

## **DETERMINATION OF THE PROSPECTIVE WORKS AND INNOVATIVE PERFORMANCE OF THE FIRMS THAT MANUFACTURE AGRICULTURAL MACHINES IN KONYA PROVINCE**

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### **Abstract**

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Konya province has an important role in Turkey's agricultural machinery manufacturing sector. The development in the sector has direct effect on agricultural production. In this study, it is aimed to determine the prospective activities and innovative performances of the firms which all of them are small and medium sized enterprises, exhibiting their present state. 112 firms are interviewed by using the complete inventory method in the study. The results of surveys are interpreted by the basic statistical methods such as frequency tables, percentage values and by using Likert Scale and Multiple Correspondence Analysis technic. 90% of the firms are micro and small sized enterprises. Firms are insufficient for the training, management and finance. It is determined that firms have no prospective work, the experienced firms are more innovative than the others. Parting of the firms should be prevented. The support of finance, quality, soft ware, quality personnel, consultancy in marketing and training and fair should be given effectively to the firms.

*Key words:* Turkey's agricultural machinery manufacturing sector, innovative performances, likert scale, multiple correspondence analysis, Konya

*Abbreviations:* CE Standards - Conformance Europeenne; EU - European Union; ISO - International Standards Organization; KOSGEB - Administration of Developing and Supporting Small and Medium Sized Enterprises; MEVKA - Mevlana Development Agency; R&D - Research and Development; SAN – TEZ - Industry Theses Program; SME - Small and Medium Sized Enterprises; TARMAKBIR - Union of Konya Chamber Industry and Turkish Agricultural Machines and Equipment Manufacturers; TSE - Turkish Standardization Institute; TUBITAK - Turkish Scientific and Technologic Reserach Organization

### **Introduction**

Developed countries are grown by using advanced technology, in direct proportion to achievements in science and technology. They created their technology by their own capital, using necessary technology in their manufacturing sectors so Machinery Manufacturing Sector got importance in manufacturing industry.

Agriculture and agricultural mechanization develop together with machinery manufacturing sector, which is integrated with technology. This sector comprises the design, manufacturing, sales, marketing, maintenance and repairs of the machines used in agriculture. Moreover, the sector has to follow technology and open to innovation.

This sector manufactures tractors, portable one-axed motor hoes, portable motor scythes, machines and equipment for tillaging and seed-bed preparation, sowing and planting machines and equipment, fertilizing machines, plant protection and irrigation equipment, harvesting machines and equipment, threshers, dryers, selectors, the machines and equipment for livestock husbandary, machines and equipment for crop and horticulture production (Anonymous, 2001). Moreover, Agricultural Equipment-Machinery Manufacturing Sector comprises of 13% of total Turkey's Machinery Manufacturing, which is important for presenting the sector's size (Arin et al., 2010).

All the manufacturing firms in study area are Small and Medium Sized Enterprises (SME). SMEs have an important role in economic and social development of countries since they have flexible manufacturing structure, have roles in regional development, reduce unemployment and create jobs (Alpugan, 1994).

Kara and Kalyoncu (2005) studied 98 firms that are active in machinery manufacturing sector in Konya. They found that because of the Research and Development (R&D) activities, 75% of them is in contact with the Administration of Developing and Supporting Small and Medium Sized Enterprises (KOSGEB) and only 9.5% of them is in collaboration with universities. They are convinced that cooperation between the universities and industry is weak.

In a study interviewed with 100 firms which are active in machinery manufacturing sector registered for Konya Industry Chamber, it is found that 82% of the firms employ workers below 60 in numbers, compete severely with other firms, and there is a powerful consensus and trust between providers and firms (Paksoy and Gules, 2007).

It is stressed that the agricultural machinery manufacturing sector in Konya exports 65% of Agricultural and Milling Machines exports of Turkey (Anonim, 2008).

Cansiz (2008) stated that in terms of firms numbers which are in Turkey's manufacturing sector, Turkey comes second after Italy, that Turkey comes first in worker numbers between 1 and 9 scale group, and that 90% of the firms in Turkey employ workers between 1 - 9 scale group but in developed countries this ratio is 60-83%.

There is not sufficient number of studies carried out in Turkey and the region. More studies on this subject should be carried out to develop policy and programs directed to manufacturing firms. In this study, it is aimed that to determine the prospective works and innovative performances of the firms that manufacture agricultural machines in Konya.

## Material and Method

The main material of this study is the primary data obtained from the firms that manufacture agricultural and mill-

ing machines in Konya. A face to face survey is conducted with firms' managers by researchers themselves. The data from surveys belong to 2011 year.

There are 201 firms that manufacture agricultural and milling machines in Konya region. These firms are a member of the Union of Konya Chamber Industry and Turkish Agricultural Machines and Equipment Manufacturers (TARMAKBIR).

Although study's main aim is to interview all the firm managers using complete inventory method, 48 of the firms did not accept to interview. Moreover, 29 firms to be interviewed could not be found in their addresses and 12 firms do not manufacture but only sale so in Konya region so the data for 112 manufacturing firms are analyzed.

The data entered into survey forms are transported into the SPSS package program. Tables and figures suitable for the study aim are created by helping with this program. Moreover, the data are analyzed by using frequencies, percentages and average values and evaluated.

A multiple correspondance analysis technique is used to determine the relationships between some variables which is determined in the phase that the data related to prospective works of firms are analyzed statistically. This technic is related to the statistichal analyzing technics with multiple variables such as principal component analysis, factor analysis multidimensional scaling. Therefore, multiple correspondance analysis technique is acombination of the methods with multiple variables and graphical methods (Dunteman, 1989). Thus, it gives more explanatory information about the relevant subject. Multiple correspondance analysis, using categorical variables instead of permanent ones, can be considered as the analysis of basic components which are applied to the data derived from  $p$  charecteristics of  $n$  individuals (Greenacre, 1998).

In the part of multiple correspondance analysis of this study, the variables such as *the situation of experience of the firms* (Experienced = the firms active over 20 years, Inexperienced = active under 20 years), *the situation of educational levels of firm managers* (Uni+ = Educational level is university or over, Uni- = educational level is under university), *considering of increasing capacity of the firms* (Yes = the ones that think to increase their capacity, No = the ones that do not think to increase), *the thought of firms about collaboration with universities* (there is = the ones that think a collaboration with universities, there is not = the ones that do not think a colloboaration with universities) are examined.

To carry out multiple correspondance analysis, indicator matrix is formed. The total level numbers of variables in columns of this matrix is 8 (2+2+2+2) and 112 in lines. In this case, A matrix with 112x8 in dimension is formed (Gifi,

1990; Mendes, 2002; Akturk, 2004). The analysis of this matrix is based on the matrix called as Burt Table or Burt Matrix (Gifi, 1990).

To interview easily with the ones who participate in survey above the innovative performances of the firms and to compare the variables with each other Likert Scale are used. Variables are weighted, these are multiplied by the percentages of relevant variables so scores are found and in the end their importance level are determined.

## Research Findings

### *The general situation of the agricultural machinery manufacturers*

All the firms in the study are SMEs. 32.14% of the manufacturing firms is micro sized (employ below ten personnel), 57.14% of them is small sized (employ below 50 personnel) and 10.72% middle sized (employ below 250 personnel).

General information about these firms are given in Table 1. In Table 1, all the firms are the ones that employ below 250 personnel. In other words these firms are micro, small and medium sized. Generally, firms employ 24.9 personnel in average. 81.9% of the personnel employed in the firms are workers. 18.1% of the rest employ engineers, technicians, accountants and marketing people.

Only, 32% of the firms is active over 20 years. It is remarkable that the most firms in this sector are new.

96.4% of the firms in Konya use their own capital. 23.2% of the firms are private company. The rest of the firms have partners but all these partners comprise wife, brothers and/or sisters, relatives. The ratio of off-family partnership is only 4.5%. Firms' owner is also manager of the firm in 67.9% of the firms. A professional manager is employed in 32.1% of the firms. A criterion that is important for the prospective

**Table 1**  
**General information about the firms**

Information about Firms	Value
Average personel number	24.9
The firms experienced over 20 years, %	32
Using own capital, %	96.4
Off-family partnership, %	4.5
Average age of firms' managers, years	50.9
The experience of firms' managers, years	28.7
The firms that have a wep page, %	92
Being proprietor of firm building, %	67.9
The firms managers who have a university degree, %	12.5

plans of the firms is the manager who has a university degree. 12.5% of the managers has this degree.

As the firms' other charesterstics are considered, the average ages of firms' managers is 50.9, their work experience is 28.7 years, 92% of the firms have a web site, 67.9% of the firms have own their management building and 32.1% of the buildings is rented.

The memberships of these firms to the Professional organizations are given in Table 2. Most of the firms are the member of more than one organization. 3/4 of the firms are the member of the Trade and Industry Chamber.

The product marketing situation of the firms is given in Table 3. 35.7% of the firms directly market their machines and 54.6% of them by dealers. Moreover, they market them through Agricultural Credit Cooperatives. 49.1% of the firms manufacture by order.

The ratio of the firms that store material is only 17%. Other firms can buy material when it finishes since they have financial problems. 95% of the firms sell their machines by installmensts or to be paid back in harvesting time. This causes more financial problems.

64.3% of the firms export machines, 14.3% of them also export machine parts. The data for annual sales from the firms could not be obtained so the export share of annual sales could not be obtained. 3.6% of the firms have an export unit. Although exported countries are various most of them are condensed in the country group of Balkan, Middle East, Arabic, Turki Republics and North Africa.

**Table 2**  
**The organizations that the firms are the members of them**

Organizations	%
Trade Chamber	71.4
Industry Chamber	68.7
TARMAKBIR	21.4
Craftsman's Asssocation	21.4

**Table 3**  
**Product marketing situation of the firms**

Marketing	Value, %
Direct machine sale	35.7
Sale through dealers	54.6
Manufacturing by order	49.1
Being able to storing	17
Sales by installments	95
Firms that export	64.3
Firms that export machine parts	14.3
The firms that have an export unit	3.6

**The prospective works of the firms**

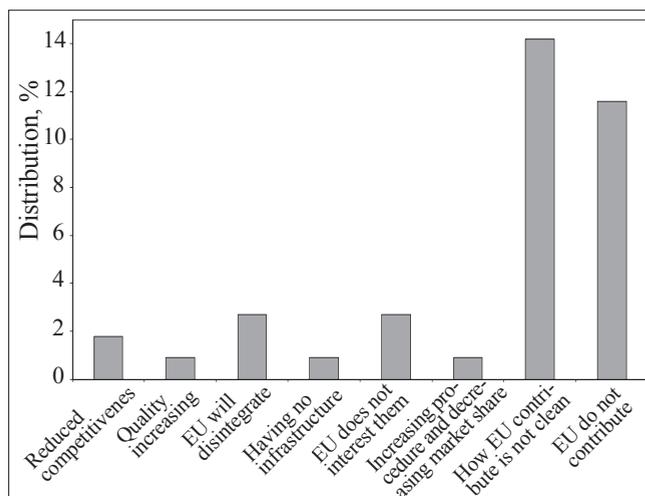
It is found that 94.6% of the firms do not think to leave their jobs, 5.4% of them think to leave their jobs on the grounds that they lack of capital, reduced market niches and high competitive conditions.

Firms do not have any net projections how turkey’s accessin to European Union (EU) affect them but 59.8% of the firms find this positive, 35.7%of the firms find this negative and 4.5% of them do not comment about it. The reasons of the firms that find it negative are given in Figure 1. As it is seen from that figure, 14.2% of the firms think how EU contribute is not clean, 11.6% of them think EU does not contribute (Figure 2).

85.7% of the firms think that they have enough information about the subjects such as Turkish Standardization Institute (TSE), machine material test, applying for patent. 24.3% of the firms do not have the quality certificates such as TSE, Conformite Europeenne Standards (CE) and International Standards Organization (ISO). 66.1% of the firms that do not have any certificate stated that they do not think to take any certificate. Only 22.3% of the firms have these three certificates.

The prospective activities of the firms are given Table 4. Approximatly, 3/4 of the firms think that they will increase their capacity and 1/2 of them expand their sales regions.

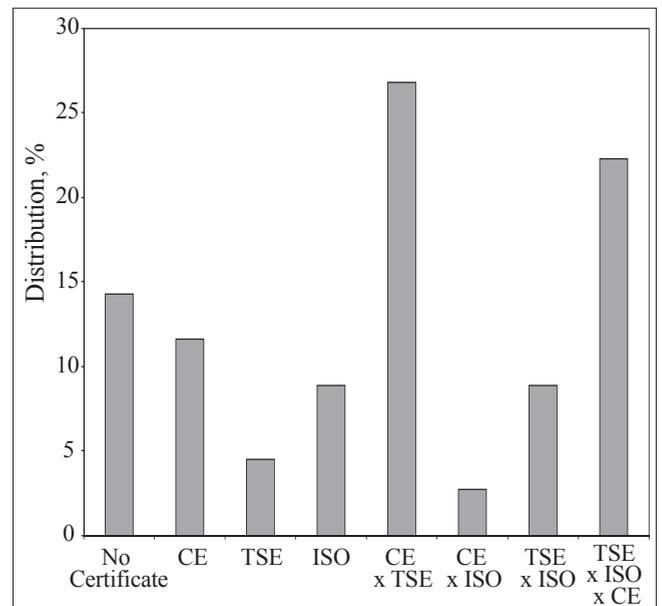
The relationship between the characteristics of the manufacturers and the prospective expectations of the firms are examined by using multiple correspondence analysis technic (Figure 3). The firms that are experiencied have the ideas for collaboration with universities and increasing their capacities. The firms that are inexperienced do not have the same ideas.



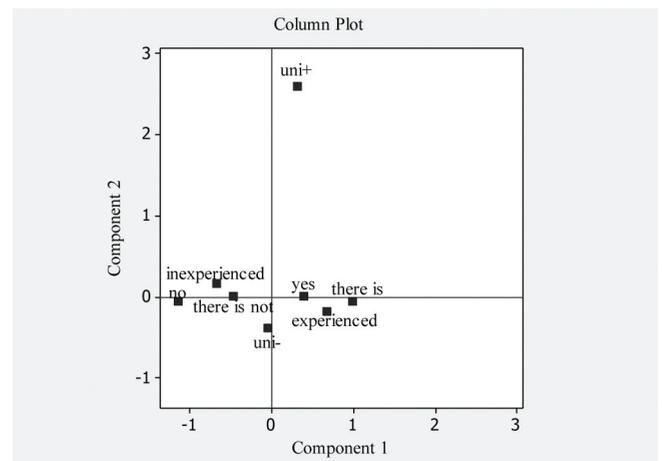
**Fig. 1. The reasons of the ones who think negative about accessin EU**

**Table 4**  
**The prospective works of the firms**

	%
The thought of increasing production design	38.4
The thought of increasing capacity	74.1
The thought of increasing sales zone	53.6
The thought of establishing R&D department	33.9
The thought of getting ISO certificate	31.2
The thought of collaboration with universities	32.1
The thought of storing	31.3
The thought of establishing an export unit within the firm	40.8



**Fig. 2. Distribution of the firms that have quality certificates**



**Fig. 3. The diagram of multiple correspondence analysis**

The relationship between the education levels of the managers and increasing capacity, and collaboration with universities is not statistically important.

### *The innovative performance of the firms*

It is found that 85.7% of the firms do not collaborate with universities, research institutes and KOSGEB. 12.5% of the firms have a project (finished or not) with Turkish Scientific and Technologic Reserach Organization (TUBITAK), Industry Theses Program (SAN-TEZ) and Mevlana Development Agency (MEVKA).

63.4% of the firms answered that they do not have any research for the question about the research of innovation of the manufacturing technologies. The rest of them, 36.6%, stated that they want to purchase machine tool directly and only one firm think to invest for a software. It is found that 83.9% of the firms that think to develop new machines do not have any activity in this subject.

It is found that 74.1% of the firms do not have any R&D unit. In this sector, there is 0.66 engineer and 0.53 technician per firms. Technical personnel work most in middle sized firms which are more in number than the others. Agricultural machinery manufacturers are not sufficient with the technical personnel and R&D. In other words they do not have sufficient quality workpower. Beside these problems, that the investments such as hardware and software require high cost is one of the biggest handicaps for giving importance to the R&D investments. Generally, 60% of the firms think that R&D activities are good but they do not appropriate resources for R&D activities.

It is found that firms do not have any national or international patent, 39.3% of them have beneficial model and industrial design certificates. There are 0.48 industrial design and 0.83 beneficial model certificate per firm. It can be asserted

that this situation is parallel with the situation of R&D. In these context, giving importance to R&D activities and as a result of this increasing patent numbers increase the growth, competitive power, productivity and technological level.

The firms that meet farmers needs have to design and modify different agricultural machines. It depends on firms' reaching information to do this. The ways of reaching information of firms are given in Table 5. The most important actors for the firms are costumers, fairs, rival firms, internet commercials, magazines, sales offices, universities and TARMAKBIR. Since the manufacturing agricultural machines is dependent on imitation foreign or domestic machines, the reflection of the problems that farmers faced to the firms is the first for firms reaching information. Again, in this context, fairs and rival firms follow this. That universities come the last is an important point here.

The importance of the results of the coloboration between the firms that manufacture agricultural machines are given in Table 6. It is found that the collaboration between firms is important for especially production phase and sharing information.

Firms have trade relations with each other because of raw materials and the material and parts obtained from side industry. The most important element of trust for the firms is the words promised by mutually (Table 7). The elements such as bank references, the image of the firms in the region and firms' physical charecteristics follow this (Figure 4).

65% of the manufacturing firms make promotion works and commercials. The firms that make commercials generally make demonstration from internet and regionally. Only 5.4 of the firms make promotion works and commercials abroad.

Generally, 39.3% of the firms do not participate in fairs within the country, 25% of them participate in fairs once a year and 35.7% more than once in a year. 67.56% of the micro

**Table 5**  
The ways of firms' reaching information, %

Groups	Weight	Agents for reaching information, %					Total Score* (Ranking)	
		Most important	Important	Can be important	Less important	Unimportant		No information
		5	4	3	2	1	0	
Fairs	63.4	19.6	11.6	3.6	-	1.8	437,4 (2)	
Magazines	25.9	29.5	21.4	16.1	4.5	2.7	348,4 (5)	
Sales offices	40.2	16.1	5.4	3.6	5.4	29.5	294,2 (6)	
Customers	72.3	13.4	6.3	5.4	1.8	0.9	446,6 (1)	
TARMAKBIR	1.8	6.3	10.7	7.1	15.2	58.9	95,7 (8)	
Universities	10.7	16.1	8.9	8	14.3	42	174,9 (7)	
Rival Firms	48.2	18.8	15.2	8	8.9	0.9	386,7 (3)	
Internet Commercials	62.5	8.9	3.6	3.6	0.9	20.5	367 (4)	

\*Total Score= Weight x Agents for reaching information

sized, 28.57% of small sized and 8.3% middle sized firms do not participate in fairs within the country.

75% of the firms do not participate in fairs, 13.4% of them participate in fairs once in a year and 11.6% more than once in a

**Table 6**  
**Collaboration with other manufactureres**

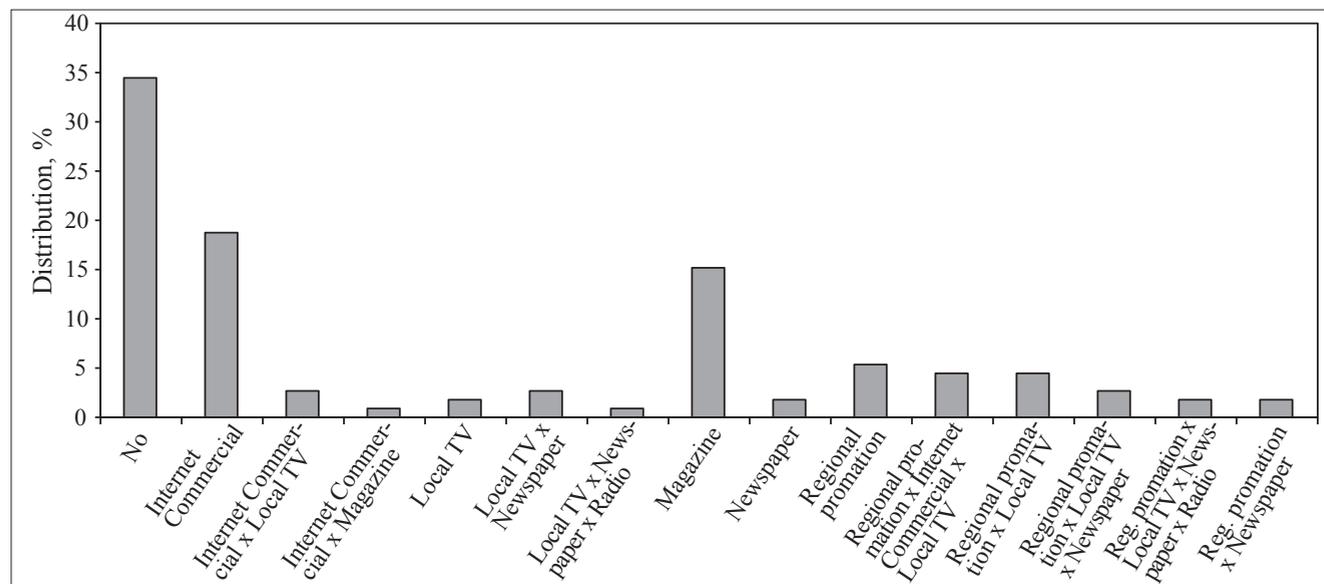
Groups	Collaboration with other manufactureres (%)						Total Score* (Ranking)
	Most important	Important	Can be important	Less important	Un-important	No information	
	5	4	3	2	1	0	
Production	17	23.2	12.5	10.7	33.9	2.7	270,6 (1)
Service	8.9	12.5	8.9	11.6	50	8	194,4 (3)
Marketing	8	12.5	4.5	6.3	58.9	9.8	175.0 (4)
Sharing information	16.1	17	16.1	12.5	33.9	4.5	255,7 (2)

\*Total Score= Weight x collaboration with other manufacturers

**Table 7**  
**Trust in relationships between firms**

Groups	Trust in relationships between firms, %						Total Score* (Ranking)
	Most important	Important	Can be important	Less important	Un-important	No information	
	5	4	3	2	1	0	
Mutual Promises	54.5	28.6	6.3	5.4	2.7	2.7	419,3 (1)
Bank references	25	17.9	18.8	11.6	23.2	3.6	299,4 (2)
Certificates firms have	12.5	14.3	20.5	8.9	35.7	8	234,7 (7)
Image and physical characteristics	18.8	18.8	15.2	7.1	33.9	6.3	262,9 (3)
Opportunist behaviors	12.5	14.3	19.6	24.1	26.8	2.7	253,5 (5)
Sharing experiences	10.7	20.5	18.8	22.3	22.3	5.4	258,8 (4)
Habits	15.2	18.8	14.3	12.5	32.1	7.1	251,2 (6)

\*Total Score= Weight x trust among firms



**Fig. 4. Situation of promotion and commercials firms made**

year abroad. 94.59% of micro sized, 68.25% of small sized and 50% of middle sized firms do not participate in fairs abroad.

## Conclusion and Recommendations

In Konya region, 90% of the firms that manufacture agricultural machines are micro and small sized. It is found that these firms are not sufficient with training, management and finance and also they do not use banking system.

68% of the firms is under 20 years in service. This situation creates competitiveness in sector and the quality problem is arisen so firms aim to reduce their production costs.

Manufacturing firms are family partnership companies. Firms do not have foreign partners. Since firms have a lot of partners, it creates disintegrating and diminishing of firms so they can not take decisions for future and growth.

Since firms owners are also managers, the ratio of the firms that have professional managers is 1/3 and the ratio of the firms that have firms owners who have a university degree is 1/8, firms have problems for future planning.

60% of the firms look positively at Turkish accession to EU. It is also positive that 86% of the firms have sufficient information about the subjects such as TSE, CE, ISO certificates, machine material test and patent application and 15% of the firms only do not have any one of these certificates. In parallel with these, manufacturing firms think to increase machine type and quantity, their market shares and to establish their own exporting unit but it seems that it is hard that firms realize these prospective plans of them but it is hard to realize the thoughts of the firms directed to their prospective plans since the 2/3 of the firms do not have the thoughts about establishing a R&D department, getting an ISO certificate, collaboration with universities. It is not easy to keep their market shares and to grow without giving importance about these subjects since taking a share from EU market of Turkey that is a candidate for EU is dependent on R&D studies in both the process of candidacy and membership. Multiple correspondence analysis results show that firms tend to increase their capacity as they get more experienced, and to make collaboration with universities

Firms' not developing a project and new product with different institutions, not having an R&D department, having a few useful and industrial design certificates show that they do not have prospective scenarios. Moreover, it shows that the level of sufficiency of the manufacturing technology of the firms should be interrogated and that they do not have their production plannings. The views of the firms about reaching information support these results.

The answers about the collaboration of the firms with other firms are remarkable because it is seen that firms make collab-

oration with each other about manufacturing and information share. This situation can be explained that 33% of the firms is micro and 57% of them small sized so it is the symptom of firms that they could not complete their institutionalization. In another words, the workshop culture is dominant in these firms. "Mutual Promises" that are the most important element in the trade relations of the firms with each other support these results.

In the light of general evaluations cited above;

- Fragmentation and disintegrating in the agricultural machinery manufacturing sector should be prevented. Otherwise, the number of micro and small sized firms will increase more in the future years. This situation is the biggest handicap for the sector development.
- The incentives of finance, quality, software, employment of quality personnel, consultancy on marketing and training and fair should effectively be given by KOSGEB to the firms that export or have potential for exporting.

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