

Table 4.5.3-1 Scale of the capital and the sales of sheetwork/welding processes

Scale of capital, sales ($\times 10^3$)	Capital	Sales
₪250 or less	45.7% (37 firms)	35.8% (29 firms)
Over ₪250 ~ ₪1,000	33.3% (27 firms)	21.0% (17 firms)
Over ₪1,000 ~ ₪4,000	8.6% (7 firms)	21.0% (17 firms)
Over ₪4,000 ~ ₪16,000	8.6% (7 firms)	12.3% (10 firms)
Over ₪16,000 ~ ₪100,000	3.8% (3 firms)	7.4% (6 firms)
Over ₪100,000	—	2.5% (2 firms)

Table 4.5.3-2 Scale of factory estate area of sheetwork/welding processes

Factory estate area (m^2)	% (Firms)
2,500 or less	71.6 (58)
2,501 ~ 6,300	16.0 (13)
6,301 ~ 16,000	3.7 (3)
16,001 ~ 40,000	6.2 (5)
40,001 ~ 100,000	1.2 (1)
Over 100,000	1.3 (1)
Total	100 (81)

4) Scale of facilities (Q06)

Enterprises of ₪250 $\times 10^3$ or less account for 95.1% (77 firms).

Enterprises exceeding the level of ₪250 $\times 10^3$ or less account for only 4.9% (4 firms).

Accordingly, it is surmised that in respect of facilities they operate business under exceedingly primitive conditions.

5) Number of employees (Q10)

Enterprises with employees 29 persons or less account for about 60%. When reviewed on the basis of 99 persons or less about 90% belong to the group. On the other hand, big enterprises of 200 persons or over account for about 5% (4 firms).

Table 4.5.3-3 Scale of number of employees of sheetwork/welding processes

Scale of employee numbers	% (Firms)
9 persons or less	14.8 (12)
10 ~ 29 persons	45.7 (37)
30 ~ 49 persons	17.3 (14)
50 ~ 99 persons	9.9 (8)
100 ~ 199	7.4 (6)
200 ~ 299	1.2 (1)
300 ~ 499	1.2 (1)
500 persons or over	2.5 (2)
	100 (81)

(2) Degree of specialization (Q05-1)

When the degree of specialization of sheetwork/welding processes is viewed on the basis of business share (%) within an enterprise in welding 60% or over will be 3.7% (3 firms) and be only 2.4% (2 firms) in sheetwork. On the other hand, enterprises of share 20% or less account for about 90% for both welding and sheetwork. The above fact tells that almost all of enterprises engaged in sheetwork/welding operate other kinds of processes as a side business and they position sheetwork/welding as a process of production stages of merchandise.

Table 4.5.4-4 Degree of specialization

Degree of specialization (%)	Welding % (Firm)	Sheetwork % (Firm)
0 ~ 20	92.6 (75)	87.7 (71)
21 ~ 40	2.5 (2)	6.2 (5)
41 ~ 60	1.2 (1)	3.7 (3)
61 ~ 80	3.7 (3)	2.4 (2)
81 ~ 100	0	0
Total	100 (81)	100 (81)

(3) Product and subcontract structure (Q05-2, 05-3 and Q70s)

1) Product and secondary subcontract

Relative to enterprises engaged in sheetwork/welding processes relation between kinds of product of subcontract and secondary subcontract will be reviewed. Firstly, according to kinds of product and in the order of size of enterprise degree ratio of engagement, the name of product, enterprise %, number of enterprises and secondary subcontract enterprise %, number of enterprises are shown as in the following table. (Up to the 10th order)

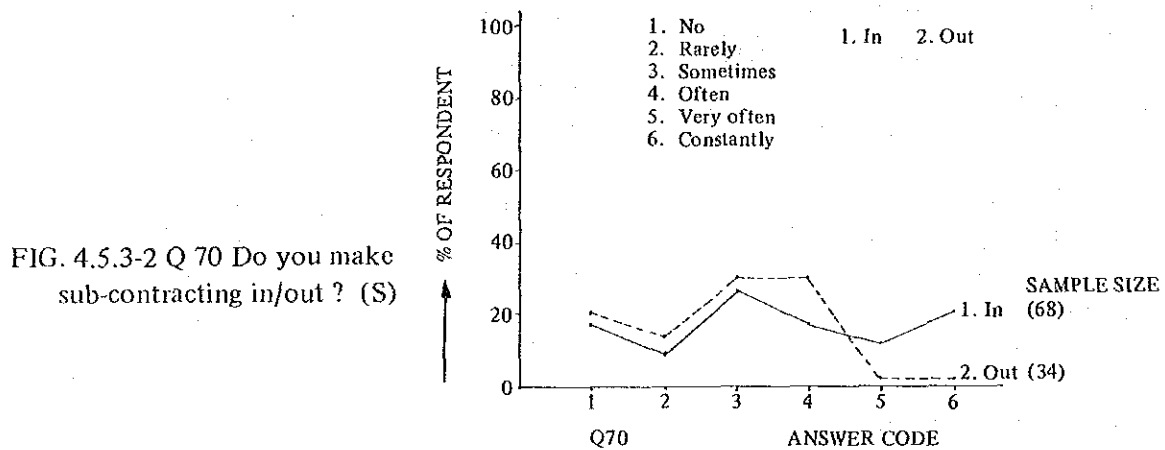
Table 4.5.3-5 Product and secondary subcontract state of sheetwork/welding processes

Order	Name of product	Primary subcontract enterprise % (Firm)	Secondary subcontract enterprise % (Firm)
1	Industrial machinery or parts	36.7 (22)	4.5 (1)
2	Motor vehicles or parts	28.3 (17)	17.6 (3)
3	Other mach. & equip. or parts	25.0 (15)	20.0 (3)
4	Civil, structural & const. mach. or parts	21.7 (13)	15.4 (2)
5	Metalworking mach. or parts	16.7 (10)	0 (0)
6	Agricultural mach. or parts	15.0 (9)	0 (0)
7	Moulds & dies or parts	13.3 (8)	25.0 (2)
8	Elect. & telecom. mach. or parts	10.0 (6)	33.3 (2)
8	Working tools or parts	10.0 (6)	16.6 (1)
8	Transport & harbour equip.	10.0 (6)	0 (0)

As can be seen from the Table in the primary subcontract the order will be industrial machinery, motor vehicles, other machinery followed by civil, structure and construction machinery, while in the secondary subcontract orders are replaced like electricity and tele communication equipment, moulds and dies and other machinery, motor vehicles and working tools. When considered together with Table 4.5.3-4, -5 the relationship of mutual reliance between enterprises on the part of subcontracting activities in way of specialization is not yet matured, and it is known that the state is yet at the initial stage of progress. In particular, judged from the size of market scale underdevelopment of subcontract structure related to the agricultural machinery of the 6th order is especially noted. It will be necessary to make further detailed study and make argument. On the other hand in the electrical tele communication machinery of the 8th order in the primary subcontract the order is raised to the 1st in the secondary subcontract. Although absolute number is small and no decisive statement can be made readily, it is noted that in this field where small parts are numerous subcontract structure is considerably in progress.

2) Subcontract frequency (Q70)

When actual state of subcontract enterprises engaged in sheetwork/welding is investigated for the trend according to the order of subcontract frequency, the result will be as Fig. 4.5.3-2. Number of enterprises high in frequency with "OFTEN" or above account for one half, 50%. It can be seen that subcontract activities are considerably active in this field. On the other hand as for secondary subcontract from primary subcontract the actual state under the product system is as previously stated. Now, when the actual state is reviewed from frequency phase it can be known that the level is considerably below the frequency of the primary subcontract. But, when considered from that "SOMETIMES" and "OFTEN" account for about 50% it can be estimated that in this field on the whole the subcontract structure is considerably advanced.



3) Subcontract enterprise relation (Q70-1)

When origin of order of primary subcontract is investigated according to each type of enterprises orders from big enterprises of answer code 4 account for the majority. It is followed by answer code 2 parent enterprise, answer code 3 same scale enterprise, etc. Also, orders from government agencies account for 23% and draw attentions. On the other hand origin of orders to secondary subcontracts will be, although order placement to big enterprises accounts for 18%, order placement to the same scale enterprises are overwhelming and account for about 60%. Reverse order placement made to parent enterprises also account for about 18%.

Q70-1 Where do you make your sub-contracting work to/from? (M/A)

1. Not applicable
2. Parent company/Affiliated company
3. Companies of the same scale
4. Companies of the larger scale
5. Government organization
6. Companies with foreign equity
7. Others, specify

1. From 2. To

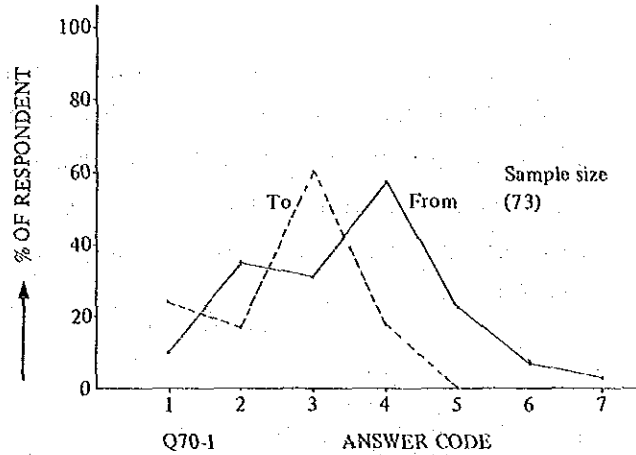


FIG. 4.5.3-3

4) Evaluation for subcontract assistance (Q70-3) and on items of assistance (Q70-2)

Firms 52 in number corresponding to 64% of the total (81 firms) obtain some form of assistance from enterprises placing subcontract orders. What will be evaluation given by such enterprises to the actual records of such assistance is shown by the solid line as actual state in the accompanying figure.

Q70-3 Assessment after assistance gotten/given (S)

1. Gotten 2. Given

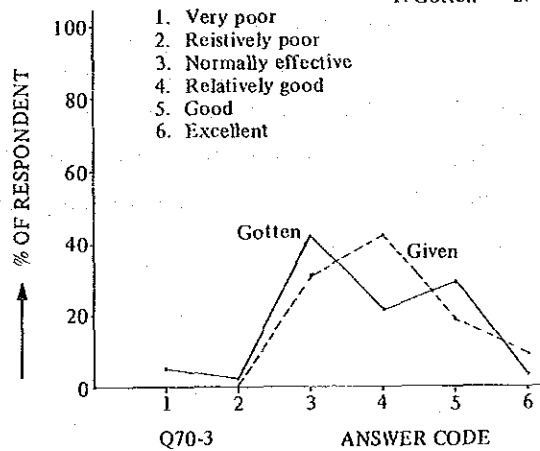


FIG. 4.5.3-4a

Ranking of acceptance lines, answer code 3, 4, 5 and 6 are totaled to be 90% or over.

It is known that relative to contents of subcontract aids received a certain evaluation has been made. On the other hand, out of these enterprises which are primary subcontractor placing of secondary subcontracts 27 firms (33%) furnish assistance to secondary subcontractors. Self evaluation covering such actual state is on the whole one rank higher than the evaluation they made covering assistance they themselves receive. It is interesting to note that a general tendency of human nature is presented that in making self evaluation one is generous and in performing evaluation of others one is prone to be stringent.

On the other hand in reviewing assistance items from origin of subcontract items are diversified in many ways and no particular trends can be observed. However, in the case of primary subcontracts, it can be seen that start up advice, financial support, engineering services, capital participation, materials supply, etc., are comparatively frequent. Also, enterprises getting no assistance and running business on their own accord account for 20% odds.

Q70-2 What assistance do you get/give for your subcontracting work? (M/A)

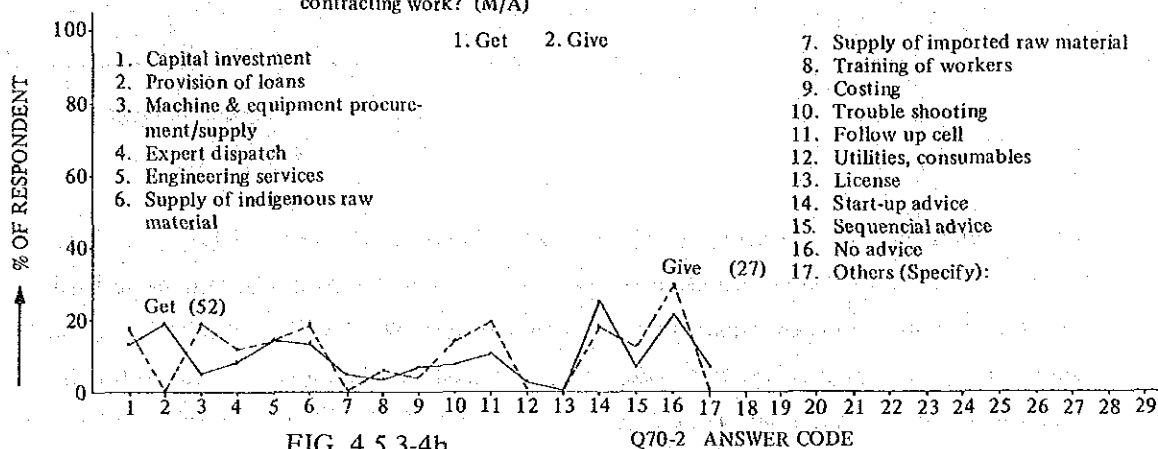


FIG. 4.5.3-4b

In assistance given to secondary subcontractors start up advice, materials supply, machine & equipment procurement/supply, capital participation, follow up cell account for slightly below 20% and such items are about the same in magnitude. Enterprises not extending assistance to secondary subcontractors account for about 30%. Thus it can be seen that taken as a whole mutual supplementary relationship among enterprises is permeated gradually.

5) Subcontract product and guaranty of subcontracted product (Q70-7)

Subcontract activities in enforcement and what is the manner product assurance within enterprise is carried out will be related to quality problem and is very much important. As can be seen from Fig. 4.5.3-5 when the contents below normal international transaction practice are taken as level 3 or less enterprises of about 80% belong to that level. For quality assurance system future promotion and mark-up of level is expected also in this field.

Q70-7 Guaranty of subcontracted product by you (S)

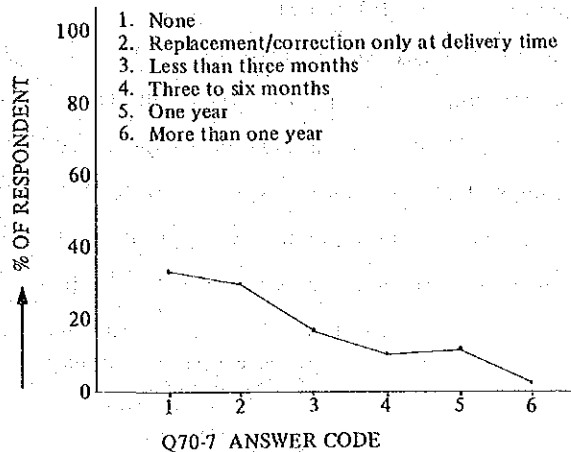


FIG. 4.5.3-5

6) After care of claim on the part of subcontractors (Q70-8)

In subcontract enterprises accounting for over 50% of their total not any person in charge of after care of claim assigned reflects the actual state. This may be a major problem to be improved in the future along with and in relation to the previously mentioned immature quality assurance problem.

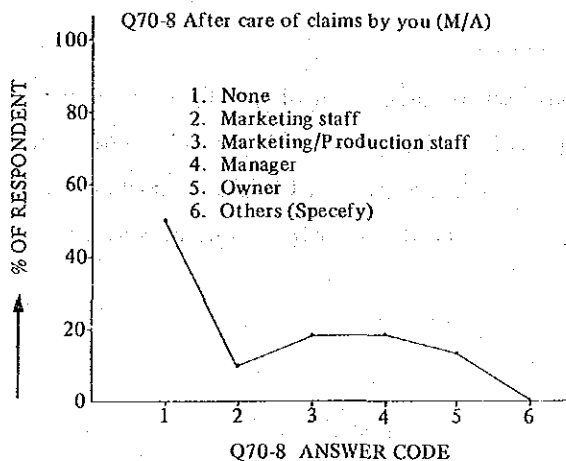


FIG.4.5.3-6 After care of claim on the part of subcontractor

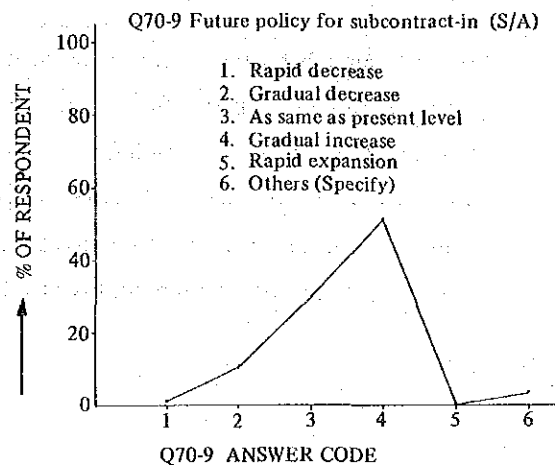


FIG. 4.5.3-7 Future policy relative to subcontract activities

7) Future policy relative to subcontract activities (Q70-9)

Enterprises having the desire of increasing the activities gradually account for about 52%. When about 28% desiring maintenance of the present state are added to the above a total 80% will be reached. As a system securing of demands as subcontractors is approved. In view of such actual state it will be necessary that the government will implement policy to further activate subcontract activities.

8) Purpose of getting subcontract job (Q70-10)

In the purpose of getting subcontract job enterprises are pointing out stable business performance account for 70% and the majority. It is followed by increase of market share, convenience of own business, and coexistence coprosperity with parent enterprises. If the consciousness of coexistence and coprosperity of Item 9 is more elevated in the future, in the phase of subcontract relationship there will be a spiritual foundation strengthened to proceed ahead for strong productivity improvement moves.

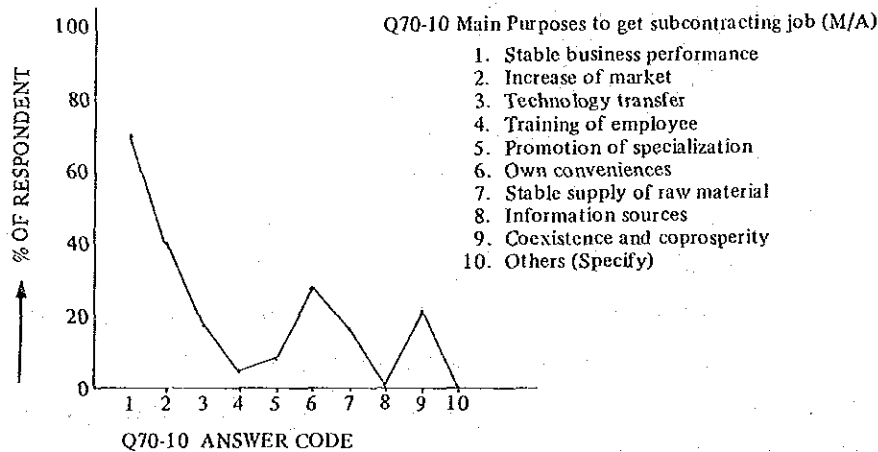


FIG. 4.5.3-8

9) Distance between origin of subcontract (Q70-11)

Within a circle of up to 20km about 40%, and within a circle of up to 40km about 60%, if a circle of 80km is counted the coverage will be about 80%. Almost all subcontract activities are performed within the range of 1 ~ 3 hours by car. On the other hand, the origin of orders 51km or over away accounts for about 14% which indicates spread of subcontract activities sphere and is noted.

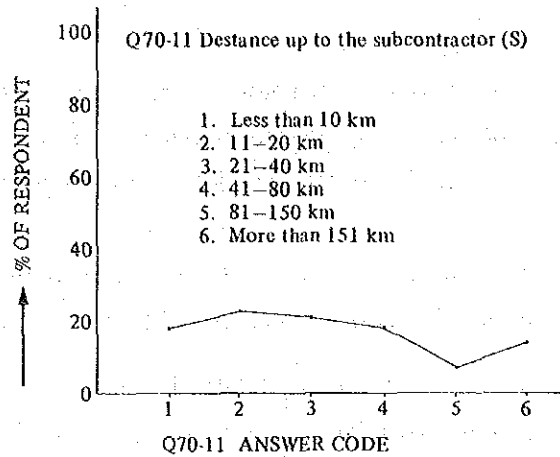


FIG.4.5.3-9

10) Minimum order scale of subcontracts (Q70-12)

As can be seen from Fig. 4.5.3-10 in general small-sized orders placed account for the main stream. Placing of order of mass production product of 1,000 pcs or over at a time account for a mere about 10%. Also, when the rank for, 101 ~ 1,000 is reviewed the figure is around 7%. In the subcontract state of the sheetwork/welding processes as well product of small-sized order placing is the general trend.

Accordingly, in pushing the structural renovation in the future how to exploit market of mass production product type subcontract structure will be a theme.

Order route of subcontracting job (M/A)

1. In 2. Out

1. Through middleman
2. Through trader/dealer
3. From market
4. Through subcontractor's introducer
5. Directly through subcontractor
6. Others (Specify)

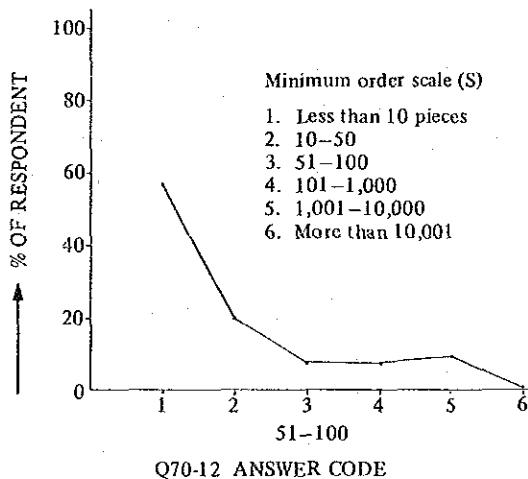


FIG. 4.5.3-10

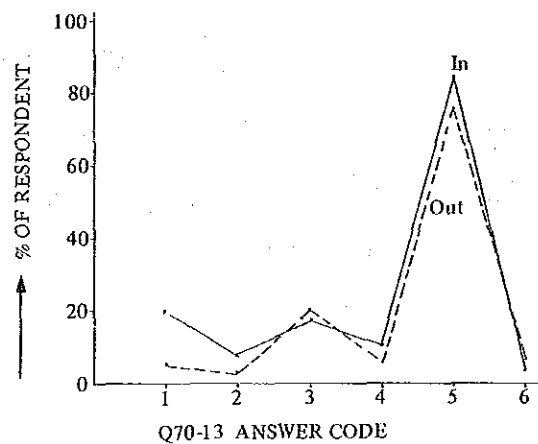


FIG.4.5.3-11

11) Subcontract order receiving route (Q70-13)

Elucidation of structure of order placing route to expedite subcontract activities is important from standpoint of planning of a promotion policy as well.

In placing orders and also in receiving orders direct transactions account for 70 ~ 80%, or the largest percentage.

Intervening of trader/dealer and market follows. On the basis of the above aspect also, importance of accelerating subcontract order is suggested to be remaining.

12) Future subcontract enterprise relationship (Q70-14)

Enterprises desiring more intensified relationship with origin of subcontracts account for about 40%, which added with those desiring maintenance of the present state comes to 90% or over. However, those skeptics of subcontract account for 7%, which added with those desiring diversification of origins of subcontract comes to about 20%. It may be necessary that more soundness of subcontract activities will be promoted.

Future relationship with the subcontractor/subcontractee (M/A)

1. Stop the new order
2. Decrease of order
3. Diversifying subcontractor
4. As it is
5. More close tie up
6. Others (Specify)

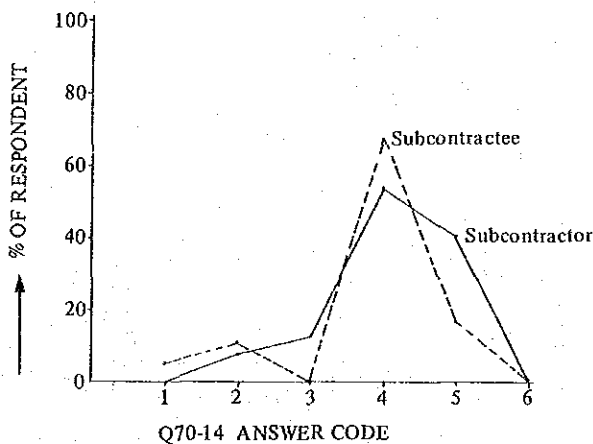


FIG. 4.5.3-12

Motivation to have started relationship with the subcontractor/subcontractee (M/A)

1. Neighbour
2. Relatives
3. Relationship between owners/managers
4. Introduction by an influential man
5. By own market cultivation
6. Others (Specify)

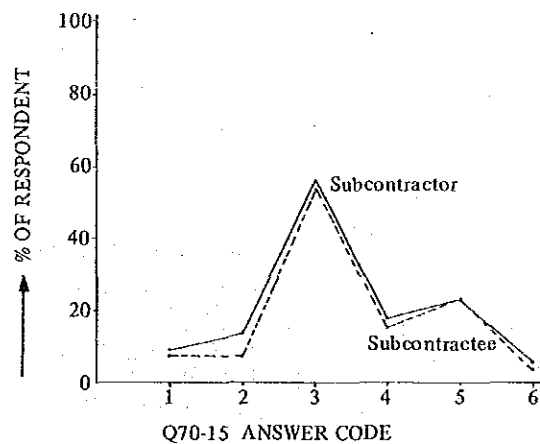


FIG. 4.5.3-13

13) Motivation to commence subcontract (Q70-15)

When the actual relationship based on human aspect of key personnel, etc. one of factors for commencement of subcontractship is investigated, cases of reasons that owners or managers of enterprises used to be familiar account for the majority, over 50%. On the other hand cases of approach made from partners or other positive market exploit account for about 22%, which appeals one pleasingly.

14) Most preferable origin of subcontracts (Q70-16)

When the actual origin of subcontracts previously mentioned is overlapped with the graph of the most preferable origin of subcontracts, then, except for big enterprises, the frequency is below the frequency for the origin of subcontracts of the actual. The above makes one surmise that in relation with other origins of subcontract some problems are inherently existing. Accordingly, the above makes one understand that as a sound structure of subcontract relationship it is generally recognized that supplementary relationship between big enterprises vs. small and medium enterprises ought to be promoted.

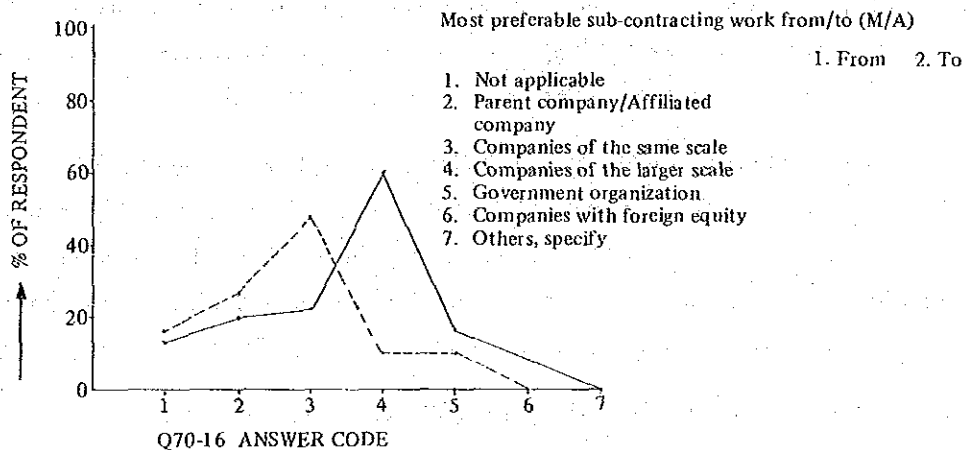


FIG. 4.5.3-14

(4) Relationship between subcontract frequency and technical level (Q300s/Q70)

Relative to the subject theme when while graphs, result of analysis, are examined in the subsequent pages the actual state is elucidated almost no conspicuous corelationship can be seen between subcontract frequency and technical level. Those in which the higher the technical level the greater will be the subcontract frequency to some extent are likely to be the followings.

- Kinds of materials used in Q311
- Kinds of welding rods used in Q315
- Frequency of use of steels attached with mill sheets in Q317
- Kinds of applicable welding process in Q324
- Frequency of use of tools and jigs in Q329
- Application of welding design in Q335
- Delayed delivery mean period in Q37 (Inverse relationship)
- Manufacturing instruction method to workers in Q47

8 items in total of the above.

Hereunder item by item will be reviewed, and principal points are made an itemized list as can be read from graphs.

1) Kinds of materials used (Q311/Q70) Refer to Fig. 4.5.3-15

Frequency of subcontracts requested for stainless steel is comparatively high. Also, it is anticipated that as raw material continually placed for subcontract rolled articles occupy a large share. Particularly, from technological phase attentions are required to be paid to the use of scrap articles and stainless steel materials.

2) Plate thickness of steel plates used (Q313/Q70) Refer to Fig. 4.5.3-16

Normally plate thickness under subcontract will be from 2mm to 12mm in an average. In continual order articles thinner plates and sheets of 4mm or less will be in greater amount. From technical phase promotion of processing techniques for thinner plates and sheets of 4mm or less as well as heavier plates of 25mm or over will be necessary.

3) Kinds of welding rods used (Q315/Q70) Refer to Fig. 4.5.3-17

There is the noticeable tendency that the higher the subcontract frequency is the enterprise the more elaborately the use of welding rods is discriminated. In other words, an enterprise using multi-purpose use welding rods to cover anything has lower frequency of subcontract frequency.

4) Quality of scrap materials (Q316/Q70) Refer to Fig. 4.5.3-18

Enterprises with rather lower subcontract frequency pay more attentions to quality identifying of scrap materials. The fact makes one assume that enterprises with higher subcontract frequency use scrap materials as auxiliary materials while those with lower subcontract frequency use proportionately more scrap materials as principal materials. Accordingly, it will be necessary to promote the plan of discriminating uses according to application after recognizing material specifications of scrap materials and to expedite modernization of scrap materials distribution system.

5) Degree of mill sheets required (Q317/Q70) Refer to Fig. 4.5.3-19

The higher is the subcontract frequency of an enterprise is the higher will be in general the frequency of using mill sheet attached raw materials showing quality guarantee. However, for the group as a whole attentions paid to quality guarantee of materials used are still of small magnitude. Edification and enlightenment from this phase will be necessary.

6) Type of press (Q321/Q70) Refer to Fig. 4.5.3-20

Use of crank type mechanical presses is most popular. But, there is no corelationship recognized between subcontract frequency and press type.

7) Kinds of welding process (Q324/Q70) Refer to Fig. 4.5.3-21

In enterprises with higher subcontract frequency probability is higher for practicing application of welding processes beyond gravity welding. However, generally speaking degree of reliance on gas welding is still high. As one of conditions to increase subcontract order receiving assuring of electric welding facilities easier to obtain stabilized quality will become the minimum condition.

8) Method for edge preparation of welds (Q326/Q70) Refer to Fig. 4.5.3-22

Edge preparation is performed in many cases by manual gas cutting. In that case performance of preparation under stabilized condition using jigs is still less. Also in heavy plate welding examples of welding performed without edge preparation (base construction of presses) are observed on many occasions. From that phase as well an improvement will be urgently needed.

Cases of no edge preparation performed at all account for about 40%. However, no corelation between edge preparation process and subcontract frequency can be recognized. The above is the point possible to be understood associated with the fact that in subcontract activities thinner plate and sheet processing of 4mm or less accounts for a large volume.

9) Kinds of shearing machines (Q327/Q70) Refer to Fig. 4.5.3-23

Manual and power driven are about half and half. No corellation between subcontract activity state and the shearing machine used is observed.

10) Kinds of plate processing tooling (Q328/Q70) Refer to Fig. 4.5.3-24

Almost all enterprises have completed installation of variety of plate processing tools. There is no corelation between subcontract frequency and kinds of processing tools.

11) State of using jigs and fixtures (Q329/Q70) Refer to Fig. 4.5.3-25

Use of jigs and fixtures has not been yet popular among subcontract enterprises. However, when relation between subcontract frequency is checked, it can be seen that enterprises with more positive subcontract activities generally make endeavor for increased productivity and improved quality through the use of jigs and fixtures.

12) Accuracy control method (Q331/Q70) Refer to Fig. 4.5.3-26

Although no discussion can be made for all of accuracy control merely on the basis of the subject question, almost no systematized accuracy quality control is permeated is told by the information that in the rank 2 dimensional inspection is applied to each individual material members. Accordingly, in the future it will be necessary to design guidance and enlightenment of plan for scientific control in relation to accuracy control in sheet work/welding processes.

13) Welding inspection method (Q332/Q70) and state of preparing plate cutting plans (Q333/Q70)

Not any one firm presented an answer. Actual state has been failed to be grasped. However, when judged from present state known by survey, etc., of each plant it is surmised that in almost all enterprises established plans are not yet applied constantly. Accordingly, enlightenment of the necessity of these items as well as spread of practice of these plans are expected.

14) Examination for qualification of welders (Q334/Q70) Refer to Fig. 4.5.3-27

One of major factors for assuring of quality of welding operation owes much to qualification level of welders. At present in Thailand as an institution of the Labor Bureau of the Ministry of Interior, there is the system for examination of qualification of welders. The system, however, is not utilized almost at all, excepting cases where some kind of official certification is required mainly in going abroad to work as welders in Middle East, etc. The present investigation also proves the fact. Although under the present state no corelationship is recognized between welder's qualification examination level and subcontract frequency, it will be necessary that in the future it will be managed that such corelation will be conspicuous. Depending upon situation inauguration and promotion of practice of examination system of the Ministry of Industry's own may be necessary.

15) Welding design method (Q335/Q70) Refer to Fig. 4.5.3-28

As for application of welding design in about 60% of enterprises performance will be partially and from time to time. As a present state no others have no performance. On the other hand when the situation is reviewed from relation between subcontract frequency in enterprises receiving subcontracts continually there are many examples of making application of welding designs. In the future through standardization of welding designs and reducing the same to manuals on the part of official organizations popular use of the same ought to be promoted for improved quality and improved productivity.

16) Delayed delivery frequency (Q36/Q70) Refer to Fig. 4.5.3-29

Delayed delivery frequency amounts to about 70% when "Very often", "Sometimes" and "Rarely" are put together. It can be surmised that production process control is not much successfully carried out. Especially, in enterprises with subcontract frequency of "Sometimes" and "Very often" the delivery control level is noticeably low. It is surmised that in those enterprises production process control is disturbed by subcontracting activities.

Accordingly, it will be necessary that relative to those enterprises in particular enterprise diagnosis, extension services etc., on production process control will be carried out.

17) Average delayed delivery period (Q37/Q70) Refer to Fig. 4.5.3-30

Average delayed delivery period is prevailingly from 4 days to a week. On the other hand, in relation to subcontract frequency it can be seen that in enterprises receiving orders constantly the delayed period will be longer. Accordingly, it will be necessary in general to provide thoroughgoing education on how to perform production process control.

18) Method of manufacturing instructions given to workers (Q47/Q70)

Refer to Fig. 4.5.3-31

Enterprises using design DWG of own firm account for 13%. Most of enterprises (about 64%) use rough sketches or verbal instructions only. But, with respect to relation between subcontract the higher is the frequency the more will be increased gradually the level of the method of instructions, which makes one surmise a correlation existing.

19) Defect rate (Q49-9/Q70) Refer to Fig. 4.5.3-32

In 86% of enterprises the defect rate is 5% or less. However, in enterprises performing subcontract work constantly average level is 4.7 and defect rate is 5% or over, and in respect of category of each level of subcontract frequency the figure is the lowest in rank. In the phase of quality control enterprise diagnosis, extension services, etc., will be urgently needed.

100 SHEETWORK AND WELDING PROCESS

Q311 Specify the kind of steel used? (M/A)

1. None
2. Scrap
3. Galvanized/tln sheet
4. Cold rolled/hot rolled sheet
5. Stainless steel
6. Others- specify

OPPER FIGURE: %
LOWER FIGURE: NO. OF RESPONDENTS

← Q70 →

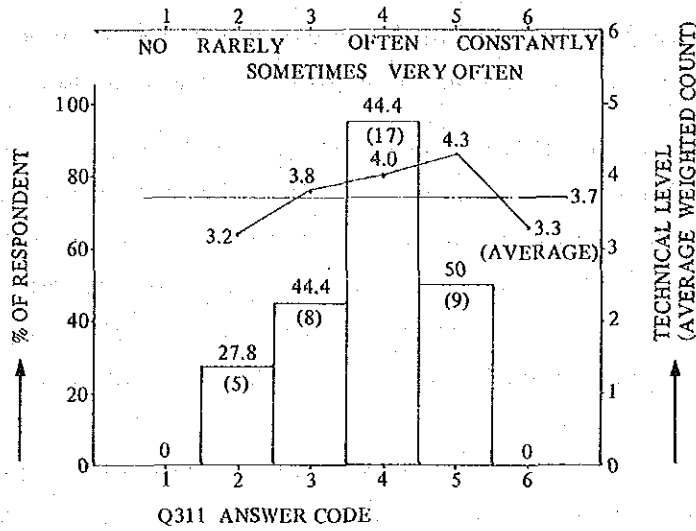


FIG. 4.5.3-15

Q313 what is the thickness of metal sheets commonly used ?

- (M)
1. Below 0.7 mm
 2. 0.7 - 2 mm
 3. 2.1 - 4 mm
 4. 4.1 - 12 mm
 5. 12.1 - 25 mm
 6. Thicker than 25 mm

← Q70 →

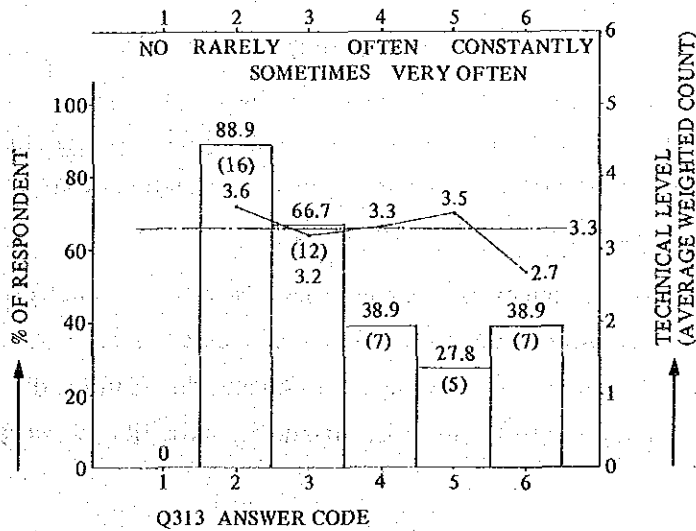


FIG. 4.5.3-16

Q315 What type of welding electrodes do you use commonly? (M/A)

1. No qualification
2. General use, all position
3. Special use, limited position, Oxidized
4. Special use, limited position, Lime-titania
4. Special use, limited position, Lime-T
5. Special use, limited position, Lime-titania
5. Special use, limited position, Low hydrogen
6. Others (Specify)

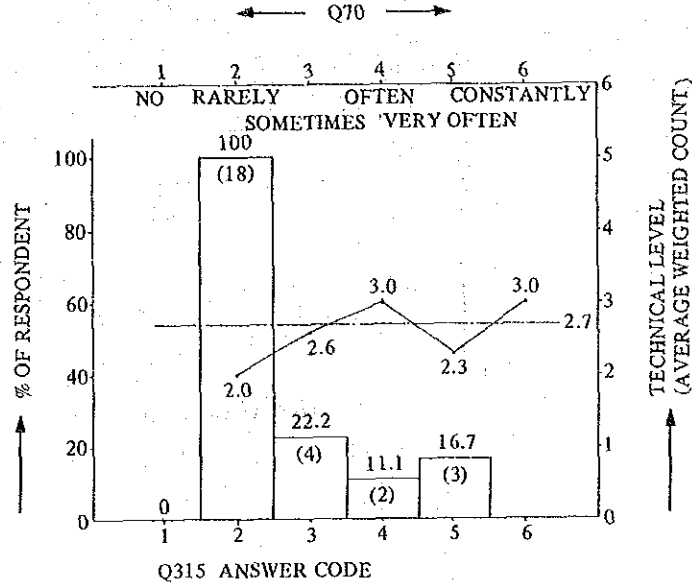


FIG. 4.5.3-17

SURVEY INSTRUMENT "QUESTIONWAIRE"

Q316 How do you notice qualification of scrap metal if you use it as raw material? (S)

1. No ways
2. Empirically
3. By prequalification of material used
4. By material test of supplier/outside facilities
5. By own material test
6. Others (Specify)

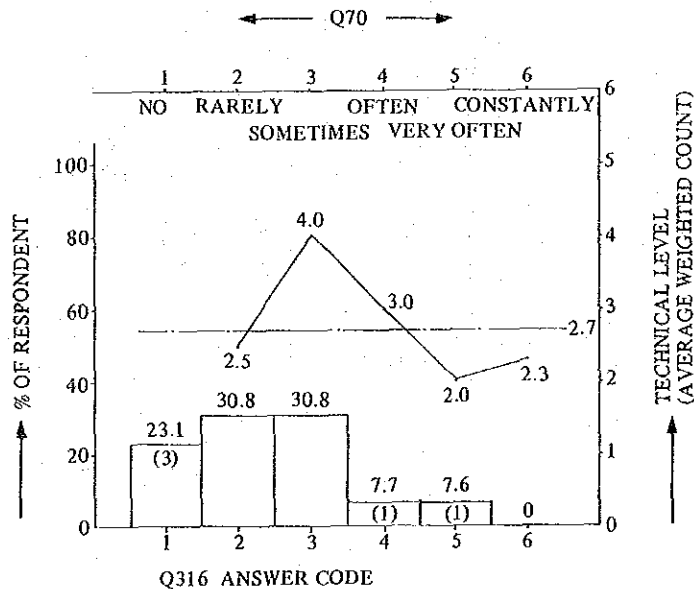


FIG 4.5.3-18

Q317 How often do you request to have "mill sheet of Metal sheets? (S)

1. None.
2. Rarely
3. Sometimes
4. Often
5. Very often
6. Always

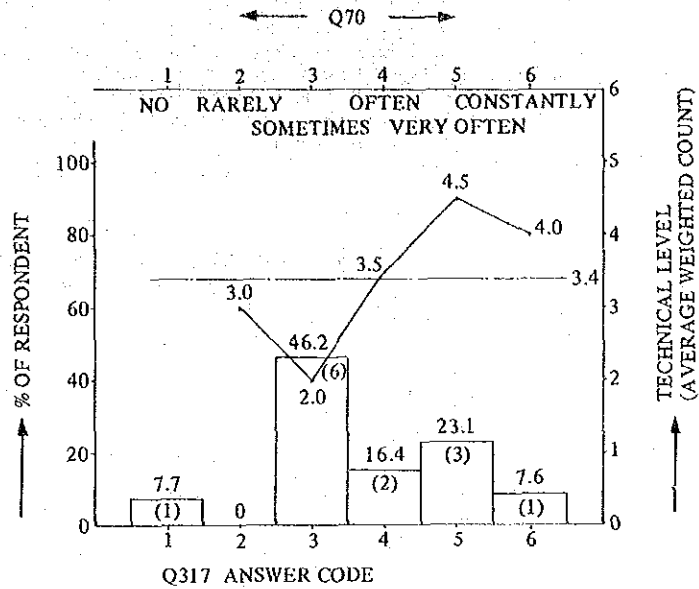


FIG. 4.5.3-19

Q321 Specify the type of press used? (M/A)

1. None
 2. Manually operated
 3. Screw
 4. Crank
 5. Pneumatic/hydraulic
 6. Others - specify
5. Pneumatic/hydraulic

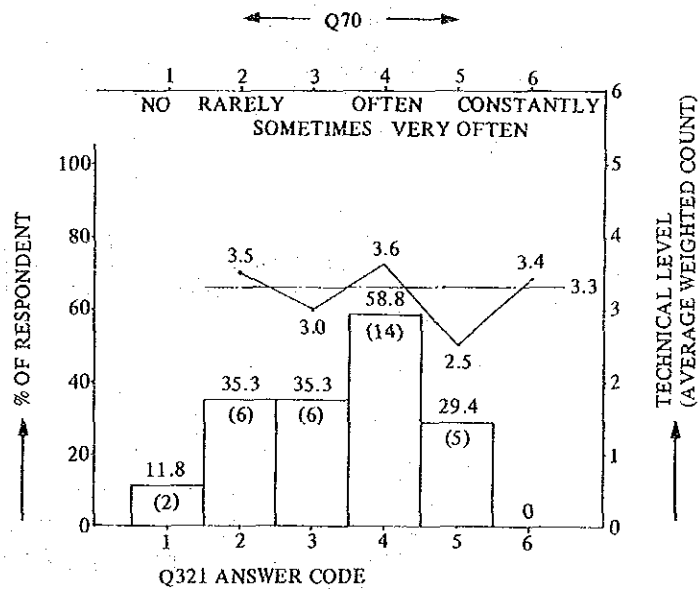


FIG. 4.5.3-20

Q327 What kind of she a
 Q327 What kind of shearing machine do you use? (M)

1. None
2. Manually operated
3. Power operated

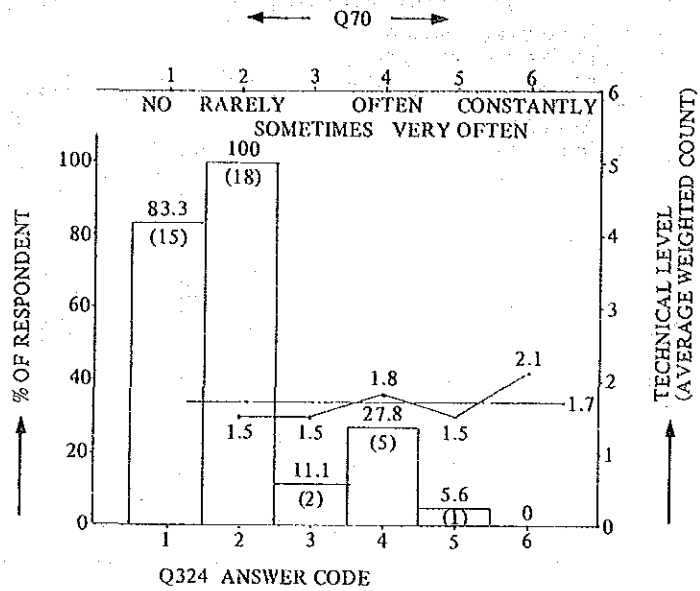


FIG. 4.5.3-21

How do you prepare welding edges? (M)

Q326

1. Not performed
2. Manual-gas type
3. Automatic-gas type
4. Automatic-machine type

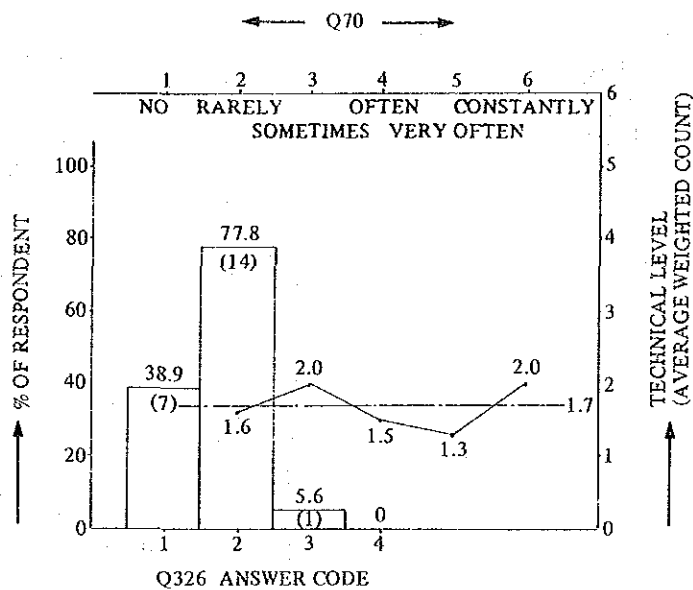


FIG. 4.5.3-22

SURVEY INSTRUMENT "QUESTIONNAIRE"

Q324 What is the type of welding method employed? (M/A)

1. Oxy-acetylene (manual)
2. Electric (manual)
3. Gravity
4. Semi-automatic
5. Automatic
6. Other-specify

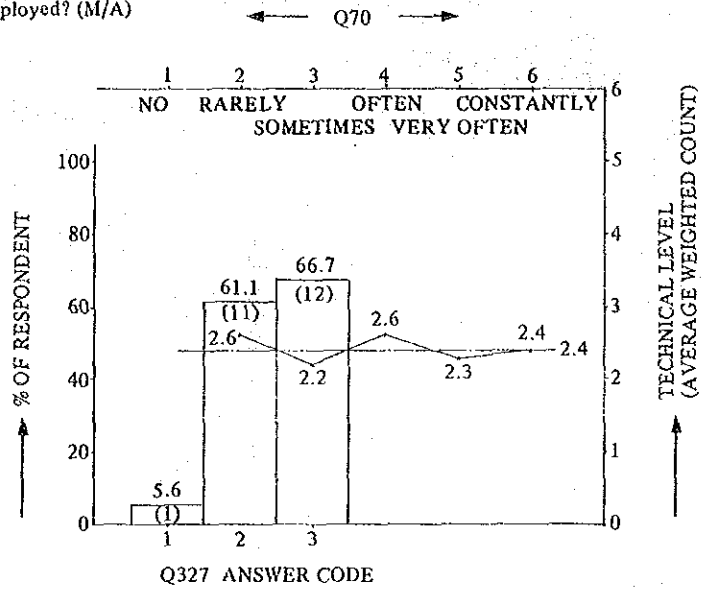


FIG. 4.5.3-23

Q328 What kind of equipment do you use for sheet metal fabrication? (M)

1. None
2. Nibbler
3. Shearing
4. Rolling
5. Bending
6. Press brake

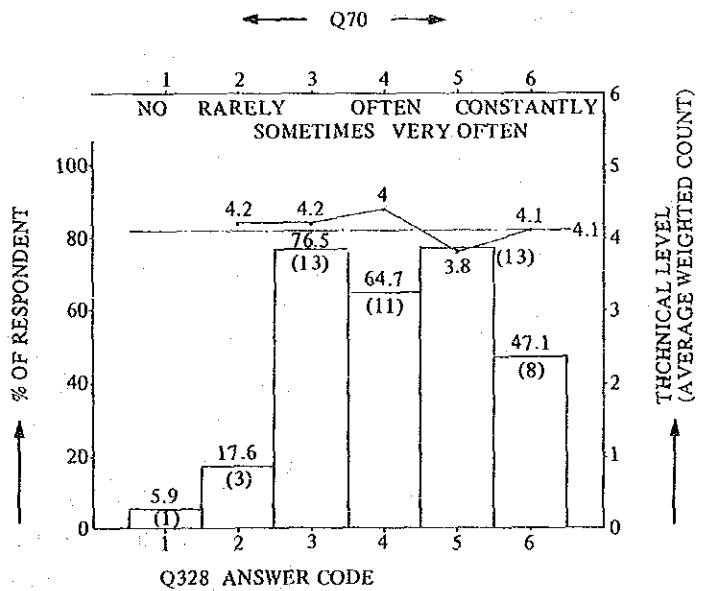


FIG. 4.5.3-24

Q329 How often do you use jigs and fixtures in your fabrication? (S)

1. Never
2. Rarely
3. Sometimes
4. Often
5. Regularly

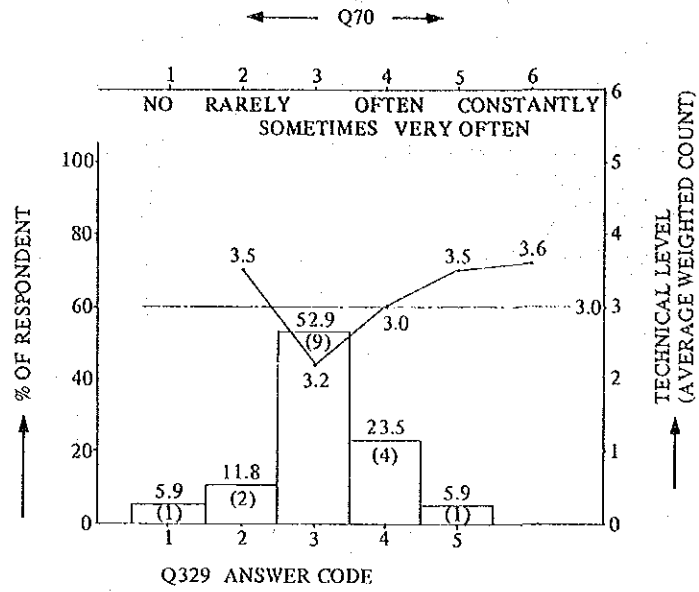


FIG. 4.5.3-25

Q331 What method is used to determine tolerance? (M/A)

1. None
2. Using a scale measure for each number
3. Using a scale measure for siee
4. Using a scale measure for selected numbers
5. Sub-assembly
6. Others-specify

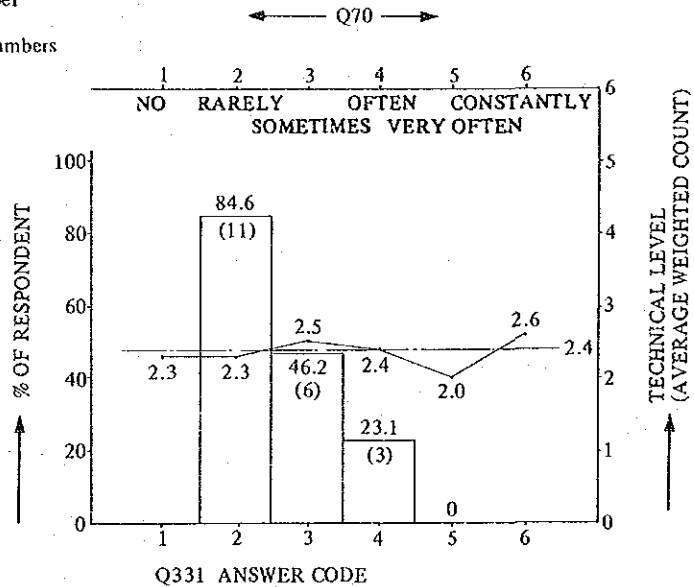
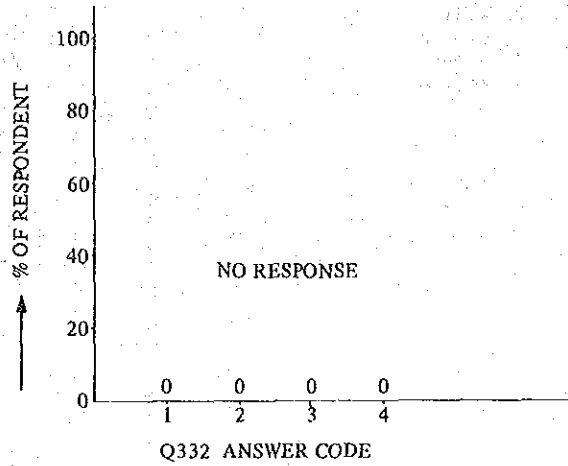


FIG. 4.5.3-26

SURVEY INSTRUMENT "QUESTIONNAIRE"

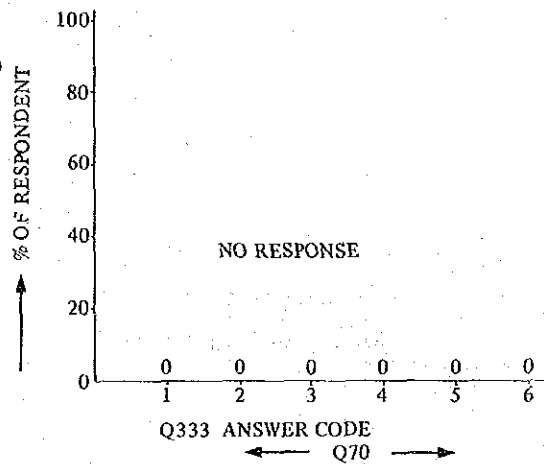
Q332 How do you carry out welding inspection? (M)

1. Never check
2. Visual check
3. Colour check
4. X-ray, ultrasonic, magna-flux



Q333 How often do you apply cutting plan of metal sheets? (S)

1. None
2. Rarely
3. Sometimes
4. Often
5. Very often
6. Always



Q334 How do you distinguish qualification of your welder? (M/A)

1. None
2. Age of experience
3. Observation of works
4. Inhouse test
5. Authorized qualification
6. Others (Specify)

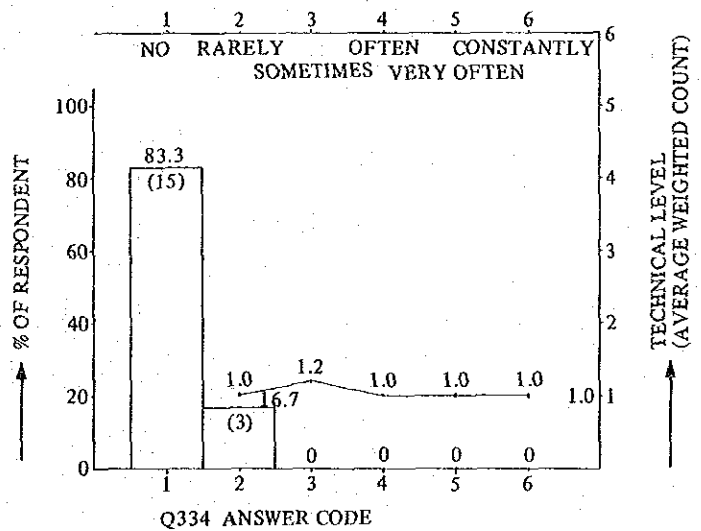


FIG. 4.5.3-27

Q335 What kind of welding design do you apply for your products?

1. None
2. Partially, occasionally
3. For main components only
4. For almost all components
5. All components
6. Others (Specify)

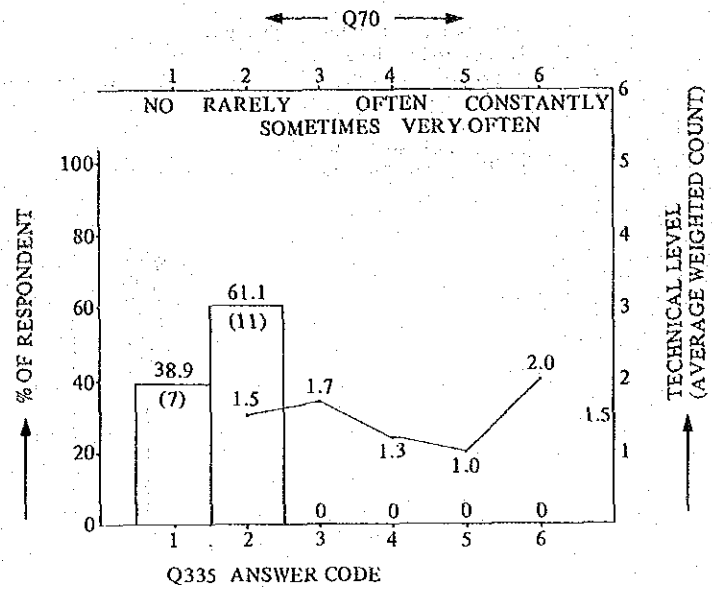


FIG. 4.5.3-28

Q36 Delayed delivery (S/A)

1. Very often
2. Sometimes
3. Rarely
4. Very rare
5. Not at all
6. Others (Specify)

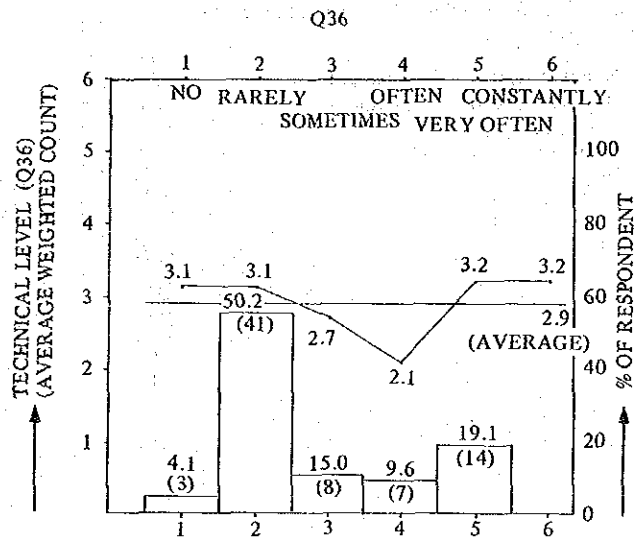


FIG. 4.5.3-29 Q70 SUBCONTRACTING-IN

- Q37** Average term of Delayed delivery (S)
1. Less than 3 days
 2. 4 days to one week
 3. 2 to 4 weeks
 4. 1 month to 2 months
 5. 3 months to 4 months
 6. More than 5 months

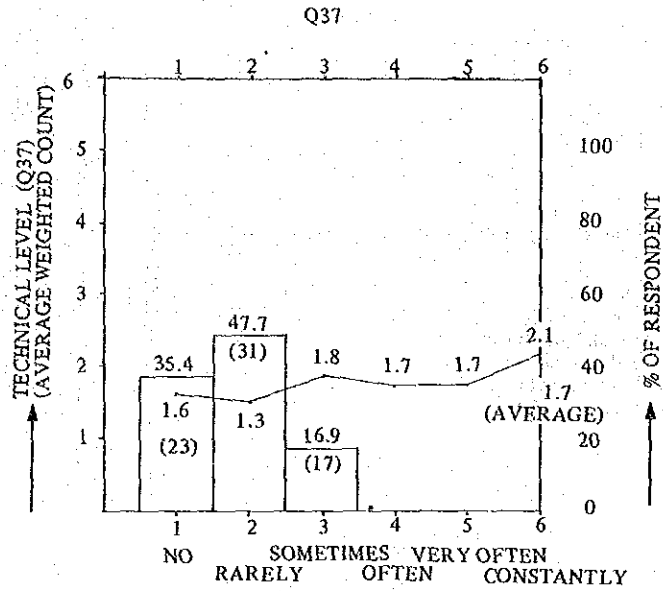


FIG. 4.5.3-30 Q70 SUBCONTRACTING-IN

- Q47** How do you instruct your workers to produce the product? (S/A)
1. Sample/rough sketch/verbal instruction
 2. Technical drawing
 3. Own design technical drawing
 4. Others, specify

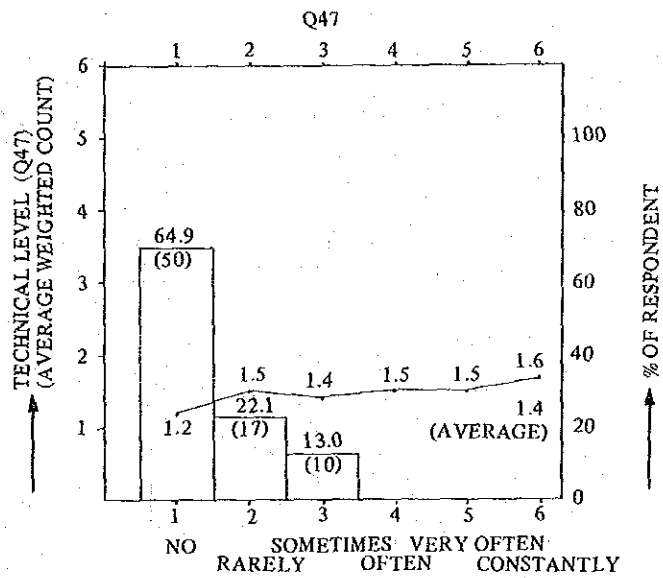


FIG. 4.5.3-31 Q70 SUBCONTRACTING-IN

Q49-9 Defect Rate after shipping (S)

1. More than 30%
2. 21-30%
3. 11-20%
4. 6-10%
5. 2-5%
6. Below 1%

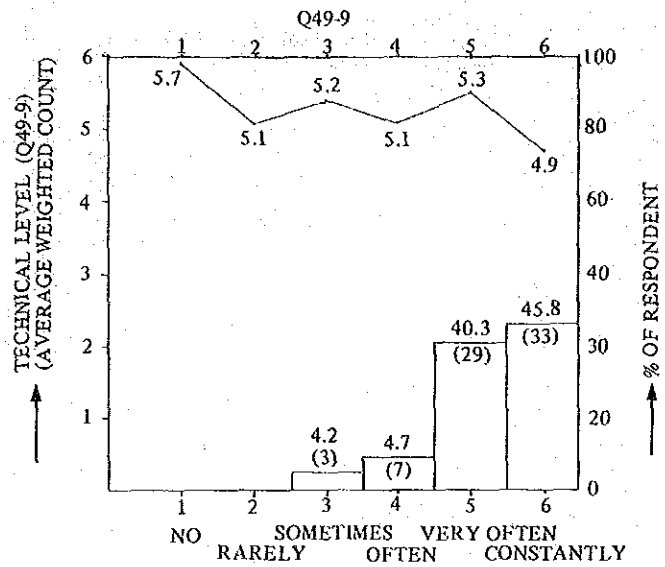


FIG. 4.5.3-32 Q70 SUBCONTRACTING-IN

(5) Market/Demands/Prices

Here, analysis of part of actual state covering market, demands and prices has been carried out in order to grasp trend unique to sheet work/welding business.

1) Market area (Q20)

It can be known that about one half of enterprises are connected to demands rooted in their own territory.

Coupled with the above enterprises whose coverage is across the domestic market account for almost all of enterprises. Enterprises making exports to LDC and NICs are noted to exist although slight in number, respectively 2.5% and 1.3%.

Q20 Where are your products sold and consumed? (M)

1. Region/District
2. Province/State
3. Country
4. Developing countries
5. Newly industrialized countries (NICs)
6. Developed countries

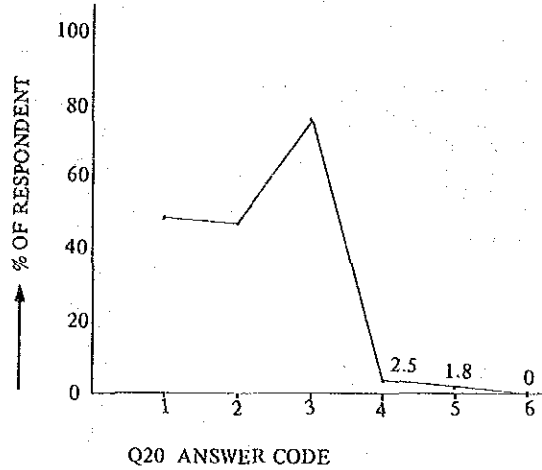


FIG. 4.5.3-33

2) Competitors (Q21)

Competitors are, as can be seen from the relation of spread of the market, almost all of them (96%) are other firms of fellow trade within the country.

However, 4% of enterprises making exports to LDC and NICs hold as their competitors, naturally overseas enterprises.

Q21 From where do your main competitors' products come? (S)

1. Local
2. Foreign

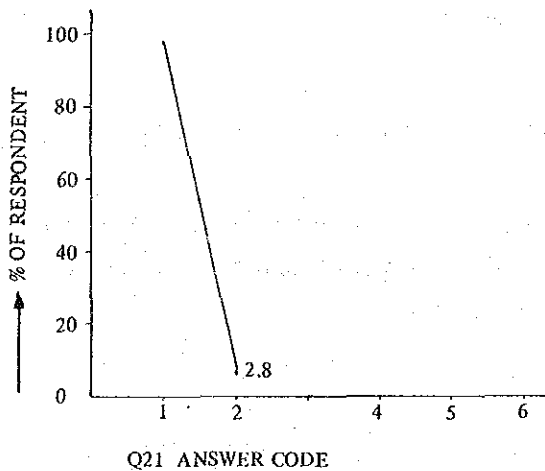


FIG. 4.5.3-34

Q22-1 How much of production orders do you have in hand? (S)

1. Non.
2. One week or less
3. 8-15 days
4. 16-30 days
5. 1-5 months
6. More than 5 months

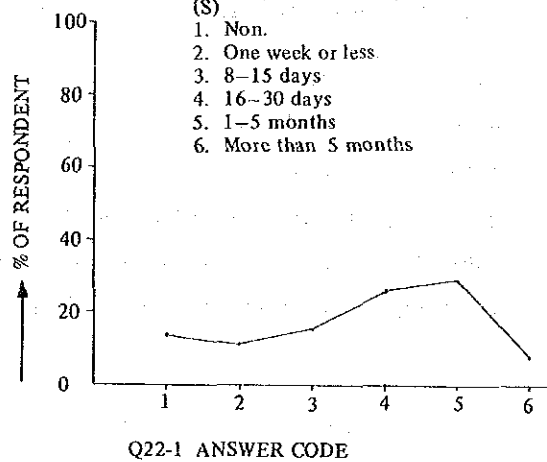


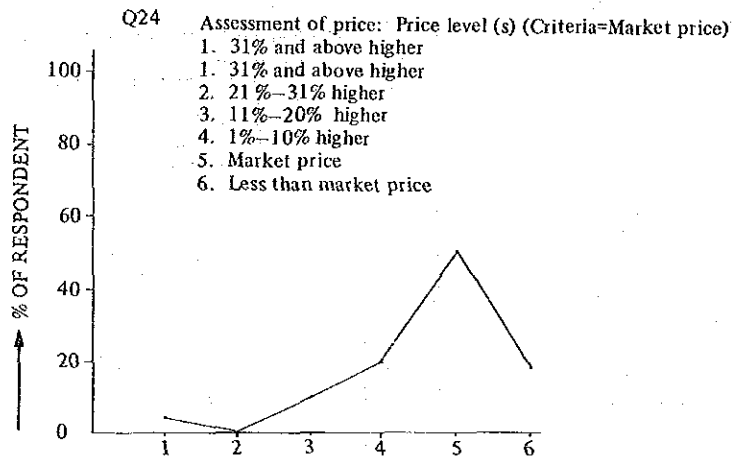
FIG. 4.5.3-35

3) Order receiving state (Q22-1)

When backlogs are reviewed enterprises securing backlogs equivalent of half a month or over of production account for about 62% and remaining 48% of enterprises carry backlogs of an equivalent of only less than half a month production. Enterprises carrying backlogs of from a month equivalent to five month's equivalent account for 28%, most prevailing. Superior enterprise carrying backlogs of five month's equivalent or over account for about 7%.

4) Price competitiveness (Q24)

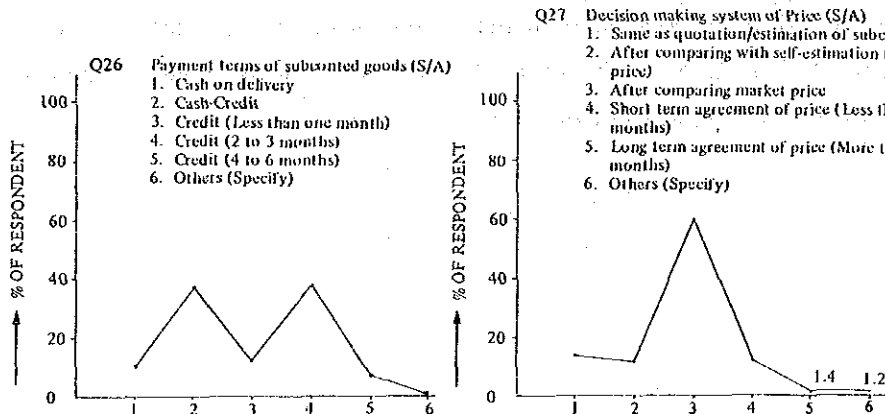
When market price is made reference enterprises with price level below the market price and having competitiveness account for about 17%; those with price higher than the market price and having not much competitiveness account for about 33%. Remaining about 50% of enterprises are in competition under the state of roughly keeping up with the market price.



Q24 ANSWER CODE FIG. 4.5.3-36

5) Payment terms (Q26)

Cases where transactions by credit are conducted and cases where cash dealings (including mixed dealing type of bills and cashes included) are about half and half. Accordingly, it can be observed that cash dealings on the market are shifting gradually to credit dealings.



Q26 ANSWER CODE FIG. 4.5.3-37

Q27 ANSWER CODE FIG. 4.5.3-38

6) Decision making system of prices (Q27)

For decision making system of price on the part of subcontract enterprises it will be desirable to aim at stabilization and assuring of order receiving through short period and long period contracts. On this matter although it depends on kinds of subcontract product in the present state about 13% of enterprises execute such contracts. Most prevailing is still the reliance on the market price accounting for about 60%.

7) Competitiveness (Q28)

Here, not only the price competitiveness reviewed in 4) but overall competitiveness in addition of some factors than the former are studied and about 27% of enterprises are found to be confident in maintaining competitiveness relative to other firms. The above information tells one that the percentage is 10% above about 17% of enterprises maintaining price level below the market price and in respect of overall competitiveness merely price phase will not count.

Q28 What is the present position of the firm in its own market?
How does it compare with its competitors? (S)

- 1. Very strong
- 2. Strong
- 3. Moderate
- 4. Weak
- 5. Very weak

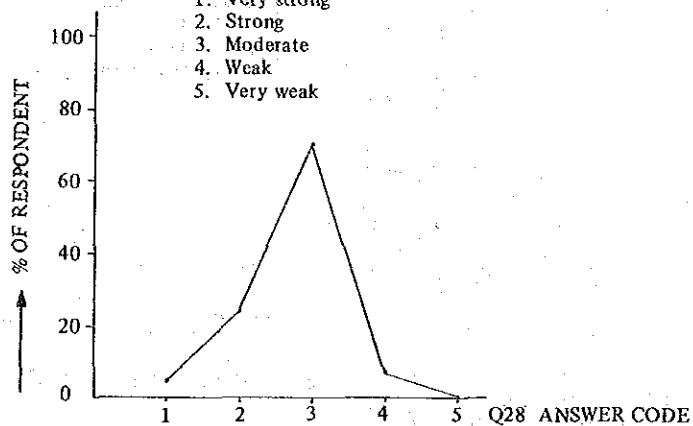


FIG. 4.5.3-39

8) Costs control (Q23)

For cost control system, as shown in Fig. 4.5.3-40 enterprises giving breakdown of integrations of materials costs and labor costs respectively account for about 70%. Enterprises conducting control of more detailed breakdown items account for 40% or less. Enterprises with the concept of depreciation introduced to costs control account for less than 30%. The above situation at the side education for enlightenment of what should be costs control ought to be provided continually.

Q23 Break down of Costing/Accounting System (M/A)

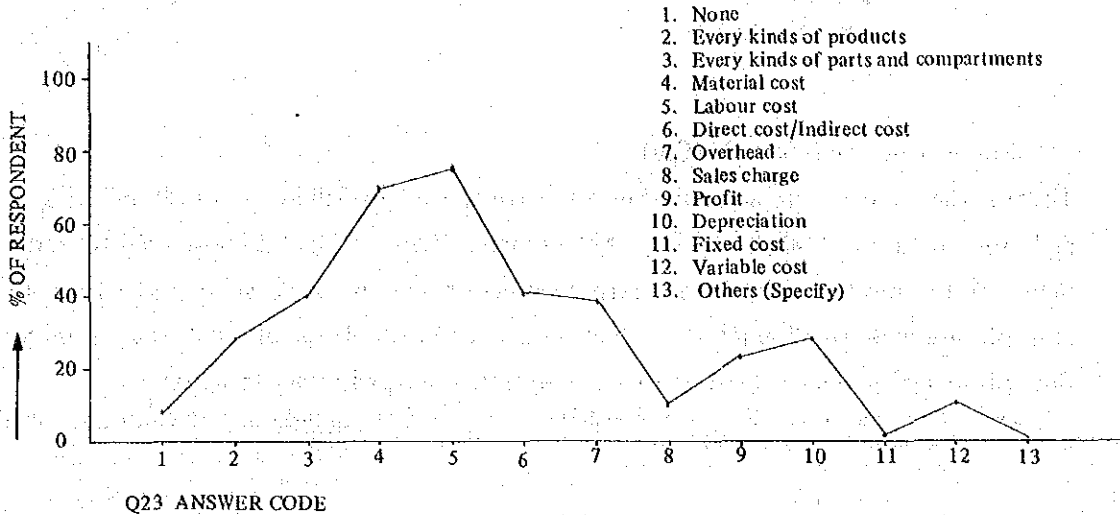


FIG. 4.5.3-40

9) Market research (Q29)

As can be seen from Fig. 4.5.3-41 covering competitors, sales prices, materials purchase prices, qualities, etc., 40 ~ 60% of enterprises conduct research. However, development for new techniques, exploitation of origin of subcontract, demand prediction, etc., are not conducted almost at all. It is expected that in this phase official organization will have institution of support system in respect of information phase.

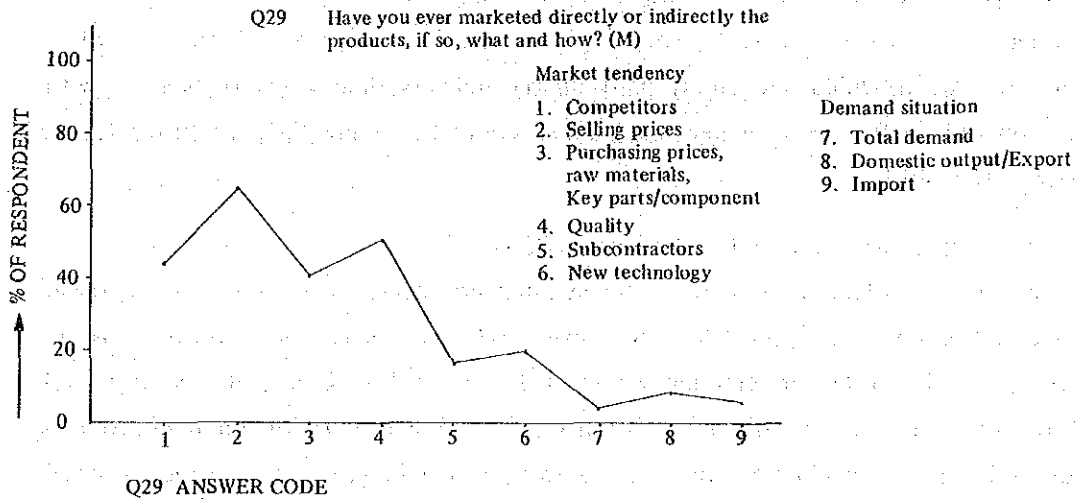


FIG. 4.5.3-41

(6) Manufacture and production techniques

In respect of the phase of manufacture and production techniques already reference has been made in the clause of technical level. Here, not items peculiar to lines of industry but items widely common to all lines of industry are studied picking out typical items representing actual state of sheet work/welding processes.

1) Monthly production scale (Q30)

There is the tendency of separation into the two poles of small amount (150 pcs or less) and large amount (1,500 pcs or over). Accordingly, when such fact is considered from the phase of technical guidance there exist technical needs of two systems - the form of multiple products small amount production and small variety of products mass production. System of guidance based on such actual state is desired to be strengthened.

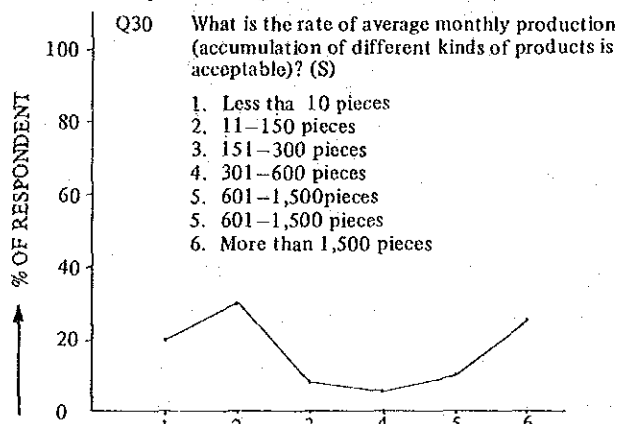


FIG. 4.5.3-42 Q30 ANSWER CODE

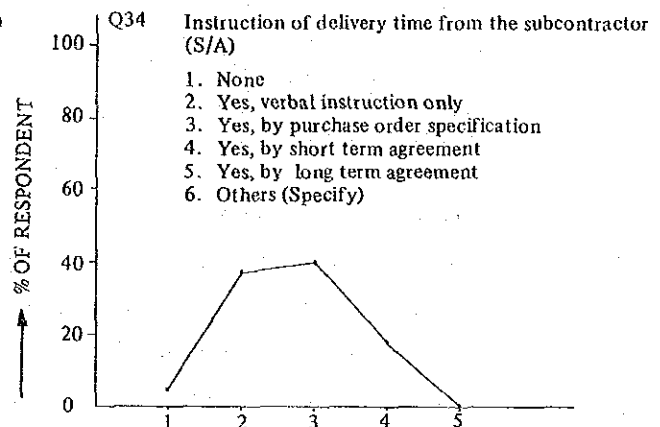


FIG. 4.5.3-43 Q34 ANSWER CODE

2) Delivery time instruction from origin of subcontract (Q34)

Although verbal instructions still account for less than 40%, it can be seen that as a whole instructions are provided adequately. Particularly, delivery time instructions along with long term and short term agreement programs account for about 20%, which represents a preferable condition.

3) Preventive measures for delayed delivery (Q35)

In about 26% of enterprises no counter delayed delivery measures are taken. On the other hand enterprises with full time delivery control staff account for close to 30%. Also in referring to delayed delivery frequency previously reviewed in respect of technical level and to actual state of average delayed delivery period it can be known that problem points relative to production process control exist inherently in a large number. Accordingly, it is necessary to design permeation of plan for production process control in long terms.

By the way, covering delayed delivery frequency (Q36) and average delayed delivery period (Q37) description has been made already in previous (4)-16) and -17) on page 4-351 respectively no description will be made in this section.

Q35 Preventive measures for delayed delivery (S/A)

1. No action
2. Occasional check of deference between planned & actual schedule
3. Weekly check of deference between planned & act
3. Weekly check of deference between planned & actual schedule
4. Daily check of deference between planned & actual schedule
5. Permanent follow up of necessary action by special staff
6. Others (Specify)

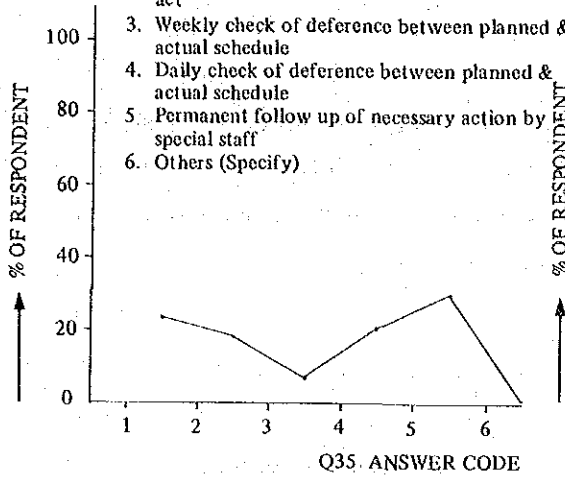


FIG. 4.5.3-44

Q39 Causes of delayed deliveries (M/A)

1. Poor process schedule
2. Delay of raw materials
3. Shortage of delivery time
3. Shortage of deliver time
3. S
3. Shortage of delivery time
4. Shortage of manpower
5. Delay of design engineering
6. Defect/Reject of delivery goods
7. Others (Specify)

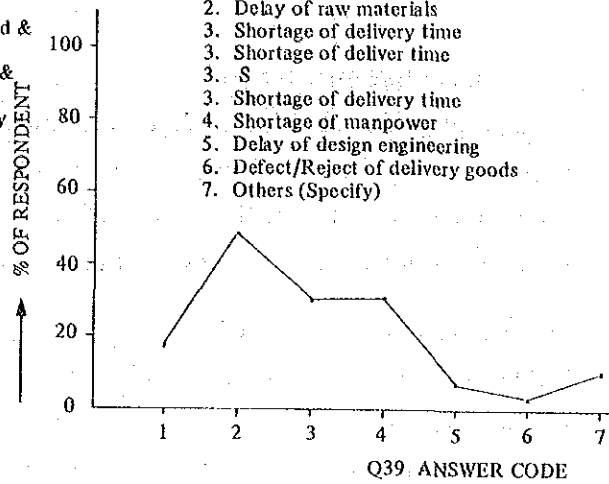


FIG. 4.5.3-45

4) Causes for delayed delivery (Q39)

As for causes of delayed delivery a cause attributable to delayed receipt of materials represents the most prevailing problem accounting for about 45% of the total, followed by shortage of delivery time and shortage in manpower. However, enterprises fundamentally recognizing the cause attributable to poor production process control itself account of 16% or so. All of the above causes are possible to be solved. Guidance will be necessary for how to mark up the level of production process control as a basic problem.

5) Competent readers of technical drawings (Q41)

Enterprises having 2~3 employees in service capable of understanding technical drawings account for 43%. On the other hand enterprises with no such employees in service at all account for 8%. In order to increase productivity it will be necessary to increase the number of persons capable of reading drawings even if they can not draft them. In this phase it will be necessary that official organizations provide aids for extensive reeducation of employees.

Q41 How many employees can understand the technical drawings? (S)

1. None
2. One person
3. 2-4 persons
4. 5-10 persons
5. More than 10 persons

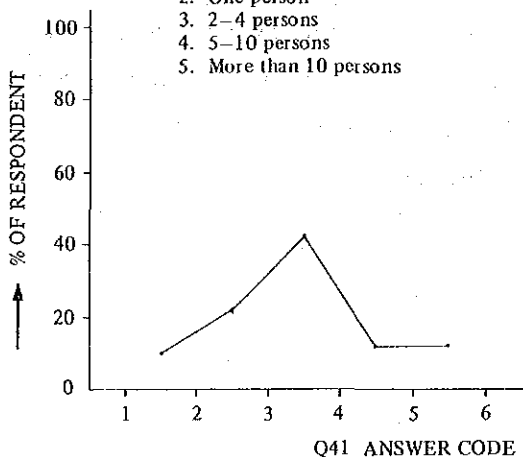


FIG. 4.5.3-46

Q43 What is the tolerance of your main products? (M)

1. 100 mm or rough estimate
2. 10 mm
3. 1 mm
4. 1/100 mm
4. 1/10 mm
5. 1/100 mm
6. Less than 1/100 mm

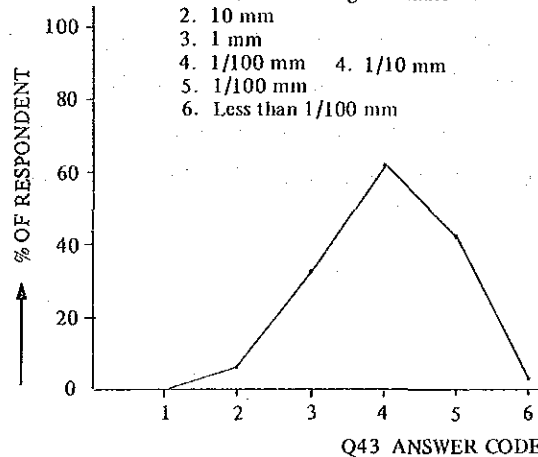


FIG. 4.5.3-47

6) Product tolerance (Q43)

A range of tolerance from 1mm to 1/100mm covers almost all products. However, in general sheetwork welding product will be covered normally with from 1mm to 1/10mm. No accuracy of up to 1/100mm is required. Accordingly, it ought to be interpreted that 1/100mm concerns accuracy of dies in the case of sheet metal press.

7) Utilization state of standards (Q44)

State of utilization of each standard is reviewed and shown in Fig. 4.5.3-48.

Among standards used, Customers' standards account for the largest percentage. However, there is a side face that unless contents of informations are scrutinized carefully judgement can be made hardly for what really will be the actual state. In this respect elucidation to be made in the future, it is considered. It can be seen that among standards used association with JIS and TIS is comparatively of a large magnitude.

Also, own standards are in use in about 22% of enterprises. It may be necessary that in the future the figure representing the same will increase and contents thereof will be deepened. Aids of official organizations in this phase as well will be important.

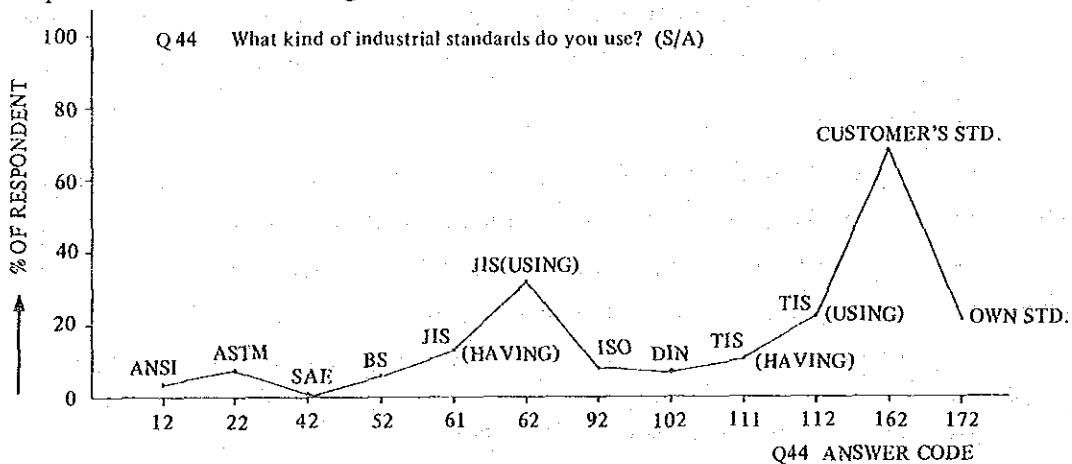


FIG. 4.5.3-48

8) R&D (Q45-1)

In about 40% of enterprises less than 1% of sales is spent for R&D. In about 20% of enterprises 1% or over is used. However, in slightly less than 40% of enterprises no R&D activities are made at all. It can be confirmed that in general it will be necessary that there will be aids from official organizations covering R&D.

Q45-1 How much to the sales do you spend on research and development? (S)

- | | |
|-------------------|-----------------|
| 1. None | 4. 1.1%–2% |
| 2. Less than 0.5% | 5. 2.1%–3% |
| 3. 0.6%–1% | 6. More than 3% |

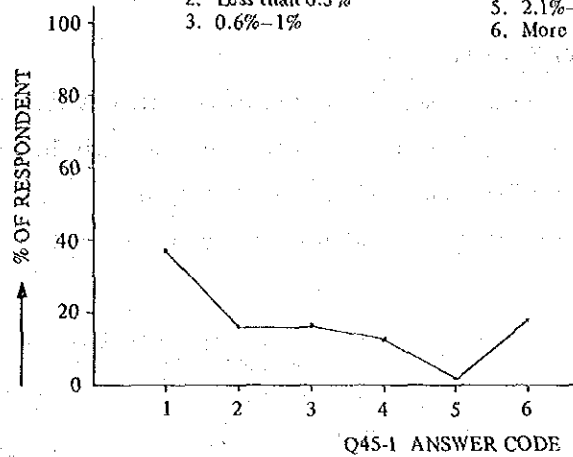


FIG. 4.5.3-49

9) Quality control system (Q46-1)

In reviewing the trend of Fig. 4.5.3-50 the actual state is found that 100% inspection is carried out by workers themselves or by management. Contents of inspection will be visual check and dimensional check for the majority. The number of enterprises having plans established for countermeasures covering problem points is only a few. Feedback of actual state of inspection results is not carried out in much systematic way.

Accordingly, enlightenment and guidance will be necessary by all means covering concrete policies for in general what should be the way of quality control.

Q46-1 Please give informations on your quality control system, i.e. the inspection systems, checking items and the feed back system. (M)

The inspection system is (are):

1. Systematic inspections are not available, "When trouble occurs check"
2. First articles inspection
3. Single sampling inspection
4. Multiple sampling inspection
5. Sequential sample inspection
6. Total (100%) inspection
7. Without acceptance or purchasing inspection
8. With acceptance or purchasing inspection by a standard inspection documents

Feedbacked of the results of inspection is:

41. Only in file, no feed back
42. Notice on the board
43. Circulating notice or inspection record to workers/managers
44. Establishing counter measures by workers/managers
45. Establishing counter measures by professional staff, statistical quality control system

Whom is it inspected by?

11. Workers themselves
12. Manager or the owner
13. Professional staff, patrol
14. Professional staff, stationary

Checking methods and items are:

21. Visual check
22. Sensory check
23. Dimensional check
24. Clearance check for moving parts
25. Hardness check
26. Surface roughness check
27. Colour check
28. X-ray check
29. Magna flux check
30. Noise check
31. Vibration check
32. Life test/running test/

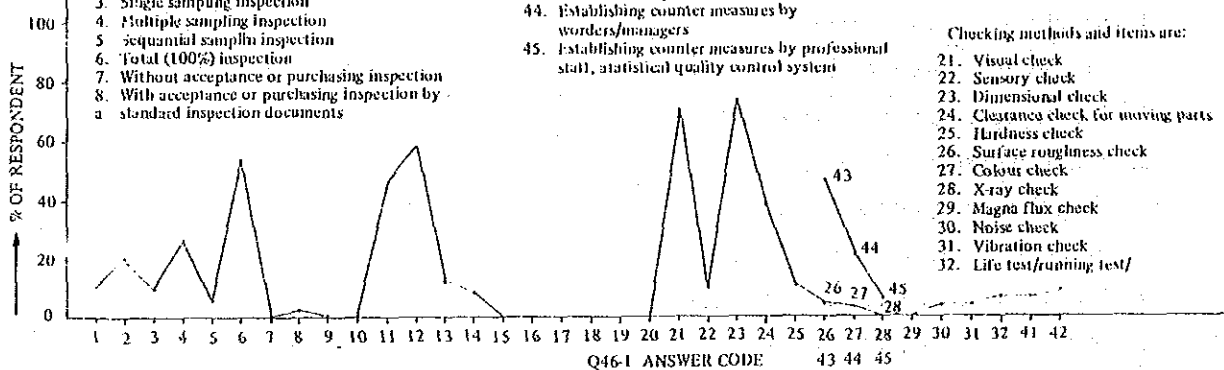


FIG. 4.5.3-50

10) Standardization level (Q49-1)

Check of level of standardization made according to each item is shown in Fig. 4.5.3-51. When reviewed in the order of level of frequency the items will be Production/Works, Quality control, Inspection/Test and Price in descending order. Such may be taken as proper, yet, standardization of design and production process will be the course to be pushed in the future.

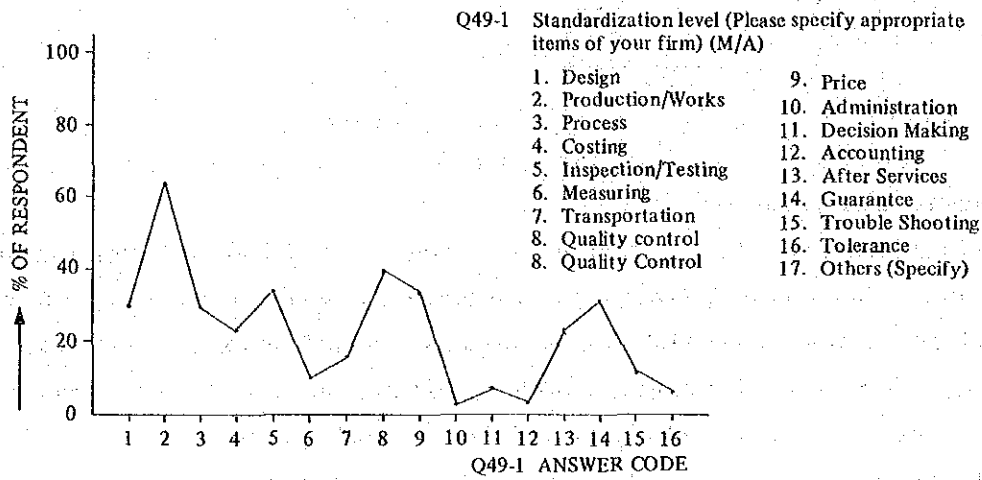


FIG. 4.5.3-51

11) Kinds of engineering (49-3)

When the execution state is reviewed from functional phase, the order will be as follows.

- ① Selection of materials (88 cases)
- ② Basic design (75 cases)
- ③ Specifications (71 cases)
- ④ Conceptual design (67 cases)
- ⑤ Structural design (63 cases)
- ⑥ Detailed design (51 cases)
- ⑦ Functional diagram (49 cases)
- ⑧ Production engineering (39 cases)
- ⑨ Procurement engineering (39 cases)
- ⑩ Material flow plan (32 cases)
- ⑪ Team engineering (30 cases)

It has been previously mentioned that as causes of delayed delivery delay in reception of materials accounts for majority of causes, which matches with procurement engineering ranked in lower level. Improvement will be desired.

On the other hand, when reviewed from phases of executing body and supply features of design engineering, the order will be as follows.

- ① Own company (100%) (178 cases)
- ② Customers supply (142 cases)
- ③ Reproduction (99 cases)
- ④ Own company (partly) (77 cases)
- ⑤ Supply from licensor (39 cases)
- ⑥ Own company (Sometimes) (36 cases)
- ⑦ Purchase from out-company (16 cases)
- ⑧ Not executed (17 cases)

It can be seen that customer supplies and reproductions are the main stream. Accordingly, in order to strengthen the business of metalworking industries, it will be necessary to increase engineering capacity of own company by all means, and official aids from this phase will be necessary.

12) Technical information sources (Q49-4)

When listed in the order of frequency level the ranking will be as follows.

- ① Human network
- ② Workshop
- ③ Other firms
- ④ Consultants
- ⑤ Magazines (Foreign)
- ⑥ Magazines (Local)/Seminars/Exhibitions
- ⑦ Contractor (parent firms)

The ISI (Industrial Service Institute, the Ministry of Industry of Thailand), extension officers, universities, etc. are ranked in lower levels.

In view of the above state it is expected that official organizations will have their role further strengthened in order to increase accessibility of to practical level, systematic and continual technical information.

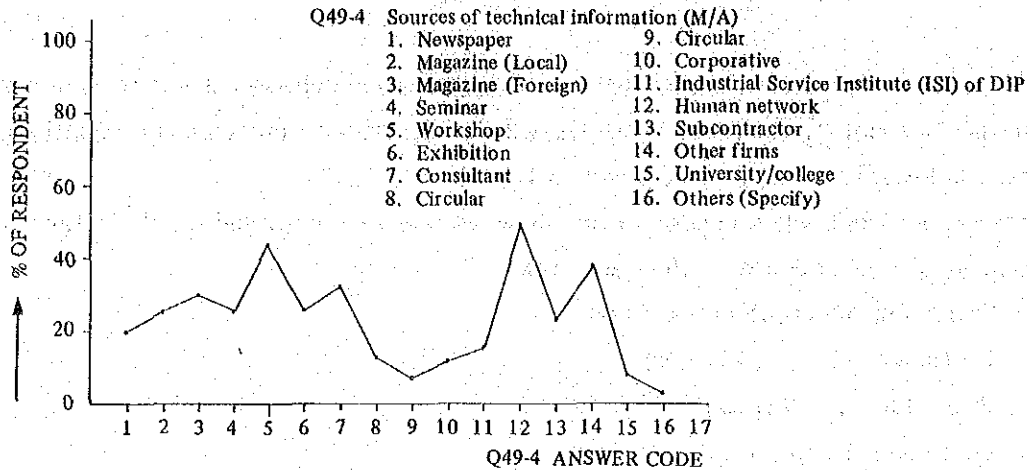


FIG. 4.5.3-52

13) Quality specifications (Q49-6)

Instructions relating to quality specifications are in many cases according to purchase order specifications. However, in the instructions from primary subcontractors to secondary subcontractors recourse to verbal instruction is also large in percentage. Provision of quality specifications will be difficult in many cases where letters of character alone are used. Therefore, provision ought to be made by rank 4, Specifications plus DWG.

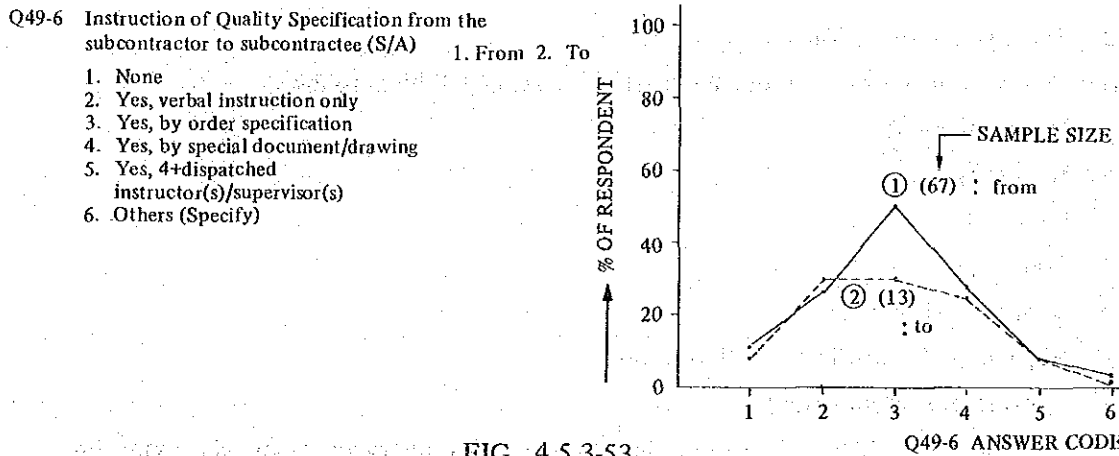


FIG. 4.5.3-53

14) Shipping inspection (Q49-7)

As for shipping inspection, cases of inspection made by full time staff dispatched from parent enterprise account for the majority, about 50%. On the other hand, enterprises of no shipping inspection reach 16%. As for the inspection system aids of official organizations will be necessary relative to preparation of manual, etc., covering how the system should be positioned in quality control systems.

- Q49-7 Shipping Inspection System (For subcontracted goods)
1. None
 2. Permanent check by subcontractor's staff before delivery
 3. Temporary check by subcontractor's staff before delivery
 4. Visual check after delivery
 4. Visual check after delivery
 5. Inspection records check
 5. Inspection records check after delivery
 6. Self-management of subcontractee
 7. Others (Specify)

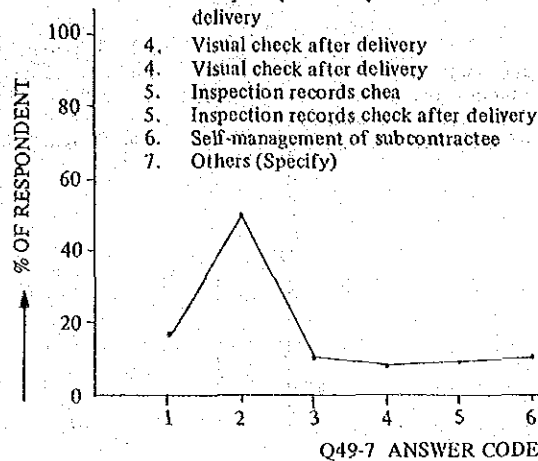


FIG. 4.5.3-54

15) Inspection records (Q49-8)

For inspection records dimensional check and visual inspection are most general. Enterprises having no records account for 30%. In view of the operational state of sheetwork welding business 4. Colour check, 5. X-ray, ultrasonic, magna-flux tests ought to be still higher in the rank of frequency. It will be necessary to design popularization and execution of inspection system based on the above points.

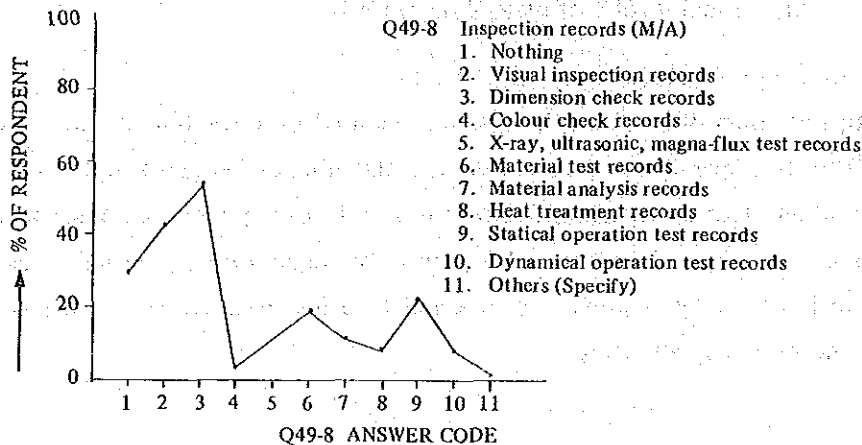


FIG. 4.5.3-55

16) Defect management system (Q49-10)

Although rough studies are carried out, almost no analysis of causes of defects occurring and improvement under scientific approach are not executed at present.

Accordingly, it will be necessary to keep providing education with middle management staff of enterprises made object especially covering plans to seek causes for defective product, how to carry out feedback to production line, etc., within the QC system.

Q49-10 Defect management system (S/A)

1. Not applicable
2. Empirically
3. Analysis of causes as a whole
4. 3. + their monetary terms conversion
5. 4. either for each kind of product or process
6. 4. both for each kind of product & process
7. Others (Specify)

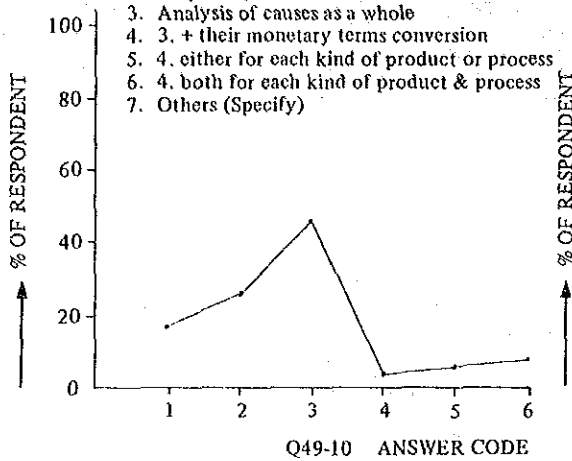


FIG. 4.5.3-56

Q49-13 Interviewer's assessment of technical level (S)

1. Very low (Primitive level)
2. Relatively low (Traditional level)
3. Normal/Average (Local level)
4. Relatively high (National level)
5. High (International level)
6. Extremely high (Exportable level)

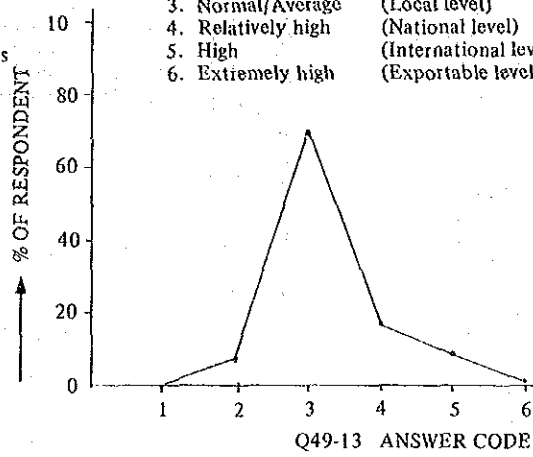


FIG. 4.5.3-57

17) Assessment of enterprise's technical level made by the interviewer himself (Q49-13) Enterprises given the assessment that their levels are higher than mean level of Thailand account for about 26%. On the other hand, enterprises given the assessment that their levels are lower than the mean level account for 6%. Majority of enterprises have been given the assessment to be of an average. How to raise such mean level to international level will be one of major roles of official organizations.

18) Status of use of recycle materials (Q50-1)

In slightly less than 40% of enterprises, various used or second-hand materials are used. Particularly, used steel plates most closely associated with sheetwork/welding business are in use by about 15% of enterprises. How they carry out quality assurance for such used materials is a problem. Concerning this point modernization of used materials market is by all means necessary as previously referred to. Aids from official organizations in this phase are necessary by all means.

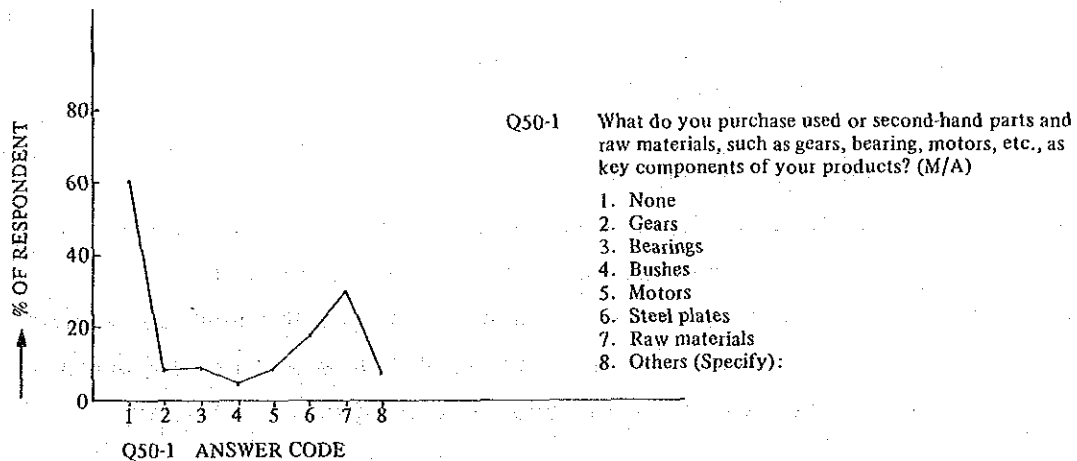


FIG. 4.5.3-58

(7) Business management and control

Concerning the present status in respect of business management control, some lines of analysis have been conducted hereunder.

1) Profit management system (Q71)

Enterprises conducting overall profit management comprehensively account for the largest number, 46% or so in percentage. Enterprises with the profit and loss statement prepared account for about 33%; enterprises conducting profit management according to each product account for 28%; enterprises conducting break-even point analysis account for 22%; and enterprises conducting profit management of only staple product account for about 18%.

Generally speaking, there is still a room for improvement in respect of profit management level also.

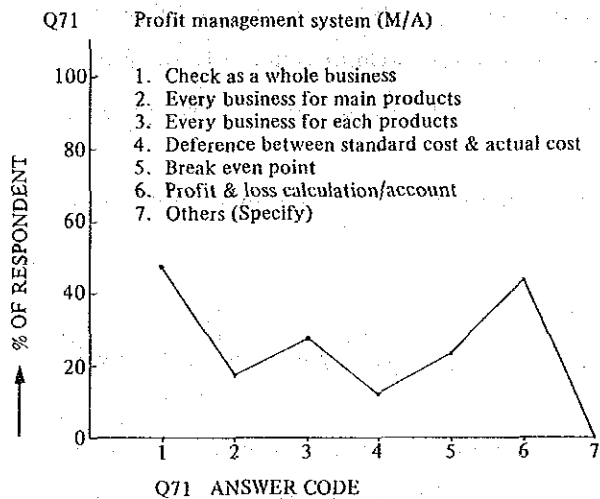


FIG. 4.5.3-59

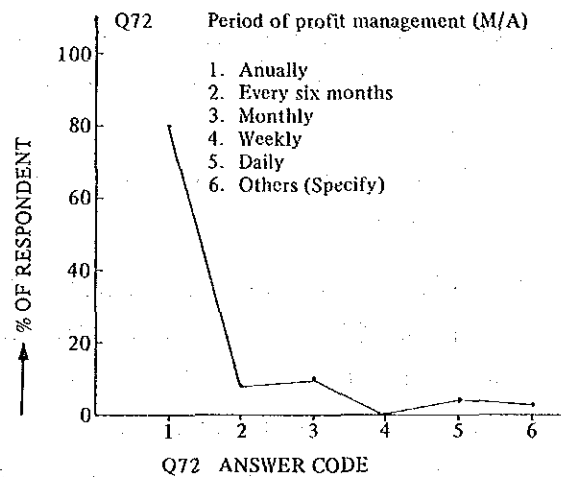


FIG. 4.5.3-60

2) Period of profit management (Q72)

As for the profit management period, one year cycle accounts for great majority, being 82%. The cycle is followed by one month, 10%, six months 7%. Enterprises conducting daily profit management account for approximately 3%. Although it depends upon scale of enterprise, it will be necessary to conduct profit management at the frequency of once every month also in small and medium enterprises.

3) Main management policy to be developed (Q73)

Enterprises listing technical R&D as to ranking item account for 55%; followed by expanded market shares, improved productivity, product R&F, reduced materials costs, quality control, curtailed labour costs, production management, and improved quality.

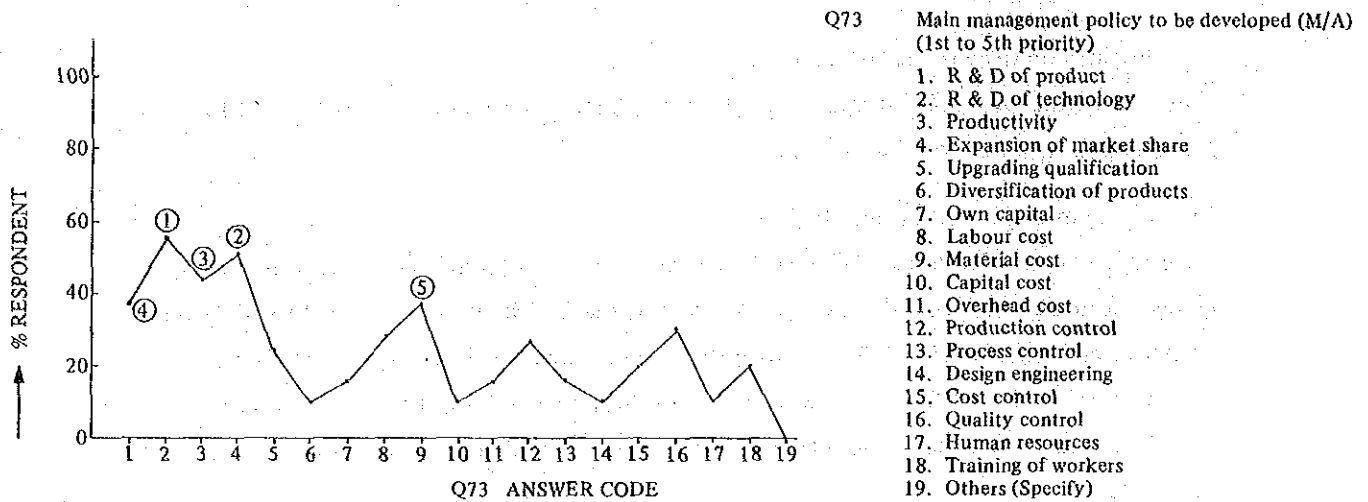


FIG. 4.5.3-61

On the other hand, it can be seen that there is some gap between needs for enterprise level improvement with respect to production process control (improvement in the phase of delayed delivery) and costs control deemed to be important in view of other analysis of actual state.

It will be necessary to eliminate such gap by strengthening enlightenment movement and guidance system.

(8) Human resources and educational level (Q11)

The fulness of human resources of each enterprise has been checked in relation to educational level as shown in Fig. 4.5.3-62.

As can be seen from the Figure human resources ranking, 1, 2 and 3, Primary school or less to 4 - 6 years higher grade school education account for the majority in each respective enterprise. It can be seen that activation of such human capabilities will lead to strengthening of the foundation to support the potential power of enterprises. On the other hand, in the educational ranking, 3, 4 and 5 where activities as middle management of enterprises are expected, 50 ~ 60% of enterprises lack at all such corresponding capabilities. With the above actual state taken into considerations fostering of talented personnel ought to be designed conceiving contents and curriculum of extension services, consultant services, seminars and workshops.

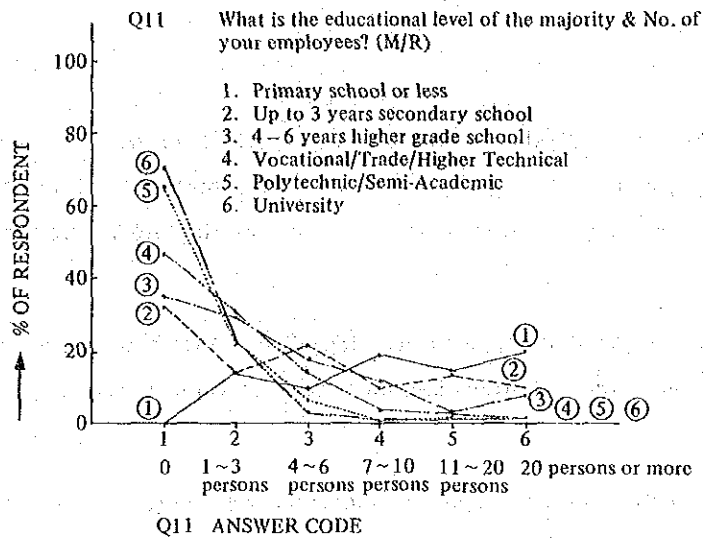


FIG. 4.5.3-62

(9) Multiway analysis

Relative to points analyzed as above, when more detailed factors covering particulars of each respective factor are analyzed, sometimes one is made to find phases overlooked up to now.

Here, out of results of analysis made covering such points, main points will be referred to, and efforts have been made to make the focus point of problems clarified further. Hereunder, results of principal analysis will be shown itemized.

1) In enterprises manufacturing civil and construction machinery and the like still 50% of firms use scrap materials recycled as raw materials. Also, in enterprises of agricultural machinery, transportation and port and harbour equipment, and pipe processing operations 25% of firms use scrap materials. The least amount of use is represented by metalworking machinery enterprise with about 13%. (Q311/Q05)

2) Stainless steel is used in 25% of firms in the civil and construction machinery enterprises. About 13% of automobile, agricultural machinery, transportation and port and harbour equipment, pipe processing and metalworking manufacturers use stainless steel. (Q311/Q05)

3) About 14% of enterprises engaged in subcontract work constantly still use scrap materials. About 7% of such enterprises use stainless steel materials. (Q311/Q70(1)).

4) In electric and telecommunication equipment use of plates and sheet of 4mm or less account for the greatest majority. Use of heavy plates of 10mm or over, particularly of 25mm or over, is limited to only civil and construction equipment, industrial machinery and metalworking manufacturers. (Q313/Q05)

5) From the viewpoint of the examiner (the interviewer of the questionnaire slip), enterprises with high level of technical potentials are limited to enterprises engaged in thinner plate and sheet processing of 4mm or less in thickness. (About 17%) (Q313/Q49-13)

6) In enterprises engaged in subcontract operations constantly, there are many enterprises engaged in processing of thin plate and sheet of 4mm or less in thickness. (About 22%) (Q313/Q70-1)

7) In civil and construction equipment manufactures, there are comparatively many cases using welding rods discriminated according to characteristics (26%) but, in agricultural machinery manufacturers generally multi-purpose welding rods are in use and in many cases the latter is used for all applications. (About 63%) (Q315/Q05)

8) From the viewpoint of the interviewer, enterprises considered to be of high level of technical potentials will be about 17% judged on the basis of their method of use of welding rods. (Q315/Q49-13)

9) Corelationship between adequate selective use of welding rods and subcontract activities frequency has been failed to be found. (Q315/Q70 (1))

10) In enterprises classified according to products making comparatively careful use relative to quality specifications covering scraps, civil and construction equipment manufacturers are rated in top ranking, and for others of agricultural machinery, transport and port and harbour equipment, pipe processing, metalworking machinery manufacturers approximately 13 ~ 25%. (Q316/Q05)

11) Between the level of previous knowledge to scrap quality specifications, technical level and subcontract frequency, no conspicuous corelationship is seen. (Q316/Q49-13/Q70 (1))

12) Enterprises making efforts for quality provisions covering raw materials steel plates etc., by obtaining mill sheets, etc., are manufacturers making automobile parts, civil and construction machinery as well as agricultural machinery. (Q317/Q05) Also, in such enterprises, there is the tendency of higher subcontract frequency. (Q317/Q70(1))

13) In civil and construction machinery manufacturers, use of manual press and screw press accounts for majority of cases. (Q321/Q05)

14) As for enterprises provided with comparatively high level of presses (crank, pneumatic pressure, oil hydraulic) result has been obtained that their technical potentials are comparatively high in respect of assessment made by examiners covering technical potentials. (Q321/Q49-13)

15) There is no correlation between the type of presses and subcontract frequency. (Q321/Q70(1))

16) Enterprises provided with semi-automatic welding machines belong to some extent to civil and construction machinery, transport, and port and harbour equipment, pipe processing, and metalworking machinery manufacturers. (Q324/Q05)

17) There is no correlation between edge preparations for welding materials and subcontract frequency. (Q326/Q70(1)).

18) Manufacturers engaged in manufacture of civil engineering and construction machinery, and piping materials are of high probability of being possessed of shearing machines. (Q327/Q05)

19) There is no correlation between shearing machines possessed and subcontract frequency. (Q327/Q70(1))

20) Many of civil and construction machinery manufacturers possess sheet metal processing equipment. (Q328/Q70(1))

21) Over majority of civil and construction machinery manufacturers utilize jigs, fixtures and the like. (Q329/Q05)

22) Correlation between the measuring method and the product can not be found. (Q331/Q05)

23) In manufacturers with higher level of subcontract frequency, there are many cases of conducting measurement of each member. (Q331/Q70(1))

24) The number of enterprise conducting qualification examination for welders is only one manufacturer of agricultural machinery. (Q334/Q05)

25) Enterprises conducting application of welding design are civil engineering manufacturer and construction machinery as well as agricultural machinery manufacturers, accounting for 30 ~ 50% or so. (Q335/Q05)

(10) Field survey

In the present investigation, an examination with interviewers mobilized on the basis of questionnaire slips and inspection survey covering local enterprises and related organizations made by the full members of the survey team have been conducted.

Almost no deviation and gaps between result of analysis made according to the response to questionnaire slips and that of survey according to field inspection are perceptible.

Particularly, problem points relative to sheetwork welding noted during the survey are as follows.

1) Agricultural machinery

Manufacture of power tillors are very much active. Under the circumstances particularly in relation to sheetworking welding processes, the problem involving the gear box and power tillor couplers will be here illustrated related to design engineering. The principal number of frame drive unit, gear housing is of plate work and accordingly, the method of after two side plates (gear bearing centering part) to be the reference mounted to a jig peripheral members are temporarily installed while being bent is a method well conceived. Using a simple jig, a high efficiency is obtained. However, in the process before and after the same no jigs and fixtures are used. Instead not only temporary installation but final installation are performed on formal jigs and fixtures and accordingly occupancy time of jigs is longer resulting in overall process disturbed creating a bottle neck. This will be a case in point to review the balance of production process plan.

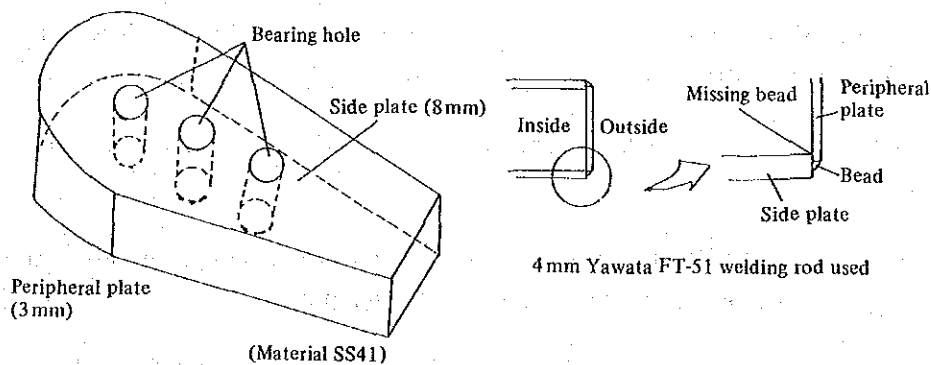


FIG. 4.5.3-63 Sketch of the gear housing and welded part

Structural surface of the housing, particularly on the combination of side plates and the peripheral plate construction of weld joints of the plate thickness is very much simplified, no backside weld as well performed, there is a problem relative to durability. Further, in some other enterprise, plate thickness of the gear box is reduced to the minimum limit and welding performed.

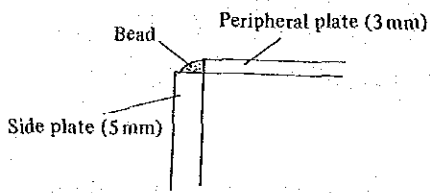


FIG. 4.5.3-64 Welded part of the gear housing (Present one)

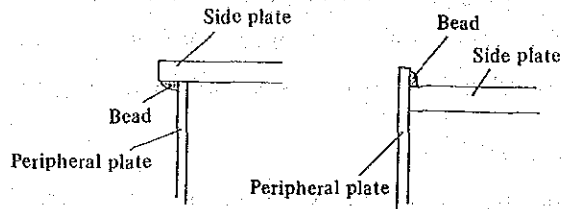


FIG. 4.5.3-65 Welded part of the housing (Suggested one)

In such a case, it will be necessary to use such design to strengthen other members, e.g., bearing, power tillor attachment equipment coupling unit, weld at the root of the handle, and weld between gear handle with such doubling as carling and such reinforcement member as stiffeners, etc., to attenuate vibrations from the gear, the chain, etc., and avoid adverse effects on the gear box. Structure wise the gear box like the one shown in the above figure (Fig. 4.5.3-65) putting importance to workability is favorable.

Particularly, the construction at the right is easier in performing positioning, functionally free from hindrance, and it is considered that external appearance as well will be better.

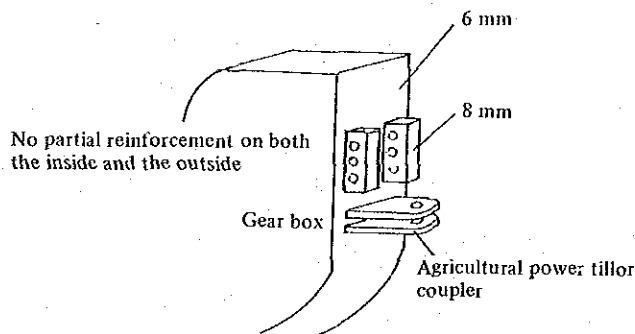


FIG. 4.5.3-66 Agricultural power tillor coupler

On the other hand, when construction of the agricultural power tillor coupling unit is checked, it is found that reinforcement treatment is not sufficient and problem remains in respect of strength. Accordingly, obstruction may be avoided before occurring by providing partial reinforcement with doubling or by providing reinforcement with stiffeners, etc., installed to the back surface.

As Thai agricultural power tillors are more steady in basic demands compared with those of neighboring countries, and are provided with competitive price level, through introduction of governmental type approval system etc., of the national government their status of the merchandise having export potentials ought to be promoted.

2) Mechanical press

In Thailand manufacture of mechanical eccentric presses are active for the purpose of manufacturing various parts. In such enterprises, many examples have been found that in manufacturing base plates and frames two pieces of heavy plates are overlapped and plate edges are welded without performing edge preparation treatment. It will be obvious that such base plates and frames fabricated by such processing will be positively subjected some day to cracking due to repeated impacts. For such components integrated types of casting will be preferable. But, economic problem remains in case such castings are not amount in demand to reasonable amount. Accordingly, the present state ought to be improved by properly making application of plug welding.

Photo 4.5.3-1

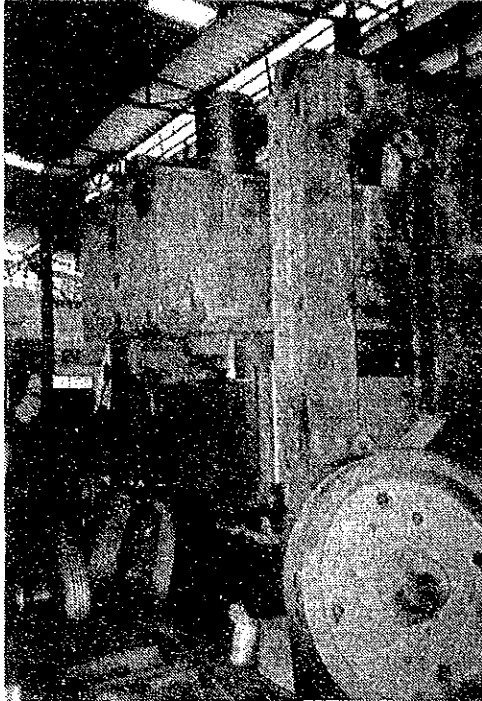


Photo 4.5.3-2



(11) Software and hardware of sheetwork/welding processes

In the phase of software, it will be necessary to keep providing improvement and popularization covering each respective detailed items, besides designing introduction and popularization of welding design method of enterprise level, of problem points for example erroneous selection of welding rod specifications, erroneous setting of welding application locations, selection of current values, shortcomings of welding table (no work table is made available and welding is performed on the floor), welding positions, method for handling welding rod in operation, method for control of welding rods, method for storage of the same, method for training of workers, etc.

On the other hand, in the phase of hardware, firstly, the actual state of many enterprises conducting gas welding is noted, and modernization expediting project by replacing the same with electric welding ought to be pushed. Electric welding has the advantage of comparatively unskilled labourers, after they realize adequate application method, may readily obtain product stabilized in quality characteristics. Also, it is easy to carry out control in safety control phase. Based on the above situations, popularization of electric welding machines ought to be positioned as one of national government's industrial structure modernization projects.

(12) Intensification of problem points involving promotion of sheetwork/welding processes

When the problem points analyzed in Clauses 1) ~ 11) are classified on the basis of countermeasure policy and promotion policy, the table as in the following will be compiled. In the same the item numbers of analysis report covering problems points derived as a result of analysis are classified into items based on the phase of function of promotion policy and the division of characteristics factor diagrams previously shown have been made the principal body and compiled into the form of a matrix.

Follow-up Responsibility Summary Table (1) Sheetwork & Welding Process (4.5.3)

No.	Responsible Organizations & Bodies	MOI										MOA					
		DIP					MS										
		ISD	INDFC	SIFO	RDC	PIO	ISD	ISD	ISD	ISD	ISD		ISD				
	Policy/Role/Object	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
1	Modernization by Types of Industry (Process/Product)	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH	BCDEFGH
2	Development of Technology	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH	ABCDH
3	Technological Consultation or Assistance	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH	ABCDEGH
4	Industrial R & D in Technology	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH	ABCDFH
5	Technological Training	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH
6	Technological Information Dissemination	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH
7	Technological Transfer	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH
8	Study and Investigation	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH	ACDEH
9	Management Modernization	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
10	Support for Establishment of Associations	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB
11	Energy Saving																
12	Promotion of S.W.L. in Provincial Area																
13	Promotion of Production Sub-contracting System	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH	ABCDEFH
14	Marketing Services Preferential Order	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH	ABH
15	Financial Assistance Improvement																
16	Bureaucratic Procedure Assistance	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
17	Infrastructure																
18	Education, Training																
19	License, R & D																
20	Standardization																
21	Planning & Coordination																

4.5.4 Machining

(1) Outline of Machining Industry

1) Present Conditions of Manufacturing in Thailand

Manufacturing in Thailand, which is the second important industry in the nation following agriculture, has grown remarkably, as is seen in Table 4.5.4-1. During the

Table 4.5.4-1 Location of Manufacturing and Agriculture in Gross Domestic Production in 1970 & 1976

	① 1970	② 1976	②/①
Manufacturing	20,097	35,575	1.77
Agriculture	36,185	46,113	1.27
All Industries	119,853	174,886	1.46

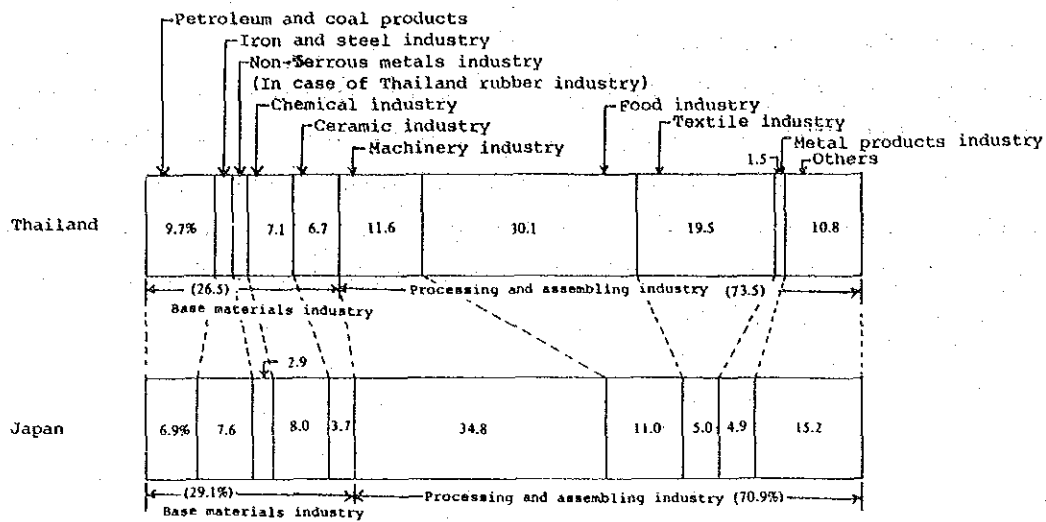
period between 1970 and 1976 the growth of manufacturing stood at 77%, surpassing largely the rate of agriculture of 27% and the average rate of all industries of 46%. However, the scale is still small and it seems that there exists scope for further improvement and development.

Table 4.5.4-2 reveals the scale of manufacturing in Thailand and the ratio of employees in manufacturing sectors to all the population. In addition, Fig. 4.5.4-1 shows composition of manufacturing sectors by industry, in comparison with that of Japan.

Table 4.5.4-2 Scale of Manufacturing in Thailand

	Total population	Labor force	Number of office	Number of employees	Ratio
1977			26,468	1,062,000	40.1
1981	48,490,000	25,215,000		1,320,000	19.1

Note : Labor force is calculated at about 52% of total population.



Source: Saeng Sanguanruang, Nisa Xuto, Preeyanuch Saengpassorn, and Chuegeep Piputsitee, Development of Small and Medium, Manufacturing Enterprises in Thailand, Dec. 1978

Research & Statistics Sec. of Secretariat of the Ministry of International Trade and Industry, Industrial Statistics 1982

Fig. 4.5.4-1 Composition by Type of Industries Thailand and Japan

(2) Actual Conditions of Machining Industry in Thailand

At this time 126 out of all the firms surveyed answered on machining. Considering these answers and analyzing results of various datum, we are now talking about machining in Thailand.

1) Actual Conditions and Scales of Firms

① Age of Firms (Q.01)

The survey reveals that 46% of the firms surveyed were established more than ten years before so that they are regarded to have their own technique.

② Capital (Q.0-1) (Q.06)

Analyzing corporation scales by capital, firms capitalized at \$250,000 or less accounted for 47.6%, and those with total assets of \$250,000 or less accounted for 98.4%, representing an important part. Such figures show that small-scale firms occupy a large part of machining industry.

③ Estates and Floor Areas (Q 01-03, 04)

As to estates and floor areas of coporations, more than 70% of firms surveyed own those of less than 2500 m². However, firms possessing areas more than 16,000 m² account for 16.7%; moreover, those possessing areas more than 100,000 m² account for 3.2%.

According to the fact that a large 83% of firms have plans to move their factories to other areas for the narrowness of the present estates, as is mentioned below, many firms are estimated to run in narrow factories.

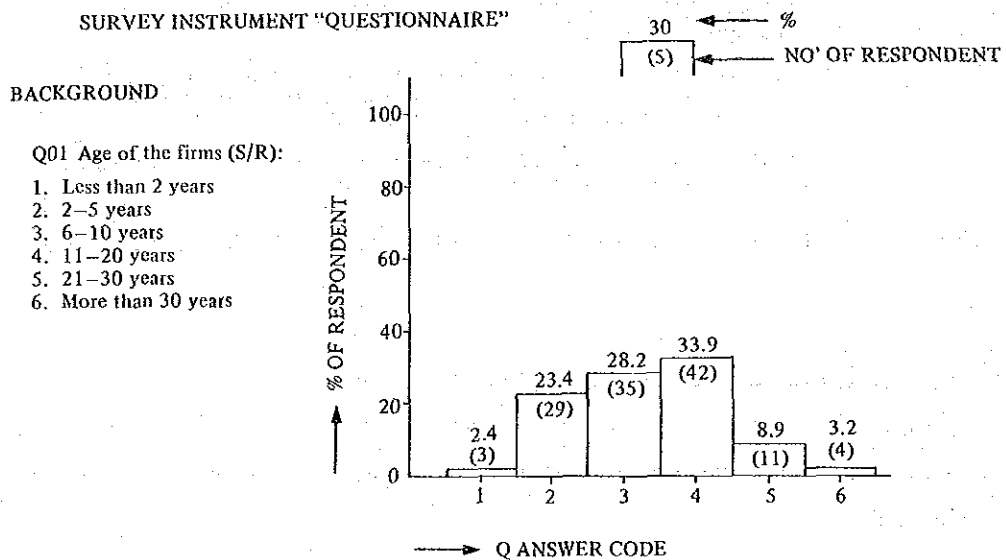


Fig. 4.5.4-2

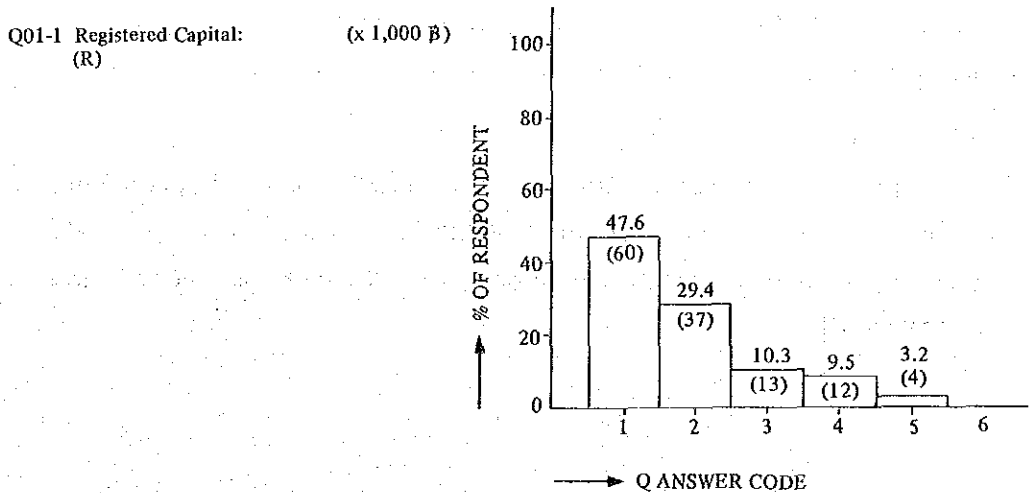


Fig. 4.5.4-3

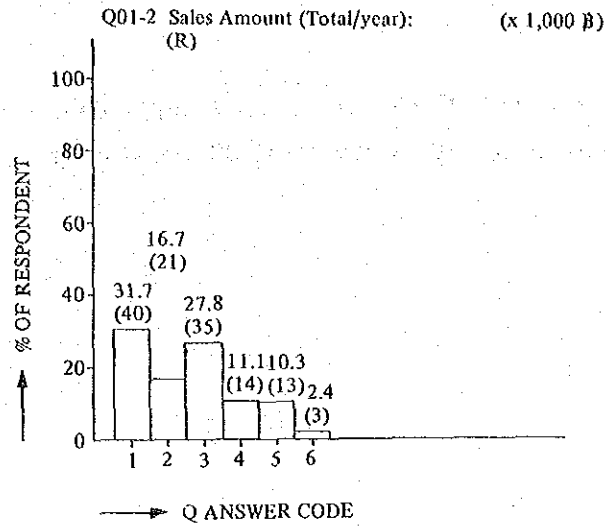


Fig. 4.5.4-4

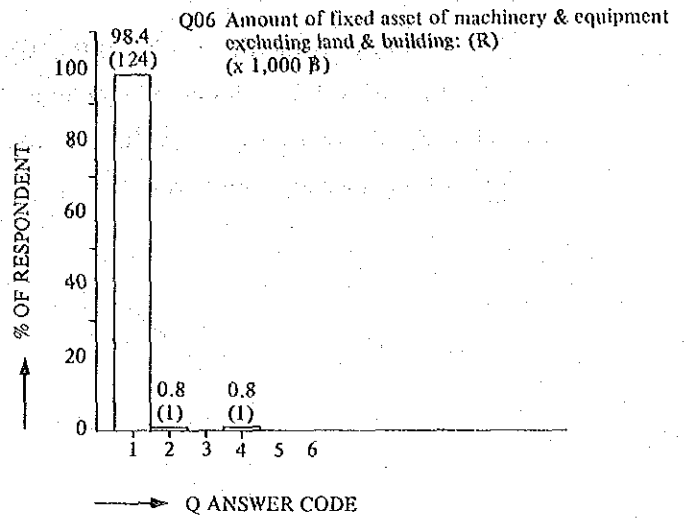


Fig. 4.5.4-5

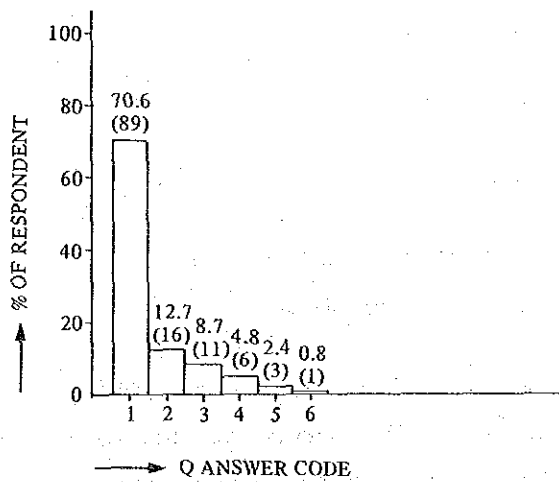


Fig. 4.5.4-6

Q01-3 Please give information concerning your factory. location, estate, building structure and floor area. (R/A)

Address of Factory	Estate (m ²)	Factory Building	
		Structure	Floor Area (m ²)
1.	2.	4. Reinforced concrete 5. Iron steel 6. Wooden 7. Special foundation	3.
21.	22.	8. Concrete floor 9. Earth floor 10. Single-story 11. Multi-story	23.

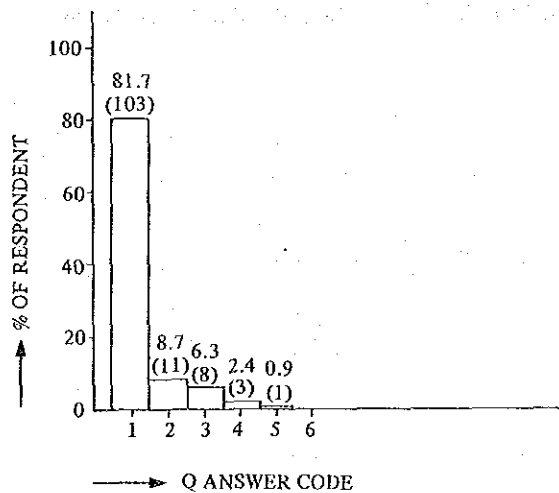


Fig. 4.5.4-7

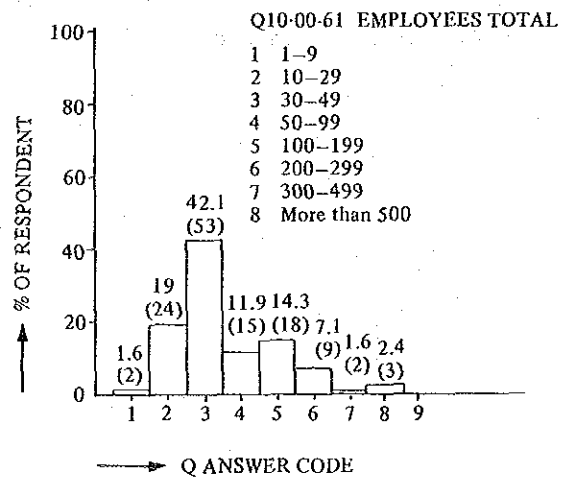


Fig. 4.5.4-8

2) Employees and Service Years (Q.10)

In respect of the number of employees, firms with 49 workers or less occupy about 63%. Skilled workers are estimated to account for 10 to 20% (Q.10.00-61), playing important roles in production.

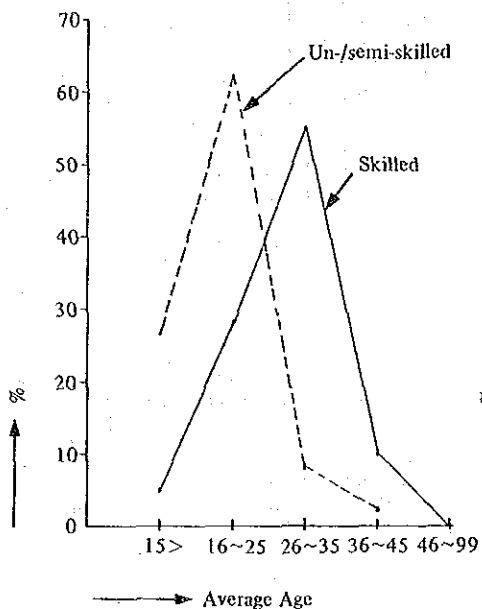


Fig. 4.5.4-9

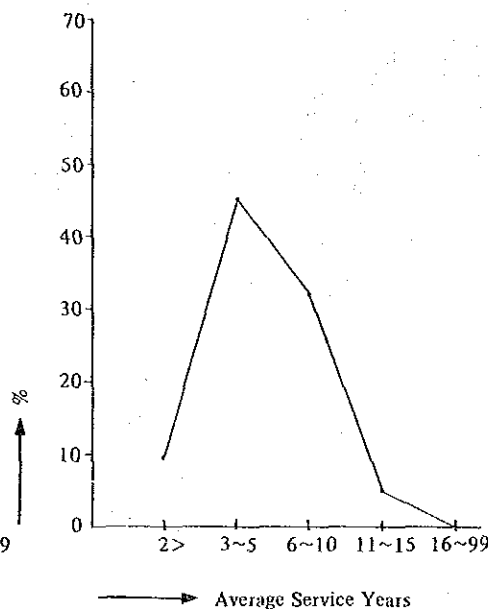


Fig. 4.5.4-10

Fig. 4.5.4-9 shows composition by age of skilled workers and unskilled workers, and Fig. 4.5.4-10 represents average service years of skilled workers. These charts reveal that those working for three to five years account for the largest part of all the skilled workers and the fact that those working for six to seven years are regarded to be skilled, although there are relative many workers having experience of six to ten years, presents a problem what level their skills stand at.

3) Goods and Subcontracting (Q.05)

① Goods

Among small- and medium-scale firms more than half don't seem to have their own specific goods. However, 20.5% of those firms manufacture standard parts, and 51.5% receive, orders of standard goods as subcontracting. Considering these facts, it's possible to instruct these firms to be promoters in standardizing machine parts in Thailand.

Fig. 4.5.4-11 shows comparison of own-made, order-receipts, and order-giving. It's remarkable that there are many firms that process standard goods and engage in repairing.

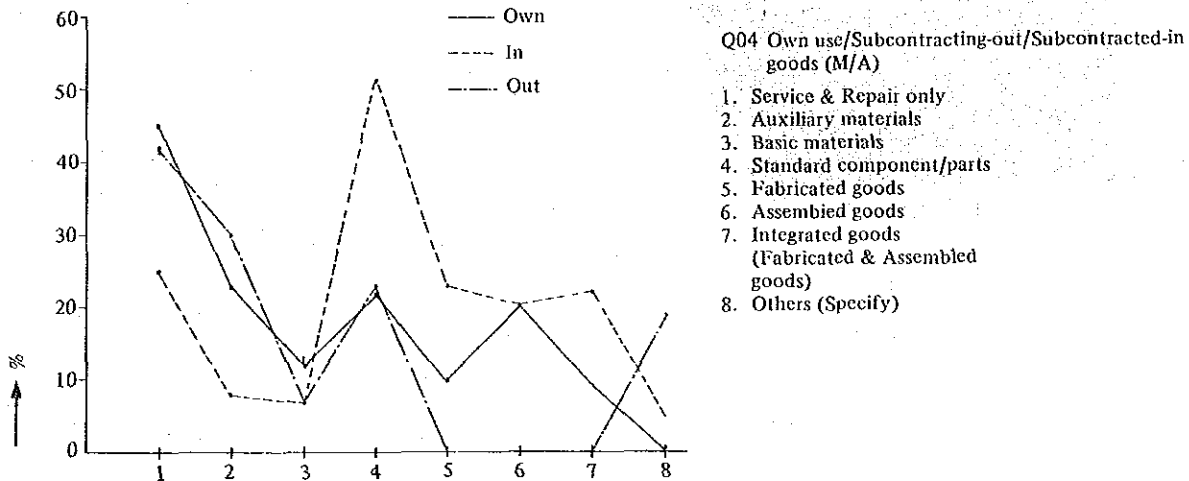


Fig. 4.5.4-11



Photo 4.5.4-1 shows a band-saw for wood working, whose body is made for welding of steel board. Though the fixed table presents a problem how to cut at a right angle, they are arranged suitably.

Photo 4.5.4-1

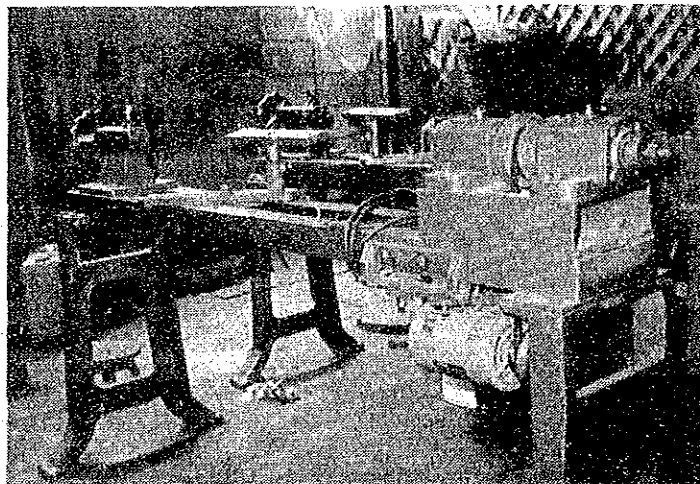


Photo 4.5.4-2 describes a lathe for wood working, which is not a machine requiring accuracy.

② Conditions of Subcontracting (Q.05)

Fig. 4.5.4-12 represents the ratios of subcontracting and of second-sub-contracting by type of industries. It shows that these ratios are remarkably high in “industrial machining or parts (type 2)”, “agriculture machinery or parts (type 4)”, and “moulds & dies or parts (type 12)”.

Analyzing these processing, about 40% of firms engage in processing of general machinery, about 18% engage in processing requiring a little accuracy, about 28% engage in processing requiring accuracy, and 14% engage in processing special parts (type 1 and 4 don't include engines.)

Q05 Kind of products Own use/Subcontracting out/
Subcontracted in: (M/A)

- | | |
|--|--|
| 1. Motor vehicles or parts | 8. Architectural/carpentry & building works or parts |
| 2. Industrial machinery or parts | 9. Railway equipment & carriage parts |
| 3. Civil structural & construction machinery or parts | 10. Working tools or parts |
| 4. Agricultural machinery or parts | 11. Metalworking machinery or parts (except item 17) |
| 5. Electrical & telecommunication machinery or parts | 12. Moulds & dies or parts |
| 6. Transport & harbour equipment not classified elsewhere but including shipbuilding & repairing | 13. Tableware/utensils or parts |
| 7. Pipework or parts (except item 16) | 14. Kitchen equipment |
| | 15. Engines & turbines |
| | 16. Pumps & valves |
| | 17. Machine tools |
| | 18. Gears |
| | 19. Other machineries & equipment or parts |
| | 20. Others, specify |

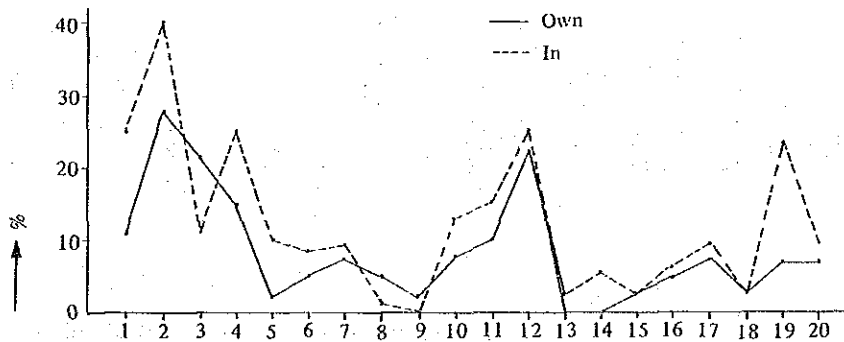


Fig. 4.5.4-12

In respect of improving machining technique in Thailand, it is also good to make a target smaller. For example, it's desirable to put an emphasis on instruction of the firms, accounting for 28%, engaging in processing requiring accuracy and it's also desirable to emphasize the instruction of firms, accounting for 28% and 18%, engaging in processing requiring accuracy and a little accuracy, respectively, with an expectation of their influence on others. Moreover, it's also good to emphasize the firms accounting for the largest 40%, with an expectation of immediate effects.

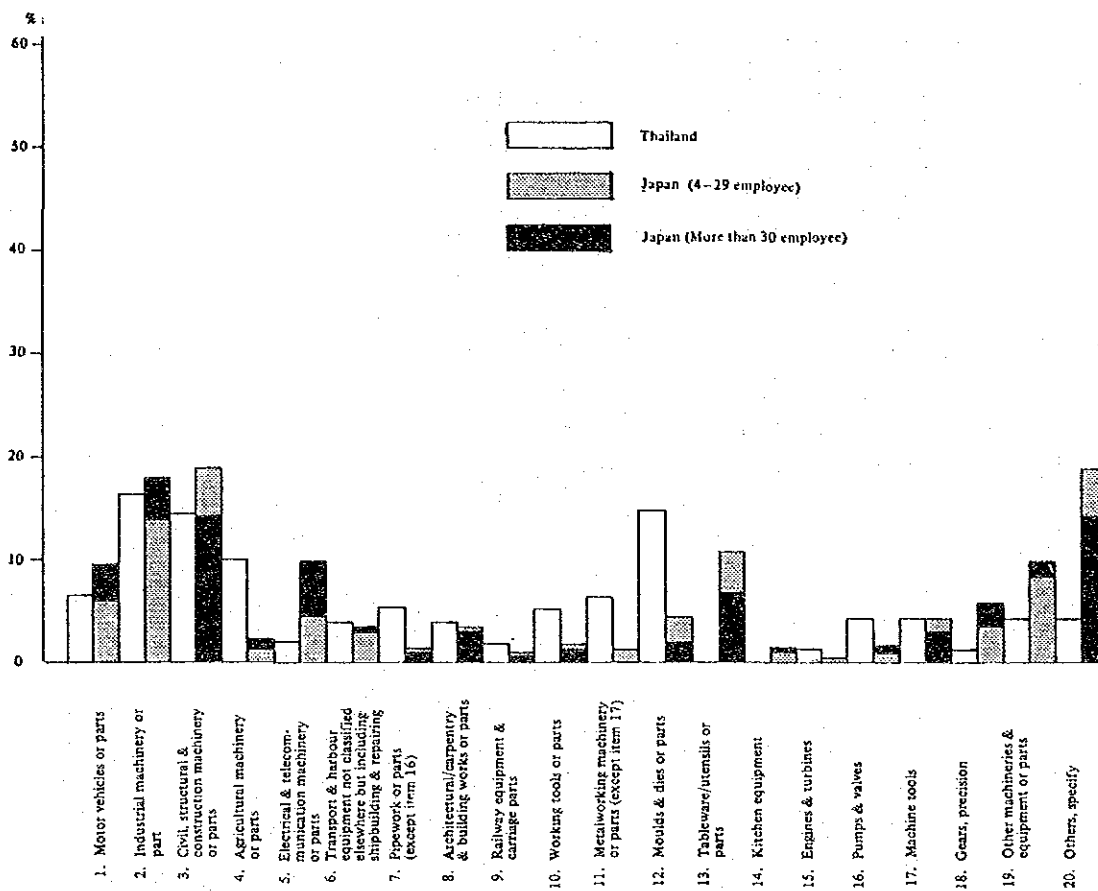


Fig. 4.5.4-13 No. of firm in terms of products

Fig. 4.5.4-13 shows for reference the comparison between Japan and Thailand in respect of ratios of the number of firms processing the same kinds of goods.

In type 19 and 20 there are distinct difference between Japan and Thailand probably because there are quite many kinds in Japan.

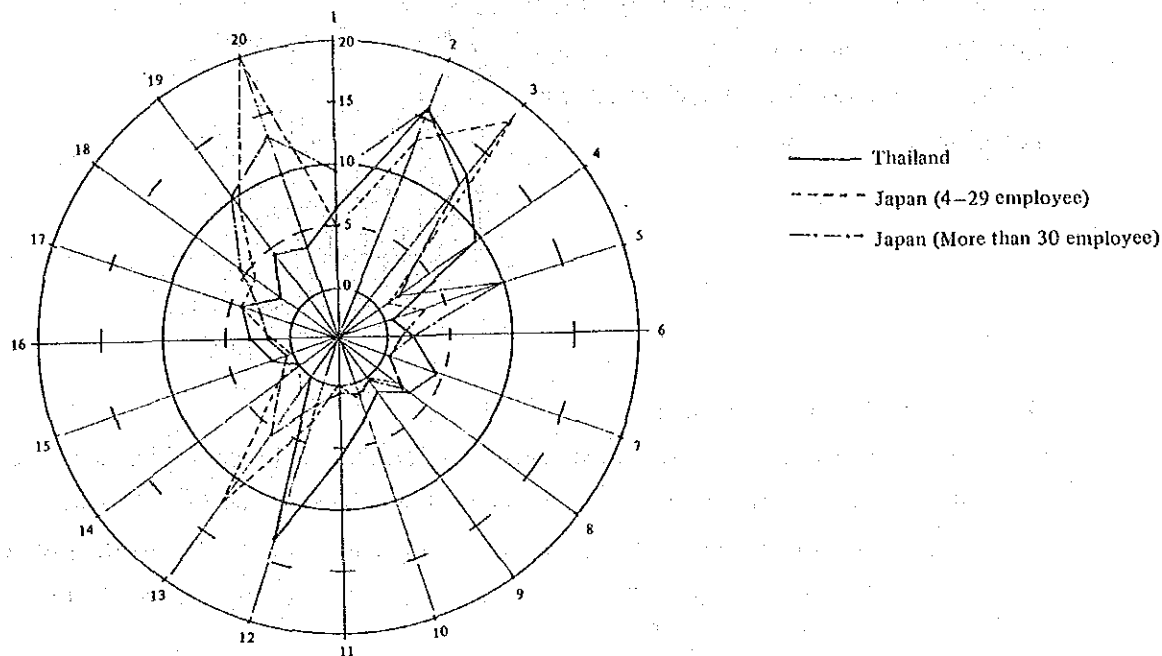


Fig. 4.5.4-14

Fig. 4.5.4-14, which is made on the basis of the previous datum, represents differences between Japan and Thailand in respect of the number of firms in individual industry.

There are many firms in “electrical & telecommunication machining or parts (type 5)”, “tableware/utensils or parts (type 13)”, “other machineries & equipment or parts (type 19)” and “others, specify (type 20)” for Japan, while for Thailand there are many firms in “agriculture machinery or parts (type 4)” and “moulds & dies or parts (type 12).”

4) Sales and Marketing Aspect

① Production Orders in Hand (Q.22-1)

As for production orders in hand, 61% of firms have more than 16 days. Taking into account of the smallness of their scale, characteristics of machining, that is only short term needed for processing, they seem to have reasonable orders.

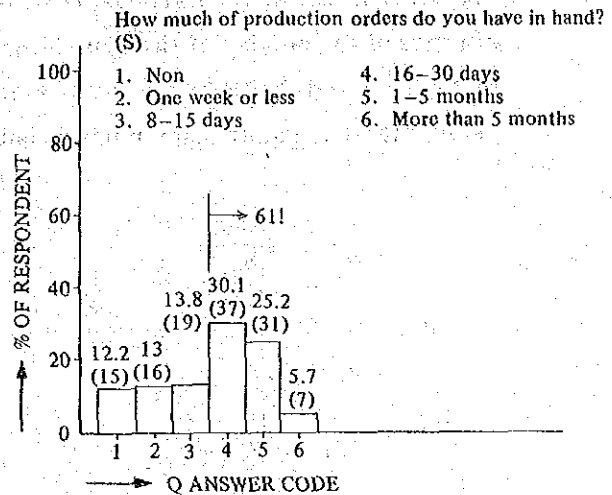


Fig. 4.5.4-15

② To where Products Are Sold

Many of the firms surveyed sell their goods to domestic customers. Moreover, more than half the firms answer that their markets are the neighborhood of their own firms. Seeing that many firms want to export, as is shown in answers to Q. 74, it's the problem to be considered in order to nourish medium- and small-scale industries in the future.

Q20 Where are your products sold and consumed? (M)

1. Region/District
2. Province/State
3. Country
4. Developing countries
5. Newly industrialized countries (NICS)
6. Developed countries

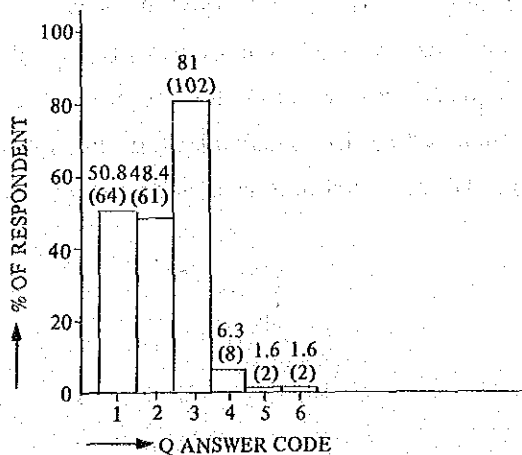


Fig. 4.5.4-16

1. 31% and above higher
2. 21%-30% higher
3. 11%-20% higher
4. 1%-10% higher
5. Market price
6. Less than market price

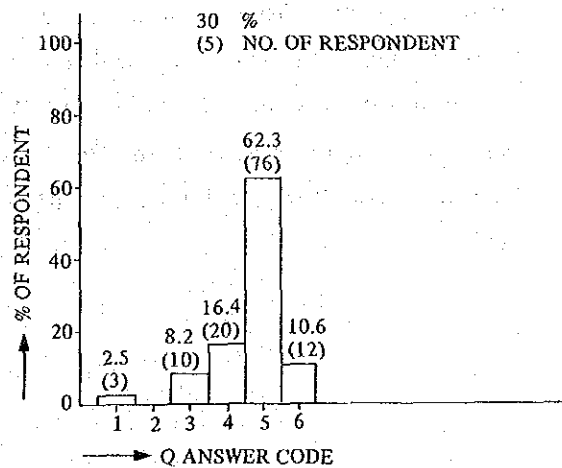


Fig. 4.5.4-17

③ Prices of Goods (Q.24, 27)

In respect of prices of goods, a major part of firms answer that their prices depend on market situations. But the fact that firms answering to set higher than market prices by 1 to 20% may suggest that firms, equipped-value are now growing.

According to the survey, more than 50% of the firms have interest in labor costs and material costs so that it's necessary to control these costs in consideration of price decision, securing of profits and nourishment of medium- and small-scale industries.

5) Conditions of Manufacturing

① Number of Processing Parts and Processing System

Though the number of parts firms manufacture vary according to their kinds, the one half of the all kinds of goods are manufactured less than 300 a month and the other half manufactured 301 or more a month.

Fig. 4.5.4-19 shows the general trend of processing machinery and its system for kinds of processing parts and the volume of one lot. Moreover Table 4.5.4-3 presents survey results of motivations Japanese firms have for selection FMS or cell system. Changes are shown by A.B.C. and so on described in the system of Fig. 4.5.4-19.

It may give some reference in future in reviewing equipment in Thailand.

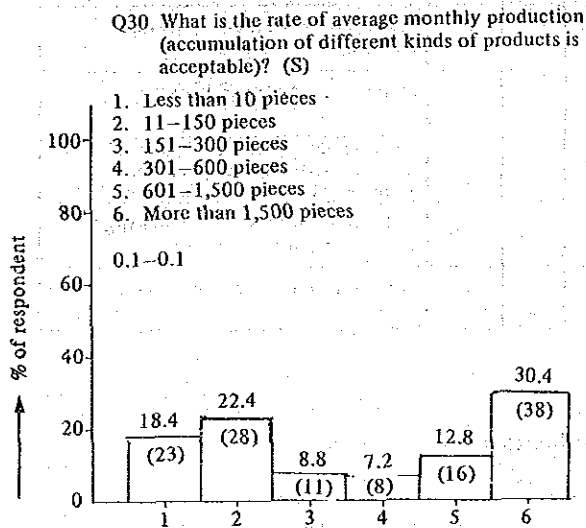


Fig. 4.5.4-18

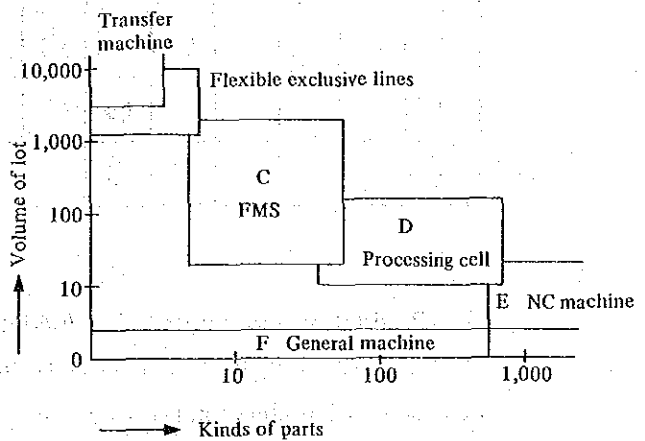


Fig. 4.5.4-19

Table 4.5.4-3 Motivation of Selecting PMS and Processing Cells

Name of firms	Motivation					Time			Change of production system	Parts for processing
	Shortage of employees	Expansion of work volume	Change to inner processing from subcontracting	Diversification of goods	Concentration of goods	Equipment renewal	Transfer of factories	Concentration of machine factory		
A	○		○						E + C	Parts for transformers and breakers
B		○							D + C	Beds and saddles of small lathe
C		○					○		E + C	Spindles, saddles and gear box of machining center and small lathe
D			○						"	Cylinder heads of diesel engines
E				○					B + C	Mission case of tractors
F				○					"	Parts for drivers of folklift
G				○					"	Frames of overlocked sewing machine
H				○					"	Shafts of electrometers
I				○		○			C + D	Beds, saddles and gear box of small lathe. Columns, tables beds, saddles of machining center
J					○			○	E + D	Beds and saddles of machining center and small lathe
K					○				"	Cutter-bodies and tools holder

(3) Production Technique in Machining Industries

1) Understanding of Technical Drawings (Q.41)

In respect of understanding of technical drawings in firms, 61% of the firms surveyed have more than 2 persons who can understand, as is shown in Fig. 4.5.4-20, while about 21% of the firms have none who understand. Firms that explain orders only orally account for 38.5%, as is described below, and taking into the contexts of works shown in Fig. 4.5.4-11, about 20% of the firms seem to work only by inspecting goods. In this sense, it's necessary to educate workers engaging in machining industry.

How to understand technical drawing in order that these firms can develop as sub-contractors or manufacturers of parts.

Without such education and processing according to such drawing, it takes quite a long time to standarize, improve productivity, and improve own-made ratios of manufacturing goods.

Q41 How much employees can understand the technical drawings? (S)

1. None
2. One person
3. 2-4 persons
4. 5-10 persons
5. More than 10 persons

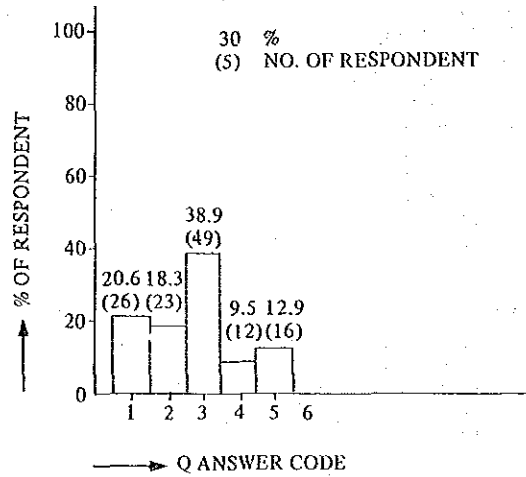


Fig. 4.5.4-20

2) Measurement, Allowance, Standard

① Measuring Tools to Be Used.

Fig. 4.5.4-21 shows measuring tools used in firms.

The survey was taken as to tools such as angle/squareness/parallism, profile, temperature, machined surface roughness, electric performance testing, testing, miscellaneous, but there were no answers from firms in relation with machining industries.

According to the survey result, vanier calipers and micrometers are used in many firms, but dial gauges are used in only 33% of the firms.

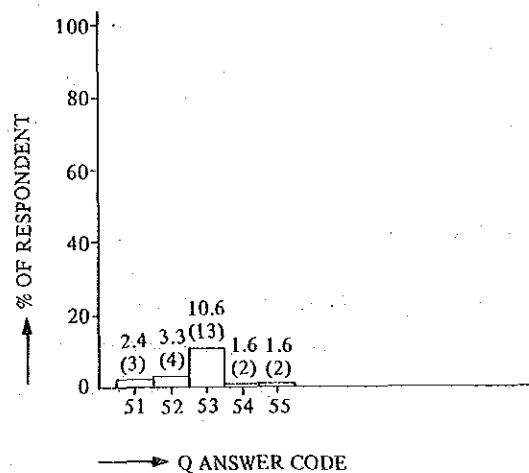


Fig. 4.5.4-21

Q42 What kind of measuring tools does your factory use?
(M)

Length/Flatness

1. Tape measure
2. Carpenter ruler
3. Steel ruler
4. Caliper
5. Vernier caliper
6. Micrometer
7. Depth meter
8. Dial gauge
9. Cylinder gauge
10. Optimeter
11. Microscope
12. Thickness caliper
13. Precision level
14. Special purpose gauge (jig)
15. Thickness gauge

Hardness

51. Brinell tester
52. Vickers tester
53. Rockwell tester
54. Shore tester
55. Harnester

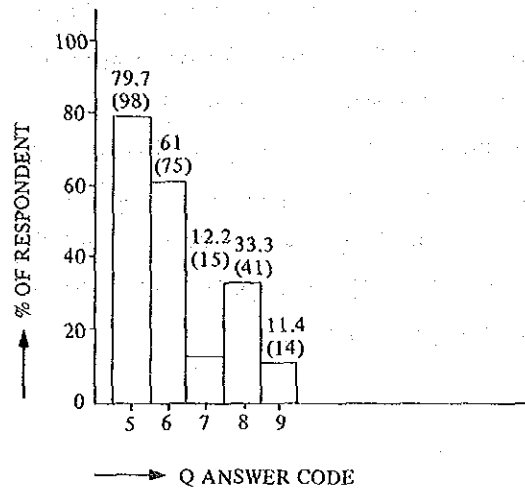


Fig. 4.5.4-21

② Allowances

Table 4.5.4-4 shows the allowances of goods processed in firms surveyed. Allowances in 0.1 mm class are found the most and second most are those in 0.01 mm class.

Table 4.5.4-4 Allowance of Parts

Allowance	%
100 mm or rough estimate	0
10 mm	8.3
1 mm	33.3
1/10 mm	52.5
1/100 mm	49.2
Less than 1/100 mm	12.5

These results correspond with those of types of measuring tools. As dial gauge are used in a small number of firms, it's a problem how they check roundness, flatness, straightness, eccentricity. Besides, the fact that they have a few measuring tools on machined surface

roughness makes it difficult to process working goods at the present. Even though they can make goods, it's impossible to guarantee their quality.

③ Standards

In respect of standards used in machining, standards of customers account for 64%, the largest share, JIS for 28%, TIS for 25%, ASTM for 5% and DIN for 5%. Besides standards of their own firms account for 19%, and it remains necessary to make survey on what standards they are. The survey at this time has left unknown the basis on which standards of costumers depend, but estimating from industrial types of orders received by subcontractors, JIS, ISO, DIN and their related lines seem to be often used in maching industry, while ASTM-related lines are often used in material-related industry. It's also estimated that TIS are often used for agricultural machinery, parts for construction and daily goods out of all the goods and machining.

3) Quality Control

① Inspection System

Each firm makes effort in improving quality of goods and 44% of the firms surveyed inspect all their goods, while 21% of the firms don't inspect al all, presenting a large problem.

Q46-1 Please give informations on your quality control system, i.e. the inspection systems, checking items and the feed back system. (M)

The inspection system is (are):

1. Systematic inspections are not available, "When trouble cocours check "
2. First articles inspection
3. Single sampling inspection
4. Multiple sampling inspection
5. Sequential sampling inspection
6. Total (100%) inspection
7. Without acceptance or purchasing inspection
8. With acceptance or purchasing inspection by standard inspection documents

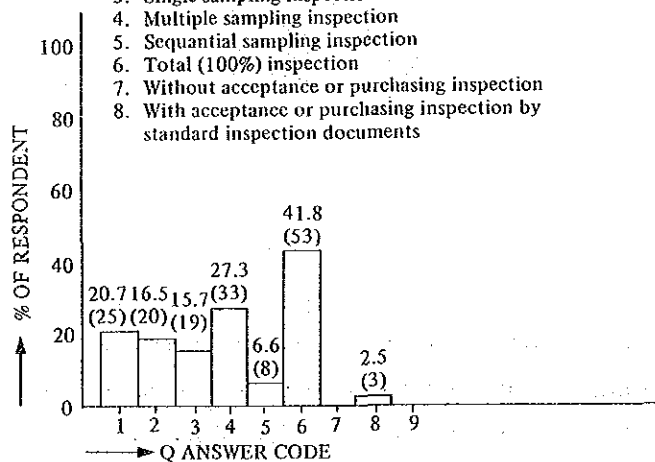


Fig. 4.5.4-22

Whom is it inspected by?

11. Workers themselves
12. Manager or the owner
13. Professional staff, patrol
14. Professional staff, stationary

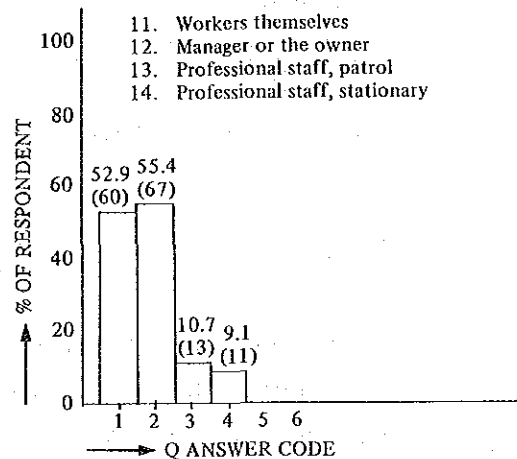


Fig. 4.5.4-23

In more than 53% of the firms surveyed, goods are inspected by workers, managers, or owners and in only 11% goods are inspected by the relevant specialists.

At present such inspection is usually made voluntarily, but until the system of quality control are established and measuring tools and measuring skills are arranged and improved, it's essential to train certain people as special inspectors.

② Inspection Methods and Checking Items

Among inspection methods, 67% of the firms take inspection by seeing and 76% take measuring inspection. Moreover, 32% of firms check allowances of moving parts, which seems reasonable as machining industry.

③ Occurrence of Defects and Relations with Inspection

Fig. 4.5.4-24 shows ratios of defect occurrences and relations with inspection before delivery and inspection system.

Q46-1 Please give informations on your quality control system, i.e. the inspection systems, checking items and the feed back system. (M)

The inspection system is (are):

1. Systematic inspections are not available, "When trouble occurs check"
2. First articles inspection
3. Single sampling inspection
4. Multiple sampling inspection
5. Sequential sampling inspection
6. Total (100%) inspection

Q49-7 Shipping inspection system (For subcontracted goods) (S/A)

1. None
2. Permanent check by subcontractor's staff before delivery
3. Temporary check by subcontractor's staff before delivery
4. Visual check after delivery
5. Inspection records check after delivery
6. Self-management of subcontractee
7. Others (Specify)

Q49-9 Defect Rate after shipping (S)

1. More than 30%
2. 21-30%
3. 11-20%
4. 6-10%
5. 2-5%
6. Below 1%

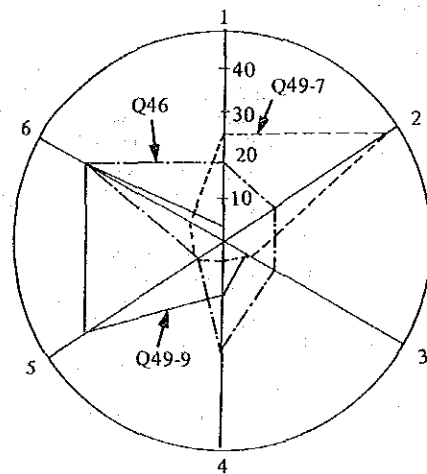


Fig. 4.5.4-24

In respect of inspection system, the ratio of firms inspecting all goods corresponds with the item of less than 1% of defects found. In addition, various kinds of sampling inspections and inspection at receiving are effective in preventing occurrence of defects.

④ Feedback of Inspection Results

Inspection results are released through circulation of the result among workers and managers (in 40.5% of the firms) and through being written on the blackboard (14%). Moreover, in 22% of the firms measuring methods are determined and in 3.3% QC system is fixed and specialist staff supervise it. On the contrary, about 10% the firms don't have any feedback.

Along with a problem existing in such feedback system, there is also another problem in making plans and to realize them.

4) Production Control

① Transfer of Order Inspection (Q34 49-6)

According to the survey, work orders are transferred through purchase order specification in 40% of the firms, though in 38.5% orders are transferred only orally, and in 8% there is nothing done about it.

Orders of machining should be made with purchase order specification and technical drawings, without which it's difficult to process goods at a certain level of quality, calculate suitable prices and secure the delivery date. Moreover, it is impossible to make programs when NC is introduced in future.

Q34 Instruction of delivery time from the subcontractor (S/A)

- 1. None
- 2. Yes, verbal instruction only
- 3. Yes, by purchase order specification
- 4. Yes, by short term agreement
- 5. Yes, by long term agreement
- 6. Others (Specify)

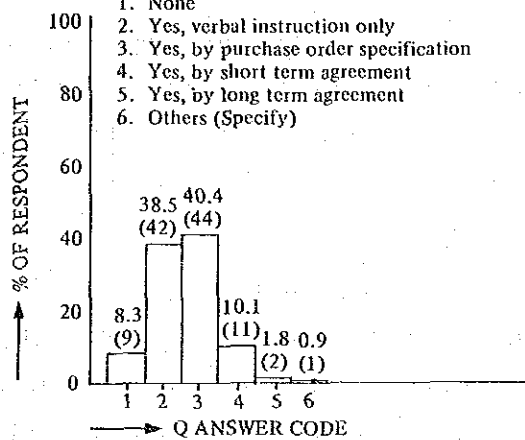


Fig. 4.5.4-25

② Delayed Delivery and Its Preventive Measures (Q36-37)

About 60% of firms suffer from delayed delivery more or less, with delayed term falling on more than "4 to 7 days" in more than 70% of the firms.

Q35 Preventive measures for delayed delivery (S/A)

1. No action
2. Occasional check of deference between planned & actual schedule
3. Weekly check of deference between planned & actual schedule
4. Daily check of deference between planned & actual schedule
5. Permanent follow up of necessary action by special staff
6. Others (Specify)

Q36 Delayed delivery (S/A)

- | | |
|---------------|---------------------|
| 1. Very often | 4. Very rare |
| 2. Sometimes | 5. Not at all |
| 3. Rarely | 6. Others (Specify) |

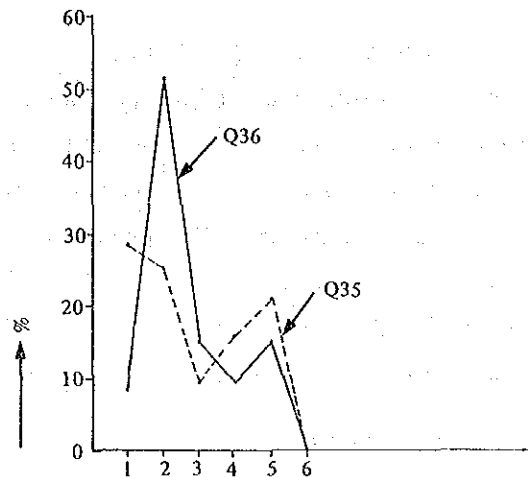


Fig. 4.5.4-26

Fig. 4.5.4-26 is a combined one from results of Q35 and Q36. It shows that firms which take no preventive measures account for 27.6% and those which check occasionally differences between planned schedule and actual one for 25.7%.

There seems to be a gap in senses between sub-contractors and parent firms, especially joint-venture ones.

③ Schedule Control (Q.39)

In respect of delayed delivery, 27% of the firms attribute it to unsuitable plans, and the others to delayed delivery of raw materials, early delivery date, shortage in workers and unsuitable designs. In another word, 27% of the firms ascribe the responsibility to themselves and may others ascribe to what is beyond their power. But it's desirable to analyze what is regarded as others' responsibility through factor analysis method (fish Bone) in TQC and so on and take some preventive measures, with improvement in management technique. Moreover, firms regarding the reasons of delayed delivery as unsuitable planning are required to take the same measures.

5) Equipment

Among machinery for metal processing furnished in each firm, as is seen in Fig. 4.5.4-27, lathes are equipped at the most, followed by drilling machines, shapers, and milling machines. Shapers are possessed in more than 60% of the firms.

Besides copy milling and surface grinders are also equipped in many firms, showing the importance of metal processing among machining. However, seeing that firms possessing NC machines number 3 or 4, accounting only for 4% and that copy millings, which are

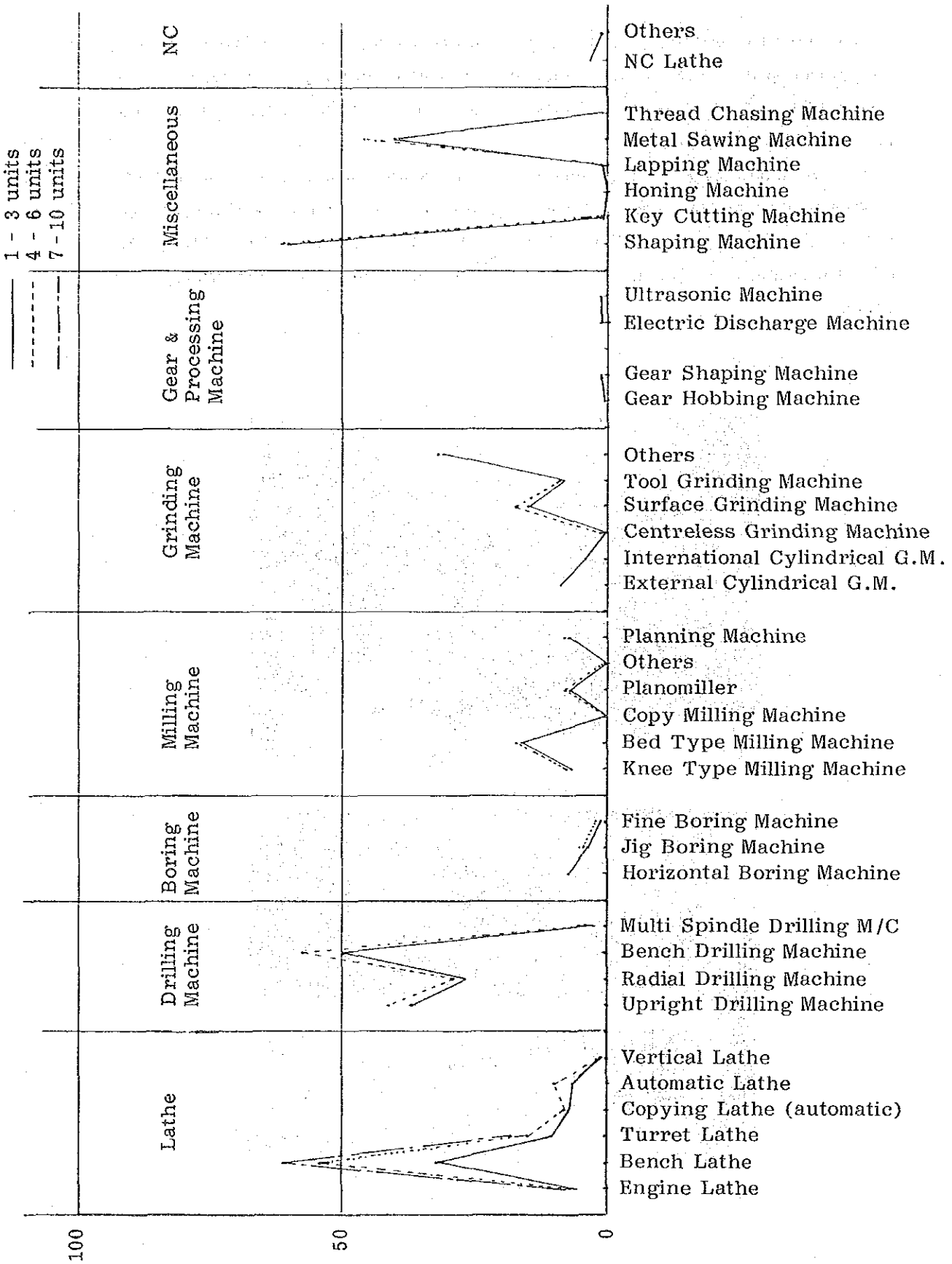


Fig. 4.5.4-27 Kind of Machine for the Manufactory

used in respect of metal processing, are often possessed but Electric discharge machines are not equipped in so many firms, productivity of metal processing doesn't seem so high. Figures of Fig. 4.5.4-27 reveals a plotting of the number of firms examined by the number of machinery they possess.

The photo shows inside of a machine factory. There are assembling areas and machine processing areas on the same spot, and parts for assembling and unprocessed parts are put together mixedly on the floor. Photo 4.5.4-4 represents speed change for spindle of lathes, located at left in Photo 4.5.4-3. Speed of spindles are changed through replacing V belt.

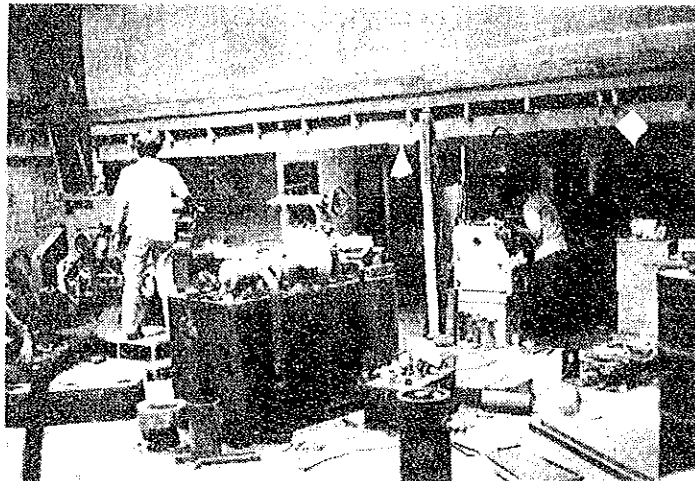


Photo 4.5.4-3



Photo 4.5.4-4

6) Education

① Educational Levels of Employees (Q.11)

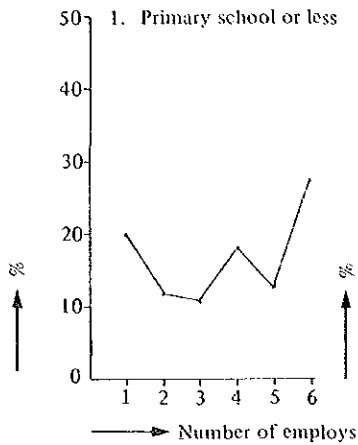


Fig. 4.5.4-28

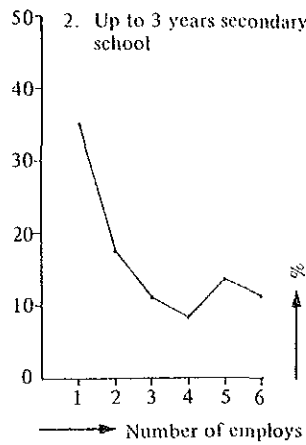


Fig. 4.5.4-29

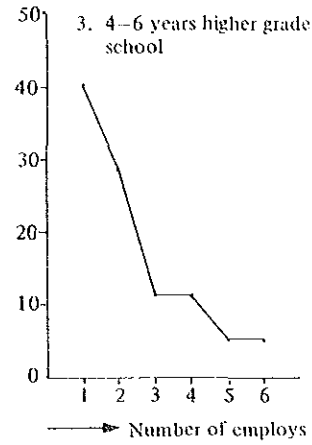


Fig. 4.5.4-30

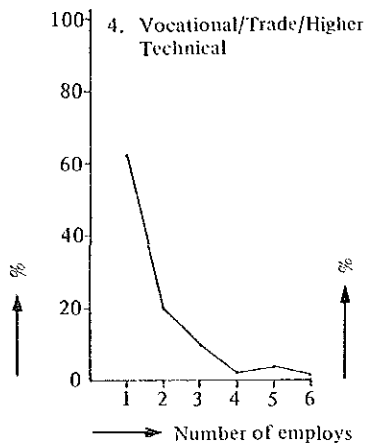


Fig. 4.5.4-31

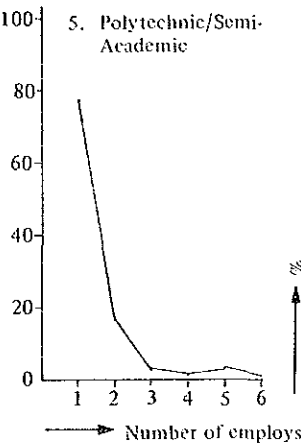


Fig. 4.5.4-32

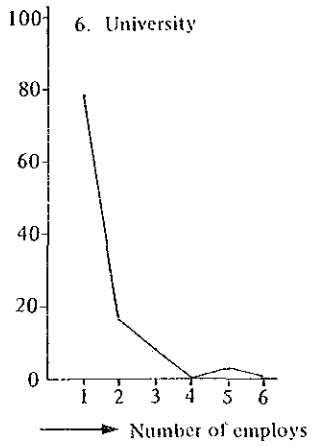


Fig. 4.5.4-33

Educational levels of employees are found in Fig. 4.5.4-28~33. There are no graduates of universities, or vocational/trade/higher/technical schools, or polytechnic/semi-academic schools in 75.4% of the firms. On the contrary, firms possessing more than 21 workers who graduated from primary school or less account for 27.8%, surpassing the 19.8% which is the ratio of firms possessing no graduates from primary school or less. In general, graduates from 'up to 3 year secondary school' account for the largest share.

② Training on Spot (Q.14)

In respect of training on spot, man to man training is taken in many firms. And in 58.7% of the firms surveyed take training wherever necessary. In order to make the training effective and raise the morale of workers, it's necessary to teach principles, rules and fundamentals at first. Then the application of these things to the spot should be taught through OJT or training through OJT with discussion between workers and instructors should be taken on the basis of fundamentals and schedules, while showing them to what extent they have developed or in what point they lack.

Training should be made in consideration of unskilled workers and skilled one, shown in Fig. 4.5.4-9 or 2), and their educational levels, seen in Fig. 4.5.4-28-33 of 6) 1. It's necessary to improve their skills step by step.

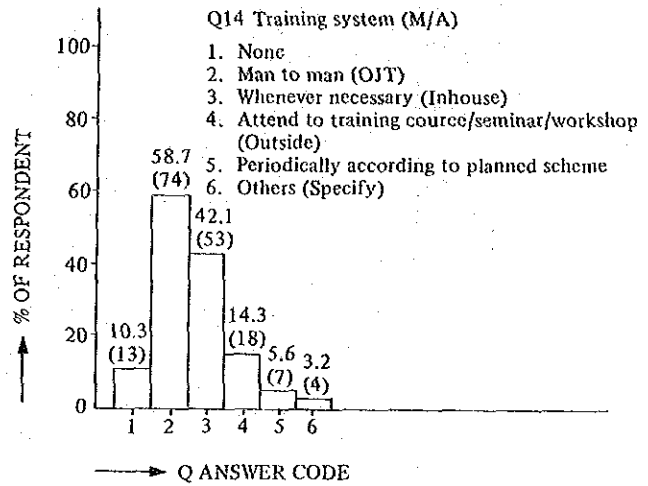


Fig. 4.5.4-34

Photo 4.5.4-5 represents the status of hole drilling on spot. It seems that there is a support on a table of ball board and that a hole drilling is made by revolving it with making frange hang on it. If there is a support on places under the drill or there are many goods to be processed, making some tools quickens hole drilling. This is probably because they are not informed of the fundamental knowledge on thrust and structures of ball board tables.



Photo 4.5.4-5

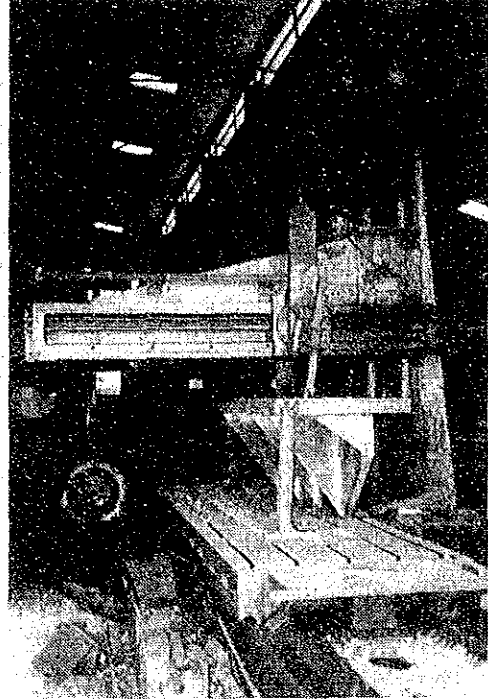


Photo 4.5.4-6

Photo 4.5.4-6 shows cutting of the flat face of welding structure with a point tool, but as it is a cantilever planer and the mount is not stabilized, depth and feed becomes small and needs much time. If processing is made with a side tool head, seen in the photo, the mount becomes stabilized and shortens the time of processing. This problem can be solved with the knowledge of fundamentals of mounting and how to use of the machinery.

(4) General

1) Purchases of Materials (Q.50)

Fig. 4.5.4-35 shows the percentages of purchases of materials to be used in their own firms. Firms that purchase nothing account for 48.7%, probably because they are often engaged in processing of parts through cutting and repairing. In future they should have targets to make the share of unit processing, assembling and development 30 to 50%, therefore raising their added-value.

In respect of purchases of materials, moreover, nearly half of the firms have their unprocessed materials for more than 30 days, and it is necessary to lessen materials in hand through arrangement of circulation and price setting.

Q50-1 What do you purchase used or second-hand parts and raw materials, such as gears, bearings, motors, etc. as key components of your products? (M/A)

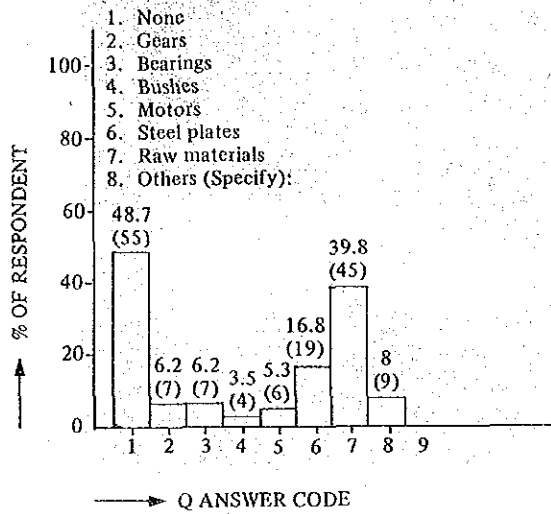


Fig. 4.5.4-35

2) Management

① Conditions of Subcontracting (Q.70-00)

About half of the firms make their subcontracting works from parent corporations and the other half make few such works.

Many firms make not so often second-subcontracting works.

Q70 Do you make subcontracting in/out? (S)

	1.In	2.Out
1. No	11	11
2. Rarely	21	21
3. Sometimes	31	31
4. Often	41	41
5. Very often	51	51
6. Constatly	61	61

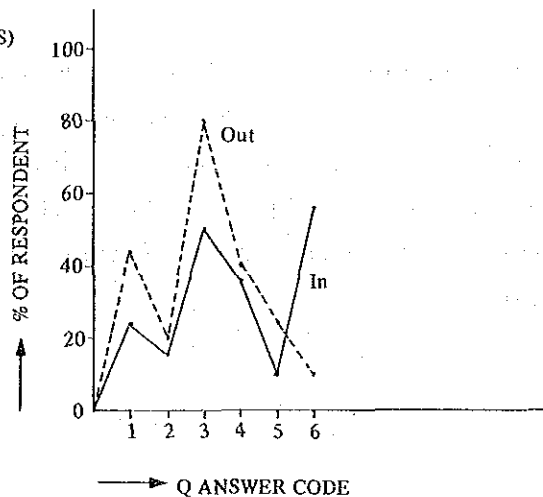


Fig. 4.5.4-36

② What They Make Their Works from and to (Q70-01, 02)

Firms making orders from large-scale industries account for a predominant 53.6% and those from small-scale ones for 25.9%. Firms having orders from government-related sectors account for 16.1%.

Q70-1 Where do you make your subcontracting work to/from? (M/A)

	1.From	2.In
1. Not applicable	11	12
2. Parent company/Affiliated company	21	22
3. Companies of the same scale	31	32
4. Companies of the larger scale	41	42
5. Government organization	51	52
6. Companies with foreign equity	61	62
7. Others, specify	71	72

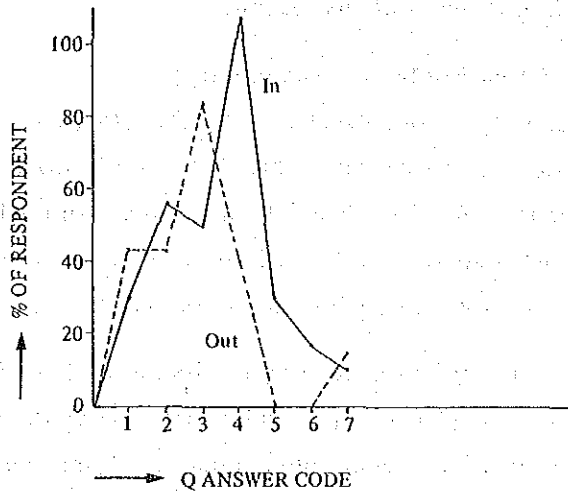


Fig. 4.5.4-37

On the other hand, firms making second-subcontracting to small-scale industries account for 42.9% and those to large-scale industries for 25%, probably considering the equipment and accuracy.

③ Minimum Order Scale

In respect of minimum order scale, firms having less than 10 account for a large 61.7%, making them hesitate to modernize equipment.

But classifying goods through methods and so on will see the possibility of modernization. Moreover use of turret and NC machine are useful.

Q70-12 Minimum order scale (S)

1. Less than 10 pieces
2. 10-50
3. 51-100
4. 101-1,000
5. 1,001-10,000
6. More than 10,001

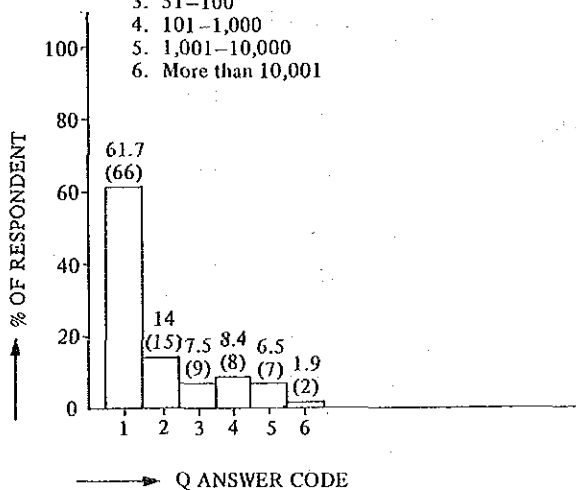


Fig. 4.5.4-38

Q70-8 After care of claims by you (M/A)

1. None
2. Marketing staff
3. Marketing/Production staff
4. Manager
5. Owner
6. Others (Specify)

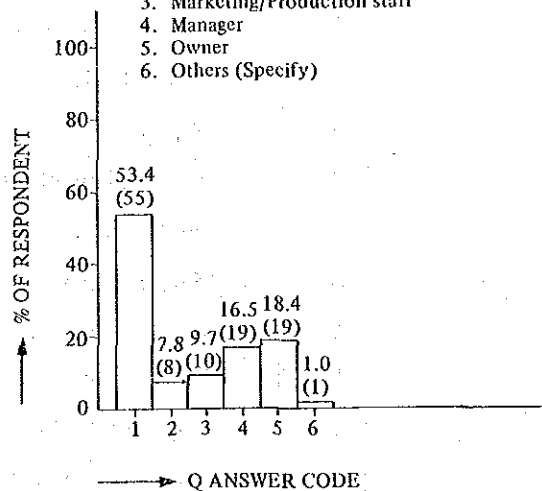


Fig. 4.5.4-39

④ Measures Against Claims

In 53.4% of the firms there are no measures against claims. On the other hand, even in those having some measures, there present problems on how their measures are as well as on those without any measures.

⑤ Order Route of Subcontracting

In respect of order-receipts of subcontracting works and order-giving of second subcontracting works, more than 80% of the firms make deals directly without any intermediaries, and less than 30% make deals through trading companies and so on. Direct dealing is good in cost, but in respect of the securing of work volume and expansion of markets, how to do with trading companies is one of the problems in future.

⑥ Aims of Subcontracting and Its Future (Q70-09, 10)

Firms aiming to continue subcontracting works and develop them further account for more than 80%, while those aiming to shrink them step by step for 12.5%. If the latter orient to production of their own goods, their is hope.

On the other hand, it is wise that they think it important to secure the volume of subcontracting works. Besides, firms plan to expand markets (36%), renew equipment (32%), and transfer of techniques (17%), therefore showing strong willingness of medium and small-scale industries.

Table 4.5.4-5 shows the top ten items of management policies on development and advancement.

Table 4.5.4-5

Q73	Main management policy to be developed (1st to 5th priority)	
1	R & D of technology	59.8%
2	Productivity	49.6
3	Expansion of market share	48.6
4	R & D of product	37.6
5	Quality control	32.5
6	Material cost	28.2
7	Production control	27.4
8	Labour cost	23.1
9	Upgrading qualification	22.2
10	Training of workers	19.7

3) Present Governmental Measures and Assessment (Q74)

Fig. 4.5.4-40 and 41 shows assesment on various measures govnenments and technical public organization are takings.

While 50% of firms assess technical-related measures as very useful, percentage of firms assessing only seminars/symposium as effective, at 69.6%, surpassed 26.1% rate that assess as very useful. It seems there are some problems in contents and P.R.

Tax system, credit assistance, export-import policies are assessed highly but relatively many firms think import surcharge and import restriction as "not useful".

Q74 Preferable government assistances and assessment of existing ones (M/A) (1st to 5th priority)

Technical/Information services by public organization

- 11. Training services
- 12. Consultancy services
- 13. Information services
- 14. Testing services
- 15. Laboratory
- 16. Standardization National
- 17. Quality control
- 18. Seminer/symposium

Financial/Marketing support Encouraging investment

- 21. Tax rebate and tax exemption
- 22. Credit assistance
- 23. Subsidy
- 24. Marketing

Protection of domestic products

- 31. Import surcharge
- 32. Import restriction
- 33. Export promotion

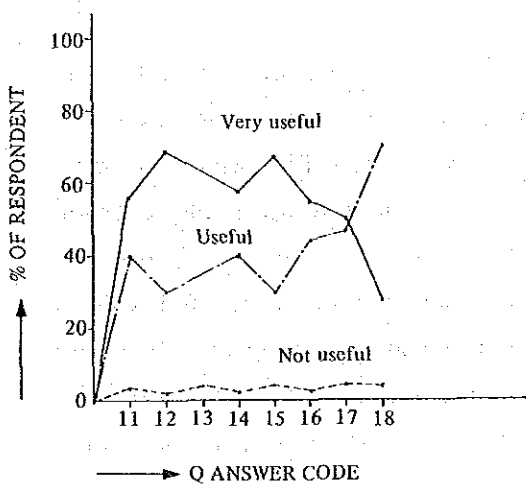


Fig. 4.5.4-40

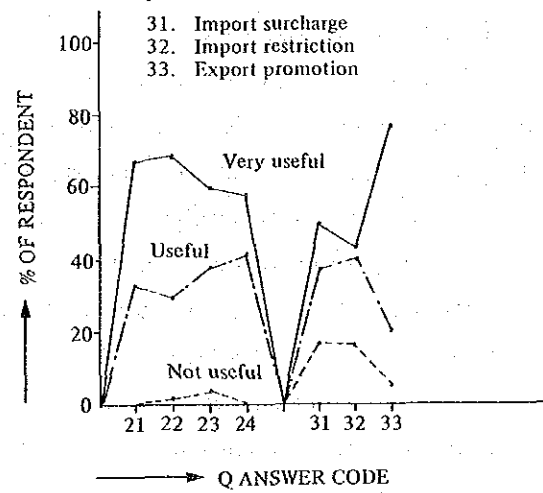


Fig. 4.5.4-41

4) Public Evils (Q90);

Firms having no claims on public evils account for 76.1%, but 26 out of 109 firms that answered have claims. The largest claim is noises (65.4%), followed by bad smells (38.5%), smoke (30.8%), drainage (19.2%), and vibration (15.4%).

Firms that take counter-measures on claims and make claimers satisfied account for 63.2%, while nearly 40% have dissatisfaction.

5) Cooperative Organization with Other Firms (Q91)

There is little idea on advancement of business through making cooperative organizations with other firms in the same line.

However, 28% of the firms consider the cooperation in havinb orders, technical development, use of machinery and equipment, and purchases of materials. How to nourish such idea needs some consideration.

6) Factory Environment and Moving Plans (Q93, 94)

Factories seem satisfied generally with their actual situations, but 22% of them complain the narrowness. The three-quarters of factories have no plan to move but the other one-quarter have plans to move because of the narrowness of sites (83.3%) and increasing goods (54.2%); that is narrowness of sites.

(5) Technical Assessment of Machining

1) Techniques of Processing

In Thailand techniques of machining of medium- and small-scale industries present mixed status, because in some fields techniques lag behind by 20 to 30 years compared with industrial nations and in other fields lag only by 5 to 10 years. Processing techniques can't be developed by themselves but it can be developed only through supplementation and rivalry with other related industries. Fig. 4.5.4-13 (ratio of the number of offices by industrial type) shows that medium- and small-scale industries prevail far and wide in Japan, thus supporting large-scale industries. But in Thailand, such cooperative relations between medium- and small-scale industries and large-scale industries are still immature.

The following are problems preventing the improvement of the processing techniques found in this survey.

- a. High ratio of unskilled workers 2) (2)
- b. Few skilled workers 2) (2)
- c. Few workers who understand technical drawings 3) (1)
- d. Few kinds of measuring tools 3) (2)
- e. Few dial gauge and surface roughness 3) (2)
- f. Few uses of tools 3) (6)
- g. Unmature fundamentals of processing
- h. Difficult access to tools

Among these things, the most important factors at present are unmaturation of fundamentals (c & g) and shortage of tools, difficult access to them, and high prices (d & h), preventing techniques from improving.

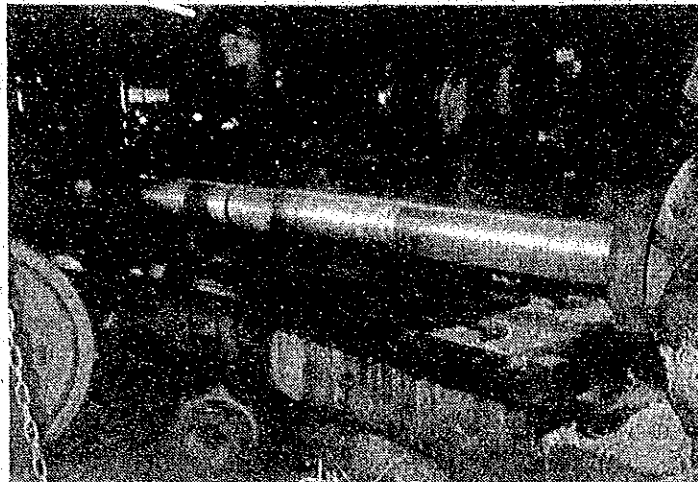


Photo 4.5.4-7

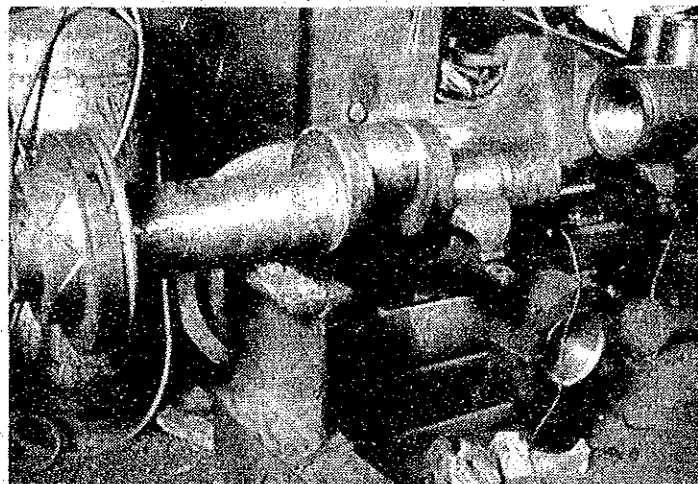


Photo 4.5.4-8

But in processing of a shaft ($\phi 200 \times 6000$ mm) seen in Photo 4.5.4-7, taken in a factory visited at this time, we checked the length of the finish of about 400 mm with outside caliper to find the taper of only 0.02 mm.

In addition, as seen in Photo 8, crank is marked (the accuracy is unclear), and it seems that the levels of skilled workers are relatively high. It seems useful in improving processing techniques to give these workers the sense of productivity improvement and educate them to show the accuracy of goods in figures.

2) Equipment

Among the main working machinery of firms surveyed at this time, sharpeners are equipped in the largest number of firms, followed by lathes and drilling machines. But among lathes and drilling machines, small-sized bench lathes and bench drills are the largest in number, respectively, suggesting that many of them are household industrial type ones for processing small goods.

In respect of each machinery, many of them are old-fashioned, as seen in Photo 4.5.4-4, resulting in low productivity.

During the research of this time, machinery is not maintained suitably. Fundamental items are not checked; for example, there are planers without basis and there are other planers with basis whose levels are not inspected after setting, and so on.

3) Quality Control

Quality control is taken but it doesn't work as a system. As standards are not applied strictly, defects rarely happen. Quality control in the real sense can't be taken without arrangement of standards and strict instruction of observation. They should make goods with technical drawings, complete goods just as the drawings direct and ascertain whether goods are made as drawings show through right methods and tools.

4) Production Management

Kinds of production management vary and the following deals with conditions of management of delivery date.

As is shown in b & c of (3) 4), there is little sense of delivery date and it's immediately necessary to educate how to control schedules and how to make counter-measures of delayed delivery. It's also necessary to let them know that production management consists of working ratio of machinery of factories, productivity, planned schedules needed for processing, ratio of obstacles of machinery, and ratio of attendance of workers.

(6) Proposals for Improvement in Techniques of Machining

In order to improve techniques of machining in Thailand, improvement of machine processing is not enough. Namely, plans on concrete methods of education and instruction of fundamentals necessary for improving techniques of machining should be made first, with consideration on balances with related various industries, as is mentioned before.

4.5.5 Machine Assembly

(1) General

1) Definition and Background

The term "machine assembly" means literally the construction of machines by putting together various machine elements worked in advance, and is one part of the production process.

In terms of production process, the sectors of forging and casting, machine work, surface treatment, etc., compose independent industries in the form of casting and forging industry, machining industry, plating industry, etc., but the machine assembly industry does not exist independently. The said distinction occurs because each one of the former ones has a fundamental technology of multi-purpose application valid for all kinds of products it manufactures, irrespective of their type, and as a consequence they can direct their outlets to many distinct fields, and as a consequence they can subsist as independent trades with high degree of specialization. On the other hand, in theory the latter one could specialize in the machine assembly business, but in reality the same process as the aforementioned one is not applicable in this case, because the various aspects related to the trade, i.e., design technology, production technology, manufacturing facilities, procurement and distribution channels, etc., change in accordance with the type of final product to be turned out.

In industrialized countries, which have a solid foundation of flourishing allied industries, firms that have their own engineering capacity, technical development capacity and marketing capacity, as well as a group of subcontractors under their control, and develop their own business as assemblers (e.g. machine tool manufacturers, electronic equipment manufacturers, etc.) can be regarded as machine assembly industries in the strict sense of the word.

In reality, however, each one of the said field requires a distinct technology according to the product it manufacturers, and as a consequence it does not make sense and it is unreasonable to give them a generic name of "machine assembly industry". It is more appropriate to handle them as independent industries classified by product.

In developing countries there is no condition for realization of assemblers engaged exclusively in the assembly of machines, because the foundation of allied industries is underdeveloped and it is unreasonable to expect the occurrence of mass-production and mass-consumption, and they do not have the technical capacity and marketing capacity indispensable to support the said massive process.

Such being the case, this section does not refer exclusively to machine assembly as a kind of industry. It examines the actual state of things of firms engaged not only in machining of mechanical parts and components, but also in the assembly work (principally small and medium scale firms and partly large firms), based on the results of a questionnaire survey.

2) Firms Object of Survey

The firms examined in this section are the 51 ones of the approximately 350 surveyed this time, that answered "YES" to the item "machine assembly" of the questions Q02-01-01/Q02-01-02 of the questionnaire of PART-III for small and medium size firms referring to products and types of industries.

The breakdown of the said firms consists of those ones engaged in the manufacturing of machinery and equipment related to automotive vehicles (7 firms), agricultural machinery (7 firms), machine tools (8 firms), pumps and valves (2 firms) and other kinds of machines (32 firms) (Table 4.5.5(6), Q05-02-01).

On the other hand, 48 (94%) of the 51 firms are classified as machining, including a wide variety of trades such as sheet work and welding (30 firms), plating and stamping (14 firms each), heat treatment (3 firms), casting and forging (2 firms each), etc. Each one of the said trades is examined in the item referring to "industrial sectors" (part of the discussion is redundant).

(2) Investigation of the Actual State of Things of the Factories

1) Outline of the Firms Object of Survey

i. Firm Age, Capital and Legal Status:

Outline of enterprises examined in this section is summarized on the basis of factory survey by questionnaire in terms of firm age, registered capital, legal status of business, factory site, building, total number of employees as follows:

Table 4.5.5 (2)
Age of Firms
(Q01-00-01)

	Freq	%
1. Less than 2 years	1	2.0
2. 2 - 5 years	11	22.0
3. 6-10 years	13	26.0
4. 11-20 years	18	36.0
5. 21-30 years	5	10.0
6. More than 30 yrs	2	4.0
Total	50	100.0

Table 4.5.5 (3)
Registered Capital
(Q01-01-01)

Registered Capital (฿)	Freq	%
1. Less than 250,000	22	43.1
2. 250,001-1,000,000	15	29.2
3. 1,000,001-4,000,000	5	9.8
4. 4,000,001-16,000,000	6	11.8
5. More than 16,000,000	3	5.9
Total	51	100.0

The age of firms after establishment is classified into "11-20 years" (36.0%), "more than 20 years" (14%), "6-10 years" (26%) and "less than five years" (24%) and these figures show that most of the firms are relatively young. (Table 4.5.5 (2), Q01-00-01).

The registered capital of the firms is classified into "less than ฿250,000" (43.1%, 22 out of 51 firms), "฿250,001-฿1,000,000" (29.2%, 15 firms), "฿1,000,001-฿4,000,000" (9.8%, 5 firms) and "฿4,000,001-฿16,000,000" (11.8%, 6 firms). (Table 4.5.5 (3), Q01-01-01).

The legal status of business of the 51 firms is classified into "family business/single proprietorship" (40.0%, 20 firms), "partnership" (34.0%, 17 firms) and "company" (26.0%, 13 companies). (Table 4.5.5 (4), Q07).

Table 4.5.5 (4) Legal Status
(Q07-01)

01-01	Freq	%
1. Family business/single proprietorship	20	40.0
2. Partnership	17	34.0
3. Company	13	26.0
4. Cooperative	-	-
5. Joint venture with foreign firms	-	-
6. Government company	-	-
7. Foreign-owned	-	-
Total	50	100.0

Some of these firms have branch factories in addition to the main factory and the scale of them in terms of estate area is classified into "less than 2,500 m²" (3/4) and "more than 2,500 m² (1/3). The factory building floor area of them is less than 2,500 m² except for one firm. (Table 4.5.5 (5), Q01-03)

Table 4.5.5 (5) Factory(ies)
(Q01-03)

03-01 Estate (m ²)	Freq	%
1. Less than 2,500	35	68.6
2. 2,501-6,300	7	13.7
3. 6,301-16,000	1	2.0
4. 16,001-40,000	6	11.8
5. 40,001-100,000	2	3.9
Total	51	100.0

03-02 Estate (m ²)	Freq	%
1. Less than 2,500	50	98.0
2. 2,500 - 6,300	1	2.0
Total	51	100.0

04-01 Factory building floor area (m ²)	Freq	%
1. Less than 2,500	40	78.4
2. 2,501-6,300	4	7.8
3. 6,301-16,000	4	7.8
4. 16,000-40,000	3	6.0
Total	51	100.0

04-02 Factory bldg floor area (m ²)	Freq	%
1. Less than 2,500	51	100.0
Total	51	100.0

1 Main factory

2 Branch factories

The number of employees, both male and female, is classified into "less than six persons" (11.8%, 6 firms), "7-16 persons" (25.5%, 15 firms), "17-40 persons" (25.5%, 5 firms), "41-100 persons" (15.7%, 8 firms), "101-250 persons" (9.8%, 5 firms), "251-630 persons" (5.9%, 3 firms) and "631-1,600 persons" (1.9%, 1 firm). (Refer to Table 4.5.5 (13), Q10-00).

The share of family business and small enterprises is 66.7%, while that of large enterprises of more than 100 persons is 17.6%.

ii. Main Products:

Table 4.5.5 (6) summarizes the results of answers to Q05-02-01 on main products.

As for the industry which involves assembly processes, these firms are mainly classified into "industrial machinery" (6 firms), "agricultural machinery" (14 firms), "metalworking machine tools" (9 firms), "woodworking machine tools" (6 firms) and "vehicles" (6 firms).

In addition, some of them are carrying out concurrently the production of semi-fabricated materials.

Of the share of each product in the whole sales amount, machines for capital goods and consumer goods take a high percentage, while production of parts and components there of and such services as repairing, subcontracting, etc. take a low percentage. (Table 4.5.5 (7), Q05-01)

The percentage of machining work carried out in these firms is classified into "21-40%" (9 firms), "41-60%" (5 firms) and "61-80%" (4 firms). There are some firms that gave an answer of "61-80%" share of precision machining of gears, dies, etc. These are different from the machine assembly examined in this section.

Table 4.5.5 (6) Commodities by Kind
(Q05-02-01)

Name of products	Freq	%	Name of products	Freq	%
<u>Basic metals & articles thereof</u>			<u>Machine tools for metal working</u>		
2. Cast iron products	3	6.7	71. Lathe	1	2.2
3. Ferric alloys	3	6.7	72. Drilling machine	2	4.4
4. Steel iron	5	11.1	73. Shaper	2	4.4
5. Wrought iron	1	2.2	74. Power press m/c	1	2.2
6. Copper	2	4.4	75. Shearing m/c	2	4.4
7. Nickel	2	4.4	76. Punching/notching m/c	1	2.2
8. Aluminum	2	4.4	<u>Machine tools for woodworking</u>		
12. Forged	1	2.2	77. Lathe	1	2.2
13. Heat treated	1	2.2	78. Drilling m/c	2	4.4
15. Punched/pressed	5	11.1	79. Planer	1	2.2
16. Bent or otherwise machined	23	51.1	80. Others	2	4.4
<u>Industrial machinery</u>			<u>Vehicles</u>		
40. Boiler	1	2.2	81. Motor cars, jeep & vans	4	8.9
41. Engine turbine	2	4.4	82. Truck, bus	1	2.2
46. Pump, hand/foot operated	1	2.2	83. Motor cycle, side car	1	2.2
47. Pump, other	1	2.2	<u>Special transport equipment</u>		
53. Civil, structural construction machinery	1	2.2	86. Ships/repairing	1	2.2
<u>Agricultural machinery</u>			<u>Miscellaneous</u>		
61. Farm tractor	4	8.9	92. Pipe work	1	2.2
62. Wheel tractor	4	8.9	93. Kitchenware, equipment	2	4.4
64. Thresher	1	2.2	94. Electrical machinery	1	2.2
67. Other farm machinery	5	11.1	98. Mining machinery	1	2.2
			99. Others, specify _____	21	46.7
			Total	45	257.0

Table 4.5.5 (7) Main Products and Processings
(Q05-01)

Category of products	Share to sales	(1) 0-20%		(2) 21-40%		(3) 41-60%		(4) 61-80%		(5) 81-100%		Total	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
<u>Machines and parts thereof</u>													
01-01. Complete machines for Capital goods		36	70.6	1	2.0	7	13.7	3	5.9	4	7.8	51	100.0
01-02. Complete machines for Consumer goods		41	80.4	2	3.9	1	2.0	4	7.8	3	5.9	51	100.0
01-03. Parts, component for Capital goods		48	94.1	3	5.9	-	-	-	-	-	-	51	100.0
01-04. Parts, component for Consumer goods		45	88.2	3	5.9	1	2.0	-	-	2	3.9	51	100.0
01-05. Gears		51	100	-	-	-	-	-	-	-	-	51	100.0
<u>Repairing and rebuilding services</u>													
01-11. For own products only		50	98.0	-	-	1	2.0	-	-	-	-	51	100.0
01-12. For domestic products		50	98.0	-	-	-	-	-	-	1	2.0	51	100.0
01-13. For import products		51	100	-	-	-	-	-	-	-	-	51	100.0
<u>Processing and/or subcontracting services</u>													
01-21. Machining		33	64.7	9	17.6	5	9.8	4	7.9	-	-	51	100.0
01-22. Casting		50	98.0	1	2.0	-	-	-	-	-	-	51	100.0
01-23. Forging		51	100.0	-	-	-	-	-	-	-	-	51	100.0
01-24. Heat treatment		50	98.0	1	2.0	-	-	-	-	-	-	51	100.0
01-25. Plating		50	98.0	1	2.0	-	-	-	-	-	-	51	100.0
01-26. Welding		51	100.0	-	-	-	-	-	-	-	-	51	100.0
01-27. Painting		51	100.0	-	-	-	-	-	-	-	-	51	100.0
01-28. Sheetwork/pressing		48	94.1	3	5.9	-	-	-	-	-	-	51	100.0
01-29. Precision machining for gears, die-mold, etc.		47	92.2	2	3.9	-	-	2	3.9	-	-	51	100.0
01-30. Others		50	98.0	1	2.0	-	-	-	-	-	-	51	100.0

iii. Sales:

a) Sales Amount and Production Orders in Hand

Annual sales amount is classified into "less than ₦250,000" (31.4%, 16 firms), "₦250,001-₦1,000,000" (11.8%, 6 firms), "₦1,000,001-₦4,000,000" (27.5%, 14 firms), "₦4,000,001-₦16,000,000" (15.7%, 8 firms), "₦16,000,001-₦100,000,000" (9.8%, 5 firms) and "more than ₦100,000,000" (3.8%, 2 firms). (Table 4.5.5 (8), Q01-02-01)

Table 4.5.5 (8) Annual Sales Amount (₦)
(Q01-02-01)

Sales Amount (₦/year)	Freq	%
1. Less than 250,000	16	31.4
2. 250,001-1,000,000	6	11.8
3. 1,000,001-4,000,000	14	27.5
4. 4,000,001-16,000,000	8	15.7
5. 16,000,001-100,000,000	5	9.8
6. More than 100,000,000	2	3.8
Total	51	100.0

Production orders in hand is classified into "none" and "one week or less" (12.2% each, 6 firms each), "8-15 days" (10.2%, 5 firms) and "16-30 days" (24.5%, 12 firms), showing that the majority falls under a short-period group as against "1-5 months" (34.7%, 17 firms) and "more than 5 months" (6.2%, 3 firms). (Table 4.5.5 (9), Q22-01-0-1).

Table 4.5.5. (9) Production Orders in Hand
(Q22-01-01)

	Freq	%
1. None	6	12.2
2. One week or less	6	12.2
3. 8 - 15 days	5	10.2
4. 16 - 30 days	12	24.5
5. 1 - 5 months	17	34.7
6. More than 5 months	3	6.2
Total	49	100.0

b) Markets, Competitor and Competitiveness

Markets of products are classified into mostly "region/district" around the location of enterprise (51.0%), "province/state" (56.9%) and the whole of Thailand (86.3%). It may be noted that three firms (5.9%) are exporting their products to developing countries. (Table 4.5.5 (10), Q20-01-01) Competitor's products are classified into "local" products (92.2%) and "foreign" products (7.8%, only four firms). (Table 4.5.5 (10), Table 4.5.5 (11))

Table 4.5.5 (10)
Territory of Market
(Q20-01-01)

	Freq	%
1. Region/District	26	51.0
2. Province/State	29	56.9
3. Country	44	86.3
4. Developing countries	3	5.9
5. Newly industrialized countries (NICs)	1	2.0
6. Developed countries	1	2.0
Total	51	100.0

Table 4.5.5 (11)
Main Competitors
(Q21-01-01)

	Freq	%
1. Local	47	92.2
2. Foreign	4	7.8
Total	51	100.0

The competitiveness in the market is classified into "moderate" (69.4%), "strong" (20.4%), "very strong" (2%), "weak" and "very weak" (4.1% each). (Table 4.5.5 (12), Q28-01-01).

Table 4.5.5 (12) Self Evaluation of
Present Position in Market
(Q28-01-01)

	Freq	%
1. Very strong	1	2.0
2. Strong	10	20.4
3. Moderate	34	69.4
4. Weak	2	4.1
5. Very weak	2	4.1
Total	49	100.0

Table 4.5.5 (13) Employees Number of Employees by Category (Q-10-00)

Classified Employee	Number of Employee		(1)	(2)	(3)	(4)	(5)	(6)	(7)	Total
	Freq.	%	1-6	7-16	17-40	41-100	101-250	251-630	631-1600	
Directly Productive Staff										
00-01 Skilled, male	Freq.	19	12	13	4	2	1	-	-	51
	%	37.3	23.5	25.5	7.8	3.9	2.0	-	-	100.0
00-02 Skilled, female	Freq.	47	1	1	-	2	-	-	-	51
	%	92.2	2.0	2.0	-	3.8	-	-	-	100.0
00-11 Unskilled, male	Freq.	31	8	6	5	1	-	-	-	51
	%	60.8	15.7	11.8	9.8	1.9	-	-	-	100.0
00-12 Unskilled, female	Freq.	45	3	2	1	-	-	-	-	51
	%	88.2	5.9	3.9	2.0	-	-	-	-	100.0
Indirectly Productive Staff										
00-21 Skilled, male	Freq.	45	3	2	1	-	-	-	-	51
	%	88.2	5.9	3.9	2.0	-	-	-	-	100.0
00-22 Skilled, female	Freq.	49	2	-	-	-	-	-	-	51
	%	96.1	3.9	-	-	-	-	-	-	100.0
00-31 Unskilled, male	Freq.	49	1	1	-	-	-	-	-	51
	%	96.1	2.0	1.9	-	-	-	-	-	100.0
00-32 Unskilled, female	Freq.	48	2	1	-	-	-	-	-	51
	%	94.1	3.9	2.0	-	-	-	-	-	100.0
Administration Staff										
00-41 Male	Freq.	46	3	-	-	1	1	-	-	51
	%	90.2	5.9	-	-	2.0	1.9	-	-	100.0
00-42 Female	Freq.	47	1	-	2	1	-	-	-	51
	%	92.2	2.0	-	3.9	1.9	-	-	-	100.0
Sub-Total										
00-51 Male, total	Freq.	7	15	15	8	4	2	-	-	51
	%	13.7	29.4	29.4	15.7	7.8	4.0	-	-	100.0
00-52 Female, total	Freq.	43	2	3	2	1	-	-	-	51
	%	84.3	3.9	5.9	3.9	2.0	-	-	-	100.0
Total										
00-61 Total, male + female	Freq.	6	15	13	8	5	3	1	-	51
	%	11.8	29.4	25.5	15.7	9.8	5.9	1.9	-	100.0

Table 4.5.5 (14) Average Age, Service Years Wage of Employees (Q-10-00)

	Directly Productive Staff				Indirectly Productive Staff				Admin Staff		Total	
	Skilled		Un/Semi-Skilled		Skilled		Un/Semi-Skilled		Admin Staff		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Average Age												
	00-03		00-13		00-23		00-33		00-43		00-53	
1. Less than 15 years.	3	5.9	11	21.6	34	66.7	45	88.2	25	49.0	38	74.5
2. 16-25	7	13.7	33	64.7	4	7.8	2	3.9	-	-	-	-
3. 26-35	36	70.6	5	9.8	10	19.6	4	7.9	-	-	13	25.5
4. 36-45	5	9.8	2	3.9	3	5.9	-	-	-	-	-	-
Sub total	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0
Average Service Yr.												
	00-04		00-14		00-24		00-34		00-44		00-54	
1. Less than 2 years.	9	17.6	40	78.4	38	74.5	47	92.2	26	51.0	41	80.4
2. 3-5	20	39.2	8	15.7	4	7.8	2	3.9	9	17.6	5	9.8
3. 6-10	18	35.3	1	2.0	8	15.7	1	2.0	10	19.6	5	9.8
4. 11-15	3	5.9	1	2.0	1	2.0	-	-	1	2.0	-	-
5. Longer than 16	1	2.0	1	1.9	-	-	1	1.9	5	9.8	-	-
Sub total	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0
Avg Wage Per Mth												
	00-05		00-15		00-25		00-35		00-45		00-55	
1. Less than 1,000 ₱	3	5.9	13	25.5	34	66.7	44	86.3	29	56.9	38	74.5
2. 1,001-1,600 ₱	-	-	1	2.0	-	-	-	-	-	-	-	-
3. 1,601-2,500 ₱	6	11.8	34	66.7	3	5.9	4	7.8	-	-	3	5.9
4. 2,501-4,000 ₱	36	70.6	3	5.8	9	17.6	3	5.9	14	27.5	9	17.6
5. 4,001-6,300 ₱	6	11.7	-	-	4	7.8	-	-	2	3.9	1	2.0
6. Higher than 6,300 ₱	-	-	-	-	1	2.0	-	-	6	11.7	-	-
Sub total	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0	51	100.0

iv. Employees:

Table 4.4.5 (13) shows the total number of employees and those in production division (directly productive staff, indirectly productive staff) and administration division classified by skilled, unskilled, male, female and number of persons (Q10-00), while Table 4.5.5 (14) shows the survey results of average age, service years and wage of employees.

According to these figures, the directly productive skilled staff in production division mainly consists of the age of 26-35 years (70.6%) with service years of 6-10 (35.3%) and monthly wage of B2,500-B4,000 (70.6%).

The directly productive unskilled staff consists of the age of 16-25 years (64.7%) with service years of less than two (78.4%) and monthly wage of B1,601-B2,500 (66.7%).

On the other hand, the indirectly productive skilled staff consist of the age of less than 15 years (66.7%) with service years of less than two years (74.5%) and monthly wage of less than B1,000 (66.7%). Nearly the same tendency applies to the indirectly productive unskilled staff.

There are two groups in the administration division - veteran and new man groups. The veteran group consists of the age of 26-35 years (35.3%) with service years of 6-10 (19.6%) and monthly wage of B2,500-B4,000, while the new man group consists of the age of less than 15 years (49%) with service years of less than two (51%) and monthly wage of B1,000 (56.9%).

As a whole, there is a high percentage young laborers of less than 15 years old (74.5%) with service years of less than two and monthly wage of less than B1,000. Besides, the middle group consists of the age of 26-35 years (25.5%) with service years of 6-10 (9.8%) and monthly wage of B2,500-B4,000 (17.6%).