Chapter 8

Selection of Priority Areas of Promotion

Chapter 8 Selection of Priority Areas of Promotion

This chapter examines which areas of technology (processing technology) or parts group should be promoted with priority in the Mexican automotive and electrical/electronic parts industries over the span of the following five years. Prior to selection, processing technologies are defined with their relative position in the context of production technology, and relations between automotive parts and electrical/electronic parts and processing technologies are clarified. Then, the method of selecting priority areas is introduced, followed by analysis and selection.

8.1 Flow of Technological Advancement in Parts Industries and Processing Technologies

As shown in Figure 8.1-1, industrial technology is divided into production technology and production management technology, both of which constitute inseparable, integral parts. In the context of production technology, the production flow moves from left to right, linking R&D, tooling technology, processing technology or essential technology, components assembly to complete the parts production process. On the other hand, industrialization in the country follows an opposite course, starting from components assembly technology, then processing technology, tooling technology, and finally reaching R&D technology.

Classification of technologies in Figure 8.1-1 is explained in detail in the following sections.

8.1.1 Production Technology

(1) Components assembly

Technology to assemble parts purchased (imported) from various sources into components on an assembly line. At the initial stage, components assembly operation starts by introducing foreign technology (and capital in some cases).

(2) Processing technology (Essential technology)

Technology to process materials into parts, also called processing technology. here, processing technology is further divided into "finishing and treatment" and "material processing."

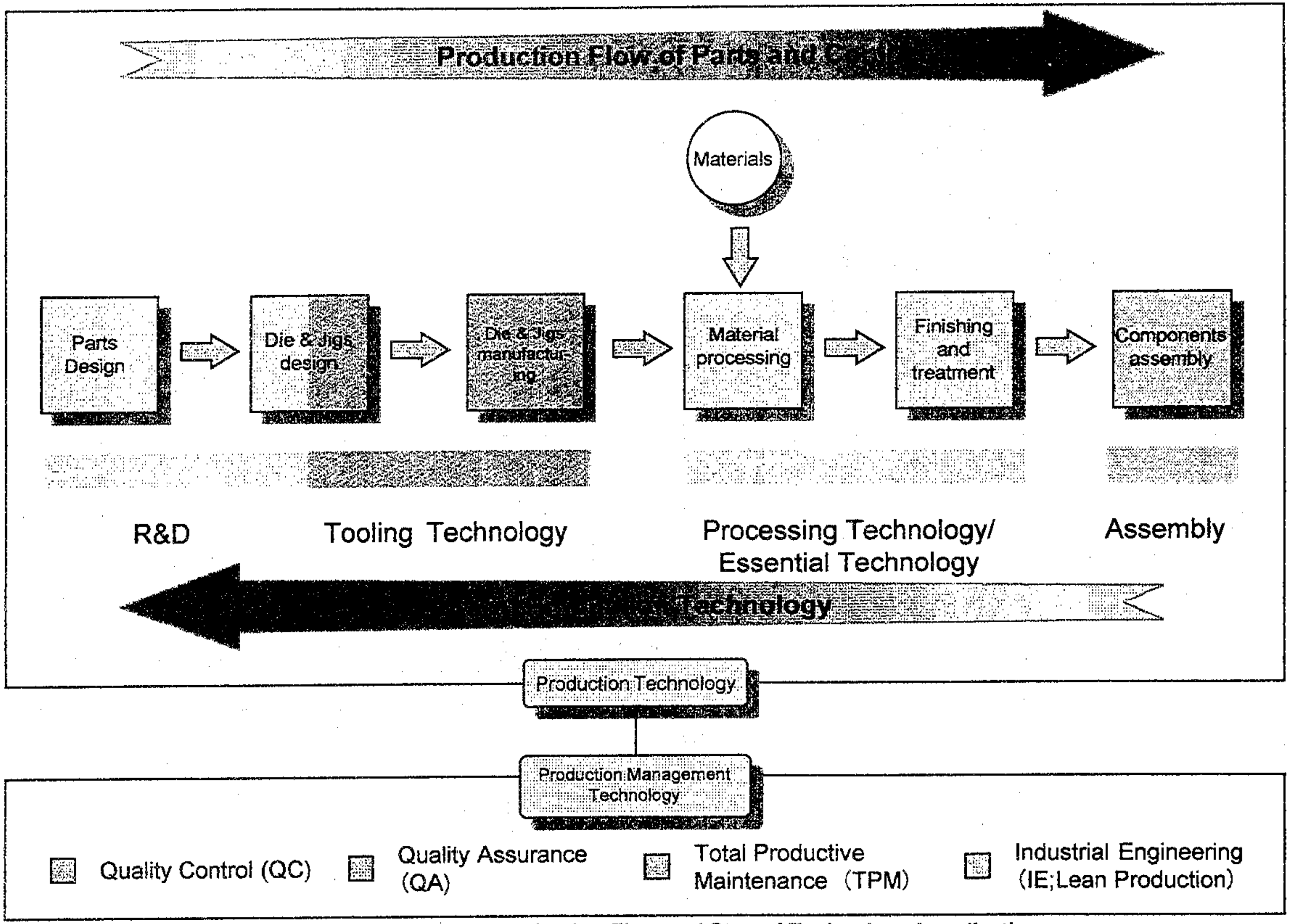


Figure 8.1-1 Production Flow and Step of Technology Localization

1) Finishing and treatment

Technology to process materials into final products through heat treatment, machining, and surface treatment, including the following processes:

- Heat treatment
- Surface treatment
- Electro- and nonelectro-plating, gilding
- Machining including electric discharge
- Printing
- Painting

2) Material processing

Technology to process materials into a specific shape by using some forms of die or mold (sand mold, stamping die, injection mold).

- Casting (including die casting)
- Forging
- Press work
- Injection molding
- Sintering

3) Other processing technologies

- Surface mounting technology (SMT)
- Soldering
- Wiring
- Adhesion
- Welding

(3) Tooling technology

Technology required to develop and design the method for making parts satisfying requirements in quality (Q), cost (C), and delivery (D) by using processing technologies, design and manufacture required jigs, mold and die, and production equipment, and layout them in the factory.

- Assembly automation technology
- Manpower saving, energy saving, and streamlining technology
- Factory layout techniques

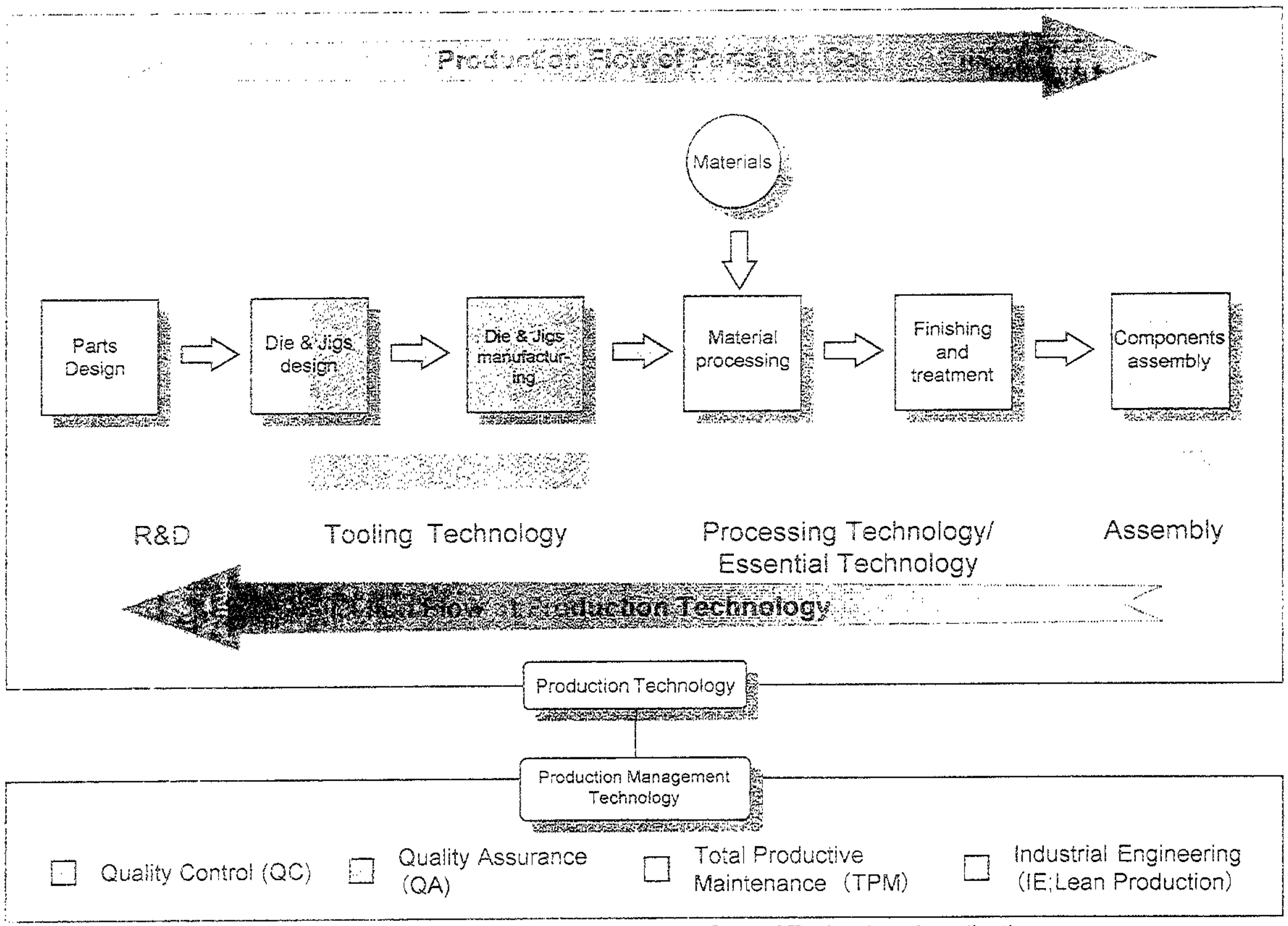


Figure 8.1-1 Production Flow and Step of Technology Localization

(4) R&D

Technology to develop parts to meet customer's needs. Technologies required for R&D, in addition to those in (1), (2) and (3), include the following:

- Material Technology
- Design Engineering - CE, etc.
- Review Technology
- Computer Aided Technology - CAE, CAD, CAM, etc.

8.1.2 Production Management Technology

Technology to effectively mobilize and manage available equipment, parts, materials, and manpower for the purpose of making parts satisfying requirements in Q, C, and D. Production management technology is roughly divided into the following areas:

- QC: Quality Control
- PC: Production Control - LP[1], TPM ,etc.
- CC: Cost Control - VE, etc.

8.1.3 Configuration of Parts and Processing Technologies

Annex 8-1 shows names of automotive components, production methods (processing technologies) and principal materials. Components of "assembling" can break down into around 20,000 parts. Machining, stamping, heat treatment, surface treatment, painting, and plating are technologies used for treatment of processed materials. Among them, heat treatment, surface treatment, painting, and plating that do not reshape the processed materials are included in processing technologies, but are not mentioned as major processing methods.

Annex 8-2 shows a wide range of electrical and electronic products by classifying them into audio/visual equipment, household appliances, and office

[1] Toyota's production management technology as called in the U.S. As its name implies, lean production means cut-throat production systems designed to reduce lead-time in each production process, bringing work in process into zero.

equipment, together with which parts groups they are using. Annex 8-3 shows detailed classification of elemental parts that belong to parts groups in Annex 8-2, and illustrate how they are incorporate into each electrical/electronic product. Finally, Annex 8-4 shows processing technologies required for manufacture of major parts.

8.2 Selection of Priority Technology Areas

8.2.1 Method for Selecting Priority Technology Areas

Processing technologies and parts groups are selected from the viewpoint of giving priority to or focusing on which technology areas for the purpose of promoting supporting industries in Mexico. The Team has established basic policy to select several areas which have highest impacts on economic and technological advancement of Mexico, rather than picking out a large number of areas without strategic focus.

The selection process proceeds in the following sequence:

1) Needs of private enterprises
To identify and rate processing technologies to be promoted for private enterprises, as identified in the visiting survey, according to importance of the needs.

2) Import substitution effect
To assess import substitution effects of technology elements by estimating costs for automotive and electrical/electronic products for each processing technology, and to determine priority areas.

3) Overall evaluation

Final screening of priority areas is carried out on the basis of analysis of the structure of parts industries in Mexico, relations with demand for secondary suppliers, and diagnosis of technological level.

Note that the process selection is based on qualitative evaluation because of no trade and production statistics available with sufficient confidence, and the lack of knowledge on assembler's intent with a comprehensive manner.

8.2.2 Evaluation Based on Needs of Parts Manufacturers

As discussed in Chapter 5.3, the Team collected needs of parts industries during the visiting survey, as to which processing technologies should be promoted in Mexico. Each enterprise was asked to select three processing technologies and rate them in order of priority (assigning three points to the first rank, two points to the second rank, and one point to the third rank), which were accumulated to obtain overall rating. Responses were obtained from 93 enterprises, from which 7 enterprises not in the automotive parts or electrical/electronic parts business were excluded, and top five processing technologies in each sector are summarized below.

Table 8.2-1 Needs of Private Sector on Processing Technology to Promote in Mexico (Top Five)

(Unit : Points)

Autoparts Sector [1]		Electparts Sector [1]		Order of Total Point	
1. Stamping	54	1. Plastic processing	61	1. Stamping	101
2. Machining	37	2. Stamping	36	2. Plastic processing	79
3. Forging	20	3. Machining	31	3. Machining	71
4. Plastic processing	18	4. Die-casting	27	4. Components assy.	38
5. Plating	16	5. Components assy.	17	5. Die-casting	36
5. Ferrous casting	16				
5. Rubber processing	16				

Note : 1) Number of valid answers - Autoparts 47, Electparts 39
Source : JICA Team Field Survey

In the automotive parts sector, forging, plating, ferrous casting, and rubber processing, which were in lower ranks in the electrical and electronic parts sector, gained high ranks. In contrast, in the electrical and electronic parts sector, components assembly and die-casting are in higher ranks. Three processing technologies are placed in high ranks for the both sectors, stamping, plastic processing, and machining.

8.2.3 Evaluation on Import Substitution Effect

The primary purpose of promoting supporting industries is to promote localization of parts and components and contribute saving in foreign currency through import substitution. To measure the import substitution effect of each processing technology, costs for finished automobiles and electrical/electronic equipment are broken down to elements for each processing technology. Note that these data are not officially available, so that the Team made rough estimation.

(1) Automotive parts

Table 8.2-2 Estimated Cost Breakdown of Parts and Components for Passenger Car by Processing Technologies (2,000cc Passenger car) [1)]

(Unit : %)

Processing Technology	Weight of Materials Used	Estimated Cost
1) Stamping	45.0	29.8
2) Forging/Bending/Machinery	22.0	7.0
3) Ferrous Casting	11.2	9.2
4) Non-ferrous Metal Processing	2.4	10.2
5) Die-casting (Al-alloy)	5.1	16.1
6) Plastic Processing	7.5	14.8
7) Rubber Processing	1.0	3.5
8) Others	5.8	9.4
Total	100.0	100.0

Note : 1) See Annex 8-5 for detailed estimation method.
Source : JICA Team's Estimate

From the above table, top five processing technologies estimated to bring high import substitution effects due to localization are as follows (excluding "Others"):

1) Stamping (29.8%)
2) Die-casting (16.1%)
3) Plastic processing (14.8%)
4) Non-ferrous metal processing (10.2%)
5) Ferrous casting (9.2%)

(2) Electrical/electronic parts

One item with the highest production volume in Mexico was selected from audio and visual equipment (color TV) and household appliances (refrigerator), and their cost breakdown for each processing technology was estimated.

Table 8.2-3 Estimated Cost Breakdown of CTV and Refrigerator [1]

(Unit : %)

Processing Technology	CTV (20")	Refrigerator (300 l)
1) Stamping	24.5	24.3
2) Plastic Processing	26.6.	31.2
3) Cutting	2.8	3.5
4) Gilding	2.1	1.7
5) Polishing	1.4	3.5
6) Painting	2.1	6.9
7) Printing	1.4	1.2
8) Adhesion	0.7	1.0
9) Casting	0.7	10.4
10) Others (Soldering, Winding)	2.8	1.7
11) SMT	28.0	10.4
12) Mold & Die	7.0	4.2
Total	100.0	100.0

Note : 1) See Annex 8-6 for detailed estimation method.
Source : JICA Team's Estimate

Top five processing technologies for the two items (excluding "Others") are as follows:

	CTV		*Refrigerator*	
1) *	SMT	(28.0%)	* Plastic processing	(31.2%)
2) *	Plastic Processing	(26.6%)	* Stamping	(24.3%)
3) *	Stamping	(24.5%)	* SMT	(10.4%)
4)	Mold & die	(7.0%)	Casting	(10.4%)
5)	Cutting	(2.8%)	Painting	(6.9%)

Note : Marked by * are duplicated each other.

8.2.4 Overall Evaluation Based on Supply and Demand and Technological Level

Overall evaluation is conducted by using evaluation results on supply and demand situation and technological level as criteria, which were obtained from the visiting survey by the Team, for selection of priority processing technologies/parts groups. Prior to selection, top five technologies based on the needs of the industries and those based on import substitution effect are compiled in the list (Table 8.2-4). In preparing the list, the following adjustments are made to convert parts name included in the import substitution effect into processing technologies:

1) SMT is included in components assembly.
2) Mold and die and cutting are included in machining.
3) Painting is included in surface treatment.

Table 8.2-4 Summary of Priority Ranking of Processing Technology (Top Five)

(Unit : Rank of Priority)

	Effective to Import Substitution			Needs of Private Sector		Total
	Autoparts	CTV	Refrigerator	Autoparts	Electparts	Points[1]
1. Stamping	1	3	2	1	2	21
2. Plastic processing	3	2	1	4	1	19
3. Machining		4		2	3	9
4. Components assembly		1	3		5	9
5. Die-casting	2				4	6
6. Ferrous casting	5		4	5		4
7. Forging				3		3
8. Non-ferrous metal processing	4					2
9. Rubber processing				5		1
10. Plating				5		1
11. Surface treatment			5			1

Note : 1) Total points are computed giving the 1st ranking 5 points, the 2nd rank 4 points, and so on.
Source : JICA Team Field Survey

(1) Ferrous casting and aluminum die-casting

Major ferrous castings for automotive parts, such as engine components and transmission cases, are already manufactured by assemblers or primary suppliers, and their localization has almost been completed. Small- and medium-sized castings such as pumps are mostly localized, including ferrous castings and aluminum die-casting, and their technological levels have reached world class, so that no technology transfer is needed.

Ferrous castings are rarely used in electrical and electronic products, while ferrous castings are used in household appliances, compressor for refrigerator and air conditioners. Those for compressors are imported for new products, and two joint ventures will reportedly enter the market in the near future. Aluminum die-casting parts are used in irons, with limited applications in audio/visual equipment, such as radiator plates of TVs (fins). Die-casting parts for irons have been fully localized. As viewed from the electrical and electronic industry as a whole, application of die-casting seems to be limited to air-conditioners and refrigerators. Considering that localization of die-casting for automotive parts has been completed, as well as given small economic impacts, there is no strong reason to select aluminum die-casting as a priority processing technology.

(2) Forging

There are around ten companies producing forgings for automotive parts in Mexico, and a half of them seems to belong to primary suppliers. Their technological level has already reached international levels. Assembly manufacturers and primary suppliers and their group companies are major users of forgings, while those not having forging shops within their own groups rely on imports. Imported forgings are crank shafts, connecting rods, truck axles, and knuckle joints, which production requires large investment, thus preventing entry of SMEs. Because the percentage share of forgings in parts cost per automobile is estimated at around 5% at maximum, and import substitution does not require many factories, thus creating relatively small technical and economic impacts, forging is rated as the processing technology with second priority.

Note that few forgings is used in electrical and electronic equipment.

(3) Stamping (press work)

Large stamping parts for automobiles (e.g., outer and inner panels, roof) are manufactured by assemblers. Primary suppliers own large presses and assembly lines to incorporate stamping parts into assemblies to be delivered to assemblers. Small stamping parts are manufactured or purchased by three types of companies: 1) those making them internally, 2) those purchasing from secondary suppliers within the same group, and 3) independent enterprises relying on import and local procurement.

Among them, priority should be given to substitution for imported parts in 3), and as automobile production increases, demand for secondary suppliers by enterprises in 1) and 2) above will emerge. The percentage share of stamping parts in total automotive parts cost is estimated at around 20% (including large press parts), which is the highest cost element for various processing technologies. Production of small stamping parts requires moderate investment affordable by SMEs and involves a large number of enterprises, it is recommended to select it as processing technology with the highest rank.

Stamping for electrical and electronic parts accounts for 25%-26% of parts costs for TVs and refrigerators, and precision and high speed stamping parts are mainly imported. In consideration to transportation cost, suppliers need to be located near assemblers, and promotion of stamping manufacturers for Maquiladora companies along the U.S. border should be given of highest priority.

(4) Plastic processing

Plastic processing parts for automobiles are mostly localized; very large parts such as fenders are manufactured by assemblers, and dashboards, console boxes, instrument panels, and door back are assigned to primary suppliers. They are located near assemblers to reduce transportation costs and avoid damage during transportation. Small- and medium-sized products are also locally available. On the other hand, precision small parts (e.g., hooks, meter pointers, gears) are imported. As automobile production increases, small plastic parts and precision parts will be increasingly ordered to secondary suppliers, making this processing technology with the highest priority. Note that the percentage share of plastic parts in the total automotive parts cost is around 10% at least.

As for large plastic parts for electrical and electronic equipment, TV cabinets and back covers are manufactured by Matsushita (Maquiladora), while Panasonic (non Maquiladora) purchases them from a non Maquiladora local company. Philips (Maquiladora) purchases from a Maquiladora local company, while many others rely on import from the U.S. There is unverified information that two foreign companies will build factories to manufacture large plastic parts in Maquiladora area.

Small and precision molded parts are mostly imported. Plastic processed parts are the largest cost element accounting for around 30% of the total parts cost for electrical and electronic equipment. In conclusion, plastic processing for electrical and electronic parts, regardless of size, is processing technology with the highest priority to target Maquiladora companies.

(5) Machining

Machining includes the process of machining processed materials that are casting or forging into parts. This is done by either manufacturers of processed materials or users who machine processed materials purchased from outside. There are manufacturers specialized in machining in Mexico, including repair shops, but there are a limited number of them, although no accurate data are available. The visiting survey for machining shops of suppliers revealed that old machine tools were used. Nevertheless, it has small economic impacts from the interest of upgrading processing technologies in Mexico, and there is no strong reason to select it as a priority area for the master plan. Instead, it is rated as processing technology with the second priority.

(6) Mold and die making

Mold and die making is classified into the machining process so far as its manufacturing technology is concerned. However, unlike general machining, die making involves sophisticated design technology which is eligible for separate consideration.

Export and import of mold and die produce a deficit for the country (not including imports by assemblers due to the lack of statistical data).

Table 8.2-5 Export/Import of Molds and Dies

(Unit : Thousand US$)

	1991	1992	1993	1994
Export	40,421	90,323	117,191	114,644
Import	138,356	221,083	216,978	254,116
Balance	(97,935)	(130,760)	(99,787)	(139,472)

Source : Anuario Estadístico del Comercio Exterior de los Estados Unidos Mexicanos, INEGI

Of total mold and die imports in 1994, plastic mold accounted for 86%, and stamping die 14%. The largest source is the U.S., followed by Japan and Germany.

The Team visited 11 companies which position machining as one of core technologies, of which 10 manufacture mold and die. 5 have metalworking shops, and others keep die/mold shops as part of plastic processing or stomping shops, mainly producing die and mold for captive consumption. In Mexico, several companies have reached design and manufacturing levels of metal stamping die for small, simple-shaped parts. Plastic mold making is lagged behind in both production and design.

As shown in Figure 8.1-5, production of processed materials is the first hurdle to be cleared by any country attempting to improve their technological level. The Team believes that Mexico has already cleared the hurdle. The next hurdle is mold/die making, followed by its design. Judging from companies the Team visited, some are about to clear the stage, while others stumble in the die making stage. Since die/mold making is one of key elements to upgrade stamping and plastic processing technologies, it should be selected as processing technology with the highest priority for strategic reasons to ensure the overall improvement of parts manufacturing technology as a whole.

(7) Heat treatment, surface treatment, plating

Heat treatment and surface treatment are often performed at shops attached to facilities of processed material manufacturers or machining companies in order to save time and cost required for transportation, or because volume quantity is difficult to attain. Among them, plating is most viable to be carried out by specialized manufacturers. While all the technologies have their own importance, their economic and technical impacts are limited in terms of positioning in the supporting industry as a whole. As a result, they should be rated as processing technologies with the second priority.

(8) PCB surface mounting technology (SMT)

Surface mounting technology (SMT) is for mounting miniaturized surface mounting devices (SMD) such as semiconductors onto a printed circuit board (PCB). Mounting is done manually in some cases, while a surface mounting machine is used for highly integrated PCBs.

PCBs are incorporated into a wide variety of electronic products such as TVs. Their manufacturing process is summarized as follows:

1) To affix a thin copper plate to a plastic insulating sheet to form a laminated sheet.
2) To print circuit patterns onto the copper plate, remove unnecessary portions of the plate by etching to complete an original board.
3) To bore holes through the board to mount resistors, capacitors, diodes, transistors, and ICs (throughhole process) to complete a PCB.
4) To insert lead wires from resistors, capacitors and other devices into the board's holes and fix them to the board by soldering. This is called SMT.

PCB imports to Mexico have been outpacing exports in the recent years except for 1993. Note that the data do not include imports by assemblers due to the lack of statistical data.

Table 8.2-6 Export/Import of PCB

(Unit : Thousand US$)

	1991	1992	1993	1994
Export	2,090	157,054	323,137	408,123
Import	37,810	249,788	317,263	464,883
Balance	(35,720)	(92,734)	5,874	(56,760)

Source : Anuario Estadístico del Comercio Exterior de los Estados Unidos Mexicanos, INEGI

Lamination of the copper plate to the insulating board is largely carried out in several countries worldwide, from which other countries import high-grade laminated sheets. In addition, production of multi-layer boards is specialty of the plastics industry to require large amounts of investment for new entry. Clearly, this deviates the objective of promoting supporting industries. At present, logic circuit design is performed by assemblers, and subsequent processes of "production of wiring boards" and "surface mounting" are carried out in Mexico. Given large demand, this area should be rated as processing technology with the highest priority.

(9) Conclusion

In conclusion, the following processing technologies and parts should be promoted with priority as supporting industries:

1) Stamping
   Small stamping for automotive parts, small and precision stamping for electrical and electronic parts

2) Plastic processing
   Small and precision stamping for electrical and electronic parts, targeting Maquiladora companies

3) Die/mold maintenance and making
   Maintenance and manufacture of mold and die for 1) and 2) above; the need for learning design theory and machining technology; strategically promoted area in a long run

4) Surface mounting technology (SMT)
   Technology for mounting electronic devices into PCBs; large import substitution effect

Chapter 9

Results of PCM Workshops

Chapter 9 Results of PCM Workshops

During the present study, a basic framework for the masterplan was developed through a series of participatory workshops by using the project cycle management (PCM) technique. This chapter summarizes the general proceeding and results of the workshops.

9.1 Workshops

9.1.1 PCM Method

PCM is a modification, achieved in Japan, of the ZOPP (objective-oriented project formulation) technique developed by GTZ (German Technical Cooperation - Deutsche Gesellschaft für Technische Zusammenarbeit) in 1983. PCM has the following three features:

1) Consistency
   - The project can be operated and managed in a consistent manner.
   - Serving as a tool to discover problems and weaknesses at an early stage of the project.
2) Logicality
   - Projects for solving problems can be formed.
   - Serving as a tool to support logical thinking, effective to prevent failure or mistake before occurrence.
3) Participatory nature
   - To allow persons representing a variety of functions and organizations to participate in the project planning and preparation process.

PCM is divided into two major stages, analysis and planning. The analytical stage consists of 1) participation analysis, 2) problem analysis, 3) objective analysis, and 4) alternative approach analysis. On the other hand, the planning stage produces project design matrix (PDM).

9.1.2 Record of PCM Workshops

During the study period, the following four PCM workshops were held at SECOFI.

February 7, 1996	Participation analysis	(37 participants)
June 13, 1996	Problem analysis I	(31 participants)
July 4, 1996	Problem analysis II	(34 participants)
September 9, 1996	Objective and alternative analyses	(39 participants)

Lists of participants are attached in Annex 9-1. The general proceedings and results of each workshop are summarized in the following sections.

9.2 General Proceeding and Results of PCM Workshops

9.2.1 First Workshop (Participation Analysis)

Date	: February 7, 1996 (Wednesday)	
Time	: 10:00 a.m. - 2:30 p.m.	Morning discussion
	2:30 p.m. - 4:00 p.m.	Lunch break
	4:00 p.m. - 5:30 p.m.	Afternoon discussion
Participants	: Mexico - 27 (including 5 advisors)	
	Japan - 8 (including moderator)	

An opinion of each participant is announced in a written PCM card at workshops. To ensure that the workshop discussions progressed smoothly, Japanese/Spanish interpreters were employed. However, the entries on PCM cards were made in English with some translation to English in case that cards are written in Spanish. Participation analysis at the workshop was proceeded as follows:

(1) To list all the individuals, groups, organizations, and associations related to supporting industries and record them on PCM cards;
(2) To select beneficiaries;
(3) To classify others into four categories, affected groups, possible implementors, decision makers, and possible financing institutions; and
(4) To identify a target group of this master plan study.

At the first workshop, intensive discussion was made in the selection of beneficiaries. The participants were to be roughly divided into two opinion groups; the one defining beneficiaries as "small- and medium-scale enterprises (SMEs) which are suppliers of parts and components," and the other believing that both SMEs and assemblers should be considered as beneficiaries by the reason why SMEs and "assemblers" are inseparable in fostering supporting industries. The participants finally agreed on the view that "SMEs" were primary beneficiaries and "assemblers" secondary ones. Then, on the condition that a beneficiary should be chosen among considerable beneficiaries, they agreed to classify "SMEs" into the beneficiary and "assemblers" into a positively affected group. Discussion on beneficiaries took long hours, and in the process, all the participants came to realize the importance of an approach to treat "SMEs" and "assemblers" as a group when developing a master plan for promotion of supporting industries.

The results of participation analysis are summarized in Table 9.2-1.

9.2.2 Second Workshop (Problem Analysis I)

Date	: June 13, 1996 (Wednesday)	
Time	: 11:45 a.m. - 3:00 p.m.	Selection of the core problem and its direct causes
	3:00 p.m. - 4:10 p.m.	Lunch
	4:10 p.m. - 7:00 p.m.	Preparation of sub problem trees
Participants	: Mexico - 22 (including 2 advisors)	
	Japan- 7 (including moderator)	

Problem analysis at the workshop was proceeded as follows:

(1) To select a core problem and its direct causes:
- Each participant selects a core problem out of those actually faced by the target group and writes it on a PCM card;
- Based on cause-and-effect relationships, a mini problem tree is developed;
- A core problem is determined; and
- Its direct causes are selected.

(2) To define the effects of the core problem.

(3) To develop a sub-problem tree for each direct cause;
- Participants at the workshop are divided into groups, a group for each direct cause.
- Based on a cause-and-effect relationship, a group constructs a sub-problem tree beneath a direct cause.

(4) To consolidate sub-problem trees into an entire problem tree.

Generally, problem analysis starts from selection of a core problem, followed by identification of its direct causes. During the workshop, however, the core problem and its direct causes were identified almost concurrently. As the scope of the study was fairly large and the workshop participants had diverse backgrounds, core problems proposed and recorded on PCM cards were equally diverse. PCM cards proposed as core problems contained direct causes too. Thus, analysis of direct causes had progressed almost concurrently with the process of identifying the core problem. Once the direct causes were identified, the effects of the core problem - the upper portion of the core problem in the problem tree - were discussed by using the PCM cards. It took three hours to identify and clarify the core problem, its direct causes, and its effects. Due to time constraint, however, the effects were not narrowed down to a tree diagram.

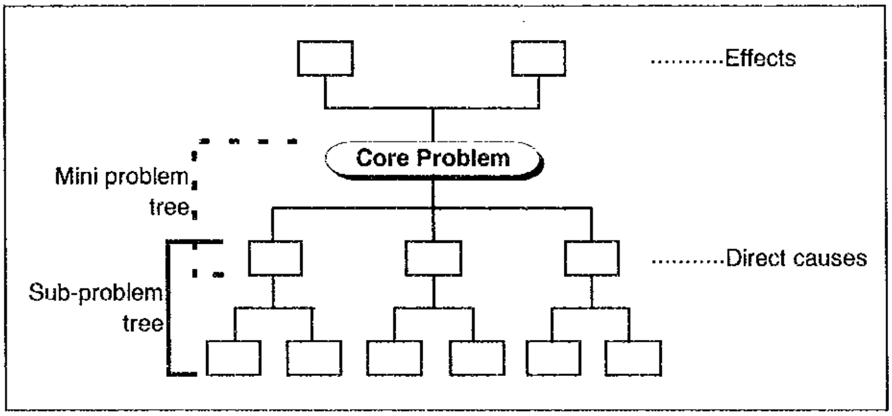


Figure 9.2-1 Structure of Problem Tree

Core problem : It is difficult to sell the parts and components manufactured by SMEs.

Direct causes : (1) There is a lack of information between buyers and suppliers;

(2) Suppliers' production capacity is too small to meet order requirements;

(3) Suppliers' production costs are high;

(4) Suppliers' products are inferior in quality; and

(5) Product delivery by suppliers is unstable in terms of schedule.

After the lunch break, the participants were divided into five groups according to the direct causes identified, and SECOFI general managers and managers acted as moderators to lead discussion in each group. While sub-problem trees were not completed due to limited time available (2 hours), important elements (cards) were mostly identified. During the last 30 minutes, each moderator reported the results of discussion made in his group showing the sub-problem tree constructed by the group.

9.2.3 Third PCM Workshop (Problem Analysis II)

Prior to the third PCM workshop, SECOFI and the Team reviewed the results of the second PCM workshop, identifying items which are not contained in the PCM cards, particularly those in technical areas, and checking and modifying wordings used in the PCM cards.

Date	: July 4, 1996 (Thursday)	
Time	: 10:30 a.m. - 2:45 p.m.	Reviewing of the core problem, its direct causes, and its effects, and development of sub-problem tree
	2:45 p.m. - 3:45 p.m.	Lunch break
	3:45 p.m. - 7:00 p.m.	Completion of the sub problem tree
Participants	: Mexico- 27 (including 3 advisors)	
	Japan- 9 (including moderator)	

At the third PCM workshop, based on both the discussion made at the second PCM workshop and the results of the review made yesterday by SECOFI and the Team, the moderator proposed partial modification of wordings of the direct causes. Then, the core problem, its direct causes, and its effects were agreed. The whole process took 30 minutes.

Modified wordings of the direct causes:

Original : (1) There is a lack of information between buyers and suppliers.

Modified : (1) There is a lack of communication between buyers and suppliers.

Original : (2) Suppliers' production capacity is too small.

Modified : (2) Suppliers' production capacity does not match buyers' order requirements.

Then, the participants were divided into five groups, each representing a specific direct cause, and each group completed sub-problem trees by spending the next hour and a half. Directors, general managers, and managers of SECOFI voluntarily acted as moderators to lead discussion in each group. Sub-problem trees completed were presented by moderators, followed by questions and answers. As elaborate discussion continued, the session took a total of three hours, or 30 - 40 minutes for each group, and finally, all the sub-problem trees were unanimously approved after some modifications.

Figure 9.2-2 attaches the result of problem analysis.

9.2.4 Fourth PCM Workshop (Objective/Alternatives Analysis)

Prior to the start of objective analysis, the problem tree developed at the second and third workshops needed to be completed. Given time constraints and a large number of participants as well as a large number of PCM cards contained in the problem tree, the Team checked the logic and wordings of the problem trees before the fourth PCM workshop to prepare the incomplete problem tree as a final draft, which was then presented to the fourth workshop participants for approval.

For the same reasons, the Team drafted a tentative objective tree diagram and alternative approaches. Since the study's primary purpose was to develop a master plan, the scope of the PCM analysis was extensive to require 176 PCM cards (only 30 - 40 cards are generally used for a specific project's problem tree). This allowed participants to the fourth workshop to concentrate group work and discuss on the clarified subjects within the allocated time frame.

Preparation works for the forth PCM workshop were as follows:

1) Completion of the problem tree
   - The Team checked the logic and wordings of the problem tree made at the third PCM workshop and completed the tree.

2) Development of a draft objective tree
   - The Team developed a draft objective tree by translating "cause-effect" relationships in the problem tree to "means-ends" relationships.

3) Classification of draft alternative approaches

- The Team classified tentative alternative approaches.

Date	: September 9, 1996 (Monday)		
Time	: 12:30 p.m. - 2:00 p.m.		Orientation on the workshop procedures, reviewing of the problem tree, the objective tree, and alternative approaches, and grouping
	2:00 p.m. - 3:15 p.m.		Lunch break
	3:15 p.m. - 5:45 p.m.		Identifying strategies and project examples
	5:45 p.m. - 6:30 p.m.		Presentation on strategy and project examples by each group
Participants	: Mexico-	29 (including 3 advisors)	
	Japan-	12 (including moderator)	

The procedure of the fourth PCM workshop was as follows:

1) Verification of the problem tree completed

2) Verification of the objective tree
   - To identify PCM cards to be added to or removed from the objective tree.

3) Selection of alternative approaches
   - To select approaches for classification;
   - To check "means-ends" relationships for each approach; and
   - To assembly selected approaches into groups.

4) Extraction of strategy and project examples for each approach (compiled for each group)
   - To complete the objective tree diagram by adding or removing PCM cards;
   - To select strategy for each alternative approach;
   - To identify one or a few project examples; and
   - To define characteristics of each project example.

Problem tree : The Team's draft was approved.

Objective tree : The Team's draft was approved by adding the expression "Enough Trust Among Partners."

Alternative approaches:

Classification into the following five approaches was approved:

(1) Technology (management) approach
(2) Technology (production) approach
(3) Manpower approach
(4) Management/administration/financing approach
(5) Subcontracting approach

After the lunch break, the participants were divided into five groups representing the above five approaches, and SECOFI staff voluntarily acted as moderators to lead discussion. Each group worked on its draft objective tree and brought it into completion by adding or removing PCM cards. Then strategy for each approach was identified and characteristics of several project examples were defined. Although the number of project examples identified was relatively small due to time constraints, each group was able to identify the overall strategy and at least one project for each approach. During the last 45 minutes, the results were presented by moderators (SECOFI staff), followed by questions and answers.

The results of the objective tree and the alternative approach are shown in Figure 9.2-3.

Table 9.2-1 The Result of Participation Analysis (February 7th 1996 at SECOFI) (1/2)

Beneficiaries	Affected Groups	Possible Implementors	Decision Makers	Financing Institutions
SMEs of parts and components suppliers	Final Assemblers	Development Banks	SECOFI	Development Banks
	Importers of parts and components	SEP (Ministry of Education)	SHCP (Ministry of Finance)	Donors
	Large manufacturers	SCT (Ministry of Transportation and Communication)	Council for SMEs	CONACYT (Council for Science & Technology)
	Current workers of parts and components suppliers	Local governments		FUNTEC (Fund for Technology Transfers for the SMEs)
	Material suppliers	STPS (Ministry of Labour)		Bilateral financing institutions
	Foreign parts and components exporters to Mexico	Technology extension service centers		Multilateral Development Banks
		CONACYT (Council for Science & Technology)		
		Universities		
		SECOFI		
		Private organizations		
		Industrial Chambers		
		Private R & D institutions		

Table 9.2-1 The Result of Participation Analysis (February 7th 1996 at SECOFI) (2/2)

Particulars
SMEs of parts and components suppliers: Small- and medium-scale parts and components suppliers in automotive and electrical & electronic industries in Mexico
Final Assemblers: Final Assemblers of automobiles and electrical & electronic appliances in Mexico
Importers of parts and components: Mexican importers of parts and components for automotive and electrical & electronic parts and components
Large manufacturers: Large-scale manufacturers in Mexico
Current workers of parts and components suppliers: Current workers of small- and medium-scale parts and components suppliers in automotive and electrical & electronic industries in Mexico
Material suppliers: Suppliers of materials for parts and components suppliers of automobiles and electrical & electronic appliances
Foreign Parts and components exporters to Mexico: Foreign parts and components exporters in automotive and electrical & electronic industries
Development Banks: Mexican Development Banks such as NAFIN and BANCOMEXT
SEP: Mexican Ministry of Education
SCT: Mexican Ministry of Transportation and Communication
Local Governments: Mexican local governments such as state governments
STPS: Mexican Ministry of Labour including vocational training centers
Technology extension service centers: such as IIE, UTT, INFOTEC, CIDESI, CIATEG, CIATEQ, CIATEJ and CICY
CONACYT: Mexican Council for Science and Technology
Universities: such as ITAM, ITESM, IPN, UNAM, CINVESTAV and IPADE
Private organizations: such as INA and AMIA
Industrial Chambers: Industrial Chambers of specific sectors such as CANACINTRA, CANIECE and CANAME including current implementors of private subcontracting promotion system
Private R & D institutions: R & D institutions in private sector
SECOFI: Mexican Ministry of Commerce and Industry
SHCP: Mexican Ministry of Finance
Council for SMEs: Council for Small- and Medium-scale Enterprises (Consejo Nacional de la Micro, Pequeña y Mediana Empresa)
Donors: Bilateral international cooperation agencies and multilateral international development organizations
FUNTEC: Fund for Technology Transfers for the Small- and Medium-scale Enterprises
Bilateral financing institutions: Bilateral development banks and funds
Multilateral Development Banks: such as IBRD, IMF and IDB

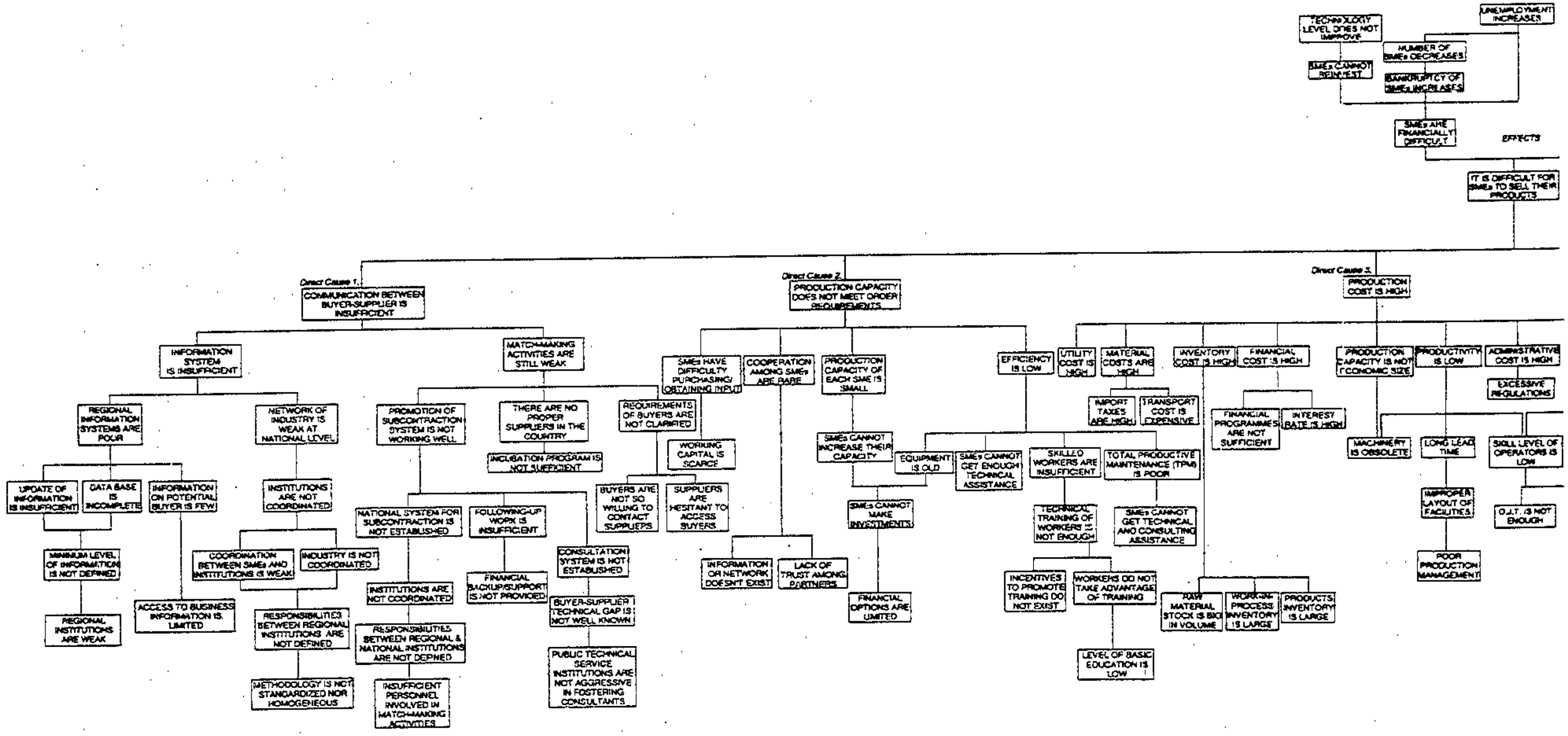


Figure 9.2-2 Problem Tree (1/2)

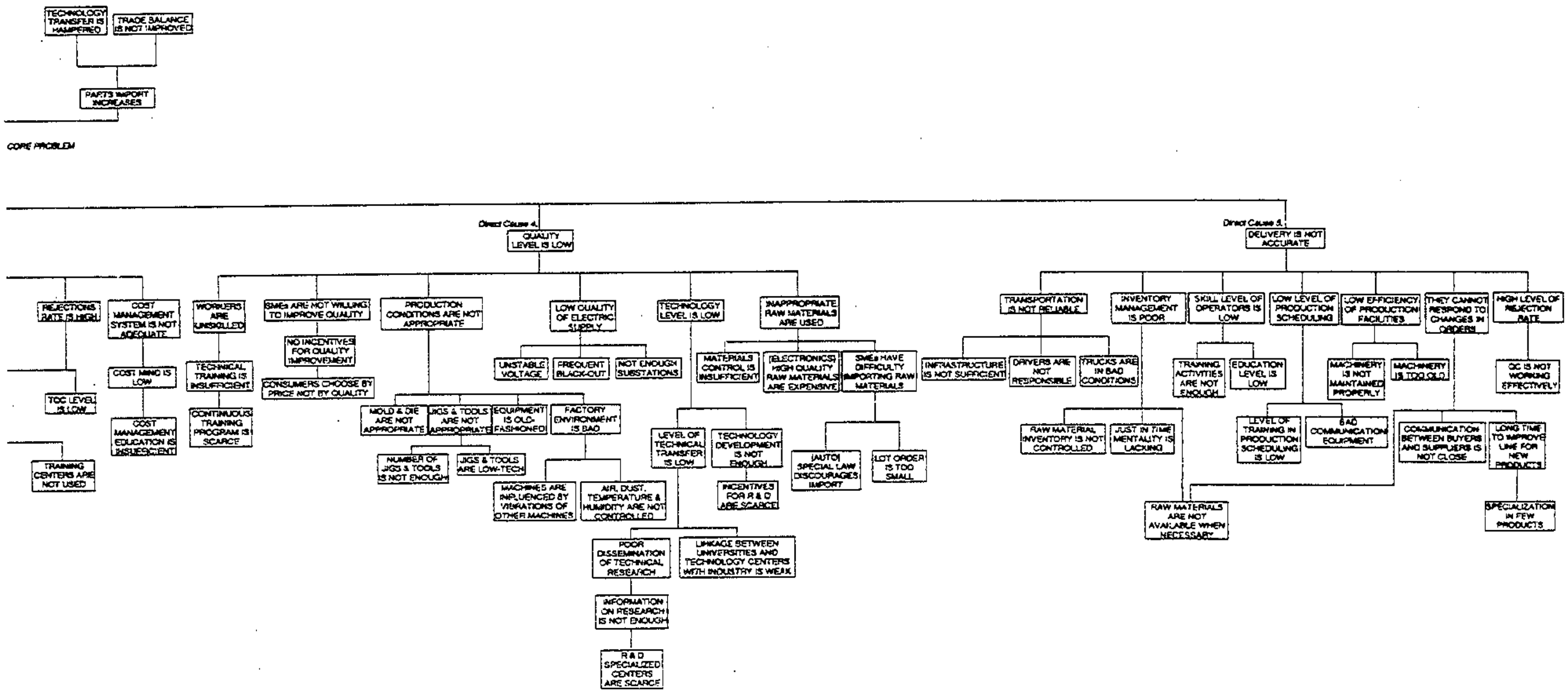
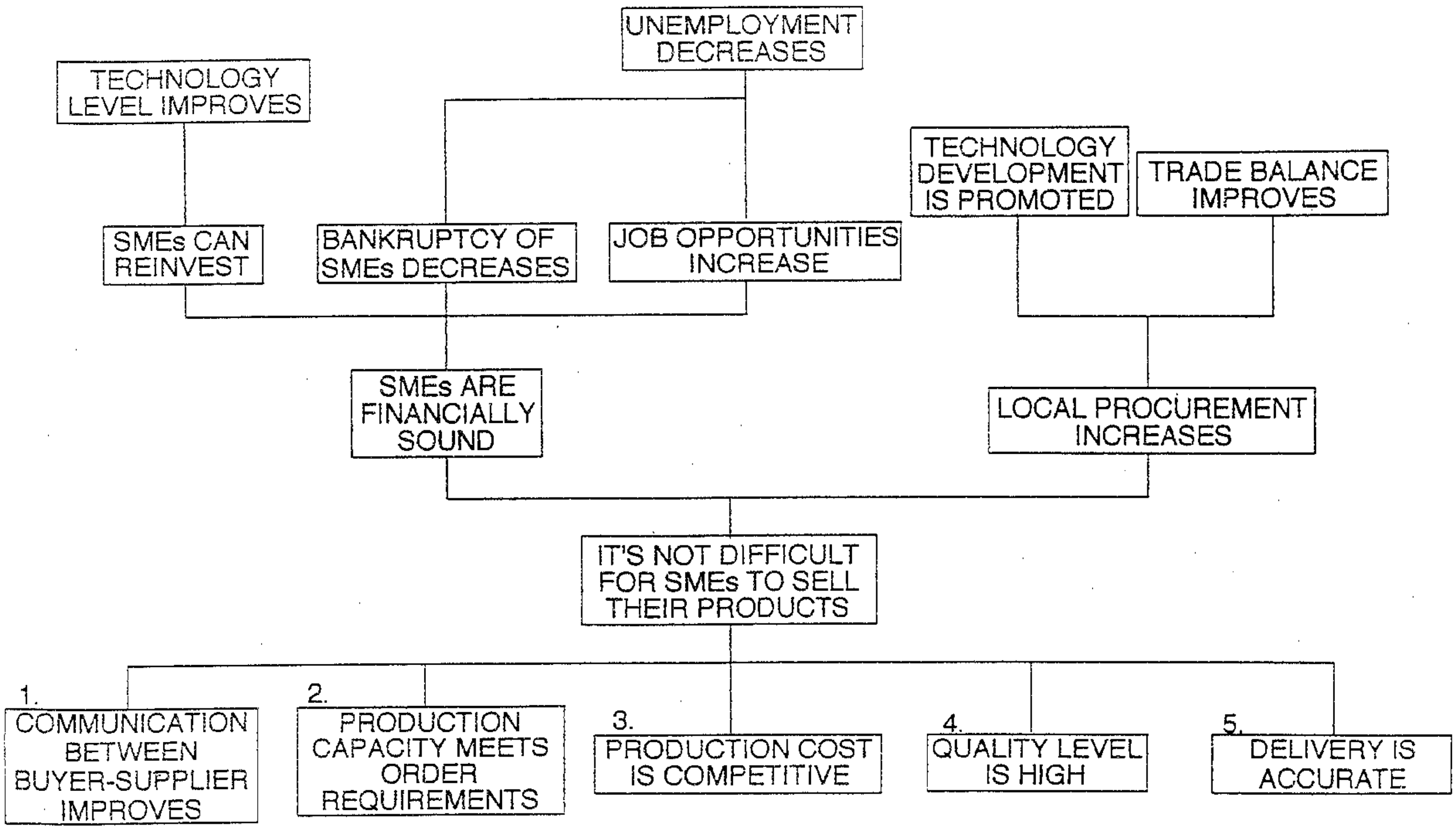
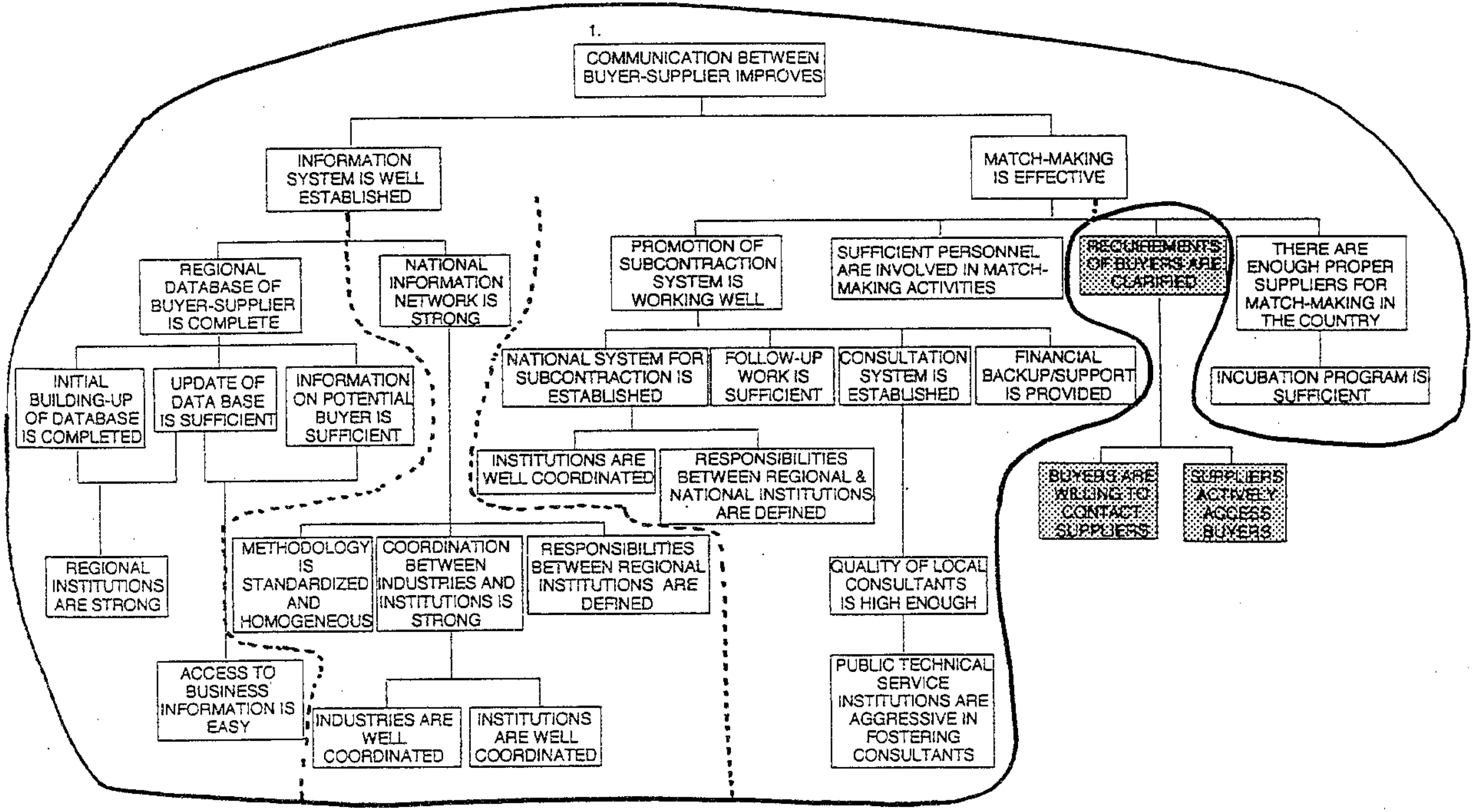


Figure 9.2-2 Problem Tree (2/2)



AN OBJECTIVE TREE
of MEXICAN SUPPORTING INDUSTRIES

Figure 9.2-3 Objective Tree and Alternative Approach (1/6)



5) Subcontracting Approach

Figure 9.2-3 Objective Tree and Alternative Approach (2/6)

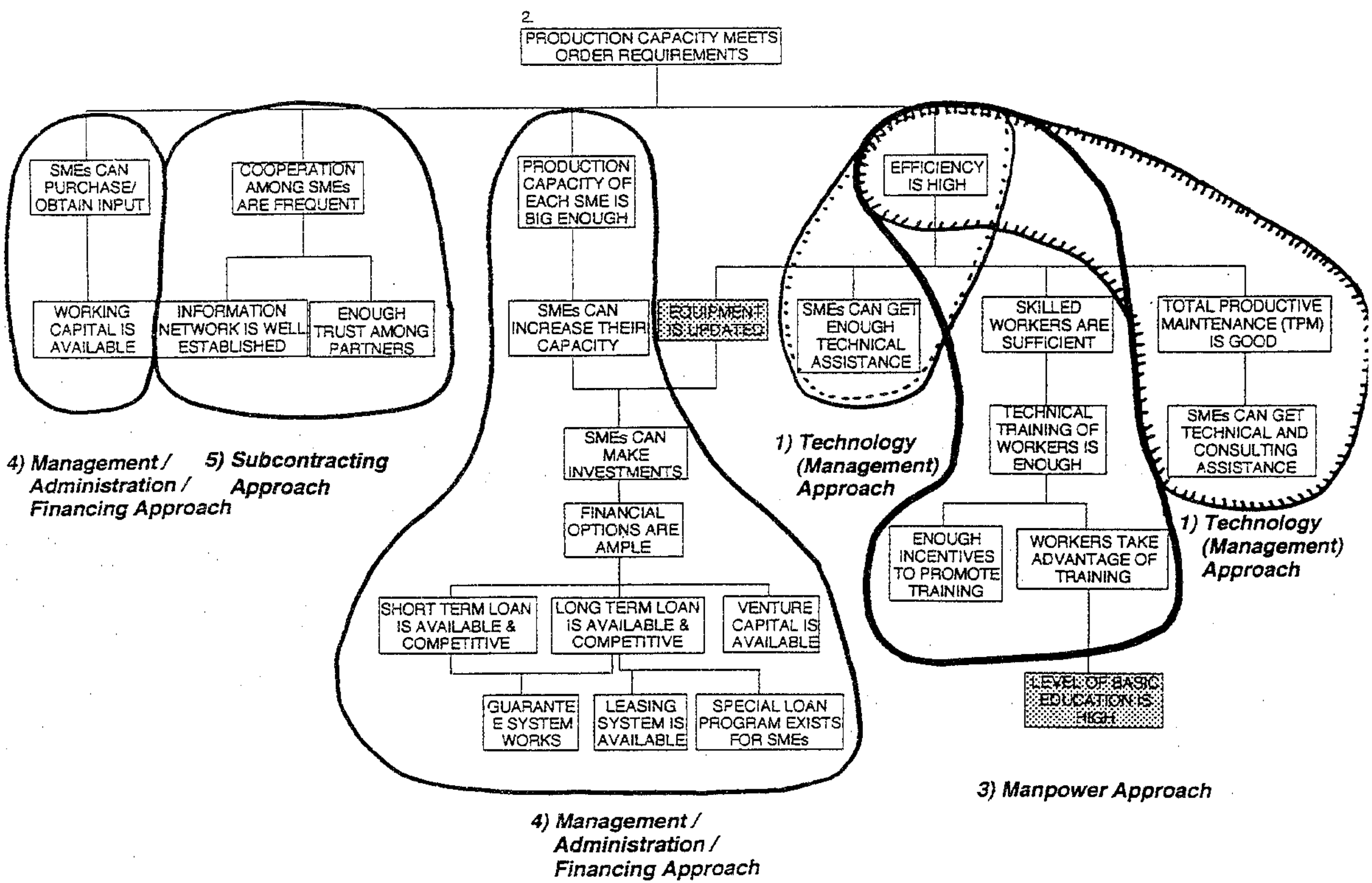


Figure 9.2-3 Objective Tree and Alternative Approach (3/6)

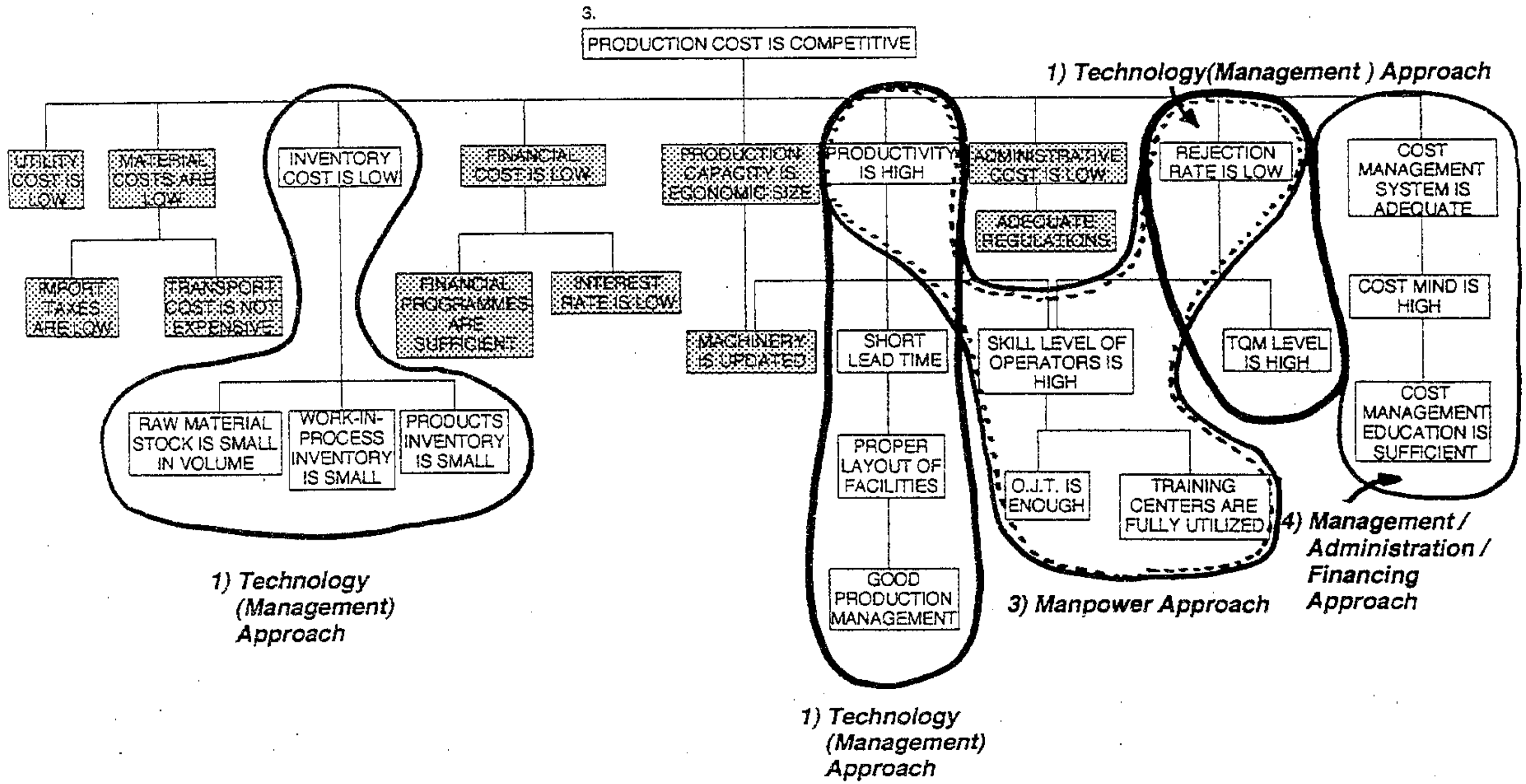


Figure 9.2-3 Objective Tree and Alternative Approach (4/6)

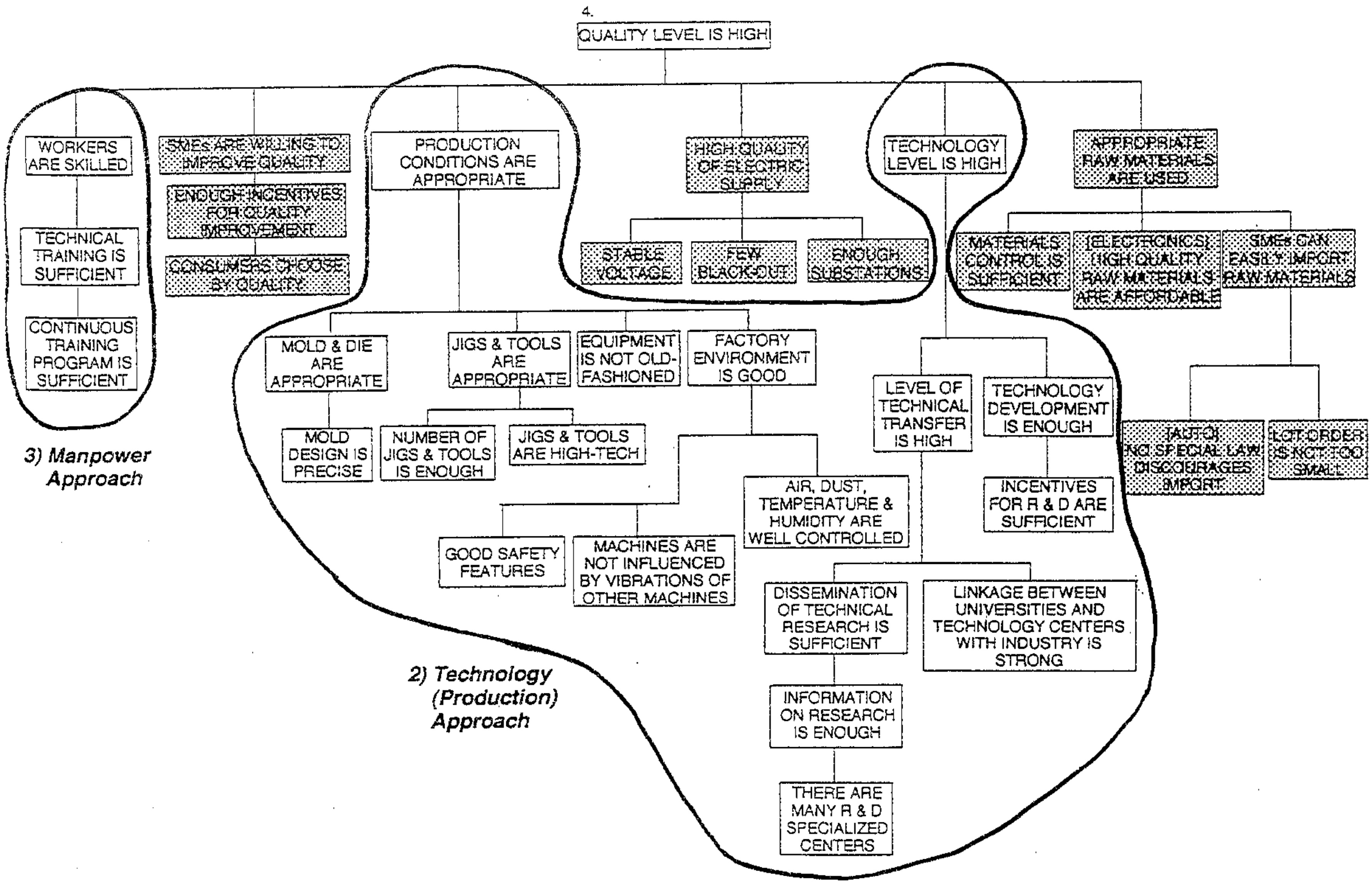


Figure 9.2-3 Objective Tree and Alternative Approach (5/6)

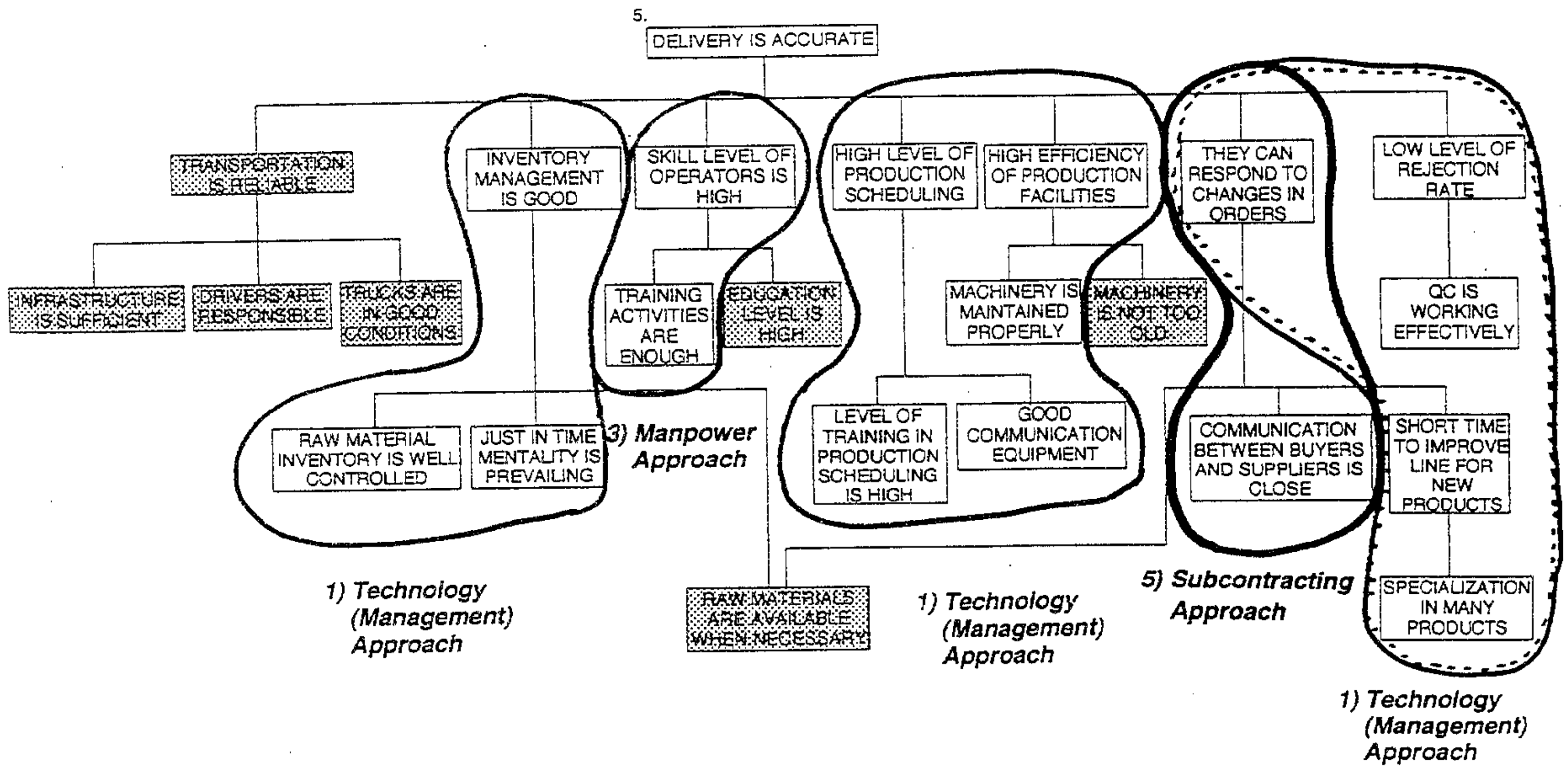


Figure 9.2-3 Objective Tree and Alternative Approach (6/6)