industries in Düzce can be said that highly valuable. But this study results showed that these companies unfortunately did not give any importance to innovation and R&D. To make a verification of this judgment, some questions were asked to firm which are related with innovation and R&D. For instance; as seen above, too few companies have R&D department and some of them do not reserved a budget for innovation and R&D. In addition, only 5.5% of these companies have trademark registration, 3.3% have patent and there is no utility model registration. When it comes to quality certifications' issue, 35.2% of these companies have TSE (Turkish Standards Institution) certificate, 33% have ISO 9001 (International Organization for Standardization) certificate, 4.4% have ISO18001 certificate, 6.6% have ISO 14001 certificate and 3.3% have CE (European Conformity) mark. As seen in these results, companies have given more attention to get quality certifications. It is actually expected result since this is a public demand.

Cohen et al., reported that sales, research productivity and patenting applications of enterprises were increased due to results of scientific studies [31]. This emphasizes to importance of cooperation between university and industry. Meanwhile, this cooperation provides contributions about Intellectual and industrial property rights along with development of R&D projects.

Patents or innovations, value and stock return can be used to measure the effectiveness of the academic knowledge on enterprise performance [3]. Meanwhile, intellectual and

industrial property rights are another important indicator for companies' innovation and R&D perspective. Previous studies indicated that lost or stolen ideas and intellectual property rights were some of the most important concern in collaborative works [32]. Additionally, problem related to intellectual property is a factor that hinders an effective collaboration [33]. Herein, almost 73.6% of the forestry and woodworking companies unfortunately were unaware of intellectual and industrial property rights. Furthermore, as seen in Table 2, we found that 56% of them did not realize the importance of university-industry cooperation. Mariti and Smiley reported that notable drivers for cooperative agreements are in general cost and risk sharing [34]. Generally companies want to get utilization from cooperation as quick as possible even now. But, innumerable creative ideas couldn't have been emerged and realized or would have come to light much later [35], [36]. This is undesired but expected result of most R&D – innovation projects. This can be said that one of the most important obstacles with regards to establishment of cooperation between universities and industry.

Table 2. Awareness about university-industry cooperation and intellectual and industrial property rights

Awareness Situation of the Companies					
University-Industry Cooperation			Intellectual and Industrial Property Rights		
Aware	Unaware	Total	Aware	Unaware	
Count 40	51	91	24	67	
% 44%	56%	100%	26.4%	73.6%	
Tax Allowance Support			Refundable Government Support		
Count 33	58	91	70	21	
% 36.3%	63.7%	100%	76.9%	23.1%	

To get rid of these obstacles, Turkish public institutions and organizations provides a lot of easiness and exemption about refundable support and tax allowances. For instance; Science Industry and Technology Ministry (SANTEZ projects), Small and Medium Sized Enterprise Development and Support Administration's projects, The Scientific and Technological Research Council of Turkey's projects, Development Agency projects and so on. Besides European Union also give some similar supports. Unfortunately, this study results showed that most of the companies were unaware of these supports and exemptions, such as 63.7% of these companies were unaware of tax allowances (Table 2). Although most of the companies were aware of refundable government support (76.9%) but only 31.9% of them utilized from these supports.

According to Severson, development university-industry collaboration also depends on cultural differences [37]. Existing cultural difference between two partners must accompany the respect rather than criticism as a barrier [38]. Cultural differences between stakeholders like universities and industries based on education level. Unfortunately, uneducated employee profile was common in especially woodworking and forestry industries in Turkey. Regarding the education level of business representatives who participated in the study was seen in Table 3.

Table 3. Education level of business representatives

Business Representatives Education Profile		
Education Level	Frequency	Percent
Primary Education	28	30.8%
Secondary Education	30	32.9%
Bachelor Degree or Higher	33	36.3%
Total	**91**	**100%**

As seen in Table 3, more than half of the company representatives were secondary education or lover degree (63.7%), only 36.3% graduated from universities. Education profiles of employees generally lower level than company representatives. Inadequacy of education level is an important difficulty with regards to initiate innovative projects and enables to establish cooperation between university and industry. Uneducated staff may not understand some new applications, innovation or project details, especially if the cooperation is based on academic research and knowledge. Moreover, in preliminary steps of the new projects, education level becomes more important since a literature review is especially needed to determine the previous studies. Workers with low education levels can fail at this step of the project. So university-industry cooperation can contribute to overcome this problem. A lot of previous study showed that public researches provide substantial contributions to industrial development, modernization or innovation in European [35], [39]. In order to get scientific publication which are related with the novel developments in industry, free access to scientific databases are vitally important [21].

To determine the reasons of weak cooperation according to company perspective, we asked questions to participants with regard to some possible difficulties. For instance; too many variation of supporting mechanism, in adequate supporting fund, university location and lack of communication, bureaucratic obstacles, industry's be against to innovation, the lack of mutual trust, inter-agency cooperation with the lack of interest and motivation, inadequate support about manufacturing by the universities and there are not enough information about success story which are about university-industry collaborations. We collected data about these possible difficulties and results were seen in Table 4.

Regarding with possible reasons about weak cooperation between university and industry, this study results showed that most of the companies did not aware mentioned possible reasons. Companies declared that they did not have idea with choosing undecided option in all possible reasons.

Table 4. Possible reason of University-Industry weak cooperation

Possible reason of University-Industry weak cooperation					
Possible Reasons		**Agree**	**Undecided**	**Disagree**	**Total**
Too many variation of supporting mechanism	Count	33	37	21	91
	Percent	36.2%	40.7%	23.1%	100%
There is adequate supporting fund	Count	19	30	42	91
	Percent	20.9%	32.9%	46.2%	100%
University location and lack of communication	Count	42	39	10	91
	Percent	46.2%	42.8%	11%	100%
Bureaucratic obstacles	Count	35	51	5	91
	Percent	38.5%	56%	5.5%	100%
Companies are inadequate to determine their requirements	Count	42	34	15	91
	Percent	46.2%	37.4%	16.4%	100%
The lack of mutual trust	Count	37	44	10	91
	Percent	40.6%	48.4%	11%	100%
Inter-agency cooperation with the lack of interest and motivation	Count	44	33	14	91
	Percent	48.4%	36.2%	15.4%	100%
Inadequate support about manufacturing by the universities	Count	32	40	19	91
	Percent	35.2%	43.9%	20.9%	100%
There are not enough information about success story about university-industry collaborations	Count	22	45	24	91
	Percent	24.2%	49.4%	26.4%	100%

As seen in Table 4, almost 40% of them chosen undecided option. When reasons were separately evaluated, it was found that there was no significant difference between the percentages of agreement and disagreement of possible reasons. Only three reasons were found relatively important. Companies' inadequacy with regard to determination of their requirements and lack of communication between universities and industries were found 46.2%; lack of interest and motivation in inter-agency cooperation were found 48.4% (Table 4). When asked to companies' assessment about status of communication adequacy of the university, 53% of these companies were found poor, almost 32% were found inadequate, only 15% of them were found that university has successful communication with industry.

All represented results above displayed that one of the main problems based on inadequate education level of staffs who were employed in woodworking and forestry industries. Nowadays, vocational and technical education in Turkey encountered crisis, including particularly woodworking related fields. That is why students do not prefer these fields. This problem is not only in Turkey but also in other countries, such as US and Europe [28], [40]. These literatures also indicated that number of students decreased due to the lack of competitiveness and innovation framework program when compared with other study programs.

4 Conclusion

This study results showed that there was weak cooperation between university and woodworking related industries in Düzce province. Furthermore, both sides of this cooperation were responsible with regards to weak collaboration. Especially companies do not care about innovation, R&D and cooperation with universities. Although a lot of problems, two major problems were found remarkable for cooperation between university and industry. First and most important one is companies' structure and managerial perspectives. As mentioned above, forestry and woodworking related companies consist of SMEs and family business. Second one is inadequate education level of companies' employee, representative or decision maker like owner, manager etc. These problems cause some impediment with regard to establishing collaborative projects. For example, family business' decision makers generally gave a biased decision regarding with family relation rather than professional perspective. Almost all strategic decisions depend on family hierarchical structure or founder's managerial vision. Therefore, projects which will benefit in the long run, may not accepted by them, like cooperation with university in R&D projects.

Companies generally focus on profit and competeveness, so they try to protect their confidential business info from early disclosure by keeping it secret. But additional costs for collaboration in a project is a major issue that surveyed firms considered. Maybe this occurs due to non-advantageous structure of furniture firms to perform a project. To overcome this problem, companies should turn over family members' management style to the professional management style and they should increase education level from the worker to the manager. Combining theory with practice accelerates the learning process, and facilitates the transfer of knowledge to the field of production. Therefore, universities also should improve some activity. For example;

- They should organize conferences related with industrial problem or state of the art developments in related industry.
- Organize some technical visits to companies.
- Higher education institutions should assign students projects or thesis that direct them to industry.
- Universities should establish project support office, test labs and communication center for industries.

We have to make sense of that entrepreneur university does not mean commercialization but it means that integration of teaching to ensure sustainable development, innovation and productivity for national and international contribution.

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6   References

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