

A MODEL

**FOR THE ASSESSMENT OF THE SECTORAL
TECHNOLOGICAL SITUATION**

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INTRODUCTION

Due to the increasing effects of the technological know-how within and upon the production process, it is necessary that countries like Turkey, who knows how to produce and is preferred in certain areas as the global production centre, become candidates for higher roles on the international production band which is gradually converging and integrating, as well as adding R&TD (Research and Technological Development) capabilities to her capabilities of production. This necessity arises from the fact that any country that does not have a certain technology “unfortunately” gives the initiative to decide on the production centre to those countries which possess that technology. It simply is not possible either to sustain an important role such as being a production centre or become a candidate for higher roles at the production band.

Technology transfer has been perceived for a long time as the way to acquire technology and then to development. However, the know-how which has been acquired through transfer of technology can only be one of the ways of acquiring technology. It is, therefore, paramount to have an infrastructure and some know-how in order to convert the transferred know-how to its derivative applications and institutionalise and manage them. Another and in my opinion the main way of acquiring technology is to possess the technology based on R&D work. That means that technological know-how should gradually be internalised and re-produced resulting in the research and technology development ability. It seems that there isn't any other way of “gaining competitive advantage due to the technological upper hand” and survive in the present world.

This (R&TD) process is not a linear but a complex and interactive spiral. It may also be the chance the lagging countries like ours have got. It is observed that the countries generally grasp this complex road in order to gain these abilities, apply the supporting means within the framework of the “national science and technology policies” through a “national innovation

system” and diversify those activities according to the needs. This study may be regarded as a contributing step towards this conceptualization and diversification of means of support. Development of a methodology which is more suitable to our own conditions and aiming an “assessment of the present sector technological situation” has therefore been attempted here.

That the model focuses on those sectors where the R&D processes have intensified is a conscious choice, the aim being the establishment of our “assets” through a dynamic assessment of the situation at the sectors where there exists comparative technological advantage(s). The term dynamic expresses the technological trends likely to shape the future and the dreams about them, as well as the complexity and liveliness of the variety of the process itself. As the objective is to grasp fully the state of affairs and to create solutions using our entire creativeness, this study develops a method which is free from any academic anxiety and directed completely towards application.

One important aspect of the model is that it is to be applied in selected areas and with selected participants. Processing of specifically collected restricted data-in-depth and reaching at more concrete results has thus been made possible. Moreover, a starting ground where the participants may control their information will be established by bringing together by means of data forms on a much wider platform all the abilities of design, design approval and technological command etc which the sub-products and the parts may contain. The further the study goes the more restricted the ground will be, resulting in the establishment of choices to focus on. There have been some previous similar studies on the area using rather shallow databases, reaching at conclusions sometimes, however, on the whole starting from the data of irrelevant parts.

Gaining a “competitive advantage based on technology” is a vitally important problem for our country, which has more than one and mutually interacting variables. Brain-power of the participants has been chosen as the most effective means to solve this complex problem. The

appropriate approach chosen here aims to bring into the open the passive information these people already possess and let them interact. The planned successive work that will follow will provide that groups will begin speaking the same language and reach a conceptual common understanding. Consequently, by unleashing – not the codified knowledge but - the tacit knowledge that those experienced people have, it will be possible to establish a meaningful base for the analysis-interpretation-solution. That the different opinions and even extreme views will be given space rather than ever-seeking a compromise will result in a diversity of solutions.

It is assumed that this study which has an objective to create a valuable resource base for many future studies will not only be a model for the other sector studies but also play an effective role within the national innovation system because of its ability of defining – by taking into account what exist and what not - the means and mechanisms of support which are in conjunction with the sector in question.

OBJECT OF THE STUDY

The objective of this study is; to improve the support programs and mechanisms, and/or to design and propose new support programs and mechanisms, as the data that the institutions that grant R&D support collect reach to certain levels where it is possible to consider the differences and the technological abilities in different sectors. This objective has been defined for the institutions that grant R&D support. It may differ according to the users of output.

AIM OF THE STUDY

The aim of this study is to determine the sectors where focusing on R&TD have been observed, and to create a dynamic technological map for each sector, through choosing and working on the companies of this specific sector. This dynamic technological map will be thoroughly investigated according to certain criteria, leading to guiding reports that will be used as means establishment of sector policies and strategies on macro and micro scales.

Micro-scale assessment reports which the participating companies may use will be produced as well as the realisation of the macro objectives such as the improvement of support programs and/or the designing of new support programs that have been referred in the previous “Objective” section.

CONCEPTUAL BASIS OF THE STUDY

The method applied here has been developed around the “dynamic” element. Being dynamic means the ability to readjust on the basis of the interaction of overlapping views of past, present and tomorrow. Being dynamic is not having the still picture of a certain instant.

What the concept dynamic explains, in this study’s context is a mode of perception/interpretation which includes

- a. Technological trends of the near future,
- b. Mutually interactive relations between the parameters over time,
- c. Flexibility to adopt to more than one choice the change may bring out.

Seen from this perspective, what is expected to be seen on a dynamic technological map is, within the framework of the basic and critical technologies of the particular sector studied, to establish dynamically the position of the companies with respect to; their ability to design and/or design verification, their command of technology (the possession and sustaining of the ability to assimilate, reproduce and develop) and, Their capacity to spread the technology and trigger the applications.

THE METHODOLOGY

The study will be realised through the individuals and institutions (**actors**) who will be effected from the results of the study, participate in and contributing to it. The means of the study are **data forms, meetings and preparing reports**.

It is intended that the study will predominantly have the objective of the improvement of the R&D support program. The participatory techniques will be employed as part of a systematic

and thoroughly defined process, which aims to direct the results to scenarios with higher probabilities. This process has been developed on the basis of the conceptual pillar of the study, i.e. the dynamic dimension. It is within this context that

- n the tacit knowledge on which the actors' insights are based will be made visible through the directing questions,
- n the diverse approaches of the actors will be put into interaction, and
- n all these will be repeated with a certain frequency.

If one wishes to explain the details of this study using a more popular language, then this study may be regarded nearer to “**forecasting**” from the point of view of focused participation and aiming to reach at higher probability scenarios; and nearer to “**foresight**” from the point of view of bringing out the instinctive approaches out to the open and interactive participation.

ACTORS OF THE STUDY

Actors of this study are

- n Companies,
- n Academicians and specialists, and
- n Concerned public and non-governmental organisations.

The companies will be chosen in accordance with the criteria listed in Appendix-3. It is requested that the participants of the second meeting (Companies' meeting) are specialists active in R&D work. And, the participants of the third meeting (Concluding meeting) are

- n Participants of the second meeting, and
- n Individuals from the strategically decision making bodies of the companies.

The main approach to the meetings at different stages is the same, and it is explained in Appendix-4.

During the selection of academicians / specialists, their relation to the sector studied and their experience in the R&D support programs. Academicians/specialists will be attending to the first meeting (academicians' meeting) and the third meeting (concluding meeting).

Concerned public and non-governmental organisations are those institutions that give R&D support or have R&D activities. These actors will be attending the third meeting (concluding meeting). It is requested that their representatives are specialists taking part in support activities and high-level leaders. The study will be executed under the leadership of one of the public and non-governmental organisations.

STEPS OF THE STUDY

Study work-flow is presented at Appendix-1.

1. The selection and classifications of sectors with R&D intensification:

If the sector is big, then this stage may be done by first sub-grouping and then choosing, on the basis of the projects for which there are applications for R&D support. (Responsible: Institutions which grant R&D support)

® **Output-1:** List of Sectors

The definition of **Sector** is based on the final product. The group of companies which are taking part in the production chain are regarded as a sector.

2. Developing criteria to determine the sectors to work upon:

The R&D intensification, technology based networks are verified by bringing their “forwards and backwards” connection with technology. The developed criteria are given in **Appendix-2**. (Responsible: Institutions which grant R&D support)

® **Output-2:** The criteria for sector selection

3. Sector selection:

It is determined according to Output-2. (Responsible: Institutions which support R&D)

® **Output-3:** The sectors to work upon

4. **The development of selection criteria for the companies of the sector:**

The criteria are given in **Appendix-3**. (Responsible: Institutions which grant R&D support)

® **Output-4:** Company selection criteria.

Selection of companies:

This is done according to Output-4. (Responsible: Institutions which grant R&D support)

® **Output-5:** Participant companies

5. **Preparation of data forms:**

(Responsible: Institutions which grant R&D support)

The data form which is given in **Appendix-5** has three tables which are formed in two stages:

Table 1 investigates the company's level of acquisition of technology on the basis of sub products and its future plans. (See Stage 1 / Table 1 + Stage 2 /Table 2) It is requested that in product tree one does not go lower than the level where critical technologies intensify (this is not valid for process technologies). Certain categories have been developed in order to understand the level of acquisition of technology. These are;

Purchase of ready technology from the Licensor Company or its procurer;

Production of the product by having the Manufacturing Data Package (MDP) and Technical Data Package (TDP); or, having MDP and TDP but outsourcing the production.

C-Design or design verification capability of the company; or capability to co-design and outsourcing the production; capability to production process and/or conceptualising it.

As one may follow, the technological capacity increases from A to C. Table 1 questions also the criticality of the product design/design verification. This "criticality" is related to role of the "design of the concerned sub-product" in the final product. If the company does not have the ability to design then it is also requested that the company presents a plan for future acquisition of the design ability.

Table 2 (See Stage 1 / Table 2 + Stage 2 /Table 2) investigates the technological areas concerning the products and searches for the company's command of technology on the basis of the subsequent product-technology matrix and planning of the process of acquisition of technology for those areas in question.

Explanations from the each company are requested on the basis both the basic and critical technologies concerning the product. Therefore it is requested that the explanations should be given at the end-columns by writing the name of the technologies. Sometimes the basic technologies are already acquired but there is a request for a plan for acquisition of the critical technology or perhaps there is not such a need. A sometimes the basic technology hasn't been acquired therefore there will be a process of acquisition. All these cases should be explained clearly.

Table 3 asks the company's relation with the procurer on technology (See Stage 1 / Table 2 + Stage 2 / Table 3). Here data concerning the sharing and dissemination of technological know-how will be collected. The information on the two columns about the stages in Table 1 should be given here.

Consequently, it will be possible to see, following these three tables, the company's technology found on its product tree, its command of technology in the critical areas for the sub products and where it stands in a certain hierarchical classification of acquisition of technology, and its plans to improve the process of acquisition of technology, its abilities and connections with **the suppliers (tiers)**

® **Output-6:** Data forms

6. Filling the Data Form and/or preparation of the report by the specialists (technology analysts) on the technological base of the company.

(Responsible: Companies)

Filling the Data Form will be done in several stages. First, each participant company will be requested to fill in the separate columns (technologies) and rows (products). This information will be organised into a ready-to-fill form with headlines in rows and columns. This unique empty form will be used as the Data Form in the study. As the Data Form has conceptual meanings to be disclosed and clarified face-to-face meetings with each company will be preferred at this stage.

® **Output-7:** Data and/or reports.

7. Selection of the participant academicians:

(Responsible: Institutions which grant R&D support)

They will be selected from the arbitration pool of the institutions giving the R&D support, in accordance with their relations to the sector and the experience they have acquired during the process of giving R&D support.

® **Output-8:** List of participant academicians.

8. Preparation of confidentiality clauses:

(Responsible: Institutions which grant R&D support)

® **Output-9:** Confidentiality clauses

9. Unification of Data Forms:

In order that company forms become sector information all data is unified in a single form.

(Responsible: Institutions which grant R&D support)

® **Output-10:** Unified Data Form and completed data

10. Preparation of the questions to be asked to participant academicians and posting them together with the unified form:

(Responsible: Institutions which grant R&D support)

® **Output-11:** Questions to the academicians

11. Preparation towards the adoption of the meeting procedures for the academicians' meeting:

(Responsible: Institutions which grant R&D support and academic support)

® **Output-12:** Meeting procedures

This will be a method to unleash the academicians' passive knowledge about the sector in question given a certain framework within a certain time limit. The information about this is given in Appendix-4.

12. Academicians' Meeting:

(Responsible: Institutions which grant R&D support and academic support)

® Output-13: Comments and debate

13. Preparing an intermediary report assessing the academic debate and sending it to the companies:

(Responsible: Institutions which grant R&D support and academic support)

® **Output-14:** Intermediary report (I)

This report is the unification of the academicians' views on the basis of the "unified sector data" and their "own passive knowledge" for the benefit of the aims of this study.

14. Preparation towards the adoption of the meeting procedures for the companies' meeting:

(Responsible: Institutions which grant R&D support and academic support)

® **Output-15:** Meeting procedures

This will be a method aiming that companies discuss their own strategies for technological development on the basis of the prepared report and in comparison with the other companies.

15. Companies' meeting:

(Responsible: Institutions which grant R&D support and academic support)

® **Output-16:** Comments from the meeting

16. Preparing a report assessing the companies' meeting and sending it to all actors:

(Responsible: Institutions which grant R&D support and companies)

® **Output-17:** Intermediary report (II)

17. Preparation towards the adoption of the meeting procedures for the concluding

meeting: (Responsible: Institutions which grant R&D support and academic support)

® **Output-18:** Meeting procedures

This is the last meeting where the interaction and participation plays primary role and the decisions are taken by all the actors together. The method of the meeting ensures that the participants put forward the necessary strategy for the sector, assessing the outer world aims; and bring proposals towards the establishment of necessary technology policies for these strategies.

18. Last meeting with all the participants:

(Responsible: Institutions which grant R&D support)

® **Output-19:** Final Report

Preparation before the meetings is important in order to have the expected outputs. Therefore, preparatory discussions with the participants are held before the meeting where the information accumulated during one stage and the questions derived from them are presented to the participants before the next stage.

FURTHER STAGES OF THE STUDY

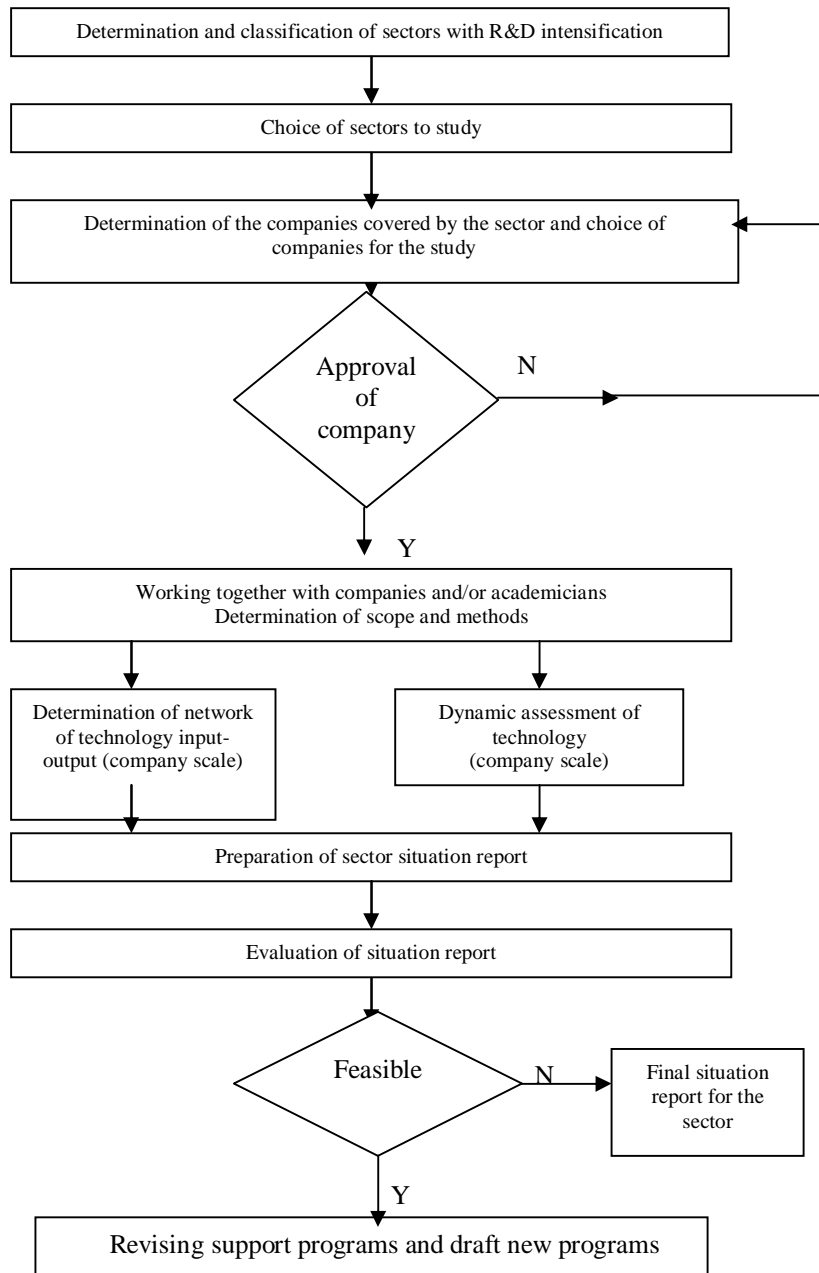
The comparative seeking of technology acquisition should continue parallel to the main study and the actors should also be requested to verify their strategy concerning this.

A comparative study on the levels reached by the companies from the countries of late-industrialisation by implementing R&D in a certain industrial branch, and through which processes they did this can be done and results of such a study may be utilised as

supplementary source of information for the transformation of the proposals crystallised in the third and last report into programs of action.

During the further stages of the study this method will be utilised in the other sectors as well, so that a general interpretation of the results of individual sectors will be possible.

APPENDIX-1 WORK FLOW



APPENDIX-2 CRITERIA FOR SECTOR SELECTION

What is the degree of the R&D intensification in the sector? The total number of R&D projects in the sector, their project magnitude, high-tech content in the project, any innovations, et cetera.

Do some companies/groups of companies aim the acquisition, development and spreading of the critical technologies?

Do some companies/groups of companies aim establishing “technology production centres”, “centre of excellence”, etc?

What is the level of R&D organisation of the sector? (Pre-competition common research centres, participation f.ex. in University-Industry Cooperation Centers projects.)

What is the weight and distribution of foreign partnerships or foreign investments? Is there any correlation between the situations asked in the previous questions and foreign partnerships?

Does the utilisation of a national/local resource in R&D activities in the sector constitute an important factor in the decision of foreign investors to move their R&D units to Turkey?

Can the created abilities become a national build-up and then sustained?

Have the objectives been defined and approved by the concerned / responsible institutions, politicians? (The perspectives of 5-year development plans, sector reports, SPO sources.)

APPENDIX-3 – COMPANY SELECTION CRITERIA

What is the level of technological base of the company?

Does the company improve its competitive ability within the sector by achieving advanced levels of production technologies, by improving the product quality, adding new properties to product, increasing the productivity? What is the comparative added value of its output (product, method, etc.)?

Does the company have any vision of acquisition of (new) technology, assimilate, develop and redevelop it and seek for its dissemination?

Does the company have any original knowledge in the international production relations (or in the international production band), within the sector? Does it have any vision in this direction?

Does the company transfer technology abroad, does it export any know-how?

Does the company have any organisation and management to sustain the R&D abilities it has acquired?

Does the company have any organisational ability to trigger / help create other activities through its own R&D work?

APPENDIX-4 - MEETING PROCEDURES

There isn't any single method towards bringing the tacit knowledge into the open upon which everybody agrees. The main reason for this is that tacit knowledge cannot be brought out into the open through the simple written questionnaires. Moreover, it is not possible to use the same mould to get the knowledge where perhaps several stages are required. Therefore, the meeting procedure should be rather flexible except certain few basic principles, and it should enable the moderator to swiftly introduce changes when the situation makes it necessary. However, the precondition for such flexibility is that all participants starting from the moderator come to the meeting well prepared.

Although the meeting procedures at different stages of the study are generally the same, each meeting may have its own specific aspects.

The general aspects of the meeting procedures are given below:

A. It is a type of meeting where the participants are thought to have tacit knowledge on a certain subject within the framework of a defined scope. It will be correct to have in all meetings homogenous groups of participants concerning the knowledge production or utilisation of knowledge. (The participants of the first meeting are defined as academicians; only the researchers with high technical knowledge and work in the participant company will attend the second meeting; and the last meeting's participants are defined as the decision makers (in the companies) who have the power to put these knowledge into practice.)

B. As there cannot be a single method to reach the level defined in the scope the meetings will be done in stages. These stages allow making returns when necessary. The most important point to remember in these stages is to secure utilisation of the knowledge reached at one stage in the next stage. It is the moderator's responsibility to direct the meeting towards the creation of this accumulation.

C. Due to the reasons given above, it is recommended that the meeting(s) should be viewed not only from the point of view of the work done during the meeting but also with its before and after.

i. Before the meeting:

All data are merged into one single form in order to make the company data sector data.

Questions are prepared and sent to the participants together with the unified data form so that the participants prepare themselves before attending the meeting. Written reports are requested from the participants.

Choice of the meeting place and time: The meeting will be arranged at such a place and time that the participants are kept away from their daily work.

The moderator prepares two different sets of directing questions before the discussion. One set of questions are prepared for the confirmation of already written information, filling in the missing information and eventually for the corrections. The second set questions, however, are aimed to enquire and find out; therefore some of them should be open-ended type questions.

Questions should be tried and if necessary corrected before the meeting.

ii. During the meeting:

The participants should be reminded on why the meeting is held and a short explanation should be made on the aim and scope of the meeting.

An informal atmosphere that can contribute to the group dynamics leaving aside the formalities should be established at the beginning of the meeting so that the participants feel at ease.

Basic rules on the structure of the meeting: Explanations on the types of questions (general questions or type of questions each participant is expected to answer), and that it isn't necessary to have a collective decision, that the discussion will be confidential, and that the

notes will be taken during the speeches so that a report can be prepared later, et cetera should be explained at the beginning of the meeting.

Discussions: The meeting should begin with the questions prepared by the moderator; there should not be any interference during the speeches except moments of explanation or cutting out the repeats. Speeches should be summarized when necessary referring to the speaker's own words. Moderator should let the meeting continue as planned or change its direction according to information need.

iii. After the meeting:

Results should be finalised as to make them basis for the next step. The report should include the matters agreed as well as the extreme views.

All participants should be told the summary of the findings of the meeting and contents of the report, and they should be asked whether any points made during the meeting was missing or incorrectly referred in the report (so that they are corrected).

APPENDIX-5 – DATA FORM (Tables)

To be sent to the companies for filling

Preface

When the projects supported by our institution within the framework of R&D support were classified with respect to their financial size and characteristics, the project from the Sector takes up a significant place. This makes it necessary for us to verify the depth of the support this sector receives and the R&D approaches of the supported companies more thoroughly from the point of view of realisation of our institution's objectives concerning policy of incentives. Depth of support may increase further by adoption of the aims of becoming technology production centre / centre of excellence in one or more chosen technological areas by different actors in the R&D field in the country.

The rings around the objective of becoming a technology production centre should include the development of new technologies, improving the ability to assimilate the technology and disseminate it to entire economy. There are two important points here. First, do these companies or groups of companies aim acquisition of certain critical technologies, developing and diffusing new technologies? Secondly, are the R&TD related institutions, individuals, politicians aware of these aims?

As these aims will overlap with the R&D support policies they are quite important for the creation of support criteria. That a national (local) resource is to be utilised in certain chosen R&TD activities may also be an important factor for foreign investors in their decision to move their R&D units to Turkey. From the point of view of the receiving end (country/company) of foreign investment, the contribution of the investments to technological development and to R&D activities depends on that country's (company's) ability to reach a certain technological level. It should be the common objective of all sides (actors) to assess the yield and steer the national resources accordingly.

There may be some tightening on the R&D grants to the sector in the near future due to the national/international necessities and economical restrictions and the traditional industries may fall out of the scope of support. These disadvantages can only be overcome by the increased content of higher technologies.

..... Company from main and/or supplier industry companies of sector has been selected for this study. It is expected that a dynamic technological map of the companies/ sector (such as their level of acquisition of technology, its reproduction, being a technological centre, et cetera) will be drawn and their vision will be marked at the end of this study. Turkey's technological map, opportunities and weaknesses in this sector will also be verified in this light. Another important leg of the study is the academicians who are the evaluators in the R&D support process. Using several meeting techniques the tacit knowledge of the academicians on the sector will also be collected and the results achieved will be assessed.

The attached Data Forms (Tables) have been prepared in order to make this study. Your company is expected to do the following:

First stage:

Please criticise the prepared tables (data forms) by also examining the definitions and explanations from the point of view of the projected results, and bring your proposals.

Please write down the heading of the rows (sub product groups and products). It is requested that this will be done utilising the main product tree. However, it may not result in a meaningful conclusion from the point of view of "our projected results" if the end product level (the very bottom part) is chosen as starting point to write the headings. It is therefore recommended that the headings are written by cutting the tree at points of intensification of critical technologies. This intervention may be done at different levels for different units,

sections, groups. Subsequently there will be more focusing on basic, critical technologies that are needed for the design of sub products and plans for developing the design abilities.

The headings in the rows of the tables may be filled by repeating more than once.

Please add a list of the referred technology areas and codes to the appendix of Table 2. F.ex.

Technological area for suspension: acoustics, vibration.

You may also utilise the technology codes that our institution uses. See...

Second stage:

Those tables that are filled by you and sent to our institution at the end of the first stage will be unified and sent back to your company. Please fill these finalised tables.

IMPORTANT: Please note that the participants who unified and utilised the data forms will be requested to sign a confidentiality clause.

EXPLANATIONS, DEFINITIONS, CODES

EXPLANATIONS CONCERNING THE TABLES

The objective of this study is to understand the accumulation of the companies over time and their future plans and draw a map of sector's technology map. Technology is the sum of all information, experience, and specialisation and R&D activities over a long time. Technology (from the point of view of its function in this study) should be taken as particular knowledge of the characteristic aspects and performance characteristics of the design activities of the company. Tacit, cumulative and leap nature of the technology is distinguished here. Therefore a suitable tool has been developed for this purpose. It is the data Form which consists of 3 tables given in the attachment.

In order that Data Form will yield the expected results same language should be used and a common ground of understanding should be achieved.

The concept of the acquisition of technology is important for the creation of such common ground of understanding. The **technology transfer** may be viewed in the late-industrialised countries as the most important means of acquiring technology. As to the form of transfer it

may be classified as technology transfer from country to country, from company to company, or from university or R&D institution to company. Several different definitions may follow. This detail has been omitted here. However, if we may give the definition of technology transfer as “transfer of the know-how which is necessary for the efficient realisation of industrial activities that include R&D, production, marketing, selling and post selling services from the individuals or institutions that acquire them”, it will then be seen that technology transfer is not as easy as the purchase of fixed capital (machinery and equipment) or the supply of their catalogues. The internalising of the know-how that has been acquired by technology transfer and its reproduction may be one of the ways of **acquiring technology**. However, the technology acquisition is realised only when the industrial activities contained in the term technology transfer have been transformed into its derivatives, the whole process has subsequently been institutionalised and knowledge, infrastructure (facilities, machinery, equipment, trained labour etc) and the ability necessary for the overall management are there. The second and essential way of acquiring technology is achieving the command of technology based on research and development. This means internalising the technological knowledge and achieving the ability to reproduce it by researching and developing. Capabilities of a company to convert the technology into economical value as main factor of competitiveness, to invest into future technologies, to develop or adjust technologies in order to meet arising needs, to bring together products and services with the technology in a better way and to manage all these with less costly and in a shorter time than its competitors, may be called as the company’s “**command of technology**”. It is of vital importance for the companies and exceeds a singular company under the present circumstances of production. Fast technological change leads companies to unite / merge some of their own abilities with those of some foreign sources. These sources may be universities, research institutes or other companies. It follows that, in order to reach success the companies should be at a certain

ability level. However, it may not be necessary to have all the abilities / technological resources under the same roof due to the economical, management difficulties. What is important for the company is where, how and when to get the needed “foreign resources and supports”, and to what extent. This is, in a sense establishment of an **extended company** (firm). There are extensive applications of this in the automotive and aeronautics sectors, between the user and technology procurer companies.

The capability of establishing and successfully managing networks could be a competitive advantage for a company. The networks established by the utilisation of foreign resources may be as successful as those networks company owns itself. The important factor here is to analyse the needs and correctly decide on the areas that will be reserved for foreign resources and those needs that will be met within the company itself.^(*)

Table I aims, given the information above, to show design and/or design verification ability and the company’s plans concerning the process to acquire that capacity. This process starts from the purchasing of the license from the licensor and follows a gradually rising trend to designing or capacity to verify the design.

Table II aims to show the company’s command of technology and its plan for the process of acquiring technology in order to achieve that. When pointing to the relation between the “technologies” given along the vertical axis and the “products” given at the horizontal axis, please mark only those that are regarded as basic or critical for the company. Please write only the full names of the technologies your company has command for each of the products in the column of “command of technology”. And please write the full name of the critical technologies in the column of “criticality of technology”. Technology, which is mentioned in the “plan for the acquisition of technology”, may include more than one product or it may be a production technology. Sometimes the acquisition of technology may bring with itself a

^(*) M. Akyos / The process of capacity development in technology at firm level and technology transfer. (Tr) / Sakarya Quality Association, II. Technology and quality production systems congress, Sakarya.

management technology, and sometimes the management technology itself may be a critical technology. If there is such a situation it should be explained during the filling in the tables.

DEFINITIONS (for this study)

R&TD: Research and development of technology

TDP: Technical data package. It includes technical information on the product. Such as the engineering drawings, material specifications, the product tree.

MDP: Manufacturing data package. It includes production information of the product. F.ex. the process flow and operation procedures.

Design (DE): is the activities that involve the development of the concept; planning the product development, production, marketing and post sale services; industrial and quality design, product definition, product design, design of means and processes of production, preparation and testing of laboratory models, determination of means and methods of test and verification, preparation of product configuration and documentation regarding design and tests.^(**)

The selection and installation of ready-made systems and equipment in accordance with the main design specifications is also seen as a special design work.

Design verification (DV): is the capacity to define the tests that are required for design verification, to prepare the test program and perform the most important part of the tests. It also includes the assessment of test results and the work to decide to make any changes in the design in conjunction with the test results.

Basic technologies: They are the already known and utilised technologies necessary to have for survival in the sector.^(***)

Critical technologies are:

On a national scale:

^(**) Frascati Manual, 1993.

^(***) M. Akyos, *ibid.*

- n Higher technologies those are decisive in the international competitiveness,
- n Technologies those are decisive for country's self-sufficiency, especially for the national defence industry,
- n Technologies regarded as "speeding factor" in the areas of application that are important for the national economy, (***)
- n Generic technologies that affect almost all range of economical activities,
- n Technologies that are fertile ground for the birth of new and original technologies and new products.

On a company scale,

- n Technologies with long time of relevance (leaving aside those technologies that are already known, acquired or easy to acquire for the product in question), higher technologies that give a competitive edge, technologies that create the conditions for the birth of new and original technologies and products.

Lower technologies: technologies that have no R&D inputs...

Higher technologies: technologies with the highest R&D input, "extreme" technologies...

TECHNOLOGY CODES

May be developed by the company, or the technology codes of institutions that give R&D support may be utilised.

(***) This definition is taken from the statement of reasons of the decision (20.12.1999 No: 99/02) of STHC (BTYK). The term speeding factor actually belongs to the terminology of chemistry. One of the stages in multi-stage chemical reactions determines the reaction speed, i.e., it is also the critical stage.

SECTOR:
COMPANY:

STAGE 1 TABLE I

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

(*) Write down the sub product groups		Buyers ready made from licensor company (*) or its procurers. Specify. (*)	Has Production Know-how (TDP+NDP), Manufactures.	Has Product Knowledge (TDP). Contracts out manufacturing.	Can design and/or design verification) Manufactures. (Specify as DE and/or DV)	Designs the product (Contracts out design of production designs together. Gets it manufactured)	Develops production process or designs it.	Criticality of the design (Not much /Medium/ Much)	Criticality of design verification (Not much /Medium/ Much)	Future plans for the process of acquisition of design ability	Future plans for the process of acquisition of design verification ability
PRODUCTS	(**) SUB PRODUCT GROUPS			Answer in Table III		Answer in Table III					

THIS TABLE WILL BE UTILISED ONLY TO SPECIFY THE SUB GROUPS. TABLE I AND TABLE II SHOULD BE FILLED SIMULTANEOUSLY. A NOTE THAT WHEN MENTIONING NEW PRODUCT DEVELOPMENT THE FINAL PRODUCT SHOULD BE CONSIDERED.
 (*) The buyers or procurers (also referred to "design partner and procurer"), "design and/or manufactures and/or procurer" according to the contract's conditions. In ready product buy from the shell.

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SECTOR:
COMPANY:

STAGE 1 TABLE II

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

(*) Please write down the name of a technology in each top long cell.		RELATED TECHNOLOGIES (**)										Criticality of the technology	Future plans for the process of acquisition of design ability	Time length of acquisition of technology	
(**) Write down the sub product groups															
PRODUCTS	(**)														

THIS TABLE WILL BE UTILISED ONLY TO SPECIFY THE SUB GROUPS AND TECHNOLOGIES RELATED TO THEM.

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SECTOR:
COMPANY:

STAGE 1 TABLE III

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

(*) Write down the sub product groups		Has Product Knowledge (TDP), contracts out manufacturing. Please specify to whom?	Designs the product, contracts out manufacturing. Please specify to whom?	Designs the product together, contracts out manufacturing. Please specify to whom?	Is there any R&D activity together with the procurer? Or, is there any plan to bring and include the procurer into the R&D process?
PRODUCTS	(*)SUB PRODUCT GROUPS				

THIS TABLE WILL BE UTILISED ONLY TO SPECIFY THE SUB GROUPS AND TECHNOLOGIES RELATED TO THEM..

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SECTOR:
COMPANY:

STAGE 2 TABLE 1

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

PRODUCTS	SUB PRODUCT GROUPS		Buys ready made from licensor company (1) or its procurers. Specify. (*)	Has Production Know-how (TDP+MDF). Manufactures. (**)	Has Product Knowledge (TDP). Contracts out manufacturing.	Can design and/or design verification. Manufactures. (Specify as DE and/or DV)	Designs the product. Contracts out design of product or designs together. Gets it manufactured	Develops production process or designs it.	Criticality of the design (Not much /Medium/ Much) (***)	Criticality of design verification (Not much /Medium/ Much)	Future plans for the process of acquisition of design ability (****)	Future plans for the process of acquisition of design verification ability (****)
						Answer in Table II		Answer in Table II				

(*) This may also be interpreted as 'response to design partner and procurer', 'design in order to buy' and to 'procurer' according to the partner's structure of the ready product purchased by the user.
 PLEASE NOTE THAT TABLE I AND TABLE II SHOULD BE FILLED FOR ALL TABLES.
 A NOTE THAT WHEN EVALUATING NEW PRODUCT DEVELOPMENT, FINAL PRODUCT SHOULD BE CONSIDERED.

SECTOR:
COMPANY:

STAGE 2 TABLE II

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

		RELATED TECHNOLOGIES (*)												Criticality of the technology (**)	Future plans for the process of acquisition of design ability (***)	Time length of acquisition of technology
PRODUCTS SUB PRODUCT GROUPS															

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SECTOR:
COMPANY:

STAGE 2 TABLE III

A STUDY FOR ASSESSMENT OF THE SECTOR'S TECHNOLOGICAL SITUATION

		Has Product Knowledge (TDP), contracts out manufacturing. Please specify to whom? (*)	Designs the product, contracts out manufacturing. Please specify to whom?	Designs the product together, contracts out manufacturing. Please specify to whom? (**)	Is there any R&D activity together with the procurer? Or, is there any plan to bring and include the procurer into the R&D process? (***)

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