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**THE PRESENT STATE OF JAPANESE CORPORATIONS'
STRATEGIC R&D MANAGEMENT SYSTEMS**

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**Masaaki Sawada,
Satoshi Tanaka, Hiroyuki Tomizawa,
Masaru Tsukamoto, Hajime Nagahama**

**Second Policy-Oriented Research Group
Second Theory-Oriented Research Group**

**National Institute of Science and Technology Policy
(NISTEP)**

**Science and Technology Agency
JAPAN**

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I Introduction

In recent years the extent to which R&D directly influences business results within the manufacturing industry has steadily increased, and views such as “business expansion cannot be achieved without building up R&D capabilities” and “companies that control R&D control the market” have become firmly established among the senior management echelons at companies.

The current sluggish business environment suffers from intense international technological competitiveness, the downturn in profits brought about by the maturation of technology, products and markets, the diversification of market needs and the expansion of operational range through business diversification. This is making it extremely difficult for the manufacturing industry to break through the present barrier erected by technology that has reached maturity and become stagnant. Companies within the industry are now being forced to choose specific themes on which to focus because of the growing diversity of new technology seeds and basic technologies, and the sharp rise in the amount of R&D investment and the increasing research time required to obtain results from R&D. Thus there is an intensifying need for the Japanese manufacturing industry to place greater importance on “strategy” and “strategic management” in order to deal with such a chaotic and highly uncertain business environment.

During Japan’s high economic growth period companies had relatively clear ideas about what they should manufacture and how, and there was no pressing need for senior management to emphasize the setting of goals to this end. Individual employees strove to improve the quality and performance of whatever they were manufacturing with the common aim of “expanding business by mass-producing better quality products in shorter periods at a cheaper cost”. Needless to say, the long-established structure was efficient and played an absolutely vital role in the realization of this aim.

During this period private-sector companies assigned most of their business resources to product development and manufacture, while their research effort focused mainly on applied research aimed at improving product quality or performance, so R&D then was perhaps closer to “R&D” in its general lack of balance. This research-development-production process was an extremely efficient means to achieve the mission mentioned above in a short period.

Companies that strengthened their business foundations during the high economic growth period poured considerable effort into R&D during the series of booms in establishing central research institutions in an effort to enhance their technological capabilities, and through this, continued to expand and became highly competitive in international markets. During this process, research and development by Japanese companies steadily took on a much more balanced emphasis, changing from the one-sided “R&D” to the more proportional “R&D”.

As companies continue to change “from producing to thinking organizations”¹, it is becoming increasingly important for them to clarify their strategies by way of a direction that employees should follow and goals at which employees should aim, that is, “what they should manufacture and how” and “what they should do to achieve this”. In today’s society we are constantly being inundated with information, so there is a growing need for systems which enable us to choose only that information which is of use to us, which facilitate the timely vertical, lateral and

¹ Reference Document: NISTEP REPORT No. 15 "From Producing to Thinking Organisations"

interdepartmental flow of information, and which promote strategic R&D management that is mindful of differentiation and the allocation of priorities.

If Japanese companies were pressed to choose organizational reform (to a dynamic and well-coordinated system) or formulation and execution of strategies or both to deal with today's highly uncertain environment, then what kind of action would they take?

This report brings together the results of a survey of Japanese companies that forms a part of a wider survey which seeks to compare the R&D management systems of Japanese, United States and European companies.

We should like to take this opportunity to express our sincere appreciation for the invaluable guidance we received from Dr. Ikujiro Nonaka, Director in the 1st Theory-Oriented Research Group, NISTEP, and for the many extremely helpful suggestions we received from Dr. Kinji Gonda, Director in the 2nd Theory-Oriented Research Group, and Dr. Masahiro Kawasaki, Executive Director of the J R D C (former director-general of NISTEP) when planning and drawing up the survey and preparing this report.

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Masaaki Sawada, Researcher, 2nd Policy-Oriented Research Group

Satoshi Tanaka, formerly Senior Researcher, 2nd Policy-Oriented Research Group
(currently first secretary at the Embassy of Japan in Canada)

Hiroyuki Tomizawa, Researcher, 2nd Theory-Oriented Research Group

Masaru Tsukamoto, Director, 2nd Policy-Oriented Research Group

Hajime Nagahama, formerly Director, 2nd Policy-Oriented Research Group
(currently professor, Department of Economics, Shinshu University)

II Aim and Assumptions

A highly uncertain business environment has been caused recently by intense international technological competitiveness, the downturn in profits due to the maturation of technology, products and markets, the diversification of market needs and the expansion of operational range through business diversification, growing diversity of new technology seeds and basic technologies, and the sharp rise in the amount of R&D investment and the increasing research time required to obtain results from R&D. In conducting this research, we worked on the assumption that within the Japanese manufacturing industry there is an intensifying need for “strategies” and “strategic management” to deal with this environment.

The aim of this research, based on a wide-ranging questionnaire, is to verify that the Japanese manufacturing industry is becoming more aware of the importance of strategic R&D management systems, and to ascertain what typical manufacturing companies, the driving force of private-sector R&D in Japan, are doing or intend to do to ensure that their R&D operations are effective and efficient in response to the highly uncertain business environment described above. Through this research, we also aimed at using the results of the questionnaire to present a number of general suggestions for effective and efficient R&D management systems that would be of benefit not just to private-sector companies, but to all institutions that conduct research and development.

As companies continue to change “from producing to thinking organizations”, it is becoming increasingly important for them to clarify their strategies by way of a direction that employees should follow and goals at which employees should aim, that is, “what they should manufacture and how” and “what they should do to achieve this”. In this research we assumed that if there is a need for strategic management that is mindful of differentiation and the allocation of priorities to deal with the uncertainty in the business environment, it then follows that there would be separate divisions for R&D strategy planning within companies to devise and execute “strategies” as a concrete internal measure to deal with such a trend. We also assumed that separate divisions for R&D strategy planning fulfill the function of coordinating interdepartmental views when devising and executing “strategies” by choosing from the vast range of business information available from various sources only that which is of use to their own company, and by processing (creating) and presenting this information in a form that is usable within the company.

On the basis of these assumptions and from the viewpoint of whether the company had established a Separate division for R&D strategy planning or not, we attempted to grasp the characteristics of R&D management within the Japanese manufacturing industry through the trends for responses to individual items about R&D management systems, such as “change in the position within company of the R&D division head”, “method of formulating R&D budgets plans”, “contact between R&D division and other divisions”, “employment conditions for and attitudes towards researchers and technicians” and “consortia”.

To avoid any misunderstanding, it should be pointed out that the existence of a separate division for R&D strategy planning does not automatically mean that a strategic R&D management system is in place. The existence of such a division was taken up merely as an indication of the growing importance of “strategy” and the extent to which “strategic management” had been introduced.

In this research we have defined “strategy” and “strategic management” as follows.

Strategy: A vision formulated for the logical and appropriate distribution of the company’s resources based on an analysis of the business-related environment within and outside the company.

Strategic management: The drawing up and execution of implementation measures (tactics), keeping in mind differentiation and the allocation of priorities in line with the formulated “strategy”.

Moreover, in our view, “strategy” is not a hostile concept even in well-coordinated systems that have a high regard for the independence of members of the organization.

III Conduct of the Survey

1. Survey Method

For the survey, questionnaires comprising 38 R&D-related questions were sent by mail to the companies being surveyed. The questionnaire is attached as Annex 1.

2. Companies Surveyed

Companies with research expenditure in excess of ten billion yen were selected for the survey on the basis of the view that since the level of R&D expenditure reflects the scale of R&D activities, it is possible to compare R&D management systems at companies whose R&D expenditure is above a set level. Moreover, this is not unrelated to the fact that the survey is also aimed at presenting general suggestions (that go beyond industrial peculiarities) about the conduct of R&D. We chose for the survey 149 companies whose fiscal 1990 R&D expenditure was at least ten billion yen according to the Quarterly Japan company Handbook, published by Toyo Keizai Inc. (The Oriental Economist). We did, however, include twelve companies whose R&D expenditure was less than ten billion yen in order to permit comparison among different industries. The minimum expenditure in these cases was 7.5 billion yen, and the average was nine billion yen.

We checked the R&D division heads or officers responsible for R&D in these companies in the company Staff List published by Diamond Co. Ltd., and mailed the questionnaires to these officers in early December 1991. In the covering letter to the questionnaire, we asked that the questionnaire be filled in by a staff member who could give responses about the company's R&D strategy, R&D management system and the overall management environment based on objective data.

3. Companies and Respondent's Position

Responses were received from 126 of the 149 companies to which questionnaires were sent (response rate of 84.6%). The companies that responded account for 64.4% of R&D expenditure, 38.4% of sales, 32.2% of employees and 55.3% of researchers among Japanese private-sector companies².

A breakdown of respondents' positions is shown in Figure 1 (N = number of respondents; Q = question number).

Figure 2 shows the sections where the respondents are involved in R&D strategy development.

² Data shown here are percentages of total figures for Japanese private-sector companies obtained from Management and Coordination Agency statistics (1991 Science and Technology Survey Report: Data on companies that are conducting research from all industries, excluding public corporations). R&D expenditure is expenditure within the company, and the number of researchers is the number of employees who are primarily engaged in research work.

Figure 1 Position of Respondents [Q.1]

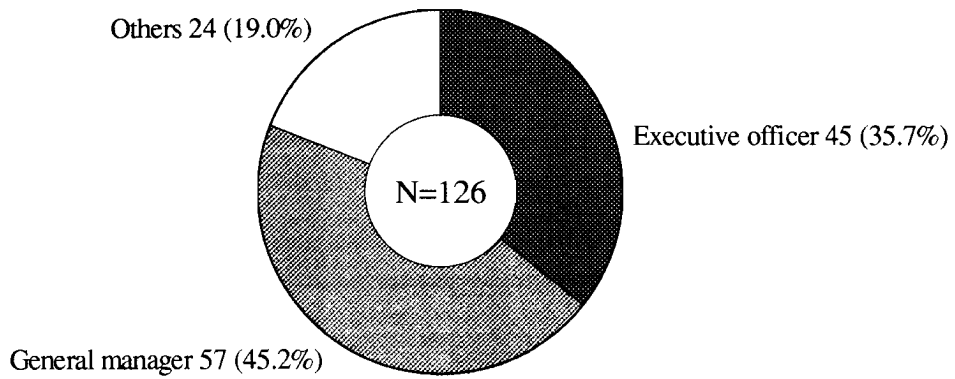
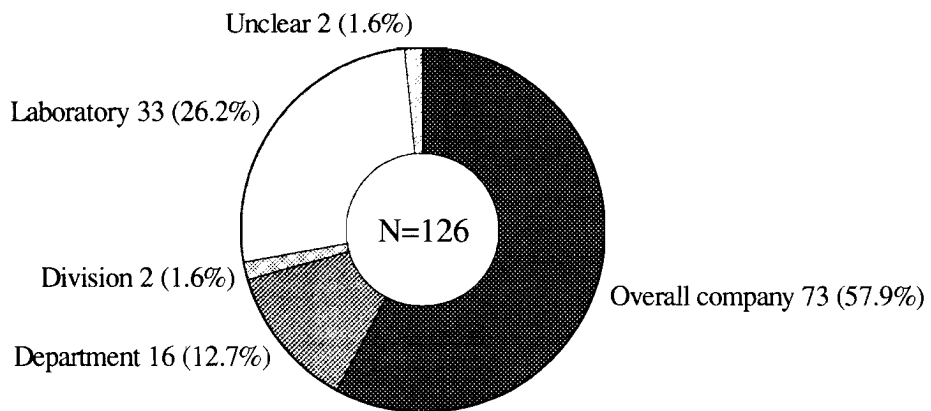


Figure 2 Sections Where Respondents are Involved in R&D Strategy Development [Q.2]



IV Survey Results

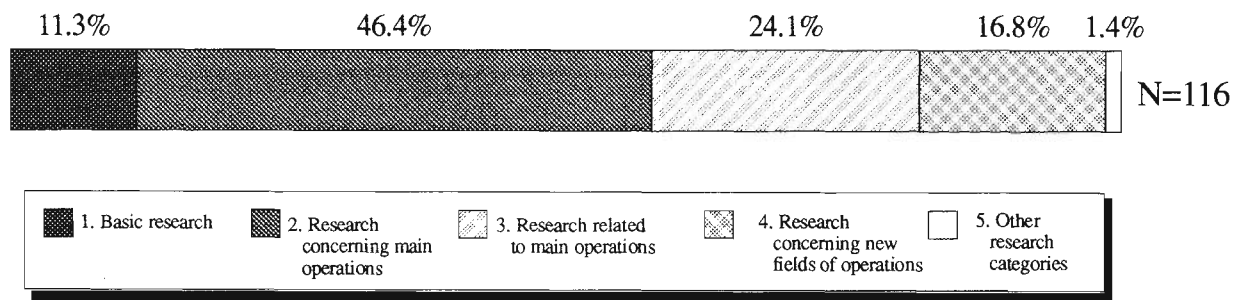
1. Outline of R&D Activities

1-1 Breakdown of R&D Activities

We asked the companies to show a breakdown of their research effort according to the number of research themes under each of the listed research categories and to the number of personnel allocated to each of the research categories. The figures for each of the research categories in the effective responses were added up, then a simple average was obtained.

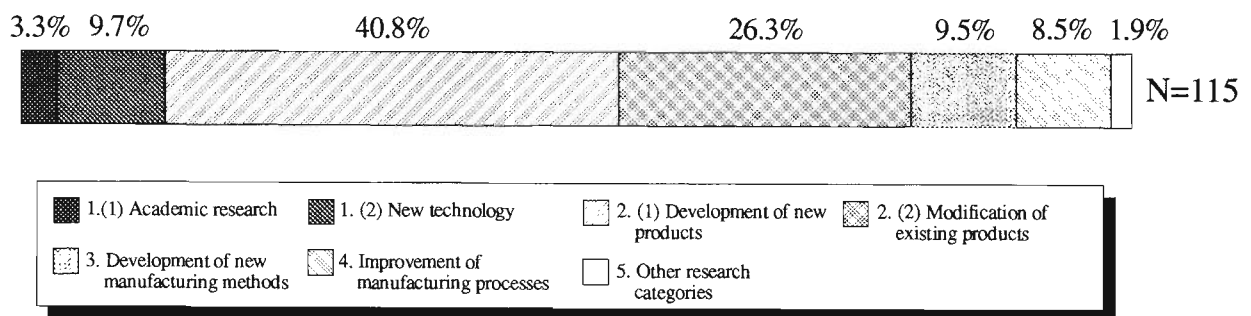
The breakdown according to the number of research themes was basic research - 11.3%, research concerning main operations - 46.4%, research related to main operations - 24.1%, research concerning new fields of operations - 16.8%, and other research categories - 1.4% (Figure 3). The percentage for basic research shown here is higher than the 10% listed in Management and coordination Agency statistics, but this can probably be attributed to the fact that the companies surveyed in this study are all major companies.

Figure 3 Breakdown of R&D Activities [Q.22]
(According to Number of Research Themes)



As for the breakdown according to allocation of personnel: basic research sub-categories (1) academic research - 3.3% and (2) research on new technology - 9.7%, applied research sub-categories (1) research concerning the development of new products - 40.8% and (2) research concerning the modification of existing products - 26.3%, research concerning the development of new manufacturing methods - 9.5%, research concerning the improvement of manufacturing processes - 8.5%, and other research categories - 1.9% (Figure 4).

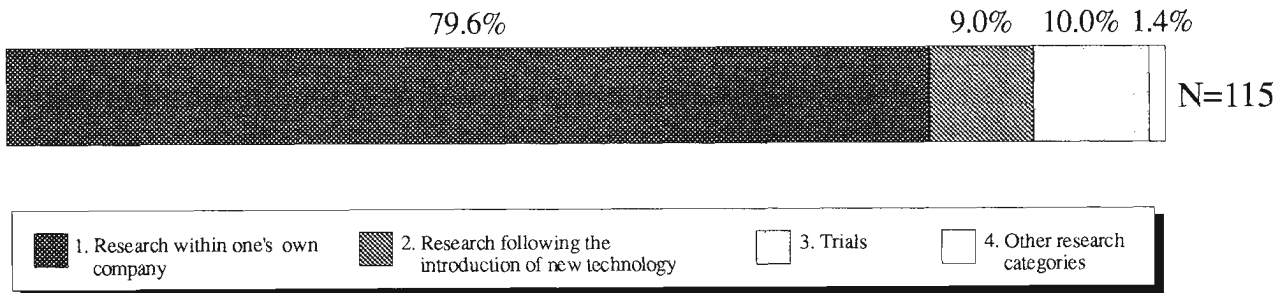
Figure 4 Breakdown of R&D Activities [Q.26]
(According to Allocation of Personnel)



1-2 Allocation of R&D Personnel

For this question, we divided research into four categories - research within one's own company, research following the introduction of new technology, trials, and other research categories - and asked the companies to indicate the percentage of their R&D personnel allocated to each category. The figures for each of the research categories in the effective responses were added up, then a simple average was obtained. Results were: research within one's own company - 79.6%, research following the introduction of new technology - 9.0%, trials - 10.0%, and other research categories - 1.4% (Figure 5).

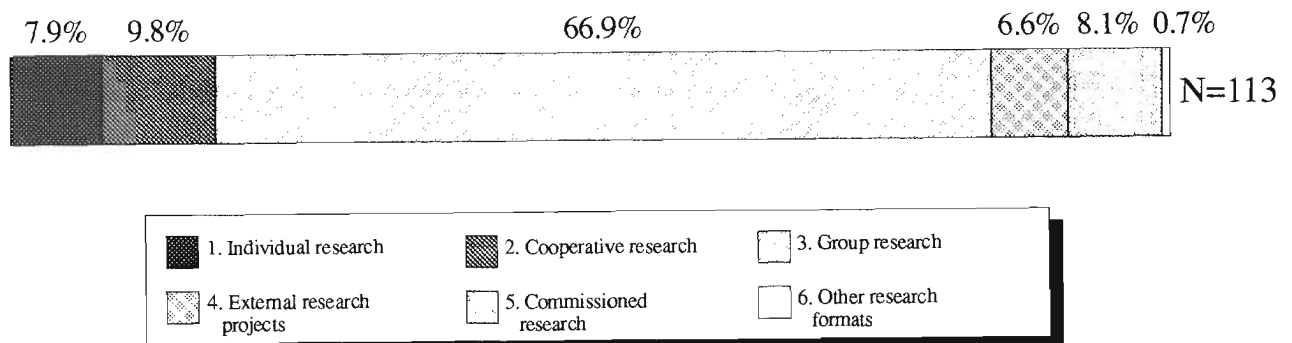
Figure 5 Allocation of R&D Personnel [Q.24]



1-3 Research Format

For this question, we divided research into six formats - individual research, cooperative research (with individuals from other groups), group research, external research projects, commissioned research, and other research formats - and asked the companies to indicate the extent to which each format is used as a percentage. The figures for each of the research formats in the effective responses were added up, then a simple average was obtained. Results were: individual research - 7.9%, cooperative research - 9.8%, group research - 66.9%, external research projects - 6.6%, commissioned research - 8.1%, and other research formats - 0.7% (Figure 6).

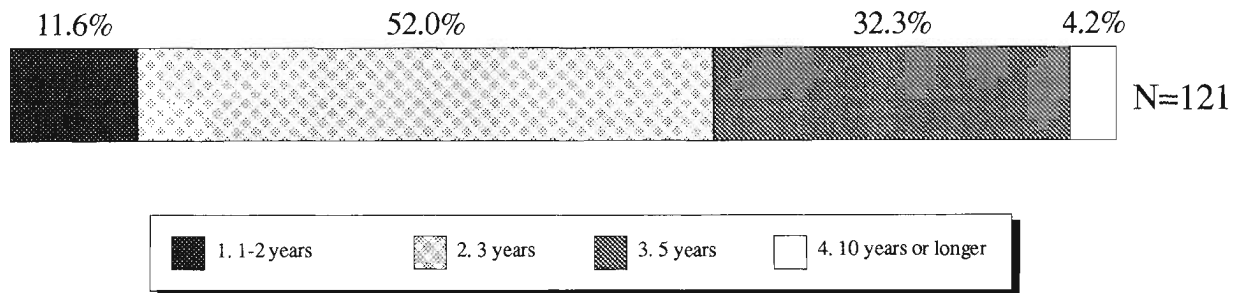
Figure 6 Research Format by Theme [Q.23]



1-4 Standard Research Period

We asked companies to indicate how long they generally spend on a single research theme; 1-2 years, 3 years, 5 years, and 10 years or longer. More than half (52.0%) responded with 3 years, while 11.6% said 1-2 years, 32.3% said 5 years, and 4.2% said 10 years or longer (Figure 7).

Figure 7 Standard Research Period [Q.21]



1-5 R&D Budget Allocation to New Research Themes

We then asked the companies what percentage of their annual R&D budget is spent on new research themes. Responses were received from 101 companies, and the simple average of their responses came to 21.7%.

1-6 Frequency of New Technology

We asked the companies to indicate the frequency with which they introduce new technology to their main market of operations on a scale ranging from very low through to very high. Figure 8 shows the results classified by the major industrial groups³ From the table, we can see that the machinery-related manufacturing industries introduce new technology more frequently than the other industries.

³ Industrial classifications

Construction: Construction

Consumption-related manufacturing industries: Food, textiles

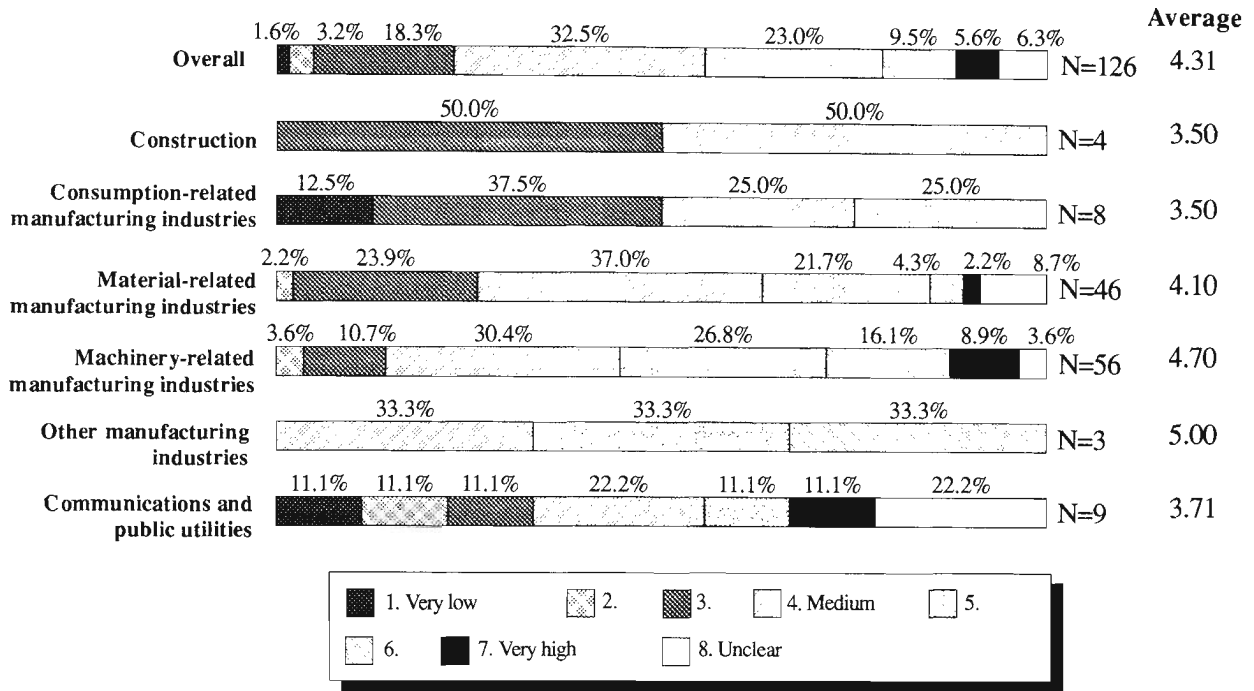
Material-related manufacturing industries: Chemicals, pharmaceuticals, paints, other chemicals, petroleum, rubber, glass, miscellaneous ceramics, general steel, non-ferrous metals, electric wire

Machinery-related manufacturing industries: Industrial machinery, other machinery, heavy electric equipment, communications equipment, domestic electrical appliances and component parts, metering instruments, other electrical equipment, ship-building, motor vehicles, precision machinery

Other manufacturing industries: Other manufacturing industries

Communications and public utilities: Broadcasting and communications, electric power, gas

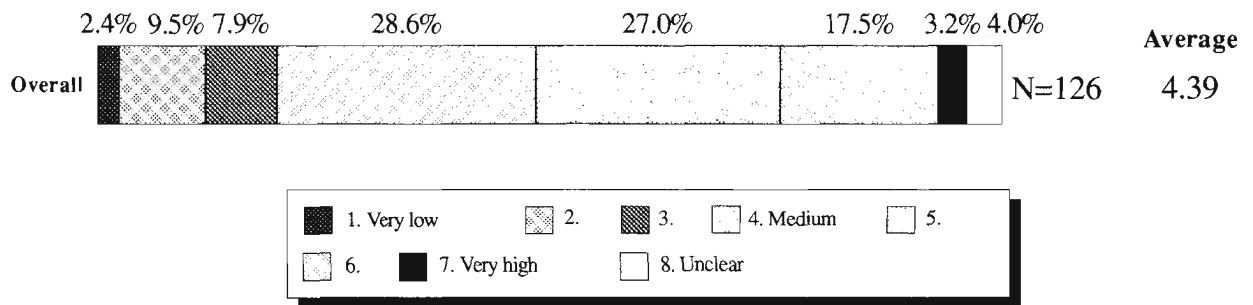
Figure 8 Frequency of New Technology [Q.10]



1-7 Need for change in Product Line

We asked the companies to indicate whether they feel there is a need for a change in their product line on a scale ranging from very low through to very high (Figure 9). About half of the companies feel that there is a relatively high need for a change in their product line.

Figure 9 Need for Change in Product Line [Q.11]



2. Growing Awareness of the Need for Strategic R&D Management Systems

2-1 Separate Divisions for R&D Strategy Planning

To confirm that there is a growing awareness among Japanese companies of the need for strategic R&D management systems, we asked the surveyed companies to indicate whether they have a separate division specially responsible for R&D strategy. Looking upon the existence or non-existence of such a division as one indication of how aware the company is about the importance of “strategy” and the extent to which it has introduced “strategic management”, we used this classification in our analysis of responses to subsequent questions in this section. Figure 10 shows the number of companies that have and the number that do not have a separate division for R&D strategy planning. Of the 126 companies that responded, 82 (65.1%) have such a division, while 42 (33.3%) do not. Figure 11 shows the sections to which these divisions belong; the division comes under the office of the president in 49 companies (59.8%), under the business headquarters in 18 companies (22.0%), and under the research laboratory in 8 companies (9.8%). We were unable to find a correlation between the existence of a separate division for R&D strategy planning on one hand and the level of R&D spending and the type of industry on the other (Figures 12 and 13).

As seen in the responses, 49 of the 126 companies have a division specially responsible for R&D strategy under the direct control of the president. These companies, we believe, are fully aware of the importance of “strategy” and “strategic management”. We can say that the other 26 companies with the division are also conscious of the need for a strategic R&D management system, and are tackling with the internal and external R&D environment in a coordinated way.

Figure 10 Existence of a Separate Division for R&D Strategy Planning [Q.5]

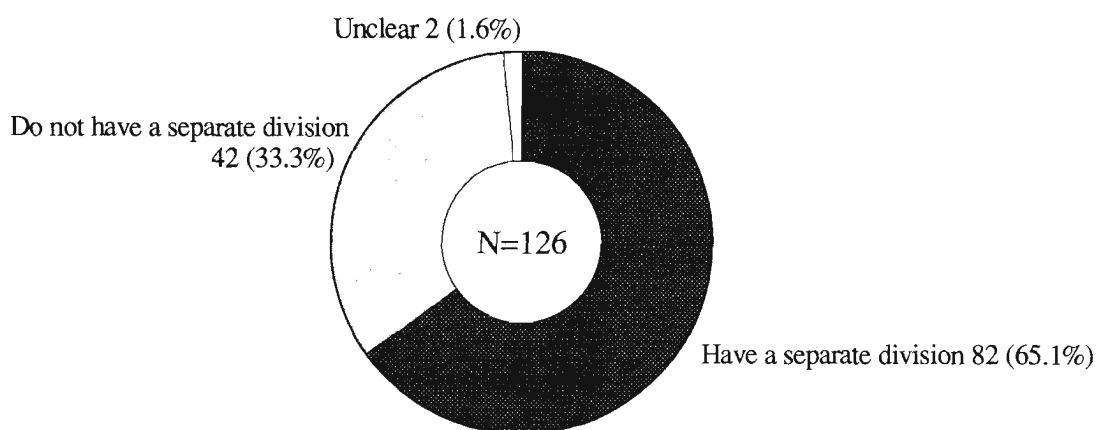


Figure 11 Section to Which the Separate Division Belongs [Q.5]

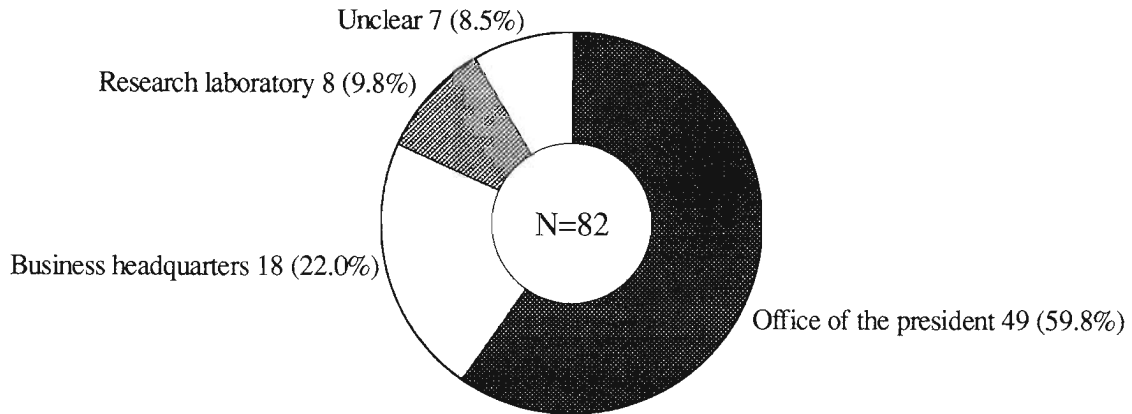


Figure 12 Existence of Separate Division for R&D Strategy Planning [Q.5]
(Classified by level of R&D spending)

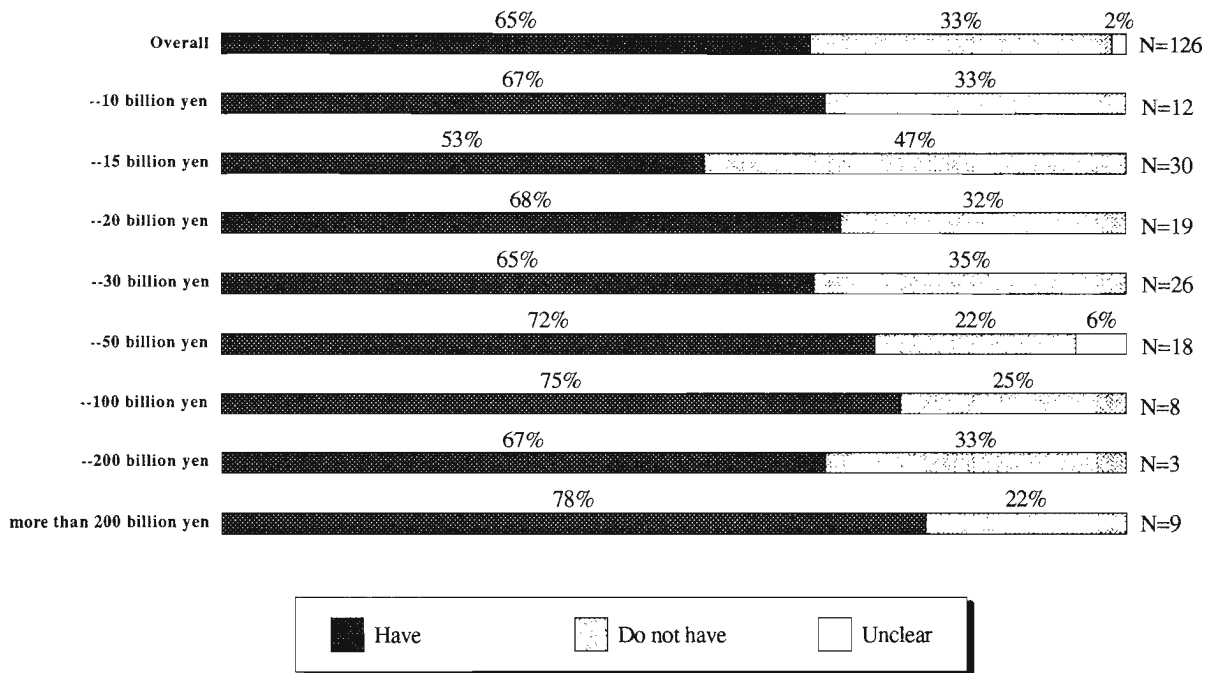
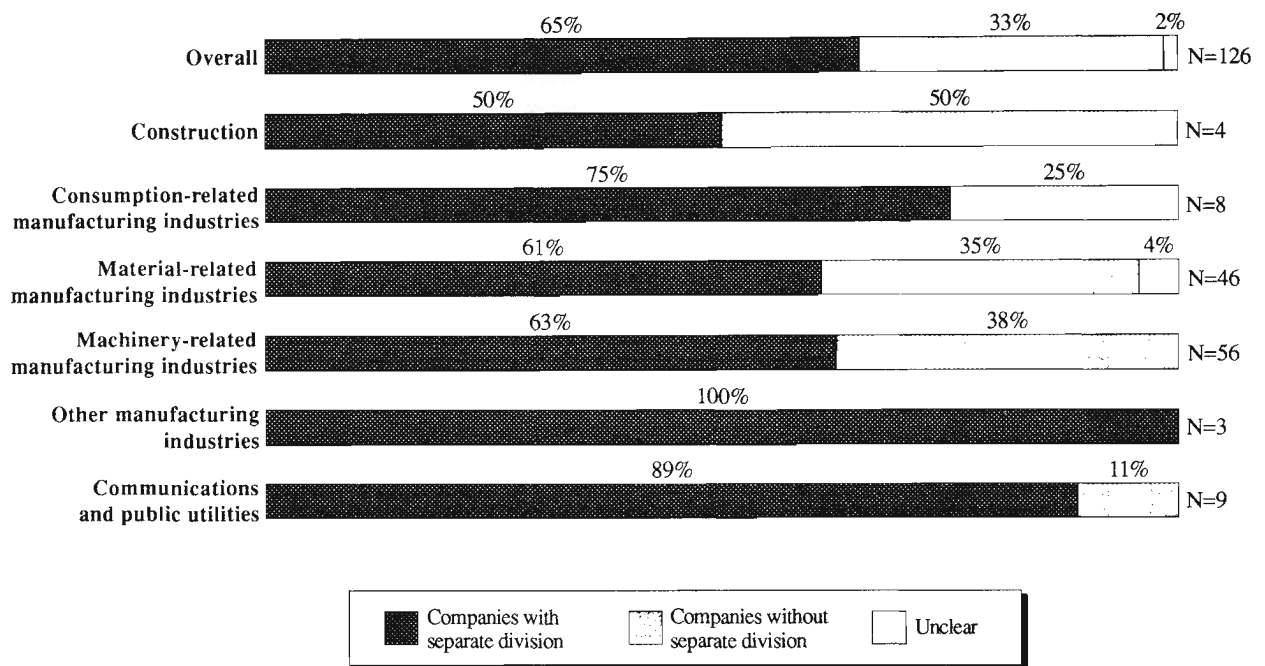


Figure 13 Existence of Separate Divisions for R&D Strategy Planing [Q.5]
(Classified by industry)

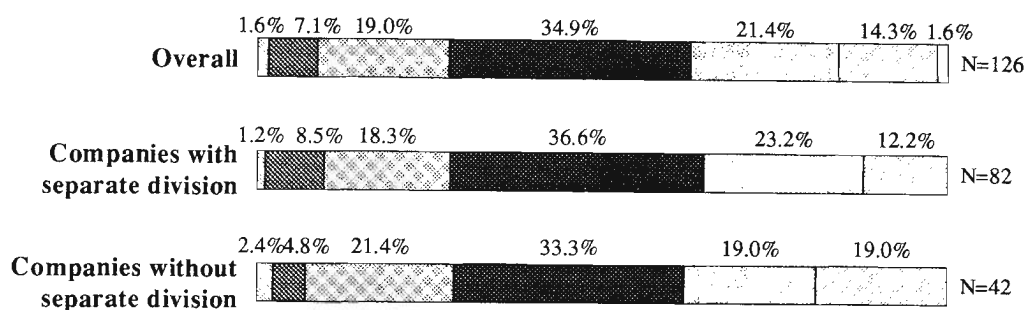


2-2 Position within Company of the R&D Division Head (comparing 1981 and 1991)

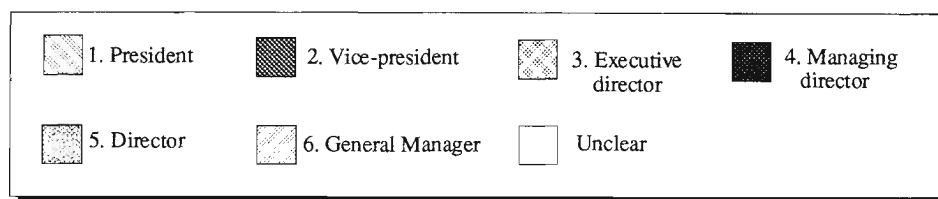
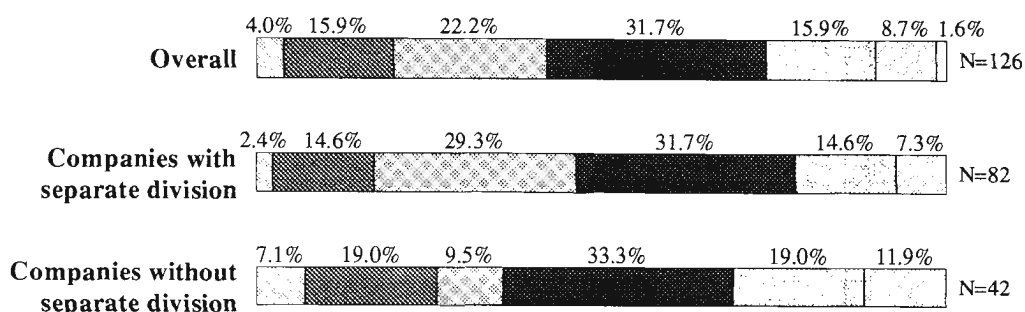
Considering the fact that these days senior management in manufacturing companies place greater importance on R&D than in the past, we asked companies to indicate the position of their R&D division head in 1991 and in 1981 in an effort to gain a statistical verification of this trend, and also to confirm that the relative influence of the R&D division within senior management has in fact increased over this ten-year period (Figure 14).

Figure 14 Position of the R&D Division Head [Q.13]

(1) Position of the R&D Division Head - 1981



(2) Position of the R&D Division Head - 1991



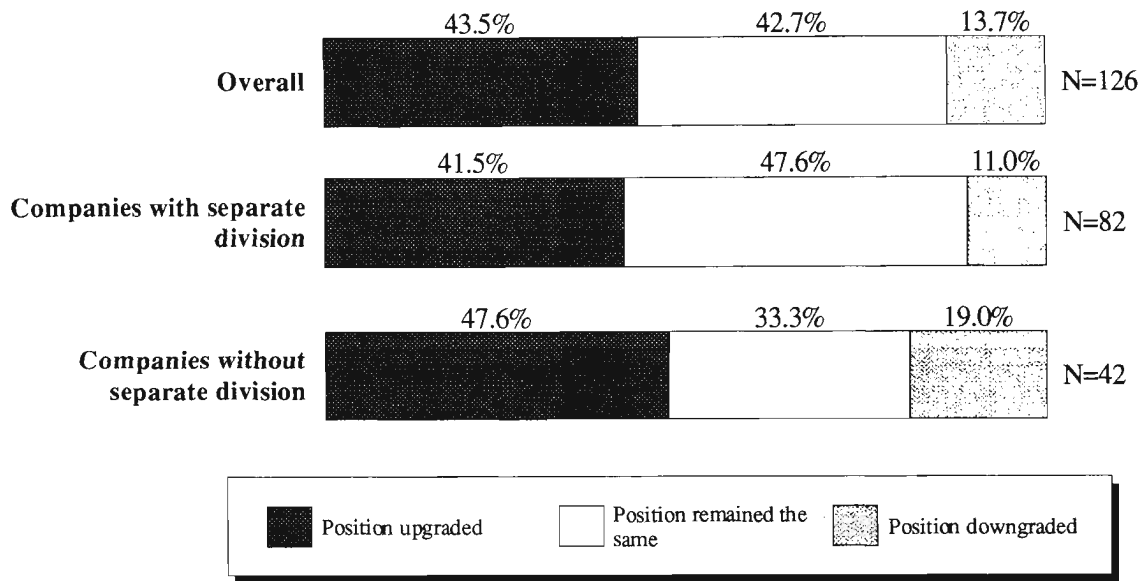
For the question, we listed six positions in descending rank order, and compared each company's R&D division head's position in 1981 and in 1991. Figure 15 shows the percentage of companies in which the position within company of the R&D division head was upgraded, was downgraded and remained the same between those ten years.

From the figure we can see that, all in all, the position of R&D division head has been upgraded in the ten years between 1981 and 1991.

This upgrading of the position can generally be attributed to:

- an increase in the relative influence of the R&D division within senior management,
- a strengthening of the company's broad strategic response to R&D, and
- a strengthening of the vertical chain of command within the R&D division.

Figure 15 Change in the Position of the R&D Division Head [Q.13]
(Comparison between 1981 and 1991)



A different trend was seen between companies with a separate division for R&D strategy planning and those without. The figure shows that the percentage of companies that upgraded or downgraded the position was lower among the companies with a separate division for R&D strategy planning than among the companies without, while the percentage of companies in which the position remained the same was higher among those with the special division than among those without. It can be seen that from the early stages, senior management at companies with divisions specially responsible for R&D strategy have recognized the importance of R&D, and have been pursuing measures to enhance their overall R&D strategy.

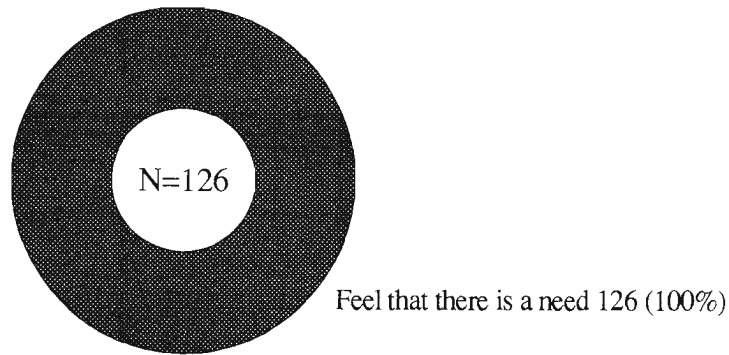
We can also see that among the companies without an R&D strategy division, those that upgraded the position within company of the R&D division head constituted the largest percentage, indicating that here, too, steady progress has been made in the tackling of R&D over this ten-year period.

2-3 Improving the Efficiency of R&D Activities

Until very recently, or even still today, to senior management, R&D has been a veritable black box whose output relative to the management resources invested is impossible to gauge.

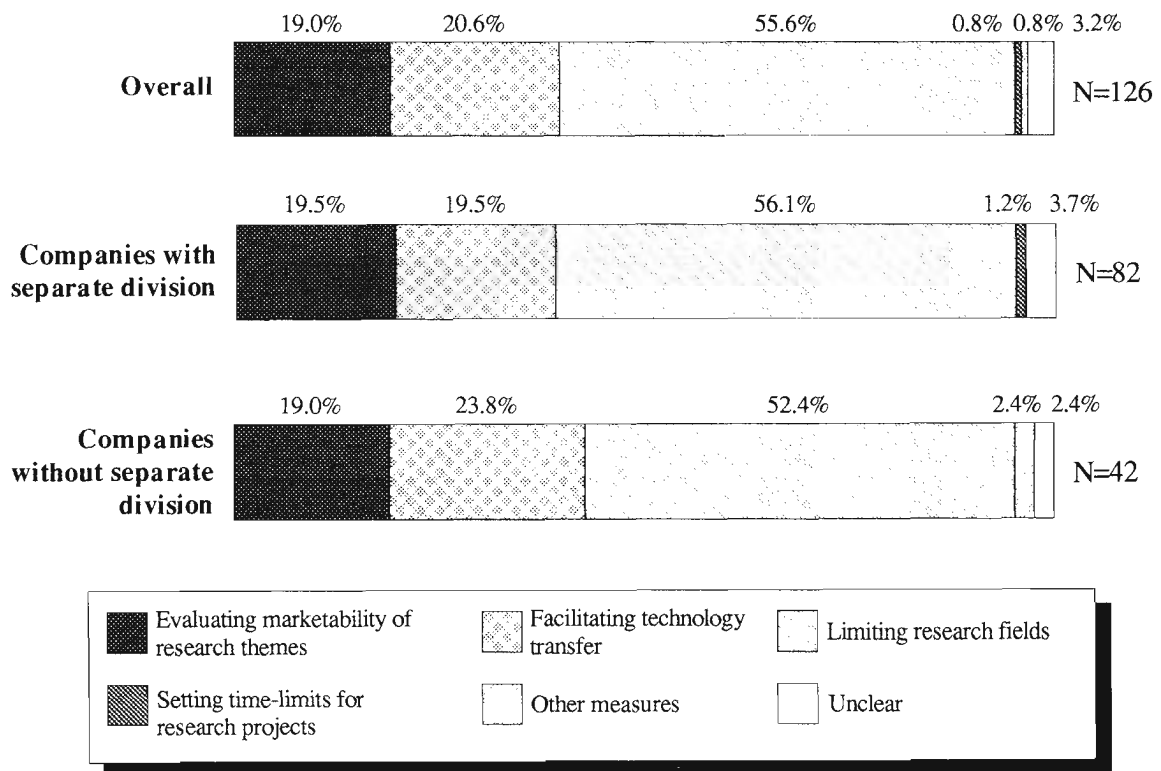
As the environment surrounding R&D grows more severe and uncertainty rises, business managers are becoming more convinced that R&D is a baffling device of obscure internal workings, but at the same time, they have a strong desire to somehow raise the efficiency of that device. All companies in the survey responded that they feel there is a need to improve the efficiency of R&D (Figure 16).

Figure 16 Need to Improve R&D Efficiency [Q.12]



We asked the companies to indicate the measure or measures they believe should be taken to raise the efficiency of R&D from those listed in the question. They were able to choose more than one measure from the list, and in these cases, they were asked to list the measures in priority order. The majority of companies gave the highest priority to “limiting research fields in which resources will be invested” (Figure 17).

Figure 17 Measures to Improve R&D Efficiency [Q.12]



This result reflects today's harsh business environment in which companies are being pressed to increase funds for R&D operations and extend the period for each R&D theme. The fact that many listed "facilitating the technology transfer from research through development to production" as their second priority was initially a surprising response from Japanese companies, which are said to have a detailed knowledge about pushing manufactured products on to the market in a short period at low cost, but considering that Japanese companies have only recently begun to seriously tackle research on a full scale, this response can be probably be seen as a result of their focusing on the smooth flow of technology from the research stage to the various other stages.

Compared to companies without a separate division for R&D strategy planning, companies with such a division recorded a lower percentage of responses giving highest priority to "facilitating technology transfer" but a higher percentage of responses giving highest priority to "limiting research fields".

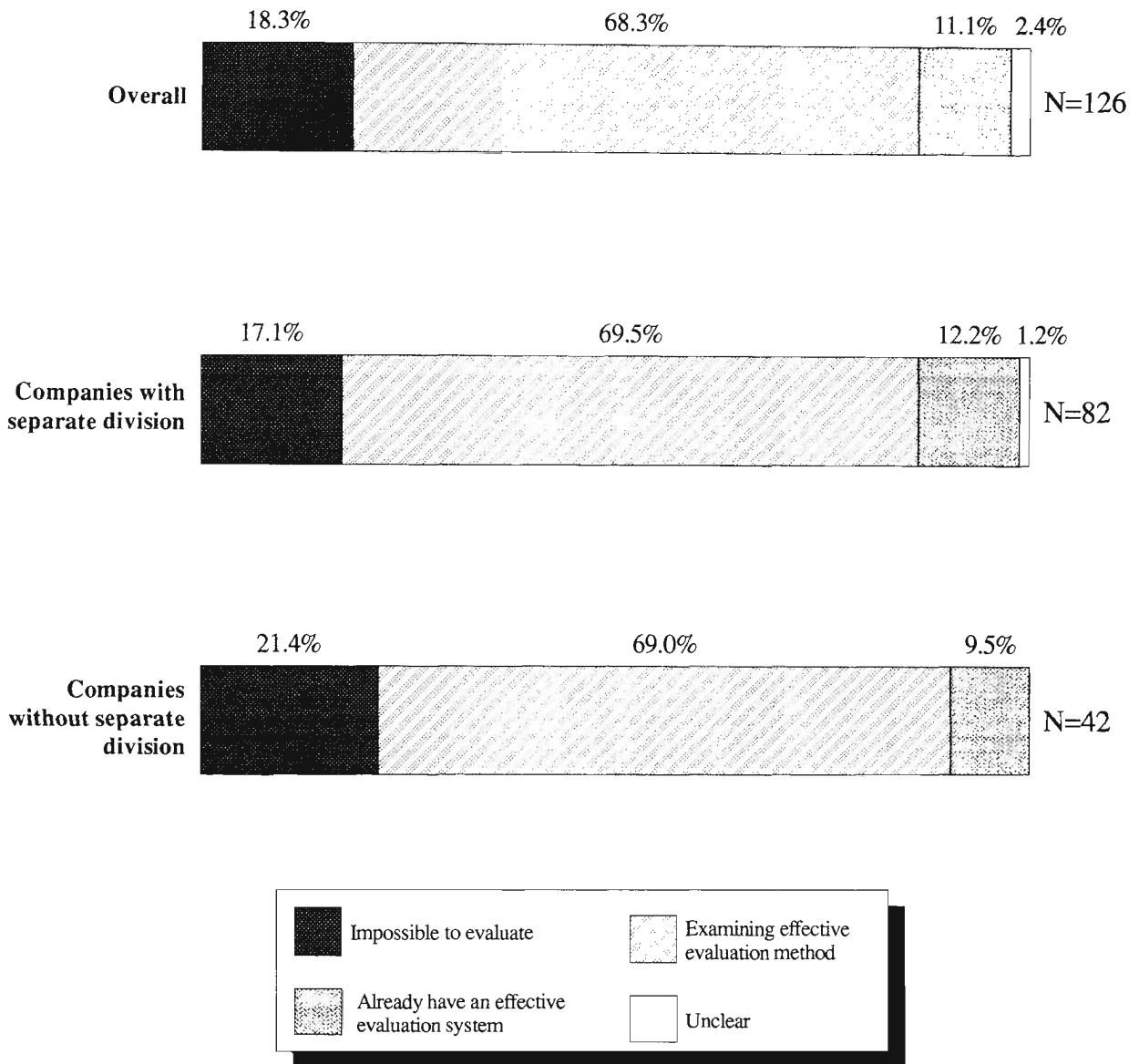
2-4 Evaluating R&D from the Viewpoint of Investment Effectiveness

From the survey, it seems that company managers realize they are not able to manage the R&D division in the same way as they manage the other divisions. As mentioned earlier, managers are not able to forecast the effectiveness of R&D investment, so to them the R&D division is a black box. Some managers assert that it is wrong to expect efficiency in R&D, and that effectively managed R&D is the key (i.e., companies should tackle research from a long-term viewpoint while seeking to ignite the creativity of individual researchers, rather than focus on short-term revenue and expenditure). Certainly, there is no argument that this should be the underlying tone in the management of R&D. Even though managers realize that they have to run their R&D effort effectively, they also want to somehow raise the cost efficiency of their R&D. Figure 18 shows the companies' responses to the question on evaluating the investment efficiency of their R&D operations. Overall, 23 companies (18.3%) responded "it is impossible to evaluate investment efficiency", 86 companies (68.3%) responded "currently examining the introduction of a effective evaluation method", and 14 companies (11.1%) responded "already have an effective evaluation system".

Among the companies that responded "it is impossible to evaluate investment efficiency", we believe there are some that by "impossible" mean "the use obtained from the evaluation would not be worth the time and effort spent in carrying it out". This may also be in the back of the minds of some of the companies that responded "currently examining the introduction of an effective evaluation method" and "already have an effective evaluation system", but it goes without saying that the accumulation of quantifiable objective data is the first step to introducing a strategic R&D management system. In this sense, we can say that 80% of all companies that responded are evaluating or examining ways of evaluating the efficiency of R&D investment with a realization of the importance of strategic R&D management systems.

We also observed a slight difference in the response trends between companies that have and those that do not have a separate division for R&D strategy planning (Figure 18).

Figure 18 Evaluating Investment Effectiveness of R&D [Q.9]



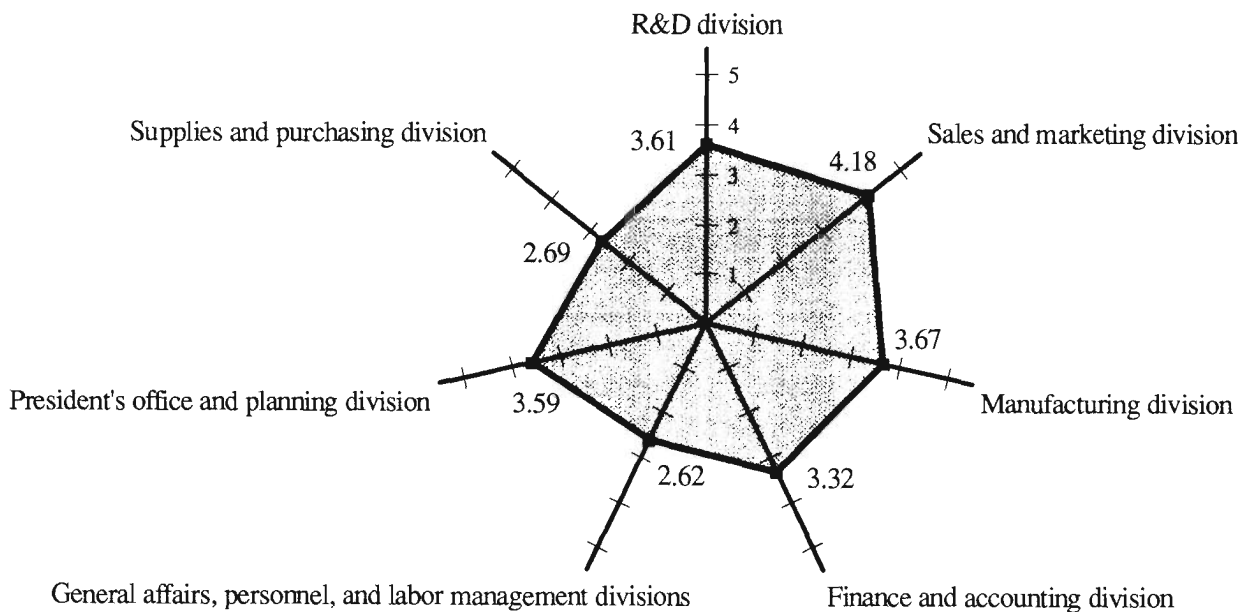
Compared to companies without a separate division for R&D strategy planning, companies with such a division recorded a higher percentage of “it is impossible to evaluate investment efficiency” responses but a lower percentage of “already have an effective evaluation system” responses.

2-5 Influence of Divisions on Matters Affecting the Performance of the Overall Company

To ascertain the level of influence that R&D divisions have on senior management, we asked the companies to indicate the relative degree of influence each division has on matters that affect the performance of the company on a scale from one to five (1 - "little or no influence"; 2 - "some influence"; 3 - "considerable influence"; 4 - "great deal of influence"; 5 - "extremely high degree of influence").

Figure 19 shows the degree of influence enjoyed by each of the divisions on matters affecting the overall performance of the company as an average of the response scale values $((1x_a+2x_b+3x_c+4x_d+5x_e)/(a+b+c+d+e))$: numbers represent response values, letters a-e represent number of companies). In the figure, the higher the average value, the greater the influence. As can be seen, the sales and marketing division has the greatest influence with an average value of 4.18, followed by the manufacturing division with 3.67, the R&D division with 3.61, the president's office and planning division with 3.59, the finance and accounting division with 3.32, the supplies and purchasing division with 2.69, and the general affairs, personnel, and labor management divisions with 2.62.

Figure 19 Influence of Each Division on Matters that Affect Overall Company Performance [Q.16]



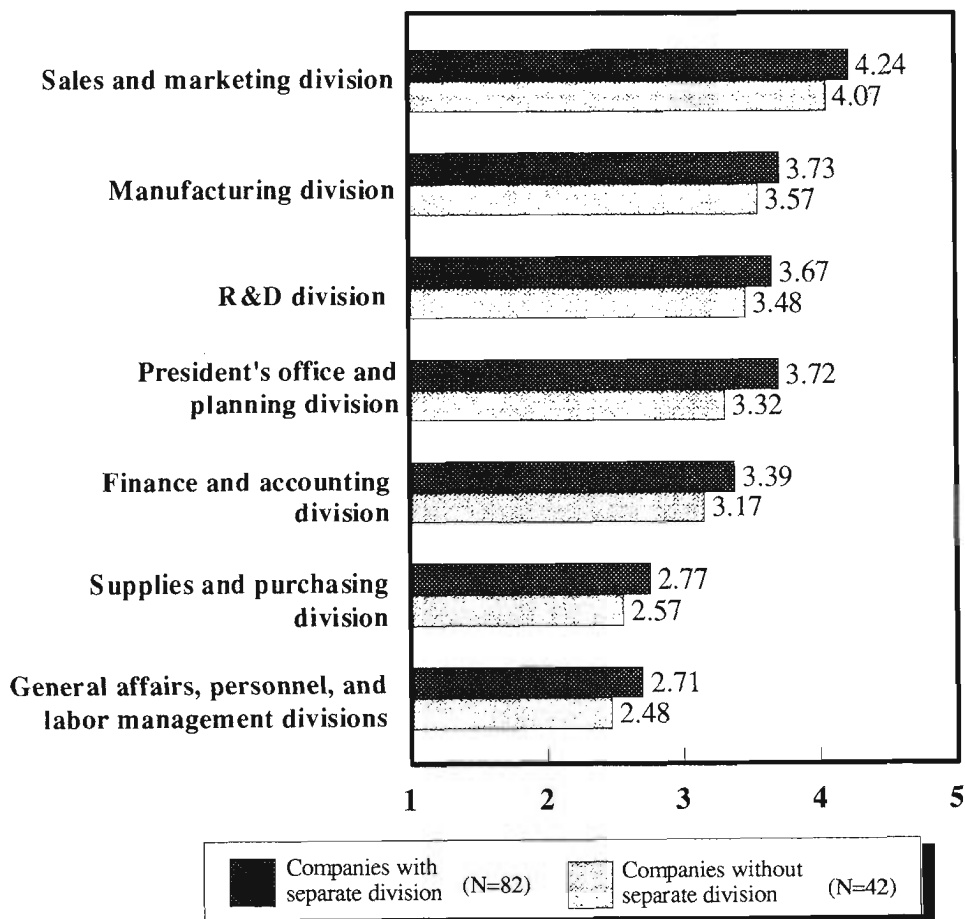
Numbers shown in the figure are the average values of the responses (N=124) from the following scale

1	2	3	4	5
Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence

As an aside, the R&D division finished second behind the sales and marketing division in the overall number of companies that gave the division a 5 grading (extremely high degree of influence).

Divisions within companies that have a separate division for R&D strategy planning generally tend to have greater influence than divisions within companies that do not have a separate division for R&D strategy planning (Figure 20). Average values for companies with a separate division for R&D strategy planning are higher than those for companies without a separate division for R&D strategy planning by 0.19 for the R&D division, 0.17 for the sales and marketing division, 0.16 for the manufacturing division, 0.22 for the finance and accounting division, 0.23 for the general affairs, personnel, and labor management divisions, 0.40 for the president's office and planning division, and 0.20 for the supplies and purchasing division.

Figure 20 Influence of Each Division on Matters that Affect Overall Company Performance [Q.16]



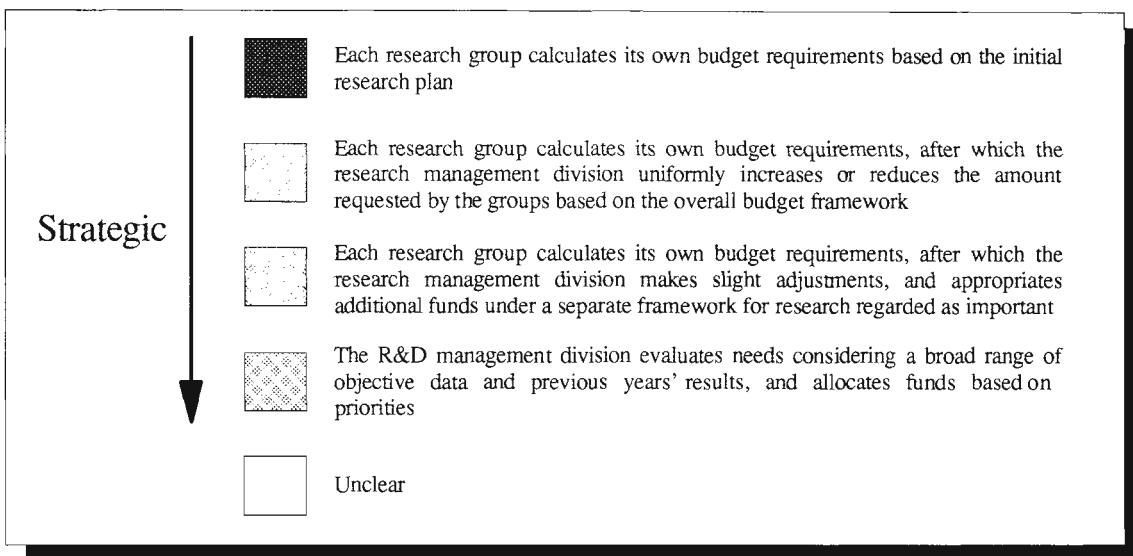
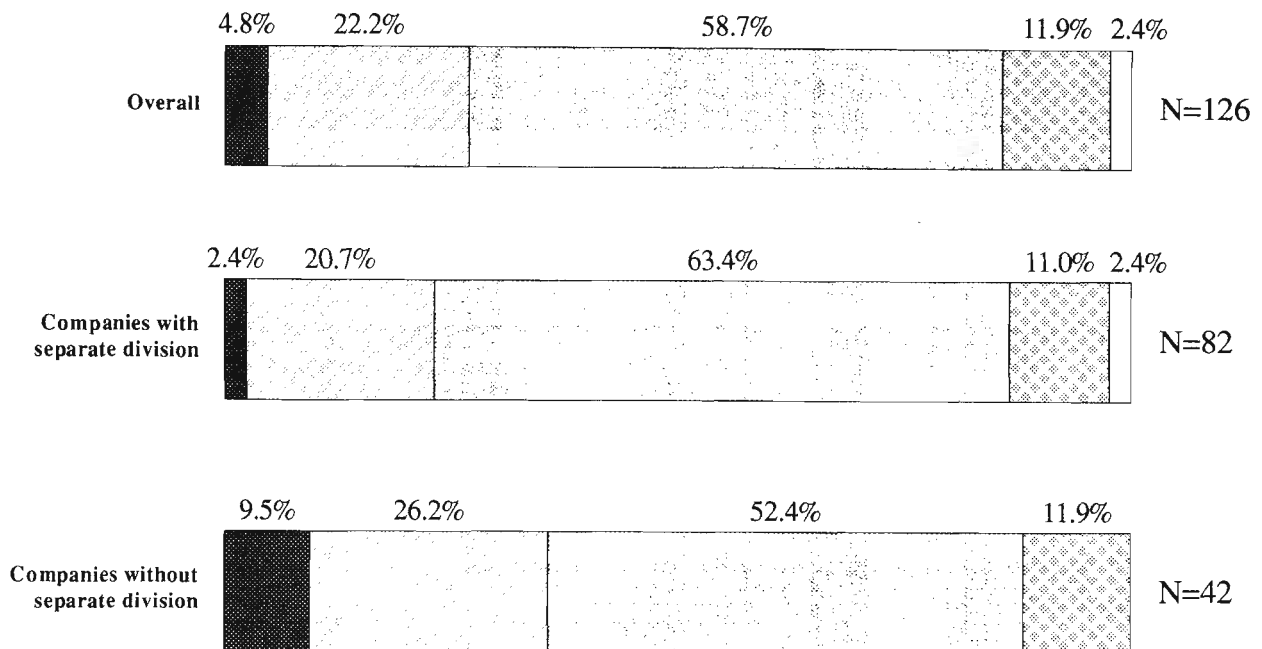
By this, it appears that companies with a separate division for R&D strategy planning generally have a greater tendency to absorb information and opinions from the various divisions, and reflect that information and those opinions in the decision-making processes of senior management.

3. Current State of Strategic R&D Management Systems

3-1 Methods of Formulating R&D Budget Plans

To determine the current state of strategic R&D management systems, we asked the companies to choose one of the five listed methods that most closely resembles how they formulate their R&D budget plan. The first listed method - “each research group calculates its own budget requirements based on the initial research plan” - indicates to us that budget formulation is largely decentralized and there is no strategic management system; the second - “each research group calculates its own budget requirements, after which the research management division uniformly increases or reduces the amount requested by the groups based on the overall budget framework” - indicates that the R&D management system lacks a strategic outlook; the third - “each research group calculates its own budget requirements, after which the research management division makes slight adjustments, and appropriates additional funds under a separate framework for research regarded as important” - indicates that the R&D management system has a strategic outlook to a degree; the fourth - “the R&D management division evaluates needs considering a broad range of objective data and previous years’ results, and allocates funds based on priorities” - indicates that the R&D management system has a strategic outlook; while the fifth - “the R&D management division evaluates needs considering a broad range of objective data and previous years’ results, and allocates funds based on priorities, but the views of the marketing division are greatly reflected in the formulation of the budget plan” - indicates that the R&D management system has a strategic outlook, and also that, conscious of parallels with U.S. and European companies, the company is influenced considerably by the views of the marketing division. Of the 126 companies that gave effective responses, six companies (4.8%) chose method one, 28 companies (22.2%) chose method two, 74 companies (58.7%) chose method three, and 15 companies (11.9%) chose method four. None of the companies chose method five (Figure 21). From this we can see that more than 70% of the companies chose methods three and four. We believe that these companies have a relatively advanced strategic R&D management system.

Figure 21 Methods of Formulating R&D Budget Plans [Q.37]



A difference in the response results was evident between companies with a separate division for R&D strategy planning and those without. Compared to companies without the separate division for R&D strategy planning, companies with the division recorded a lower percentage of responses for method 1 “each research group calculates its own budget requirements based on the initial research plan” and method 2 “each research group calculates its own budget requirements, after which the research management division uniformly increases or reduces the amount requested by the groups based on the overall budget framework”, but a higher percentage of responses for method 3 “each research group calculates its own budget requirements, after which the research management division makes slight adjustments, and appropriates additional funds under a separate

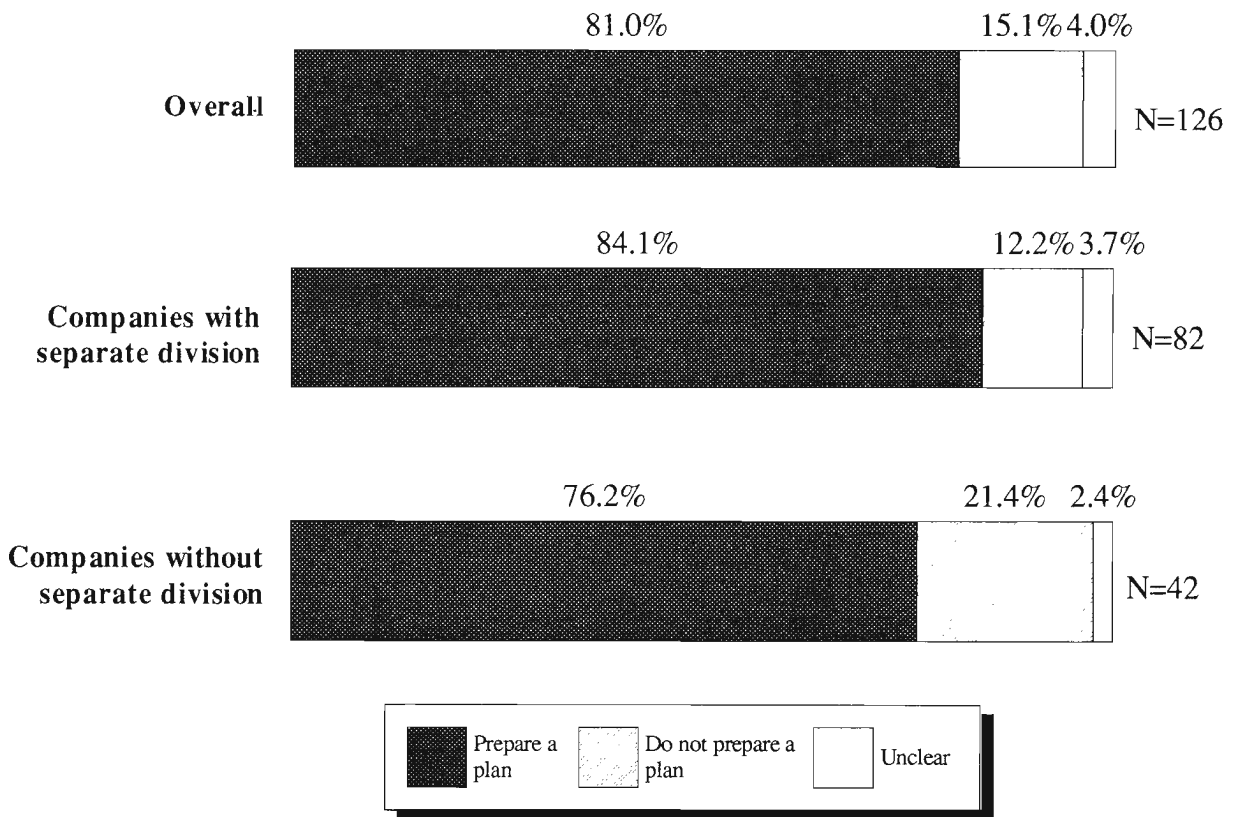
framework for research regarded as important”. We believe this shows that in the formulation of R&D budget plans, the companies with a separate division for R&D strategy planning follow a set strategy in budget allocation and adjustment, and in this regard, are well ahead of the companies without the division in applying strategic management to R&D.

3-2 Preparation of Company Research Plans

In this question we asked the companies whether they prepare a company research plan, what period the plan covers, who is responsible for preparation of the plan, and who approves the plan. Here we assumed that the company research plan is implemented by the company as a whole in accordance with the company strategy over a longer period than the normal research plan.

Of the 126 companies that gave effective responses, 102 (81.0%) indicated that they do prepare company research plans, while 19 companies (15.1%) indicated that they do not (Figure 22).

Figure 22 Company Research Plan [Q.6]



As can be seen in Figure 23, of the 102 companies that prepare a plan, the highest number, 50 (49.0%), replied that their plans cover five years, 41 companies (40.2%) replied three years, and ten companies (9.8%) replied ten years.

As for responsibility for plan preparation, 33 companies (32.4%) replied “head of the research management division”, while the same number replied “research management director” (Figure 24).

Figure 23 Period of Company Research Plan [Q.6]

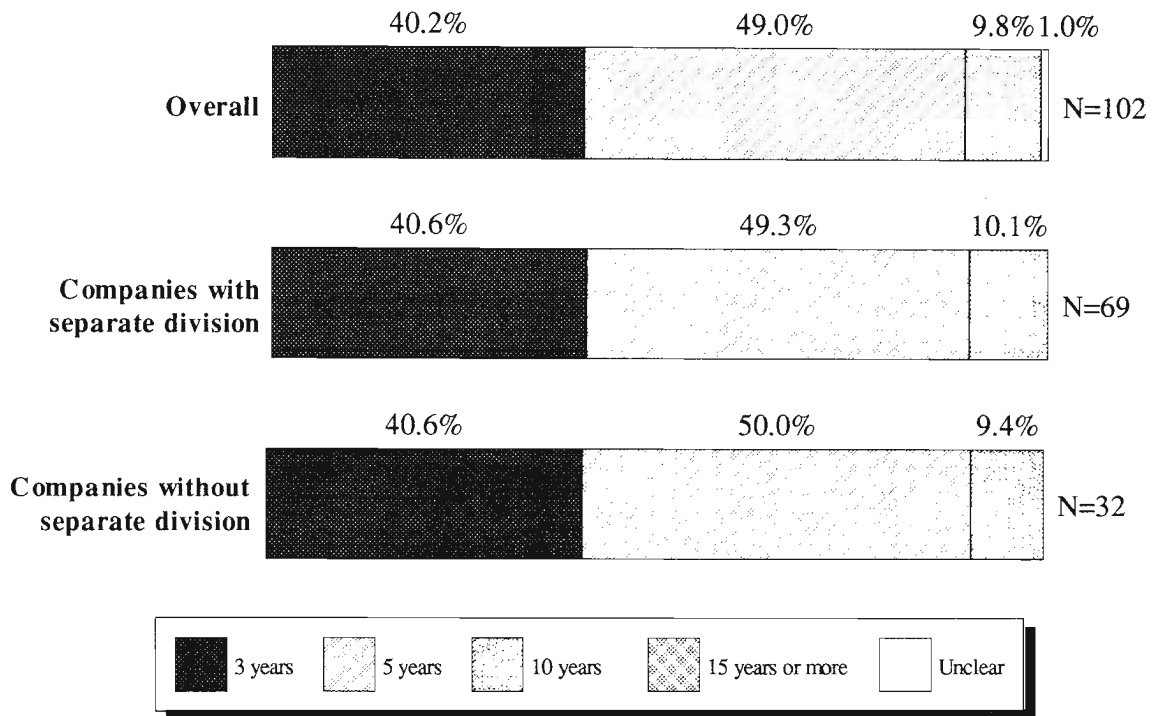
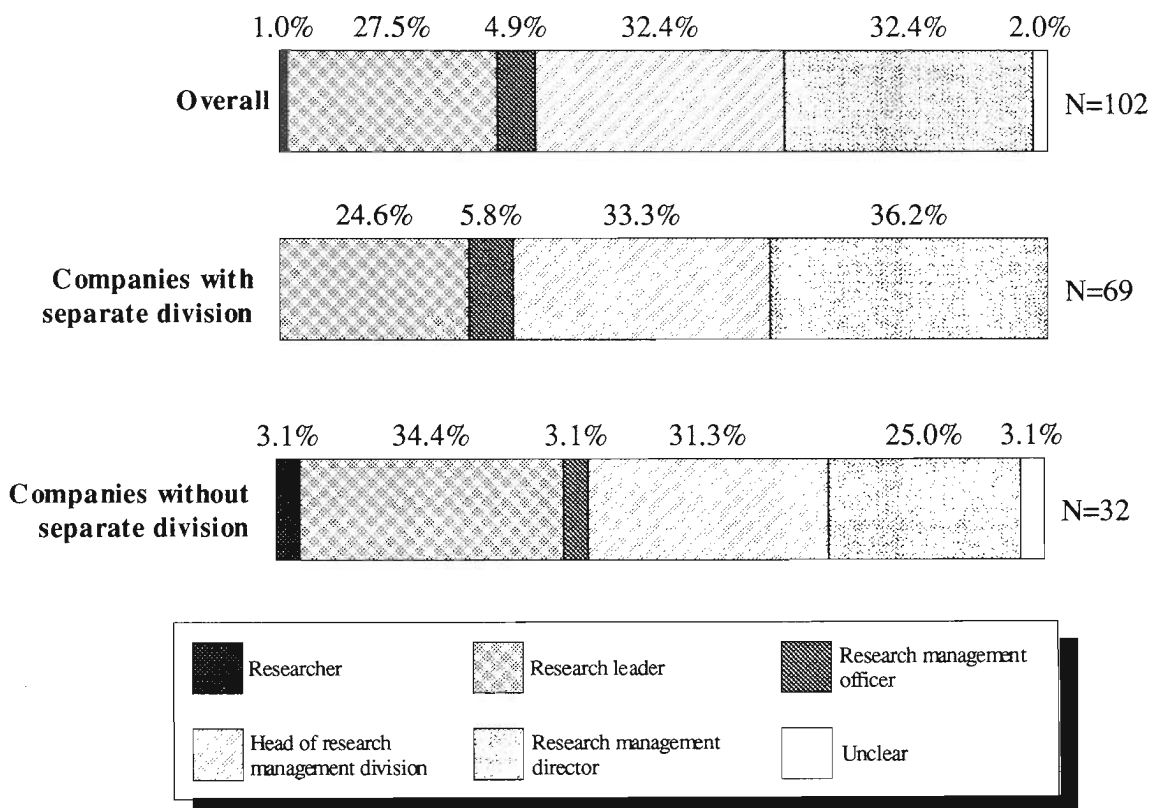


Figure 24 Responsibility for Preparation of Company Research Plan [Q.6]



As for the approving authority for the company research plan, 58 companies (56.9%) replied “responsible director”, and 36 companies (35.3%) replied “company president” (Figure 25).

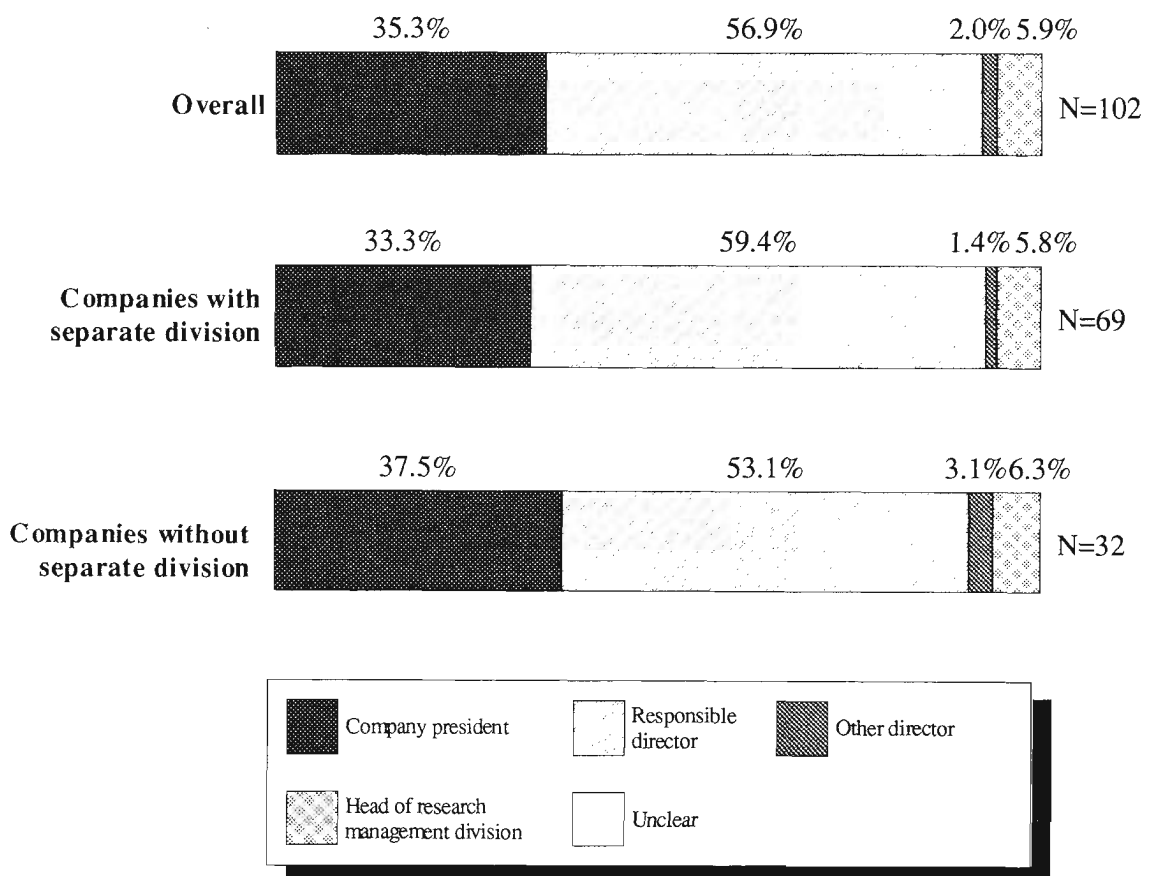
As shown in Figure 22, the percentage of companies which replied that they prepare a company research plan was higher among companies with a separate division for R&D strategy planning than among companies without the division.

No difference was observed between the two groups of companies in the period of the research plan (Figure 23).

Regarding responsibility for plan preparation, among the companies with a separate division for R&D strategy planning the highest percentage replied “research management director”, whereas the highest percentage of companies without the division replied the lower ranking position of “research leader”. An overall trend which did appear was that companies with the separate division for R&D strategy planning tended to allocate responsibility for company research plan preparation to a higher ranking position compared to the companies without the division (Figure 24).

As shown in Figure 25, the percentage of companies which replied that the company president approves the company research plan was lower among companies with a separate division for R&D strategy planning than among companies without the division.

Figure 25 Approving Authority for Company Research Plan [Q.6]



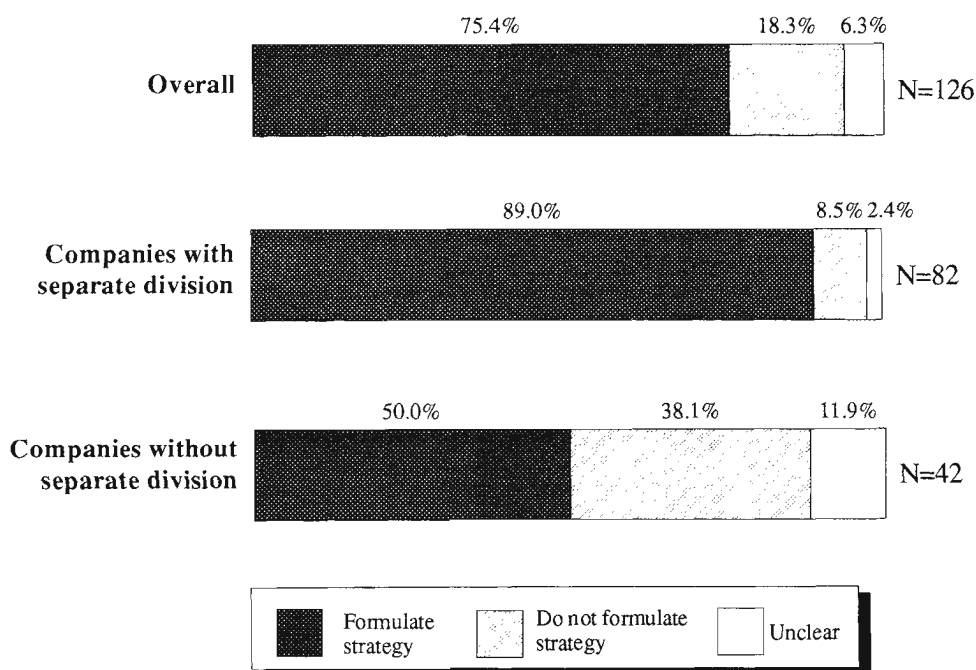
In summary, a higher percentage of companies with a separate division for R&D strategy planning prepare company research plans than companies without the division, companies with the division tend to allocate responsibility for preparing the plan to a higher position in view of its significance and importance, and reflecting a shift towards the delegation of authority, a higher percentage of companies replied that the approving authority is “responsible director” than replied “company president”.

3-3 Formulation of Company Research Strategy

In this question we asked the companies whether they formulate company research strategy, what period the strategy covers, who is responsible for formulation of the strategy, and who approves the strategy.

Of the 126 companies that gave effective responses, 95 (75.4%) indicated that they do formulate a company research strategy, while 23 companies (18.3%) indicated that they do not (Figure 26).

Figure 26 Formulation of Company Research Strategy [Q.7]



Of the 95 companies that formulate company research strategy, the highest number, 41 (43.2%), replied that their strategy period is five years, and 33 companies (34.7%) replied ten years (Figure 27).

As for responsibility for strategy formulation, 51 companies (53.7%) replied “research management director”, and 31 companies (32.6%) replied “head of the research management division” (Figure 28).

Figure 27 Period of Company Research Strategy [Q.7]

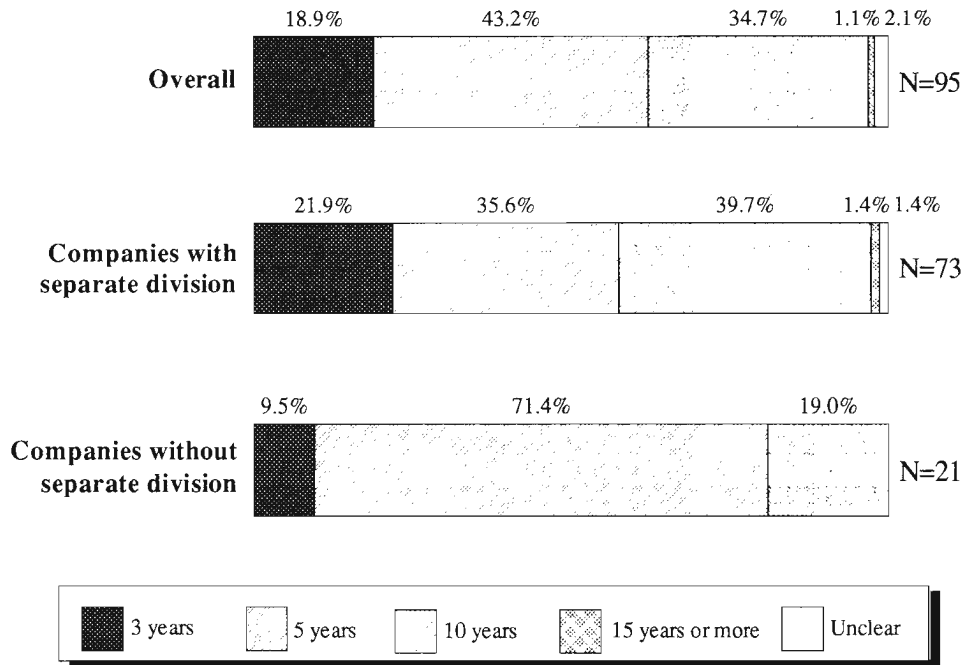
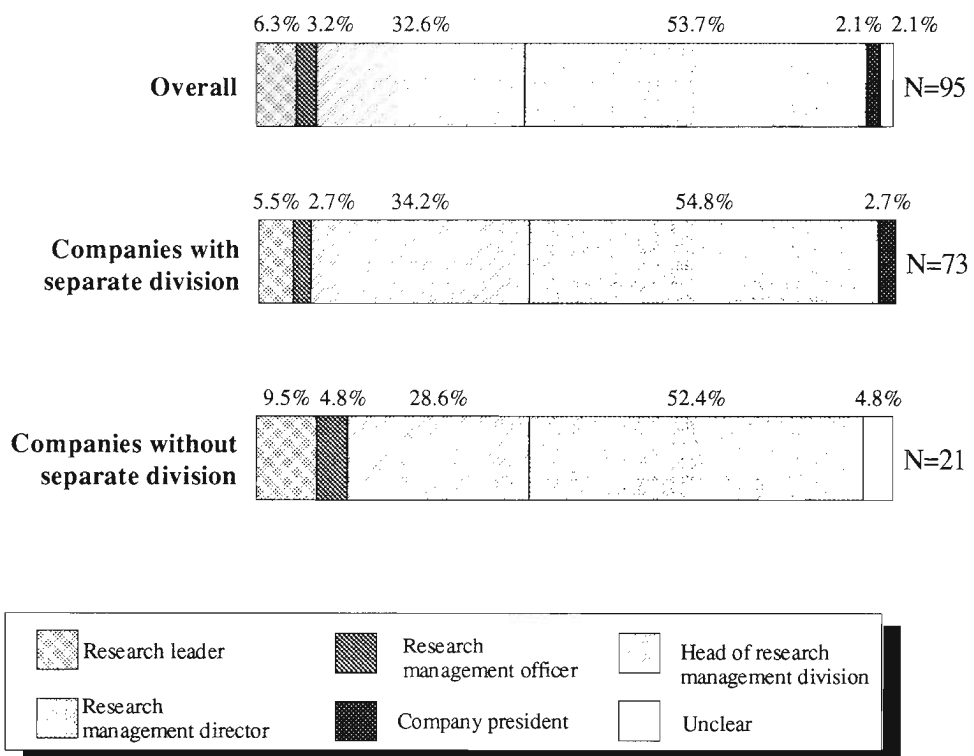
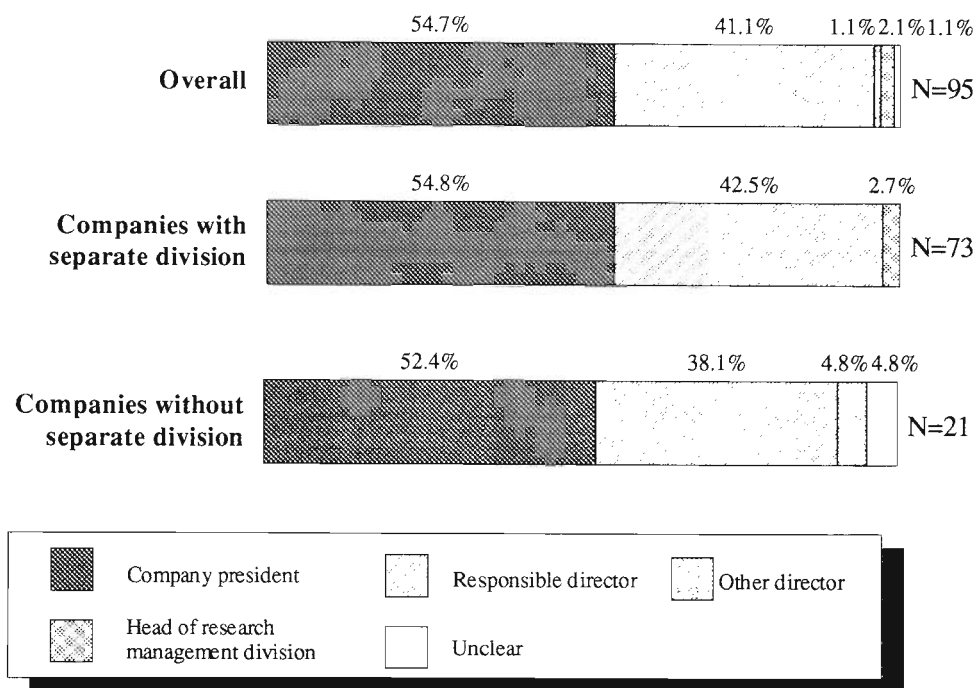


Figure 28 Responsibility for Formulation of Company Research Strategy [Q.7]



As for the approving authority for company research strategy, 52 companies (54.7%) replied “company president”, and 39 companies (41.1%) replied “research management director” (Figure 29).

Figure 29 Approving Authority for Company Research Strategy [Q.7]



The percentage of companies which replied that they formulate company research strategy was significantly higher among companies with a separate division for R&D strategy planning than among companies without the division (Figure 26).

A considerable difference was observed between the two groups of companies in the period covered by the research strategy (Figure 27). Companies with a separate division for R&D strategy planning were fairly evenly spread among “three years”, “five years” and “ten years” in their responses, whereas more than 70% of companies without the division responded “five years”. Even though companies with a separate division for R&D strategy planning formulate comprehensive research strategies that broadly cover the short- medium- and long-term, they were limited to one response only in this question, so this, we believe, probably explains why their responses were as evenly spread as they were. Another reason could be the difference in the R&D period according to industry type, for there were many more companies with the division (72) than without the division (21) and they covered a much broader range of industries. Moreover, product life-cycles vary depending on the industry, and this is possibly reflected in the period covered by the research strategy. Although the responses were fairly evenly spread, more than 40% of the companies with a separate division for R&D strategy planning replied that their research strategy covers ten years or more, and considering the fact that the highest percentage of companies (50%) replied that their company research plans cover a five-year period, we can say that companies with

the division have a more correct understanding of the meaning of the terms “strategy” and “plan” as defined in this survey.

There were no differences between the two groups of companies in their responses on the person responsible for formulating company research strategy, however, both of the two companies that replied “company president” have a separate division for R&D strategy planning (Figure 28).

There were also no differences between the two groups of companies in their responses on the person responsible for approving company research strategy (Figure 29).

3-4 Considerations in the Formulation of R&D Strategy

We asked the companies to indicate the relative weight they give certain items in formulating R&D strategy on a scale from one to five (1 - “very important”; 2 - “important”; 3 - “cannot say either way”; 4 - “not very important”; 5 - “not important”) (Figure 30).

The item to which companies attach greatest importance in the formulation of R&D strategy is “importance of the technology for the company’s future” with an average response value of 1.45, followed by “market needs” with 1.56, and “capability of the R&D division” with 1.63.

The item to which least importance is attached is “trends in national and international projects” with an average response value of 2.67, followed by “existence of limitations in the technology” with 2.63, and “resources spending relative to that of the competitors” with 2.63.

There is no question about the top three items in terms of importance. It would also seem to stand to reason that the second least important item, “existence of limitations in the technology”, should be given such a low grading, considering the fact that technological limitations are incidental to R&D. The position of the third least important item, “resources spending relative to that of the competitors”, was unexpected. We can surmise that it is difficult to obtain information about the competitors, but, essentially, we would have thought that this consideration is vital to a company’s R&D strategy formulation.

Overall, companies with a separate division for R&D strategy planning attached greater importance than the companies without the division to all items (the average value of the difference of average values is 0.20; Figure 31). Compared to companies without a separate division for R&D strategy planning, companies with such a division attached much greater importance on “costs required to achieve a breakthrough” (difference of average values = 0.40), “trends in national and international projects” (0.33), and “product cost competitiveness” (0.33). The top three choices for both groups of companies (those with a separate division for R&D strategy planning and those without) were the same as the overall result: “importance of the technology for the company’s future”, followed by “market needs” and “capability of the R&D division”.

Figure 30 Considerations in the Formulation of R&D Strategy [Q.19]

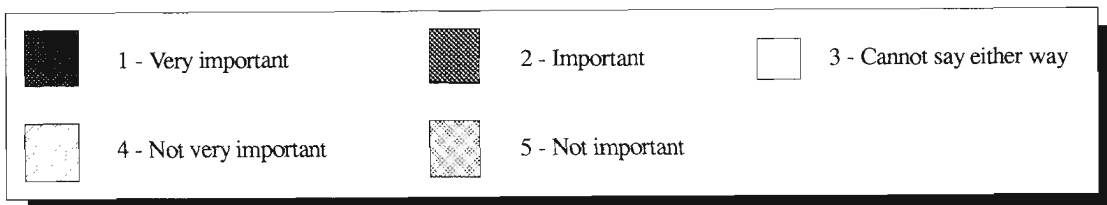
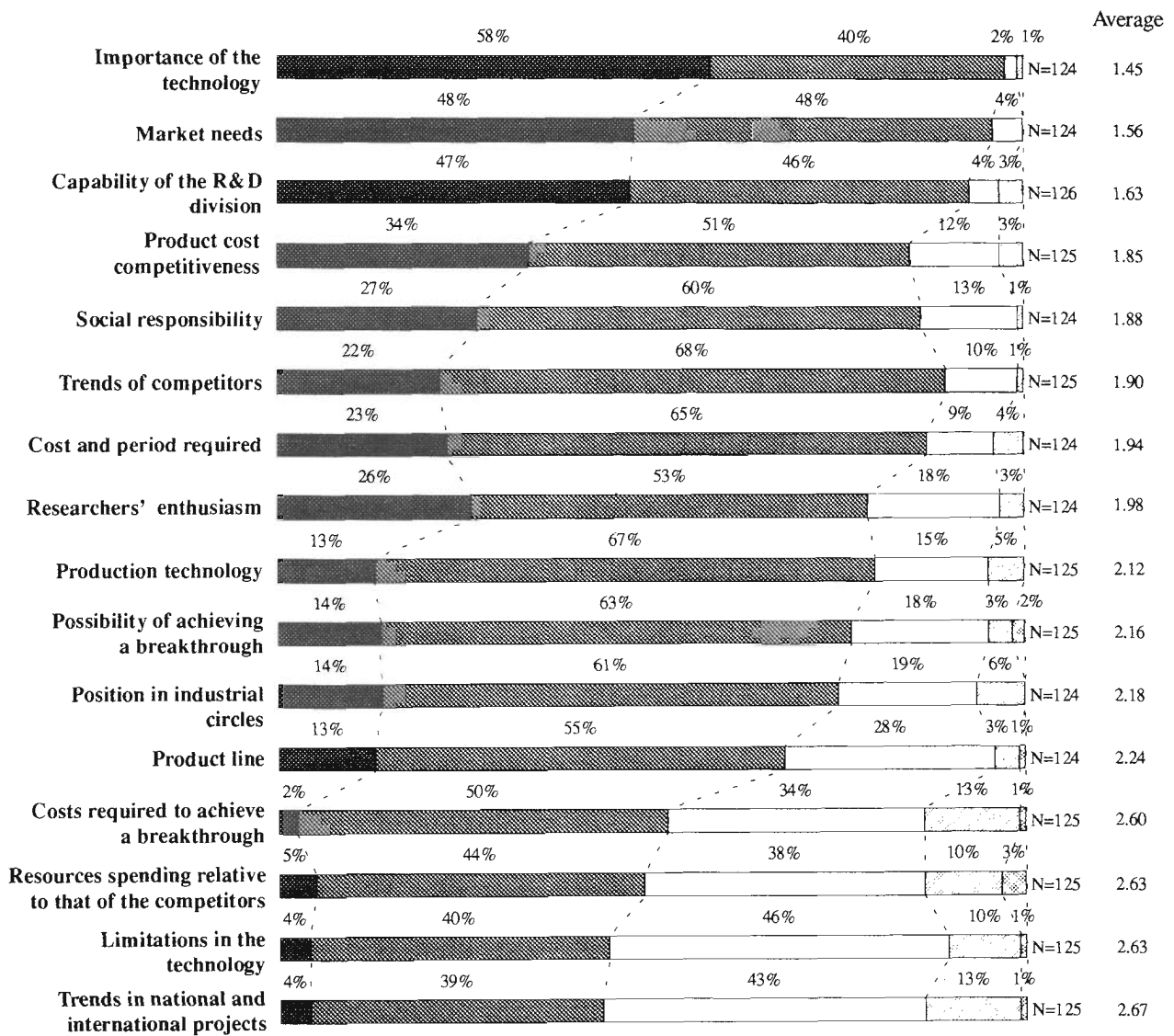
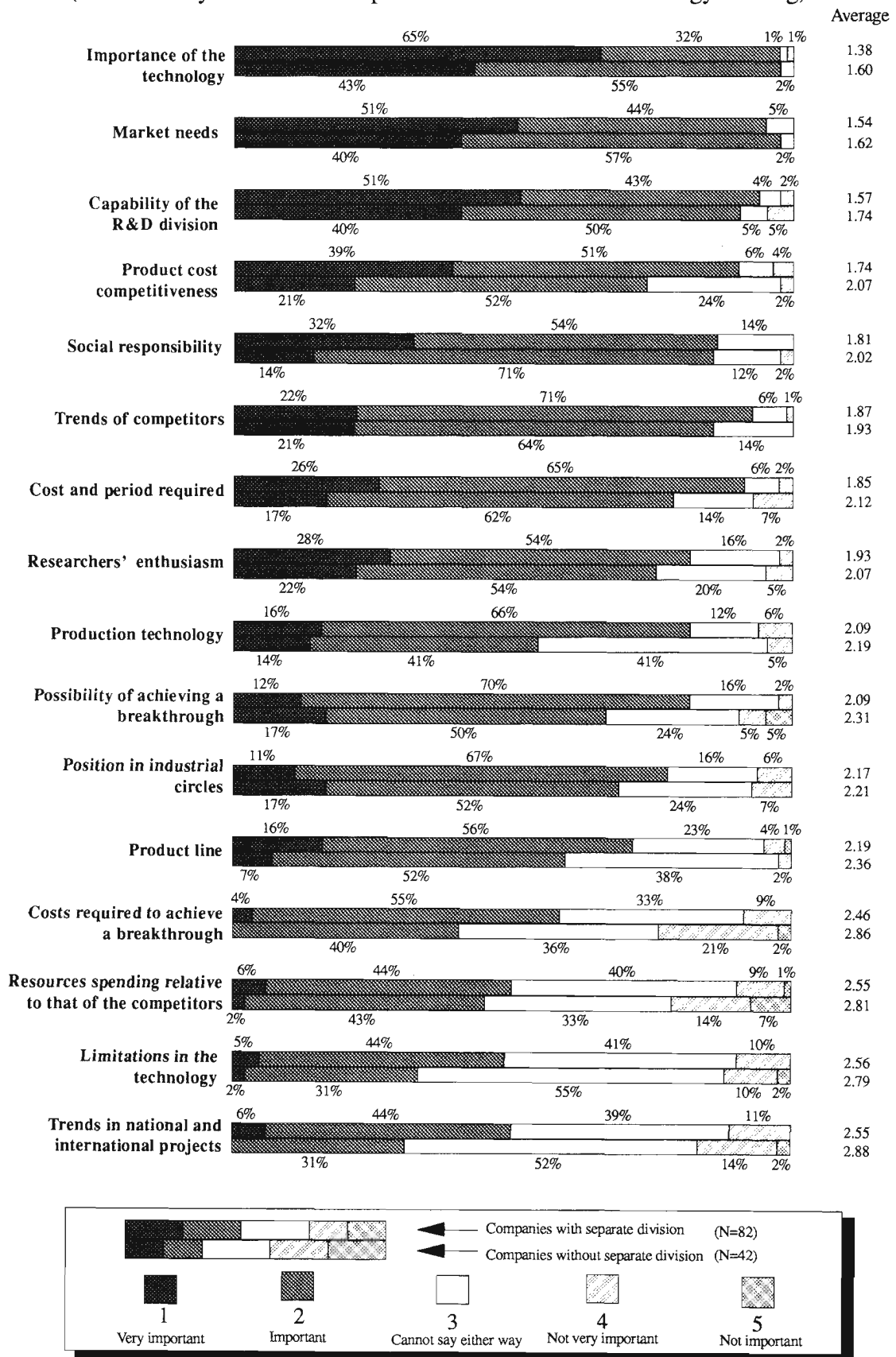


Figure 31 Considerations in the Formulation of R&D Strategy [Q.19]
 (Classified by Existence of separate Division for R&D Strategy Planning)



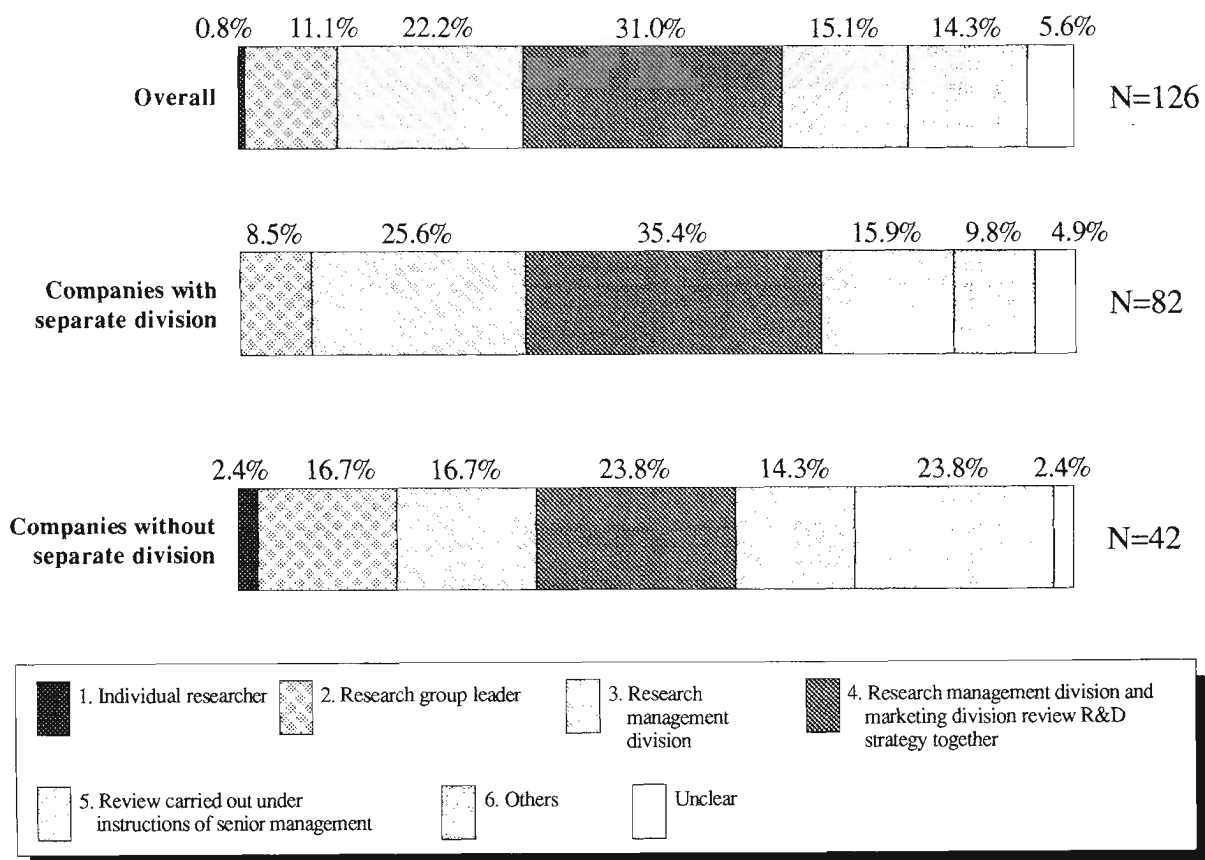
From this we can see that companies with a separate division for R&D strategy planning are more closely examining the various elements that make up the internal and external environment when formulating the company R&D strategy than are the companies without the division.

3-5 Review of R&D Strategy in Response to Changes in the R&D Environment

To ascertain the extent to which strategic R&D management systems are in place, we asked the companies to indicate which division (or individual as the case may be) reviews R&D strategy during its implementation in response to changes in the R&D environment (trends in other companies, market scale, rise of alternative technologies).

Of the 126 companies that gave effective responses, 39 companies (31.0%) chose response number 4, “the research management division and marketing division review R&D strategy together”, 28 companies (22.2%) chose response number 3, “the research management division gives appropriate instructions”, 19 companies (15.1%) chose response number 5, “review carried out under instructions of senior management”, while only one company (0.8%) chose response number 1, “researcher reviews at his/her own discretion”, and 14 companies (11.1%) chose response number 2, “research group leader reviews at his/her own discretion” (Figure 32).

Figure 32 Responsibility for Review of R&D Strategy [Q.30]



For this question we assumed that response number 3 indicates that the company is dealing with changes in the R&D environment systematically to a degree, response number 4 indicates that the company is dealing with changes systematically and strategically, and response number 5 indicates that senior management decides upon the review of R&D strategy based on systematic data collection and analysis (the companies surveyed were all relatively large, so we think it would be impossible for senior management to grasp and make an independent judgment on all outstanding issues). The results show that almost 70% of companies are dealing with changes in the R&D environment systematically and strategically to a certain extent.

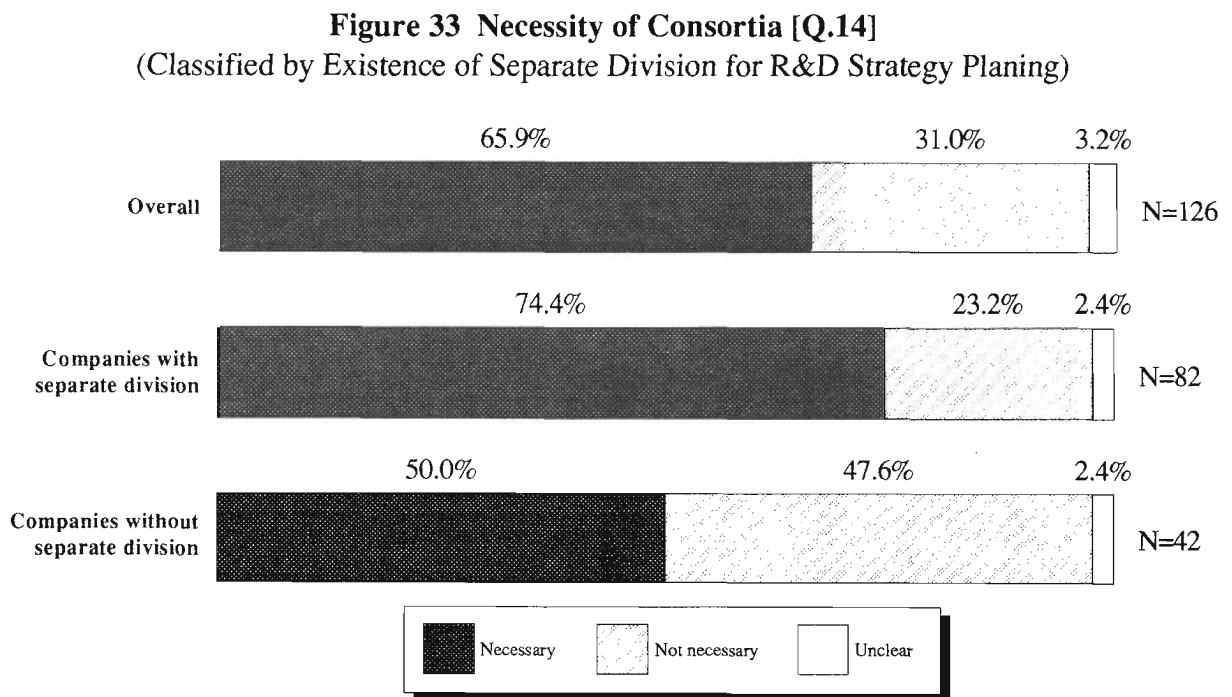
A much greater percentage of companies with a separate division for R&D strategy planning replied “the research management division gives appropriate instructions” and “the research management division and marketing division review R&D strategy together” compared to the companies without a separate division for R&D strategy planning, indicating a greater tendency to deal with changes systematically and strategically.

3-6 Research Consortia

In this section we asked the companies about research consortia. Consortia in this context refers only to private-sector consortia, and excludes government-initiated consortia or consortia established with public funding. We asked the companies whether they feel research consortia are necessary, whether they have participated in a research consortium, and if so, in a typical case, what motivated them to participate, what the nationalities of the other participating companies were, and whether the consortium was successful or not.

(1) Necessity of Consortia

Of the 126 companies which responded, 83 (65.9%) feel that research consortia were necessary, while 39 companies (31.0%) do not feel that they are necessary (Figure 33).



For reference, Figure 34 shows a breakdown of these figures by the scale of R&D expenditure, and Figure 35 shows a breakdown by industry type.

As shown in Figure 33, a much higher percentage of companies with a separate division for R&D strategy planning replied that they feel research consortia are necessary (74.4%, or 61 companies) compared to companies without the division (50.0%, or 21 companies).

Figure 34 Necessity of Consortia [Q.14]
(Classified by Scale of R&D Expenditure)

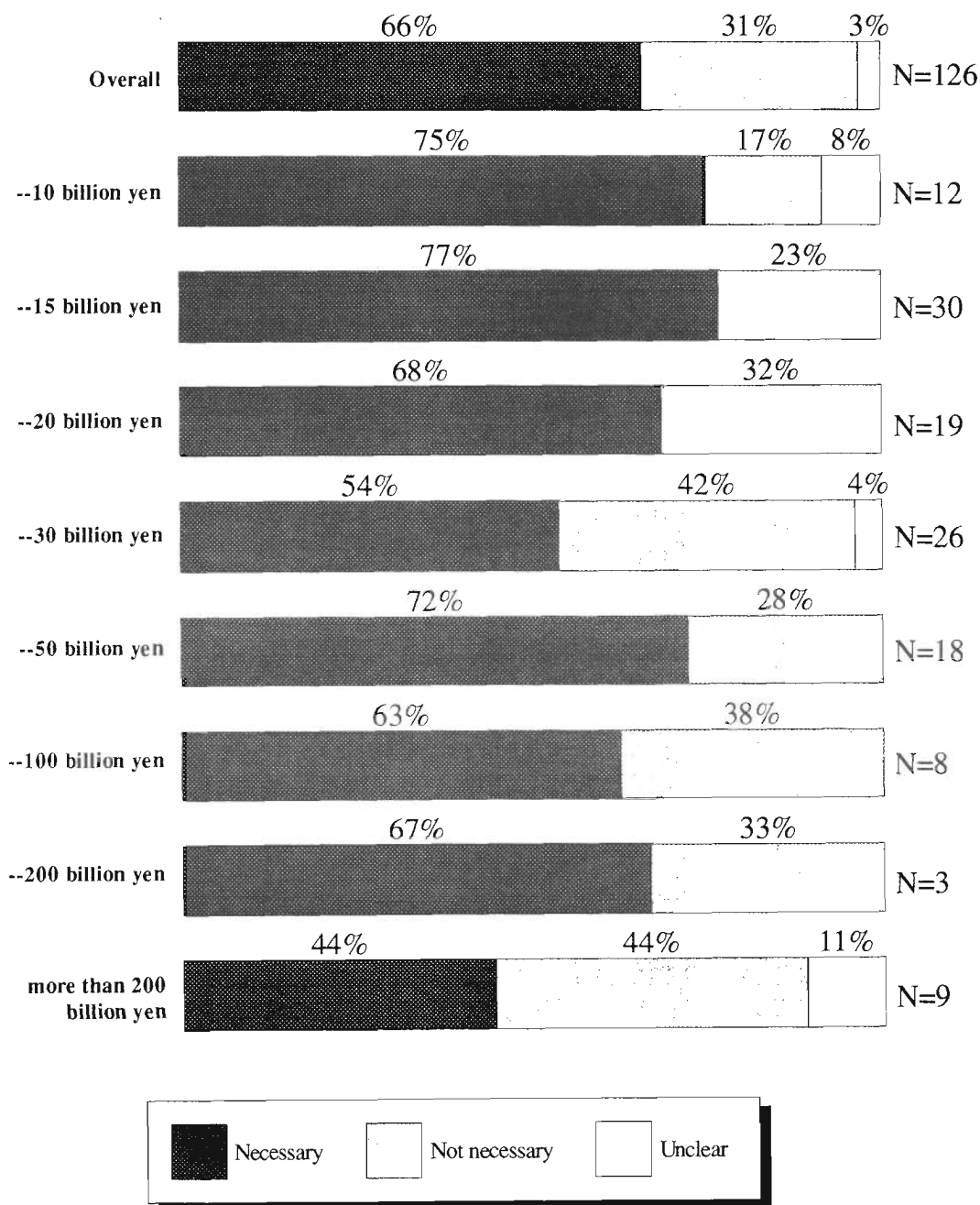
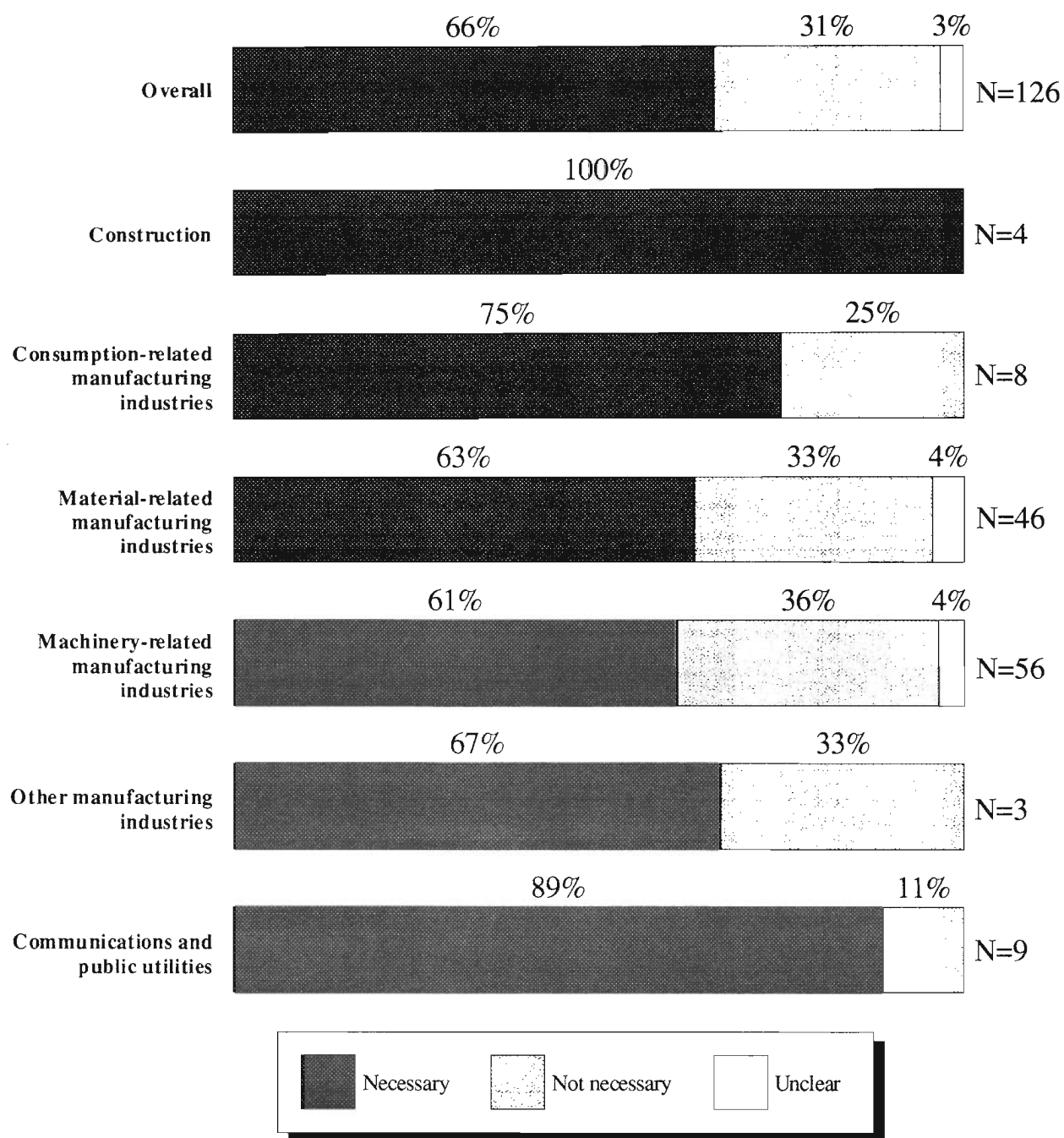


Figure 35 Necessity of Consortia [Q.14]
(Classified by Industry Type)



(2) Participation in Consortia

Overall, 47.6% (60 companies) replied that they have participated in a research consortium, while 47.6% (60 companies) replied that they have not (Figure 36). Figure 37 shows a breakdown of these figures by the scale of R&D expenditure, and Figure 38 shows a breakdown by industry type.

Figure 36 Participation in Consortia [Q.14]
 (Classified by Existence of Separate Division for R&D Strategy Planning)

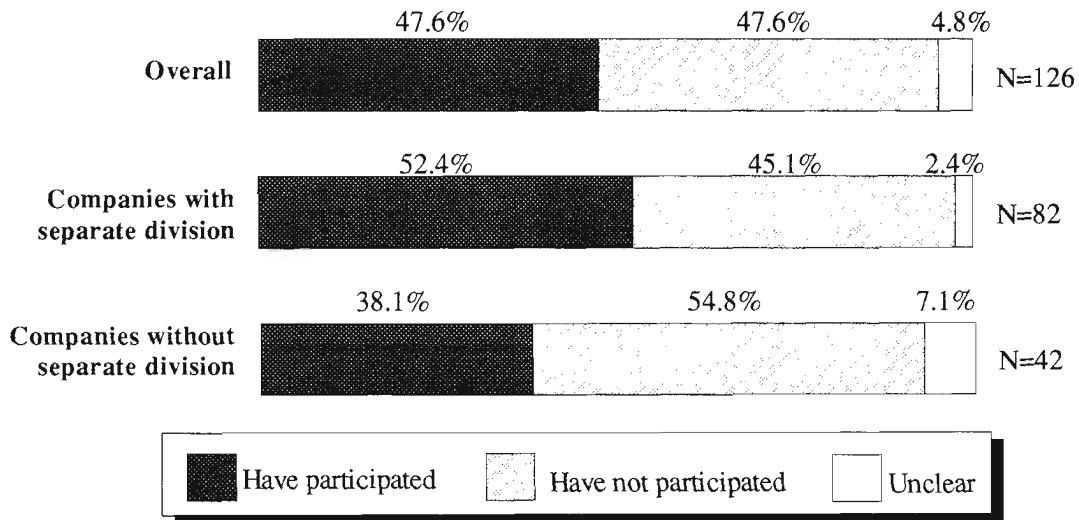


Figure 37 Participation in Consortia [Q.14]
 (Classified by Scale of R&D Expenditure)

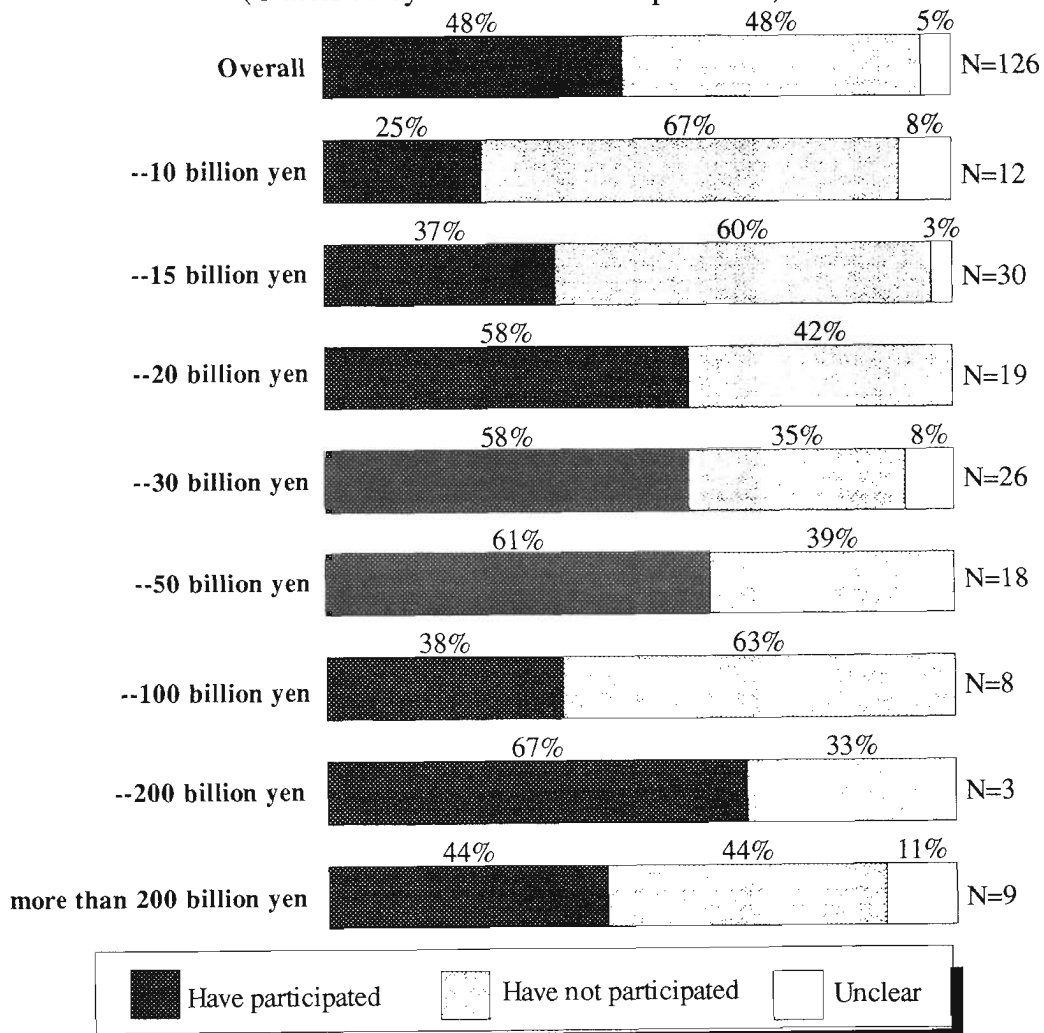
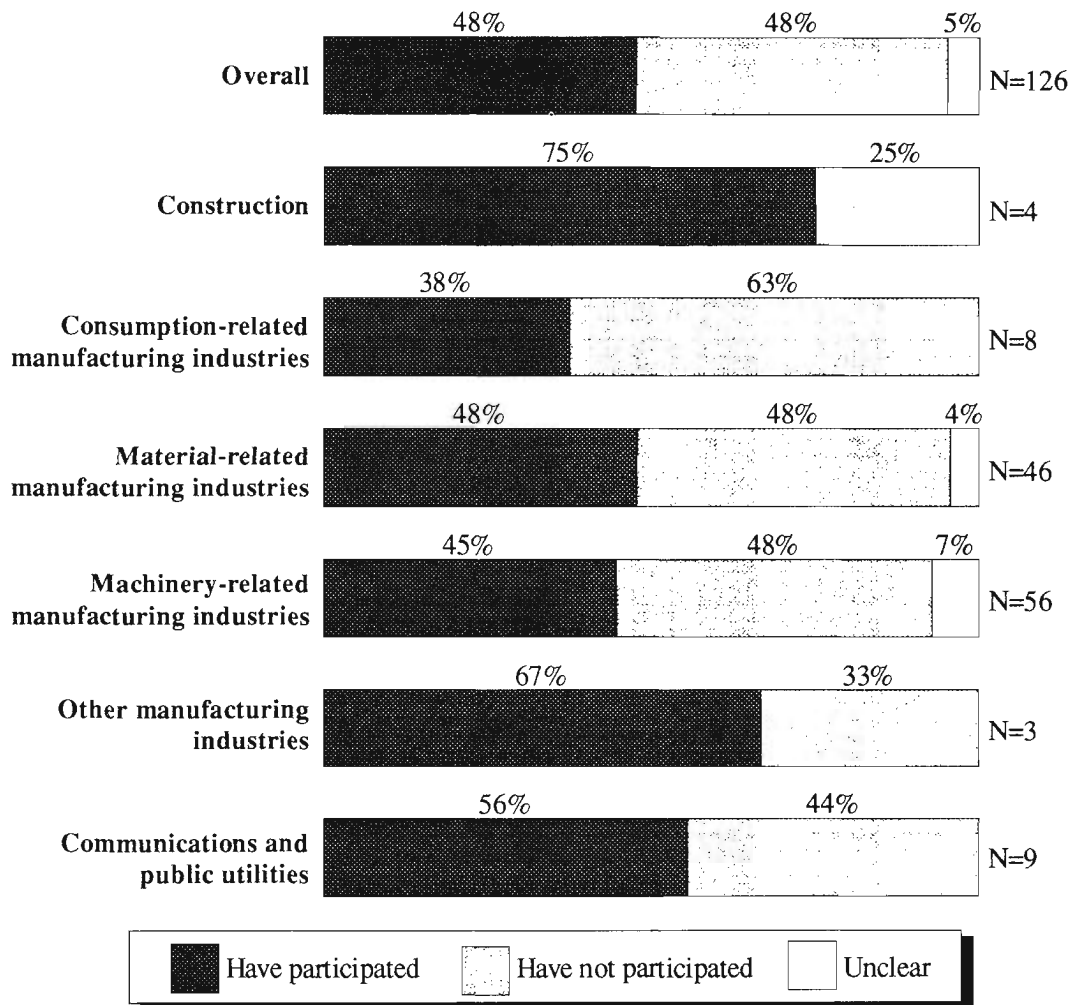


Figure 38 Participation in Consortia [Q.14]
(Classified by Industry Type)



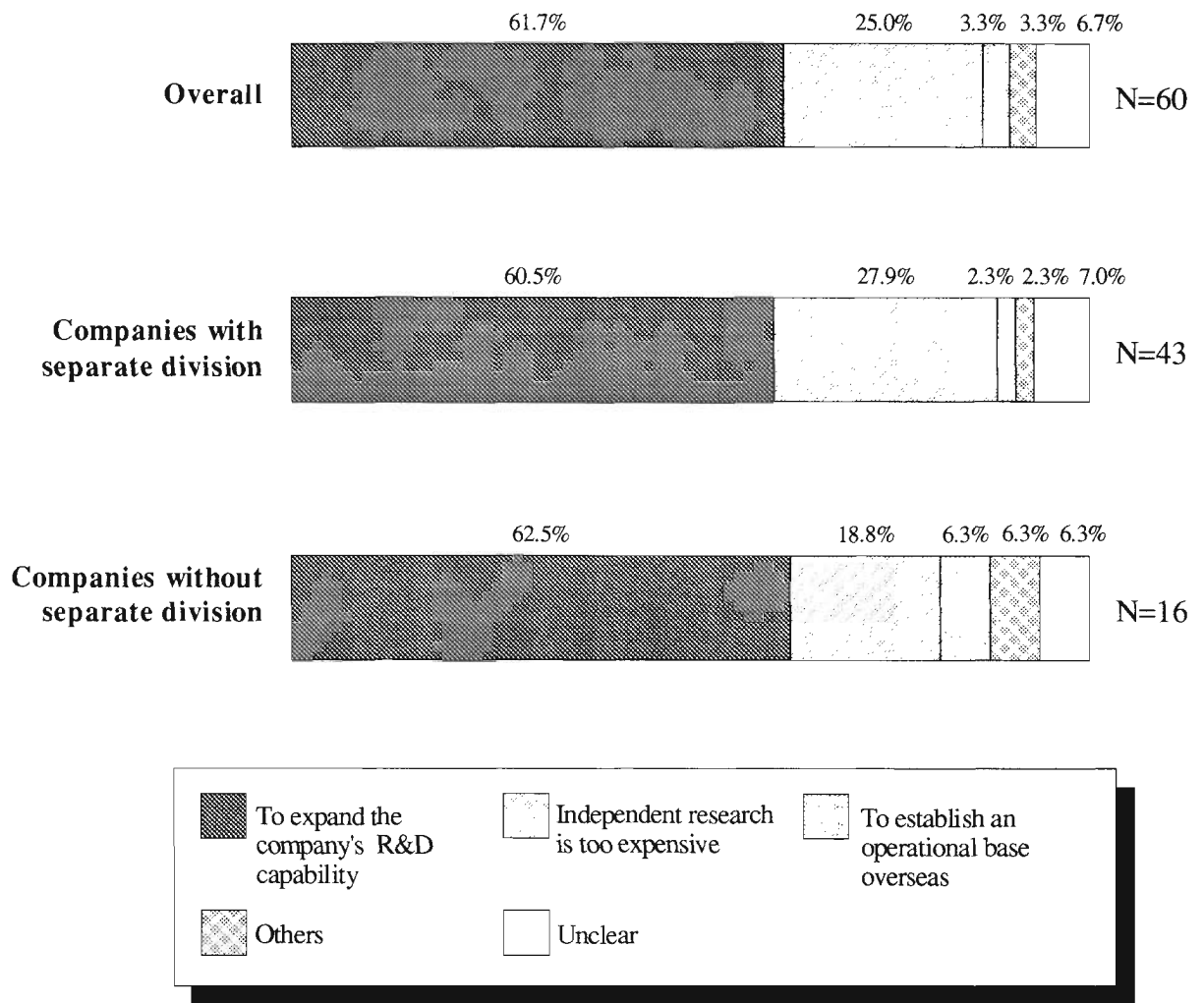
More than half of the companies with a separate division for R&D strategy planning replied that they have participated in a research consortium, whereas only about 40% of companies without the division gave the same response (Figure 36).

The following sections (3) - (5) refer to companies which have participated in a consortium.

(3) Motivation to Participate in Consortia

We asked the companies that have participated in a consortium to select a typical case and indicate what motivated them to participate. Overall (of the 60 companies that have participated), 61.7% (37 companies) chose “to expand the company’s R&D capability” as the motivating factor, 25% (15 companies) chose “independent research is too expensive”, while “to establish an operational base overseas” and “others” were chosen by only 3.3% (two companies) each (Figure 39). Thus a desire to expand their own R&D capability was the main factor that motivated the companies to participate in a consortium.

Figure 39 Motivation to Participate in Consortia [Q.14]

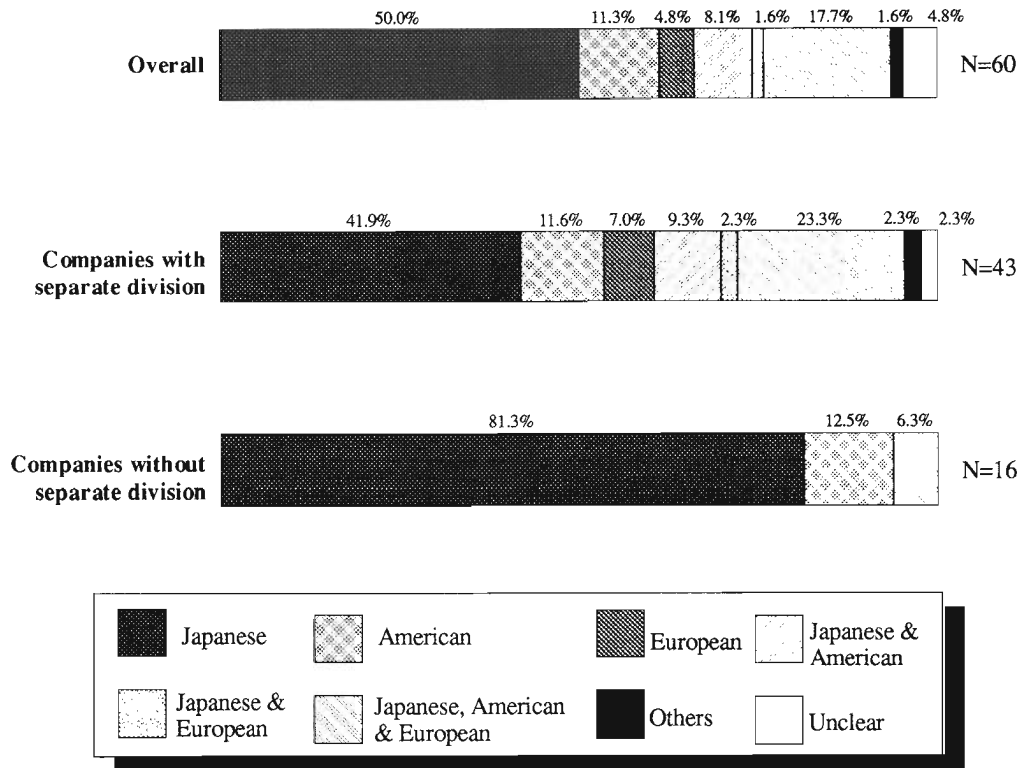


The percentage of companies with a separate division for R&D strategy planning that chose “independent research is too expensive” (27.9%) was almost ten percentage points higher than the corresponding percentage for companies without the division (18.8%), and from this we can infer that companies with the division are slightly more sensitive to high research costs. There was virtually no difference between the two company groups in the response rate for “to expand the company’s R&D capability”.

(4) Nationalities of Participating Companies

We then asked the companies to indicate the nationalities of the companies with which they participated in the consortium, again in a typical case; 50.0% (31 companies) replied that the consortium was among Japanese companies, while 45.2% (28 companies) replied that the consortium included at least one overseas company (Figure 40).

Figure 40 Nationalities of Participating Companies [Q.14]

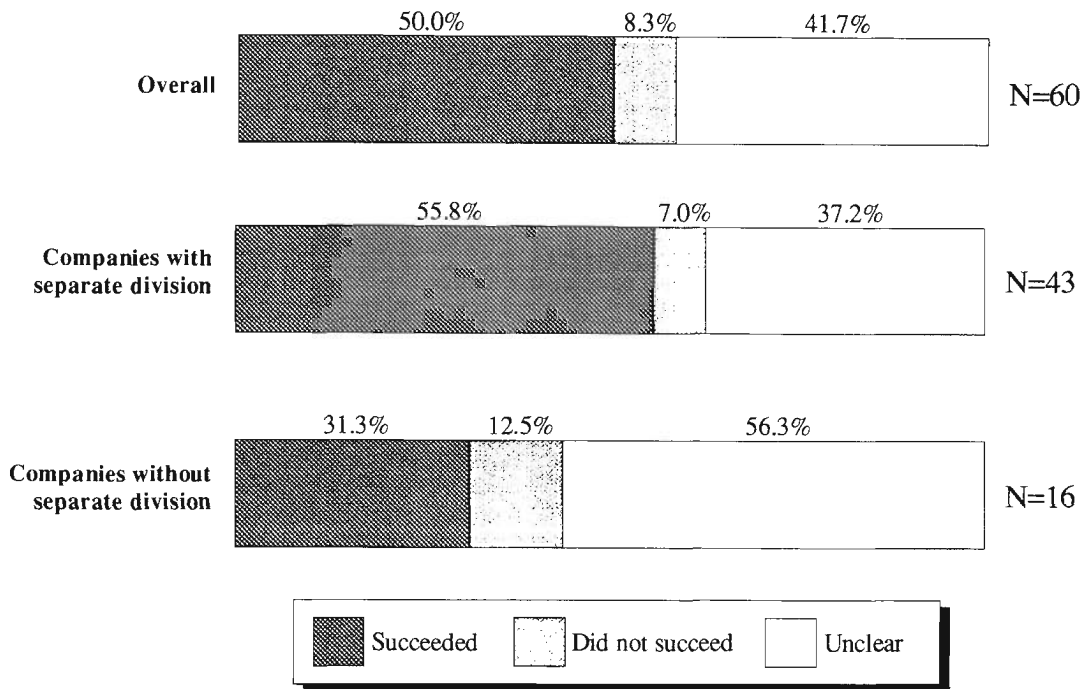


One trend that does stand out in the figure is that companies with a separate division for R&D strategy planning tend to participate in consortia with companies that cover a much broader range of nationalities compared to companies without the division. A much higher percentage of companies with a separate division for R&D strategy planning listed European companies and North American and European companies as the other participating companies in the consortium compared to those without the division. From this we can infer that the companies with the division are actively tackling the construction of a global network, whereas the companies without the division have yet to develop a strong international outlook in their R&D.

(5) Success of Consortia

We then asked the companies to indicate whether the typical consortium they selected succeeded or not. Overall, 50.0% (30 companies) replied that the consortium succeeded, while 8.3% (five companies) replied that the consortium did not succeed; 41.7% (25 companies) did not reply, and were listed as “unclear” (Figure 41).

Figure 41 Success of Consortia [Q.14]



There was a difference between the responses by companies with a separate division for R&D strategy planning and the responses by those without. A much higher percentage of companies with a separate division for R&D strategy planning replied that the consortium succeeded (24 of the 43 companies, or 55.8%) compared to companies without the division (five of the 16 companies, or 31.3%).

From the overall results of this section on companies’ awareness of research consortia, it can be seen that companies with a separate division for R&D strategy planning are positively and effectively incorporating the consortium into their business strategy to a greater degree than companies without the division, i.e.. they have a strong tendency to approach research consortia as a means of reducing the impact of increasing research costs, and they are actively constructing global networks through these research consortia.

3-7 Technology Transfer

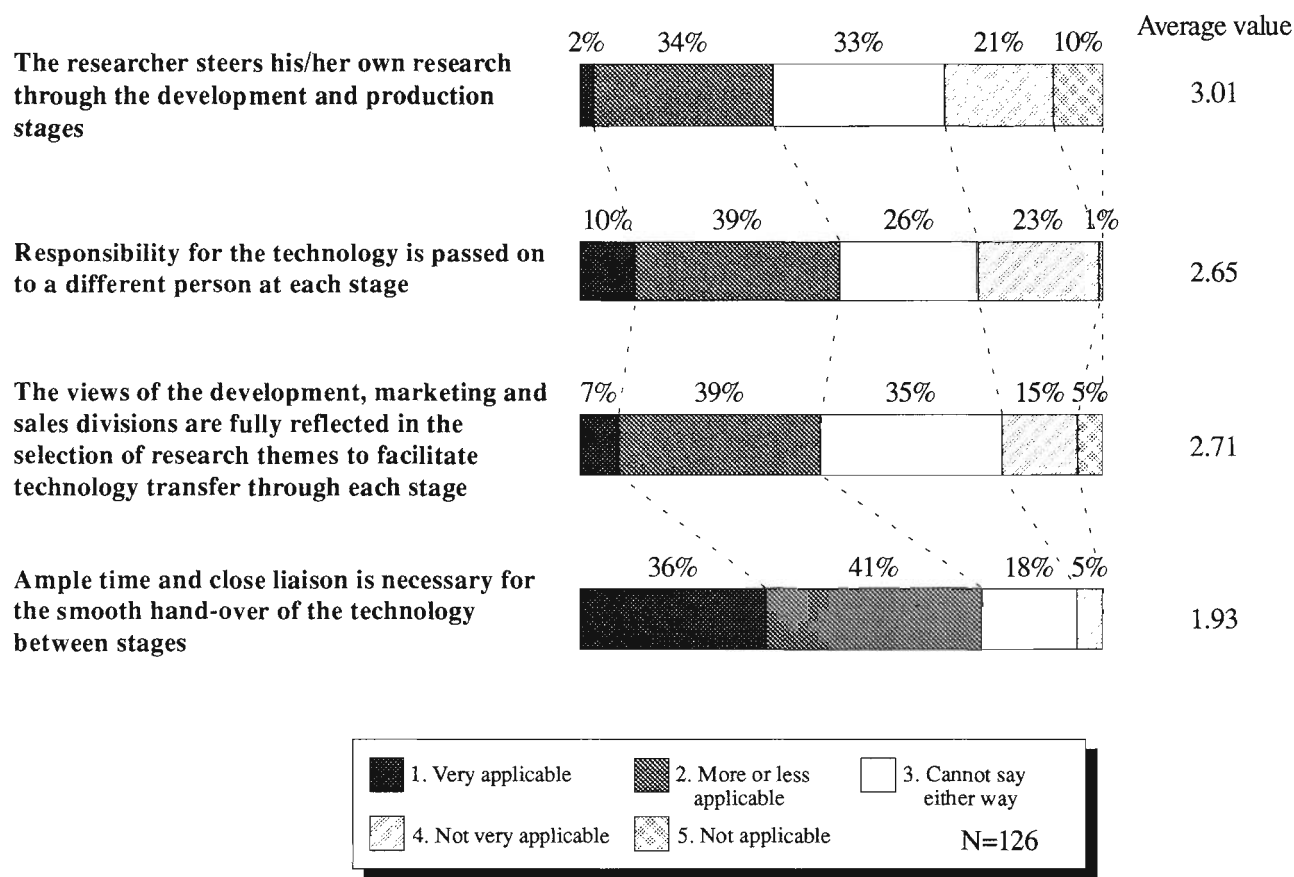
Here we asked the companies to indicate whether several listed items are applicable to the processes under which research results flow to the development production stages, on a scale from one to five (1 - “very applicable”; 2 - “more or less applicable”; 3 - “cannot say either way”; 4 - “not very applicable”; 5 - “not applicable”).

For this question, we assumed that item number 1 “the researcher steers his/her own research through the development and production stages” is a typical example of the Japanese style of technology; item number 2 “responsibility for the technology is passed on to a different person at

each stage of research, development and production” is a typical example of the flow at European and American companies, which promote the division of work responsibilities and specialization; item number 3 “the views of the development, marketing and sales divisions are fully reflected in the selection of research themes to facilitate technology transfer through each stage” indicates highly strategy-oriented management; while item 4 “ample time and close liaison is necessary for the smooth hand-over of the technology between stages” indicates the companies’ level of awareness about the need for sufficient time and close liaison in technology transfer.

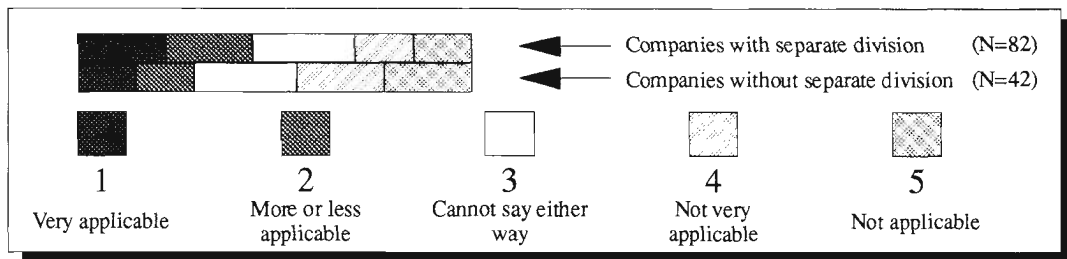
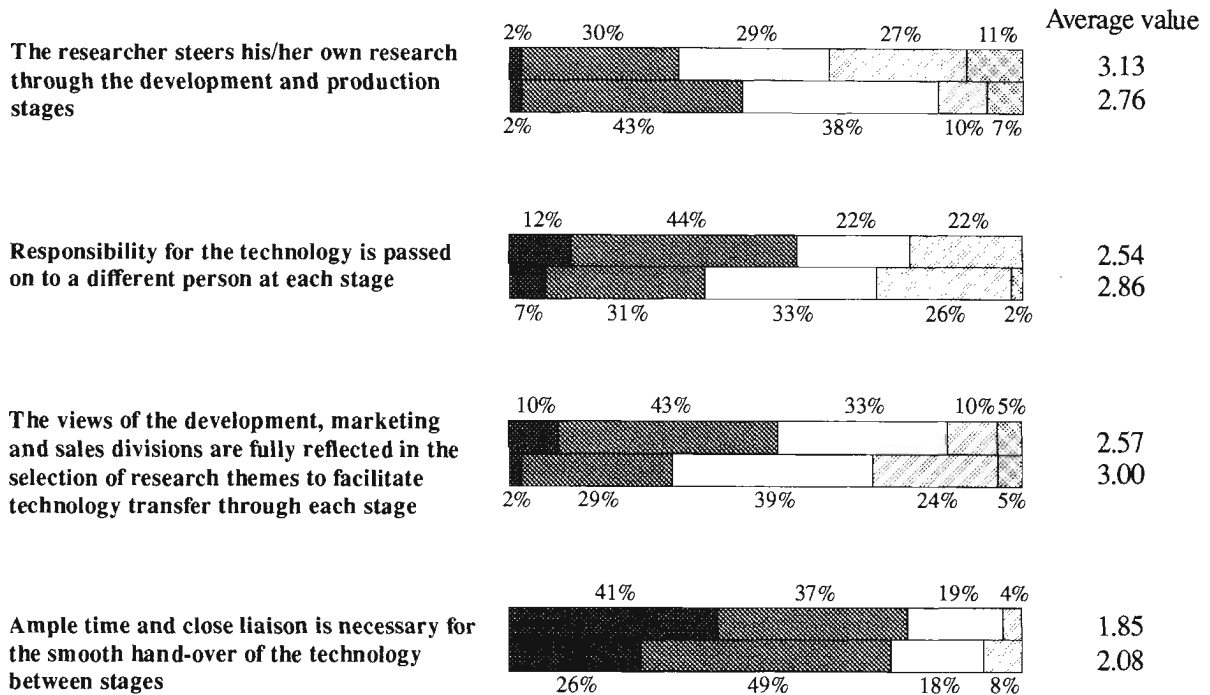
From the results we can see that the companies have generally adopted the division of work responsibilities style to a greater degree than the style of item number 1 “the researcher steers his/her own research through the development and production stages”, and that they have a very high awareness about the need for sufficient time and close liaison when technology is handed over between stages (Figure 42).

Figure 42 Technology Transfer Between Stages [Q.33]



A difference in the results was seen between companies with a separate division for R&D strategy planning and those without (Figure 43).

Figure 43 Technology Transfer Between Stages [Q.33]
 (Classified by Existence of Separate Division for R&D Strategy Planing)



The average value of responses to “the researcher steers his/her own research through the development and production stages” is 3.13 for companies with a separate division for R&D strategy planning and 2.76 for companies without the division, indicating that this style tends to apply more to the companies without the division.

The average value of responses to “responsibility for the technology is passed on to a different person at each stage” is 2.54 for companies with a separate division for R&D strategy planning and 2.86 for companies without the division, indicating that this style applies more to the companies with the division.

The average value of responses to “the views of the development, marketing and sales divisions are fully reflected in the selection of research themes to facilitate technology transfer through each stage” is 2.57 for companies with a separate division for R&D strategy planning and 3.00 for companies without the division, indicating that this is much more applicable to the companies with the division.

The average value of responses to “ample time and close liaison is necessary for the smooth hand-over of the technology between stages” is 1.85 for companies with a separate division for R&D strategy planning and 2.15 for companies without the division, indicating that this tends to be more applicable to the companies with the division.

From the results, we can infer that the companies with a separate division for R&D strategy planning are pursuing a division of work responsibilities in the technology transfer process and are considering ways to facilitate the flow of the research results through the various stages when selecting research themes, and also have a high awareness of the need to listen to and coordinate the opinions of the different divisions. In these companies we can see the tendency skillfully to incorporate and blend the merits of the European and American style of dividing work responsibilities and the merits of the traditional Japanese style in which research results move with the individual.

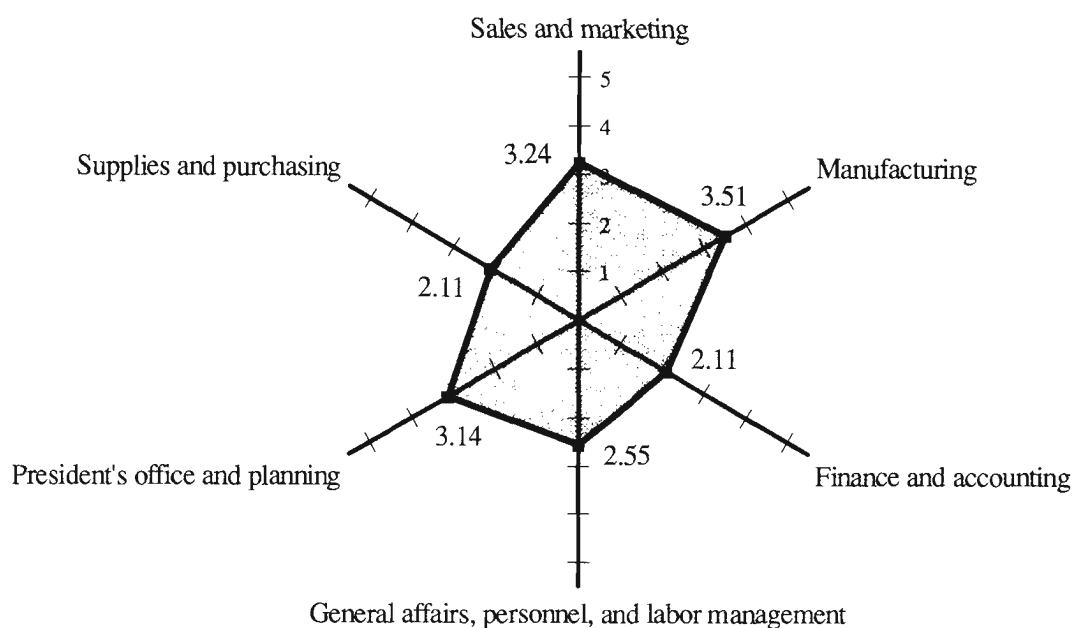
4. Contact Between R&D Division and Other Divisions

4-1 Degree of Contact

In this question, we asked the companies to indicate how often the R&D division comes into contact with the other divisions, on a scale from one to five (1 - “little or no contact”; 2 - “meetings held half-yearly”; 3 - “meetings held monthly”; 4 - “meetings held weekly”; 5 - “contact on a daily basis”). Through this question we sought to clarify the relative degree of contact between the R&D division and other divisions in the company (sales and marketing; manufacturing; finance and accounting; general affairs, personnel, and labor management; president’s office and planning; supplies and purchasing).

Figure 44 shows the degree of contact between the R&D division and other divisions according to the average values of responses. In the figure, the higher the average value, the greater the degree of contact between the divisions. The division that has the most contact with the R&D division is the manufacturing division with an average response value of 3.51, followed by the sales and marketing division with 3.24, the president’s office and planning division with 3.14, general affairs, personnel, and labor management divisions with 2.55, the finance and accounting division with 2.11, and the supplies and purchasing division with 2.11.

Figure 44 Degree of Contact Between R&D Division and Other Divisions [Q.17]

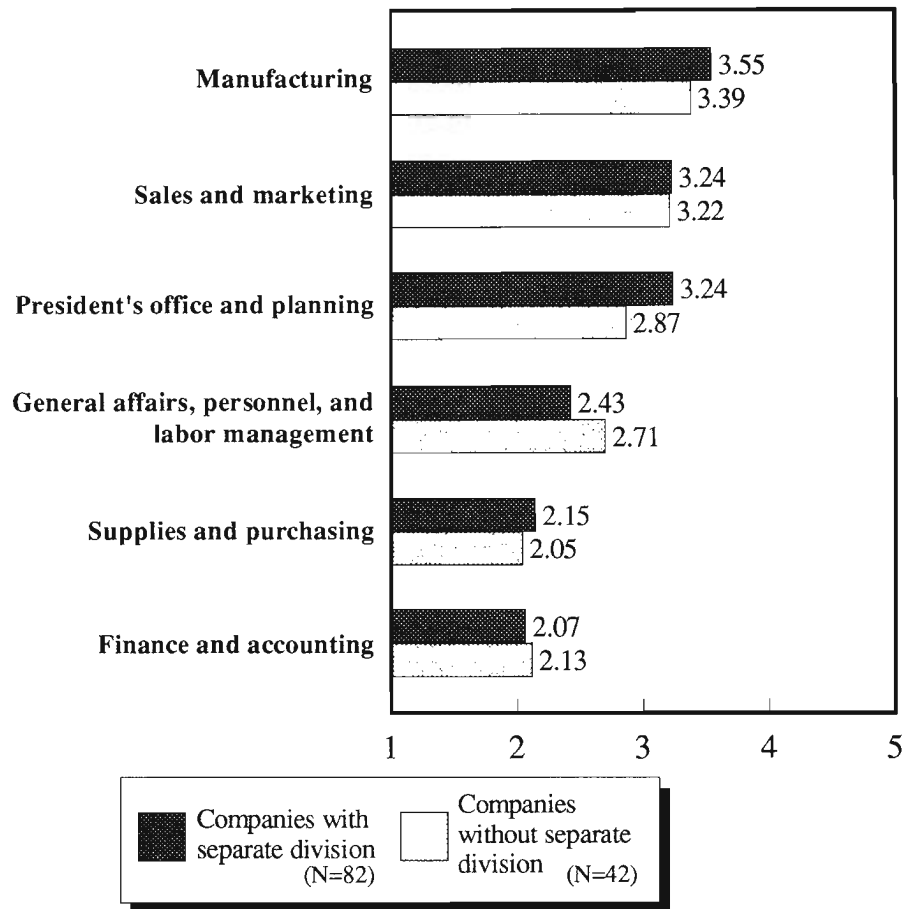


Numbers shown in the figure are the average values of the responses from the following scale (N=124)

1	2	3	4	5
Little or no contact	Meetings held half-yearly	Meetings held monthly	Meetings held weekly	Contact on a daily basis

Response results varied depending on whether the company has or does not have a separate division for R&D strategy planning. According to the average values of responses, the R&D division in companies with a separate division for R&D strategy planning maintains closer contact with all other divisions except the finance and accounting division and the general affairs, personnel, and labor management divisions, compared to the R&D division in companies without a separate division for R&D strategy planning. In particular, the R&D division in companies with a separate division for R&D strategy planning maintains a much closer contact with the president's office and planning division compared to the R&D division in companies without a separate division for R&D strategy planning (difference in average values of 0.37). On the other hand, the R&D division in companies without a separate division for R&D strategy planning tends to maintain closer contact with the finance and accounting division and especially the general affairs, personnel, and labor management divisions (difference in average values of 0.28), compared to its counterpart in companies with a separate division for R&D strategy planning (Figure 45).

Figure 45 Degree of Contact Between R&D Division and Other Divisions [Q.17]
 (Classified by Existence of Separate Division for R&D Strategy Planing)



4-2 Influence of Other Divisions in the Formulation of R&D Strategy

We asked the companies to indicate the degree of influence other divisions have when the company formulates R&D strategy with respect to the four specific examples of (1) establishing research facilities, (2) hiring new graduates, (3) selecting research domains, and (4) preparing research budget plans, on a scale from one to five (1 - "little or no influence"; 2 - "some influence"; 3 - "considerable influence"; 4 - "great deal of influence"; 5 - "extremely high degree of influence").

Figures 46-53 show the degree of influence that each division has as an average of the response values. In the figures, the higher the average value, the greater the influence held by the division.

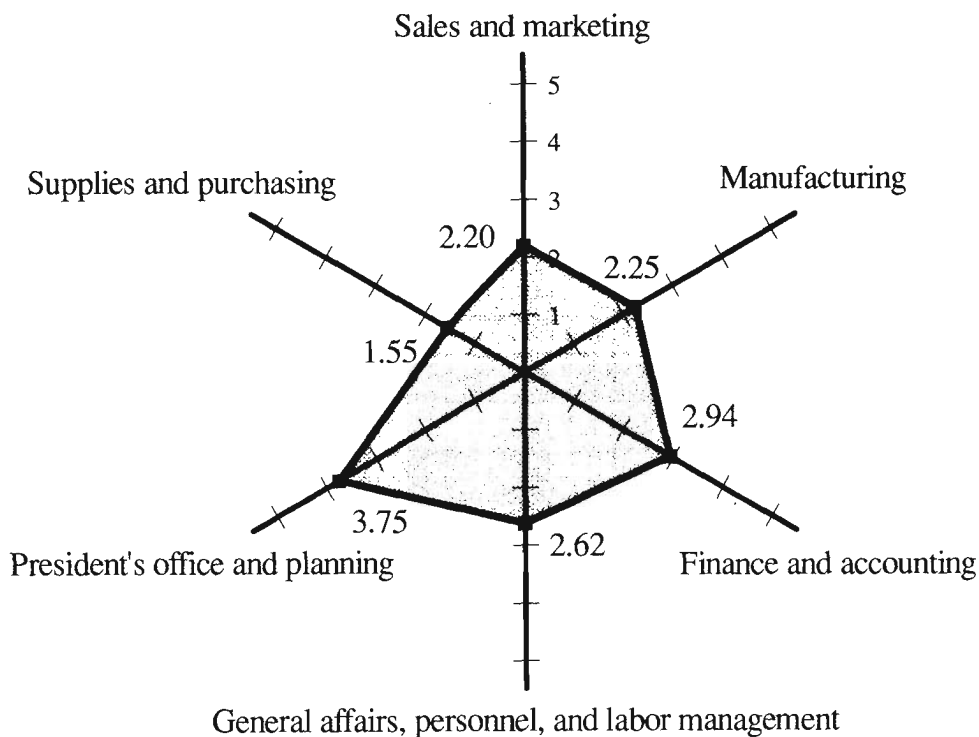
(1) Establishment of Research Facilities

Overall, the president's office and planning division has the most influence on the establishment of research facilities with an average response value of 3.75, followed by the finance and accounting division with 2.94, general affairs, personnel, and labor management divisions with 2.62, the manufacturing division with 2.25, the sales and marketing division with 2.20 and the supplies and purchasing division with 1.55 (Figure 46). As can be seen in Figure 47, the president's office and planning division has the most influence on the

establishment of research facilities both at companies with and at companies without a separate division for R&D strategy planning, but its influence is much greater at the companies with a separate division for R&D strategy planning than at those without the division, with a difference in average values of 0.58, the largest gap between the two groups of companies. The next largest gap between the two groups is in the influence of the manufacturing division, which is much greater at companies with a separate division for R&D strategy planning than at companies without the division by 0.40.

Figure 46 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(1) Establishment of Research Facilities

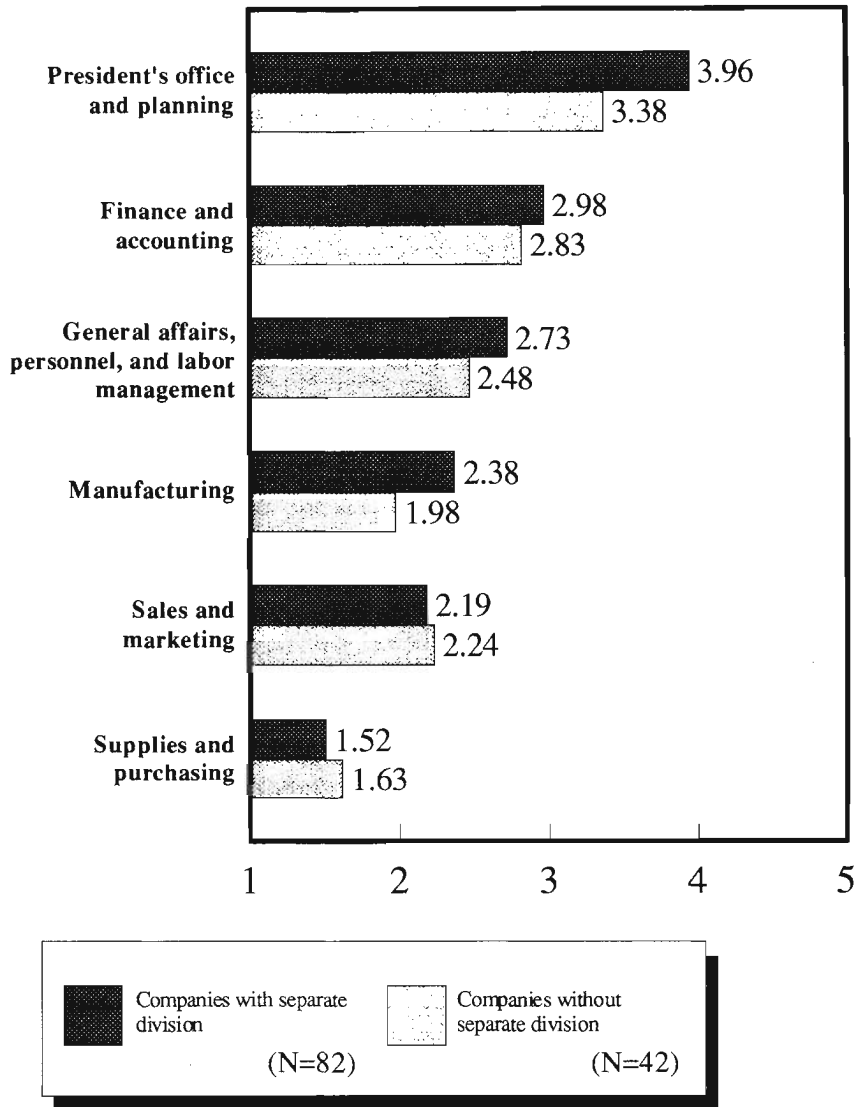


Numbers shown in the figure are the average values of the responses (N=124) from the following scale

1	2	3	4	5
Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence

Figure 47 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(1) Establishment of Research Facilities
 (Classified by Existence of Separate Division for R&D Strategy Planing)



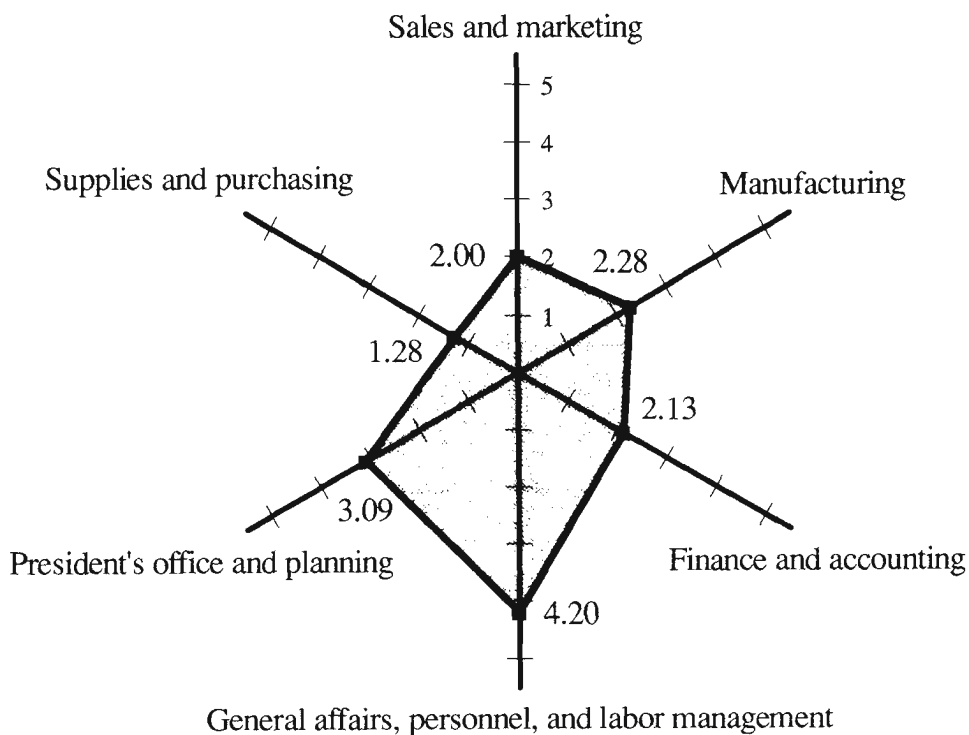
(2) Hiring of New Graduates

Overall, the general affairs, personnel, and labor management divisions have the most influence on the hiring of new graduates with an average response value of 4.20, followed by the president's office and planning division with 3.09, the manufacturing division with 2.28, the finance and accounting division with 2.13, the sales and marketing division with 2.00 and the supplies and purchasing division with 1.28 (Figure 48). As can be seen in Figure 49, the general affairs, personnel, and labor management divisions have the most influence on the hiring of new graduates both at companies with and at companies without a separate division

for R&D strategy planning, but the influence is much greater at the companies with a separate division for R&D strategy planning than at those without the division, with a difference in average values of 0.31. Significant differences between the two groups of companies can also be seen in the influence of the president's office and planning division and the influence of the manufacturing division, which are much greater at companies with a separate division for R&D strategy planning than at companies without the division by 0.55 and 0.51, respectively.

Figure 48 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(2) Hiring of New Graduates

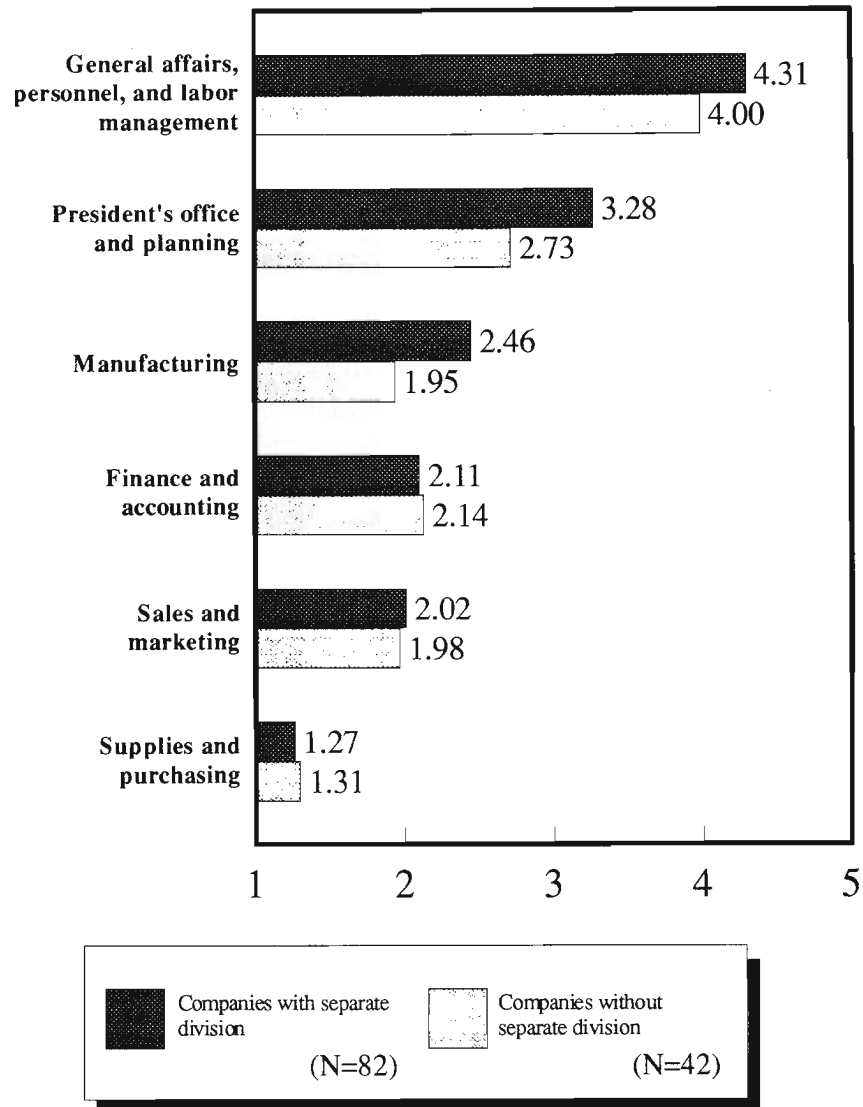


Numbers shown in the figure are the average values of the responses (N=124) from the following scale

1 Little or no influence	2 Some influence	3 Considerable influence	4 Great deal of influence	5 Extremely high degree of influence
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Figure 49 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(2) Hiring of New Graduates
 (Classified by Existence of Separate Division for R&D Strategy Planing)



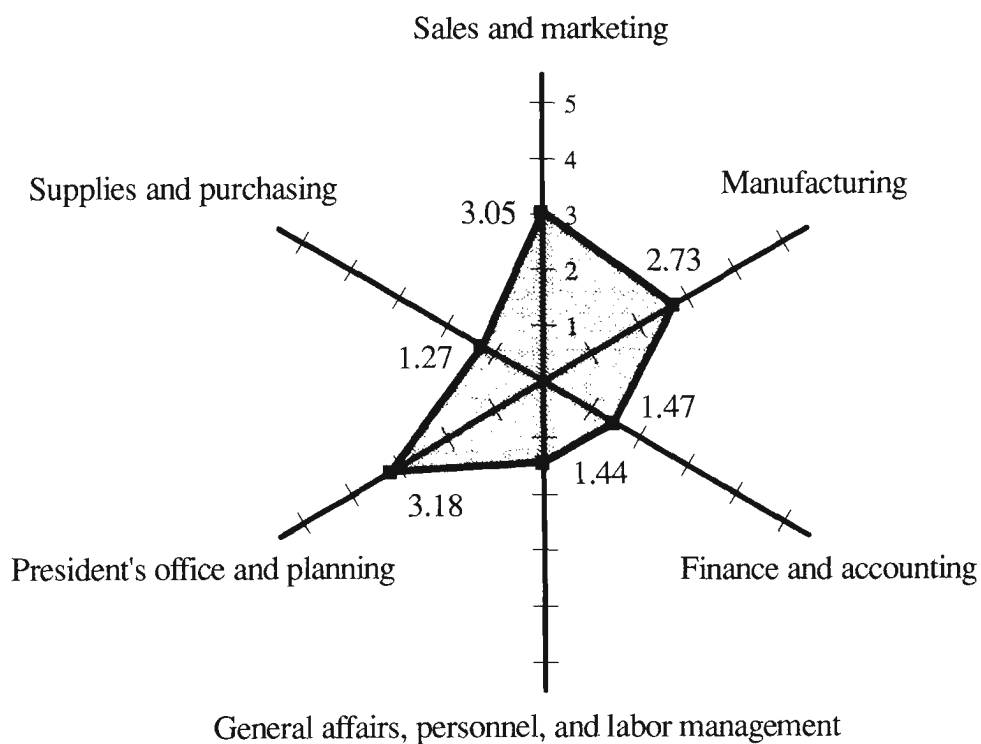
(3) Selection of Research Domains

Overall, the president's office and planning division has the most influence on the selection of research domains with an average response value of 3.18, followed by the sales and marketing division with 3.05, the manufacturing division with 2.73, the finance and accounting division with 1.47, the general affairs, personnel, and labor management divisions with 1.44 and the supplies and purchasing division with 1.27 (Figure 50). As can be seen in Figure 51, the president's office and planning division has the most influence on the selection of research domains both at companies with and at companies without a separate division for R&D

strategy planning, but the influence is much greater at the companies with a separate division for R&D strategy planning than at those without the division, with a difference in average values of 0.27. Significant differences between the two groups of companies can also be seen in the influence of the manufacturing division and the influence of the sales and marketing division, which are much greater at companies with a separate division for R&D strategy planning than at companies without the division by 0.45 and 0.27, respectively.

Figure 50 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(3) Selection of Research Domains

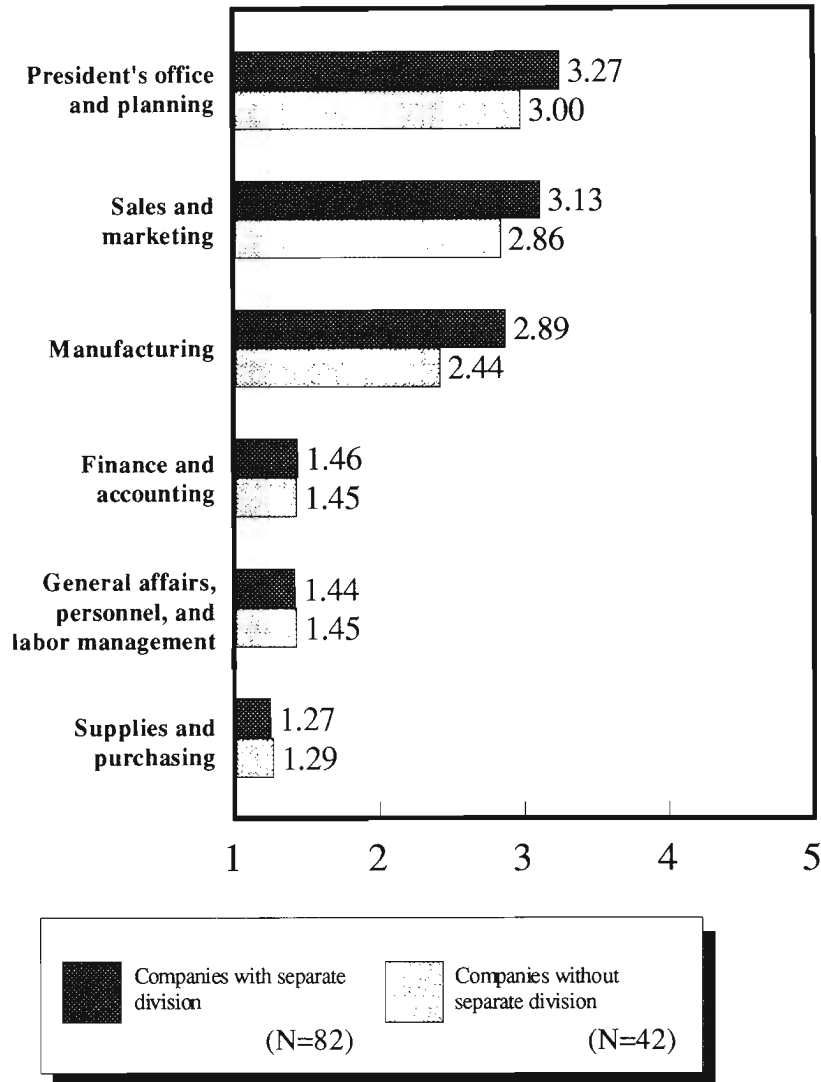


Numbers shown in the figure are the average values of the responses (N=124) from the following scale

1	2	3	4	5
Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence

Figure 51 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(3) Selection of Research Domains
 (Classified by Existence of Separate Division for R&D Strategy Planing)



(4) Preparation of Research Budget Plans

Overall, the president's office and planning division has the most influence on the preparation of research budget plans with an average response value of 3.48, followed by the finance and accounting division with 3.44, the sales and marketing division with 2.19, the manufacturing division with 2.11, the general affairs, personnel, and labor management divisions with 1.78 and the supplies and purchasing division with 1.30 (Figure 52). As can be seen in Figure 53, the president's office and planning division has the most influence on the preparation of research budget plans at companies with a separate division for R&D strategy planning, while the finance and accounting division has the most influence at companies without a separate

division for R&D strategy planning. Significant differences between the two groups of companies can be seen in the influence of the president's office and planning division and the influence of the manufacturing division, which are much greater at companies with a separate division for R&D strategy planning than at companies without the division by 0.40 and 0.39, respectively.

Figure 52 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(4) Preparation of Research Budget Plans

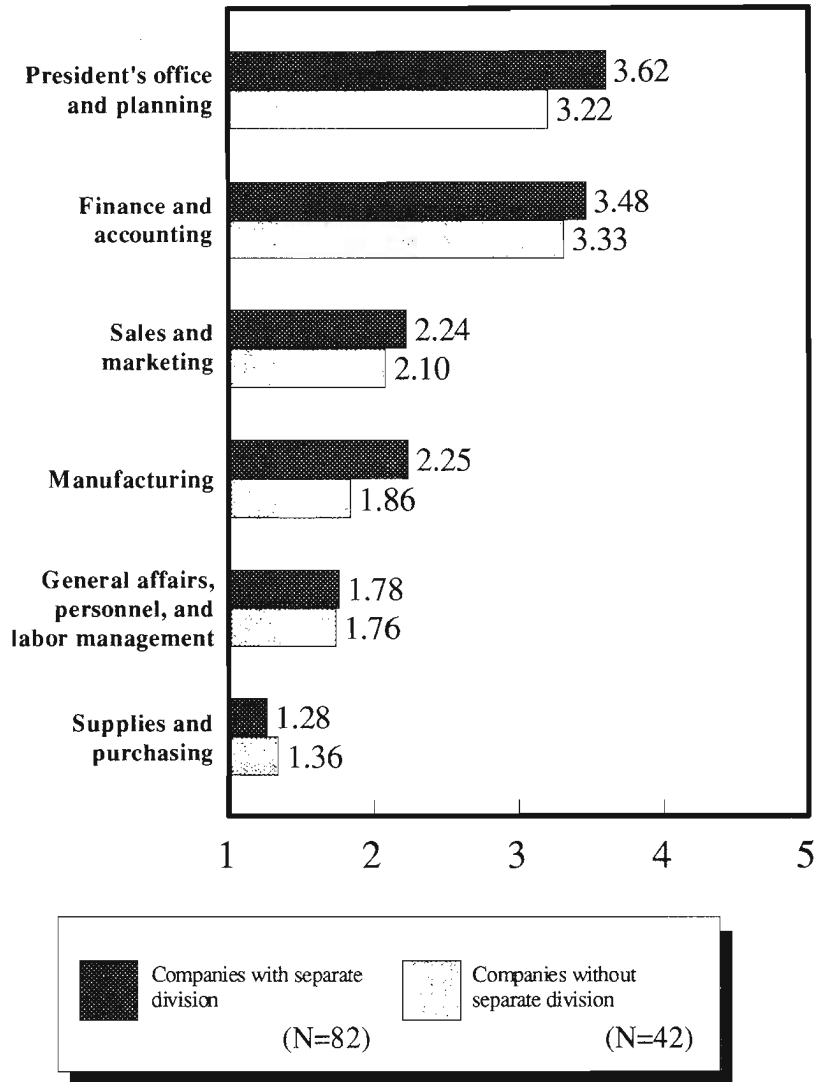


Numbers shown in the figure are the average values of the responses (N=124) from the following scale

1	2	3	4	5
Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence

Figure 53 Influence of Other Divisions in the Formulation of R&D Strategy [Q.18]

(4) Preparation of Research Budget Plans
 (Classified by Existence of Separate Division for R&D Strategy Planing)



Generally, the president's office and planning division and the manufacturing division have a greater influence on the formulation of research strategy at companies with a separate division for R&D strategy planning than at companies without a separate division for R&D strategy planning. Moreover, the overall influence of the various divisions is greater at companies with a separate division for R&D strategy planning, indicating, we believe, that the opinions of these divisions are reflected to a greater degree in the formulation of R&D strategy.

5. Company Employment Conditions for and Attitudes Towards Researchers and Engineers

5-1 Employment Conditions for Researchers and Engineers

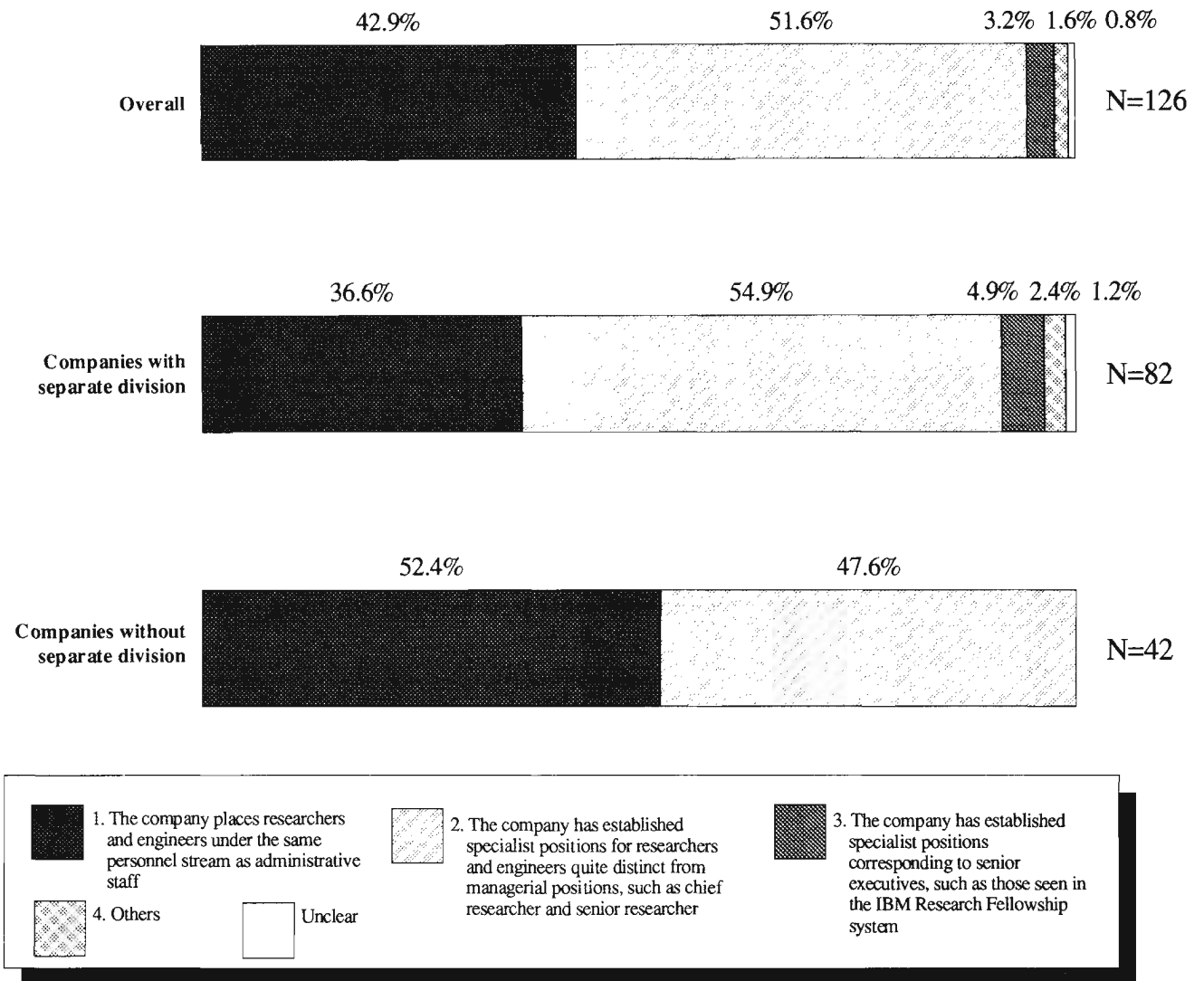
In this question we asked the companies to choose from four descriptions the one which is most applicable to the employment conditions for their researchers and engineers; 1 - "the company places researchers and engineers under the same personnel stream as administrative staff", 2 - "the company has established specialist positions for researchers and engineers quite distinct from managerial positions, such as chief researcher and senior researcher", 3 - "the company has established specialist positions corresponding to senior executives, such as those seen in the IBM Research Fellowship system", 4 - "others". Figure 54 shows that, overall, 54 companies (42.9%) chose response 1, 65 companies (51.6%) chose response 2, four companies (3.2%) chose response 3, and two companies (1.6%) chose response 4.

We believe that among the companies that chose response 2 - "the company has established specialist positions for researchers and engineers quite distinct from managerial positions" - are companies that substantially place their researchers and engineers under the same personnel stream as administrative staff, so in this sense, it would appear that, as is quite often said, the employment conditions for researchers and engineers are not as good as they perhaps should be.

A difference in the results was seen between companies with a separate division for R&D strategy planning and those without. As shown in Figure 54, response 1 ("the company places researchers and engineers under the same personnel stream as administrative staff") was chosen by a higher percentage of companies without a separate division for R&D strategy planning, while response 2 ("the company has established specialist positions for researchers and engineers quite distinct from managerial positions") was chosen by a higher percentage of companies with a separate division for R&D strategy planning. All four companies which chose response 3 ("the company has established specialist positions corresponding to senior executives, such as those seen in the IBM Research Fellowship system") have a separate division for R&D strategy planning.

While we cannot say that companies with a separate division for R&D strategy planning uniformly have established favorable employment conditions for their researchers and engineers, it can be inferred from the above that they are at least giving constructive thought to their employment conditions and how they can be improved.

Figure 54 Employment Conditions for Researchers and Engineers [Q.34]



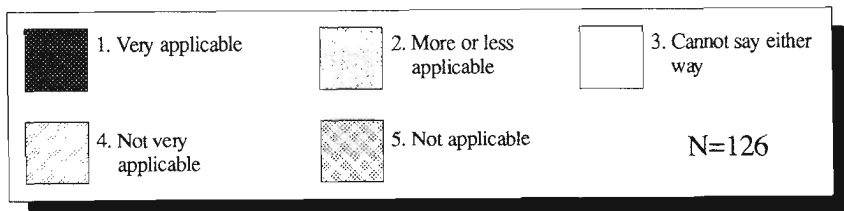
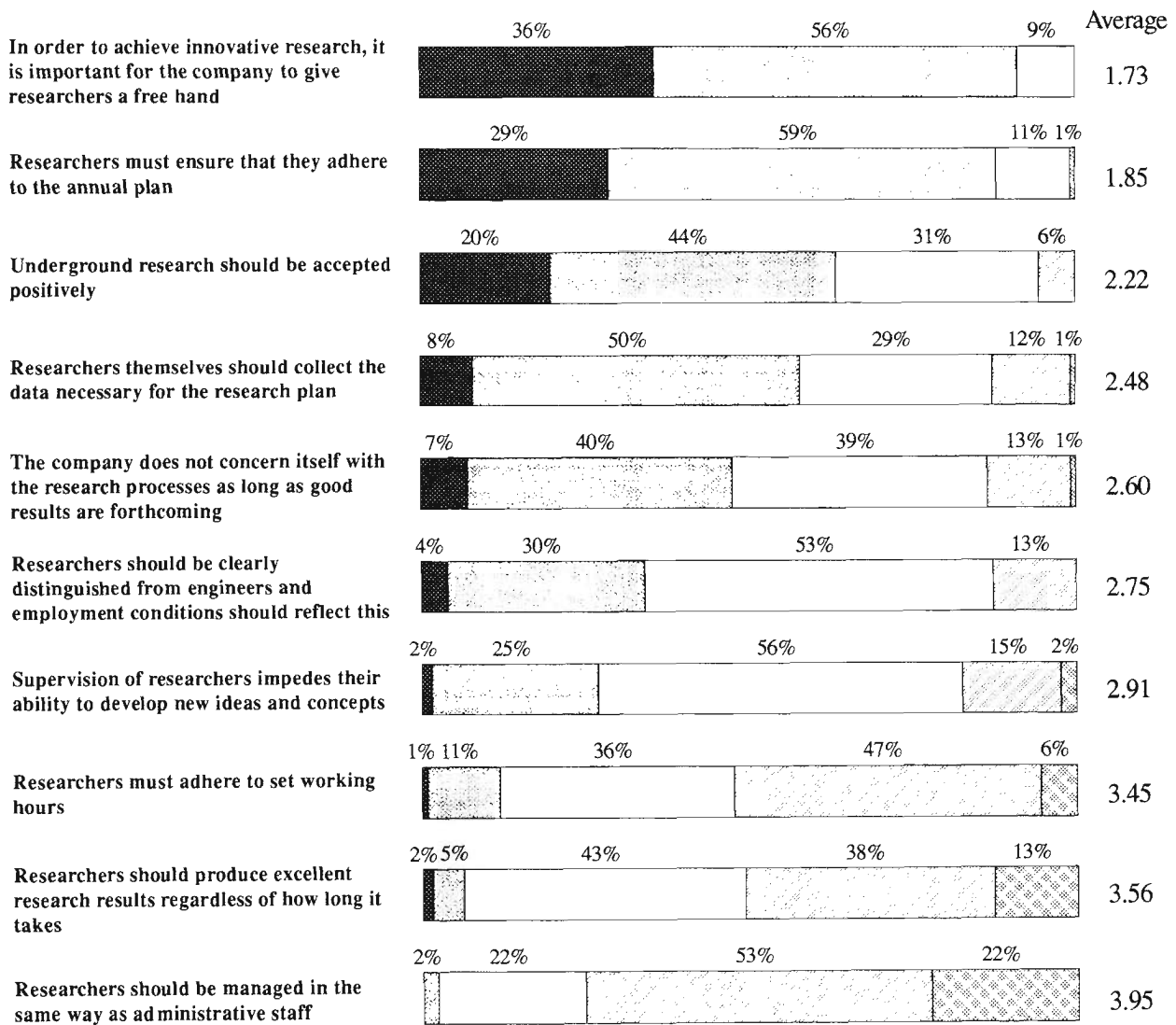
To ensure effective and efficient R&D operations, it is essential for companies to maintain a positive R&D environment for researchers and engineers, that is, a well structured work environment and good conditions of employment, including appropriate levels of pay. Unfortunately, it seems that Japanese companies still have much to do in this regard.

5-2 Attitudes Towards Researchers and Engineers

We then asked the companies to indicate their attitudes towards research and researchers in the management of R&D by marking the applicability of a series of statements on a scale from one to five (1 - “very applicable”; 2 - “more or less applicable”; 3 - “cannot say either way”; 4 - “not very applicable”; 5 - “not applicable”).

Figure 55 shows the results in descending order of applicability according to the average response value (the lower the average value, the more applicable the statement).

Figure 55 Attitudes Towards Researchers and Engineers [Q.35]



Companies face the dilemma that even though they have a conceptual understanding that “in order to achieve innovative research, it is important for the company to give researchers a free hand”, in reality, organizational constraints mean that they are simply not able to give researchers complete freedom in their research, and this is reflected in the results for “supervision of researchers impedes their ability to develop new ideas and concepts”.

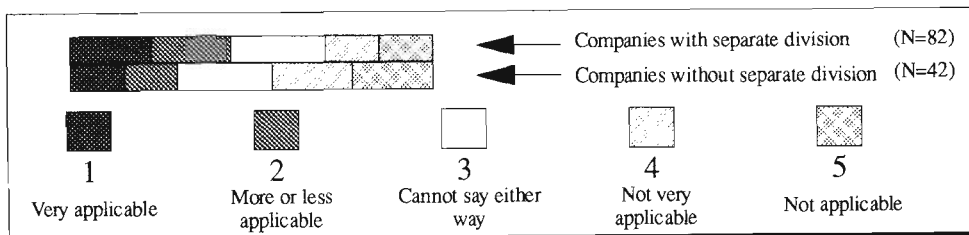
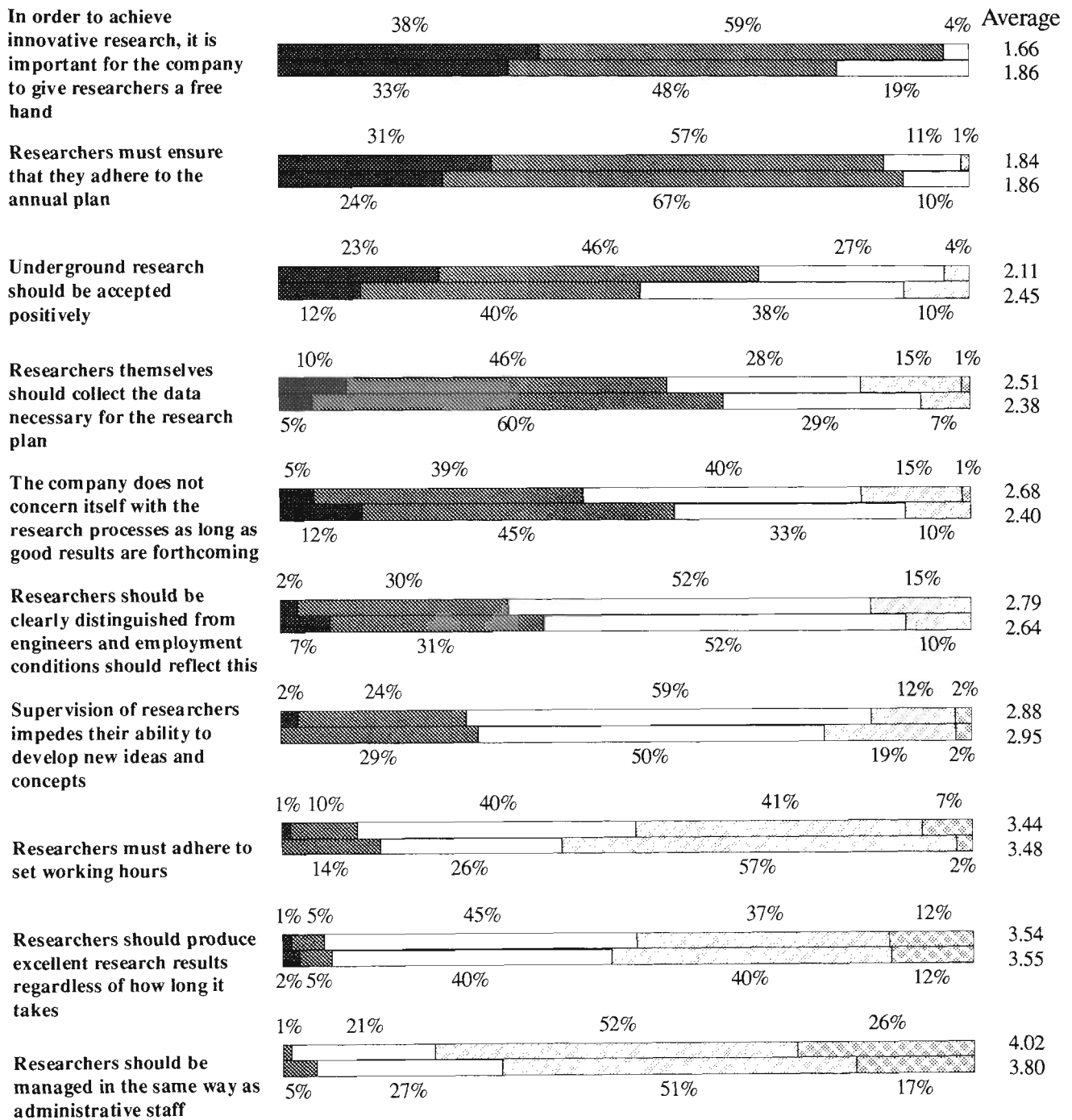
Although more than 40% of companies indicated in the preceding section that “the company places researchers and engineers under the same personnel stream as administrative staff”, the very negative response to the statement “researchers should be managed in the same way as administrative staff” indicates that there is quite a gap between the ideal and reality.

From the responses to all of the statements we can see that companies are groping for a balance between the “management” of researchers and “maintaining a high level of research freedom”.

There were considerable differences in the responses to the statements listed below between companies with a separate division for R&D strategy planning and those without (Figure 56).

Figure 56 Attitudes Towards Researchers and Engineers [Q.35]

(Classified by Existence of Separate Division for R&D Strategy Planing)



Companies with a separate division for R&D strategy planning generally gave a more positive response to “underground research should be accepted positively” with an average response value of 2.14 compared to companies without the division with an average response value of 2.45, a difference of 0.31.

Similarly, companies with a separate division for R&D strategy planning generally gave a more positive response to “in order to achieve innovative research, it is important for the company to give researchers a free hand” with an average response value of 1.66 compared to companies without the division with an average response value of 1.86, a difference of 0.20.

In contrast, companies with a separate division for R&D strategy planning generally gave a more negative response to “the company does not concern itself with the research processes as long as good results are forthcoming” with an average response value of 2.72 compared to companies without the division with an average response value of 2.41, a difference of 0.31.

Companies with the division also gave a more negative response to “researchers should be managed in the same way as administrative staff” with an average response value of 4.02 compared to companies without the division with an average response value of 3.81, a difference of 0.21.

As we have described, there is a considerable difference between companies with a separate division for R&D strategy planning and companies without the division in their responses to these four statements, and while these results and in fact the results of all responses indicate that companies with the division give high consideration to the notion of independence for individual researchers, they also show that these companies have a greater tendency to have their researchers work within the basic organizational framework of the company than companies without a separate division for R&D strategy planning. It can possibly be argued that as a result of repeated trial and error to find efficiency in the management of R&D operations, companies with a separate division for R&D strategy planning have reached the conclusion that it is important to give high regard to researchers’ creativity and raise their level of independence in order to foster innovative research.

6. R&D Performance

6-1 Ratio of New Products and Ratio of Sales for New Products

The number of papers published and the number of applications for patents are often used to gauge the performance of R&D operations. These focus on “quantity”, whereas in this report we have tried to focus on the “quality” of research, that is, the extent to which R&D has contributed to the business showing of the company, and to this end, we have tried to evaluate R&D operations through the ratio of new products and ratio of sales for new products, which are generally used as strategic indicators of R&D in the manufacturing industry.

We define new products as products that contain new technologies, and the ratio of new products, expressed as a percentage, is the figure obtained when the number of new product types is divided by the total number of product types produced by the company. The ratio of sales for new products is the percentage that sales of new products accounts for in the company’s total sales amount.

We expected there to be a diverse range of definitions for new products, deepening on the industry type and the company, but here we took it upon ourselves to look at the results on the greatest common measure level and base our comparisons on that. As expected, there were various

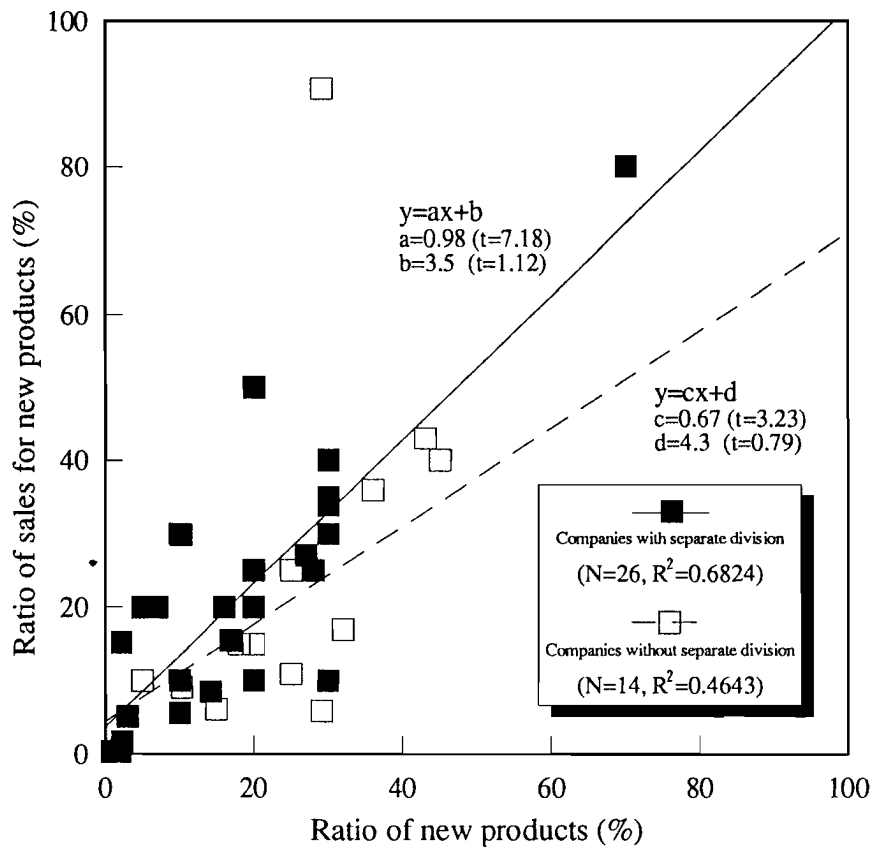
definitions for new products. Most companies in the assembly-type industry define new products as products that have been on the market for up to three years (4-5 years for the automobile industry, which defines new products as a complete model change), and most companies in the material-type industry define them as products that have been on the market for up to five or ten years. For the fiscal 1990 data, 49 companies (out of 126) provided their ratio of new products, and 57 companies provided their ratio of sales for new products; a total of 41 companies provided both ratio of new products and ratio of sales for new products. Most of the companies that did not respond to this question commented that they could not determine the figure because of the massive number of different product types.

While we can take the line that the higher the ratio of new products, the greater the fruit from R&D operations, here we have considered that a value of more than one when the ratio of sales for new products is divided by the ratio of new products indicates that the R&D operations are efficient. By evaluating R&D performance in this light, we believe that industrial characteristics inherent in the figures for ratio of new products and ratio of sales for new products can be disregarded, thereby enabling us to compare the R&D performance of companies in different industries. Even where the ratio of new products is high, if the sale of new products makes only a small contribution to overall product sales, that is, the ratio of sales for new products is low, the R&D operations are not really giving a good return on the investment. The performance of various divisions in the company, including marketing capability as well as R&D capability (technological advantage of the new product), greatly affects the ratio of sales for new products, so in the context of creating new technologies and new products that can contribute to overall product sales, we believe that the ratio of sales for new products by itself is an acceptable yardstick for R&D performance in a broad sense.

Unfortunately, because of the limited amount of data, it would not have been reasonable to use the ratio of sales for new products / ratio of new products equation as a standard for defining an excellent company with efficient R&D operations. For reference, we have shown the ratio of new products and ratio of sales for new products data obtained from the 41 companies for fiscal 1990 in Figure 57.

Figure 57 Correlation Between Ratio of New Products and Ratio of Sales for New Products [Q.4]

(Fiscal 1990 Data)



Using this data, we then compared the responses given by companies with a separate division for R&D strategy planning and companies without the division. As mentioned in section 2-1, we were unable to find a correlation between the existence of a separate division for R&D strategy planning on one hand and the level of R&D spending and the type of industry on the other, nor could we find any correlation between the existence of the division and industry type among the 41 companies which provided the data.

Of the 41 companies, 26 have a separate division for R&D strategy planning and 15 do not.

In Figure 57, the black squares represent companies with a separate division for R&D strategy planning, and the white squares represent those without the division. The unbroken line - is a regression line for companies with a separate division for R&D strategy planning, and the broken line --- is a regression line for companies without the division. The company positioned at point 30, 93 stands out considerably, and upon checking their calculation methods, we found that their calculation standards were quite different from the other companies. We therefore concluded that we had to treat the figures for that company as anomalous and decided to exclude them when compiling the regression line for companies without a separate division for R&D strategy planning.

Comparing the distribution of companies with and companies without a separate division for R&D strategy planning through their respective regression lines, we can notice a significant difference between the two groups of companies. The inclination of the regression line for companies with the division is 0.98 (t check 1% significance), whereas the inclination for companies without the division is 0.67 (t check 1% significance), revealing that companies with the division tend to have a higher ratio of sales for new products / ratio of new products.

We also analyzed these figures according to industry. The industries we analyzed are the material-related manufacturing industries⁴ (16 samples) and the machinery-related manufacturing industries⁵ (21 samples). Here, too, we excluded the data for the company at point 30, 93 (material-related manufacturing industries) as anomalous.

Table 52 shows the simple average of ratio of sales for new products and Table 53 shows the simple average of ratio of sales for new products / ratio of new products for companies with a separate division for R&D strategy planning, companies without the division, and overall, broken down into material-related manufacturing industries and machinery-related manufacturing industries. Although Table 52 shows that in the material-related manufacturing industries, companies without the division went against the trend and returned a slightly better result in the ratio of sales for new products than companies with the division, Table 53 shows that in all classifications, companies with the division returned a better result in the ratio of sales for new products / ratio of new products than companies without the division, indicating that, as surveyed, the performance of the companies with the division tends to be better than that of the companies without the division.

Table 52 Simple Average of Ratio of sales for new products (Q.4)

	Material-related manufacturing industries No. of companies	Machinery-related manufacturing industries No. of companies	Material-related plus machinery-related No. of companies	Overall No. of companies
Overall	13.9 15	26.5 21	21.3 36	20.5 40
Companies with separate division	13.8 10	29.5 12	22.4 22	21.1 26
Companies without separate division	14.0 5	22.5 9	19.5 14	19.5 14

(Data for company at 30, 93 are not included)

⁴ The material-related manufacturing industries are "chemicals" (six samples), "pharmaceuticals" (five samples), "other chemicals" (one sample), "petroleum" (one sample), "glass" (one sample), and "general steel" (two samples) for a total of six industry types and 16 samples.

⁵ The machinery-related manufacturing industries are "industrial machinery" (three samples), "heavy electric equipment" (one sample), "communications equipment" (one sample), "domestic electrical appliances and component parts" (six samples), "other electrical equipment" (three samples), "motor vehicles" (six samples), and "precision machinery" (one sample) for a total of seven industry types and 21 samples.

Table 53 Simple Average of Ratio of Sales for New Products / Ratio of New Products (Q.4)

	Material-related manufacturing industries No. of companies	Machinery-related manufacturing industries No. of companies	Material-related plus machinery-related No. of companies	Overall No. of companies
Overall	1.64 15	1.10 21	1.32 36	1.33 40
Companies with separate division	1.76 10	1.25 12	1.48 22	1.47 26
Companies without separate division	1.38 5	0.89 9	1.07 14	1.07 14

(Data for company at 30, 93 are not included)

From the above, we can see that accurate market feedback is reaching the R&D division at companies with a separate division for R&D strategy planning, and this is enabling them to focus on R&D operations for new products that can contribute to their overall sales effort.

Although the above results do not allow us to say definitely that “the R&D performance of companies with a separate division for R&D strategy planning is better than that of companies without the division”, they are nonetheless interesting. The fact that the relatively large companies which responded to this survey have a grasp of their ratio of new products and ratio of sales for new products as quantitative data, and use these data as effective strategic indicators for their R&D operations itself is a strong indication of a highly strategy-oriented management structure and awareness.

V Summary of Survey Results

In this research we were able to verify through objective data obtained from a wide-ranging questionnaire that companies in the private sector are becoming increasingly aware of the importance of R&D, and of the need for “strategy” and strategic management systems to enhance their R&D operations. We were also able to confirm that not only do these companies have a high awareness, but they have translated this awareness into action and are carrying out highly strategy-oriented R&D at the practical level. Manufacturing industries in Japan have steadily shifted from a generally unbalanced “R&D” with greater emphasis on development to a more balanced R&D with generally equal emphasis on research and development, and this has led to a greater need for “strategy” and “strategic management”. To this end, companies in the manufacturing industry are continually trying to improve their R&D management systems through trial and error in an effort to raise the effectiveness and efficiency of their R&D operations.

Below we have summarized the results detailed in chapter IV.

1. As can be seen in the general upgrading of the R&D division head’s position and the increase in the relative influence of the R&D division within the company over the past ten years, the importance of R&D in the Japanese manufacturing industry is greater than it has ever been.
2. (1) Sixty-five per cent of companies that responded to the survey have established a separate division for R&D strategy planning.
(2) All companies responded that they feel there is a need to improve the efficiency of their R&D operations.
(3) Eighty per cent of companies gave a positive response about evaluating the efficiency of R&D investment.
(4) Seventy per cent formulate a strategic R&D budget.
(5) Seventy-five per cent formulate a company research strategy.
(6) Companies are seeking to expand their R&D capability and reduce the burden of rising R&D costs by participating in research consortia.
(7) Companies are generally incorporating the strong points of both American and European methods and Japanese methods into the flow of technology through the different stages.

From the above, we can conclude that the need for “strategy” and “strategic management” in the Japanese manufacturing industry is continuing to grow, and that companies are carrying out highly strategy-oriented R&D at the practical level.

3. Companies are very aware that as they pursue efficiency in a broad sense, they must improve employment conditions for researchers and engineers and their general attitudes towards researchers and engineers in order to bring out the creativity of individual researchers to its fullest.
4. Generally, compared to companies without a separate division for R&D strategy planning, companies with the division (82 of the 126 companies) tend to be more strategy-oriented in their research management, for example their positive efforts to construct global networks through participation in consortia; tend to coordinate the views of the various divisions in the company and give greater market feedback to the R&D division; and tend to have a better R&D performance in terms of the correlation between the ratio of new products and the ratio of sales for new products. They also tend to have a greater understanding about R&D

management and how to improve the research environment, including their overall treatment of their researchers and engineers, so that the most effective and efficient R&D operations can be achieved.

VI Conclusion

Are companies today showing a tendency to reduce their R&D spending in an effort to cut costs and improve their short-term management efficiency as the recession and the growing severity of the business environment following the bursting of the economic bubble continue to chip away at their operating margin? Through this research, at least, we found that the enthusiasm for R&D in typical companies in Japan's manufacturing industry is not so shallow that it could be pushed aside for the perception of short-term efficiency, rather, it flows very deeply. Even where R&D spending has been reduced, the cut has been minimal, and over the long term, we believe that R&D spending will only ever increase, it will never decrease.

Japanese companies are fully aware of the need for "strategy" and "strategic management" in their efforts to use their management resources as effectively as possible to cope with the growing uncertainty in the business environment. Although management has a deeply-rooted desire to raise the efficiency of R&D operations, it would appear they have begun to realize in the face of repeated trial and error that innovative results are beyond reach if their first consideration is to chase after efficiency of investment (input) and research results (output).

Through this study, we can suggest that the following three points form the key to effective and efficient R&D operations.

1. Companies should place importance on clarifying strategies by way of a direction that employees should follow and goals at which employees should aim, that is, "what they should manufacture and how" and "what they should do to achieve this".
2. Companies should establish systems for strategic R&D management which emphasize differentiation and the allocation of priorities and which facilitate the timely vertical, lateral and interdepartmental flow of information, and the selection and storage of useful objective data when formulating effective "strategy".
3. Instead of trying to strictly supervise researchers and engineers, companies should supervise at the minimum level they require as members of the organization, delegating authority to the research unit and giving researchers as free a hand as possible so that they can proceed freely with their research and achieve innovative results.

The third is based on the companies' responses on employment conditions for and their thoughts about researchers and engineers, but there is still considerable scope for companies to improve employment conditions for researchers and engineers, improve the R&D environment, and review their basic R&D management structure. On reflection, it appears that herein lies the key to effective and efficient R&D operations. Even if companies have a broad conceptual understanding of this point, it is likely that they will have some hesitation about putting it into effect, simply because there are no data to support its effectiveness. It is hoped the fact that we noticed a tendency for companies with a separate division for R&D strategy planning to be more progressive in their basic attitudes towards the R&D environment and R&D management and to display generally a better R&D performance than companies without a separate division for R&D strategy planning will become the foundation upon which companies can improve their R&D environment.

From the survey we discovered that there is a growing need for "strategy" and "strategic management" among Japanese companies, and that 70% of companies have established a separate

division specially responsible for R&D strategy. The survey shows that companies generally appear to be dealing with today's highly uncertain environment by adopting their own strategic policies and operations. As the establishment of a separate division for R&D strategy planning can be regarded as organizational reform in a broad sense, the fact that the majority of Japanese companies have established a separate division for R&D strategy planning can be viewed as a broad-based transitional measure leading towards a highly coordinated corporate structure that can deal precisely with the various uncertainties of today. Unfortunately, in this study we were not able to find out the actual functions of the separate divisions for R&D strategy planning in detail. This, and the actual measures being adopted to deal with the environmental uncertainties, are areas that we should like to tackle in a future research project.

As stated in chapter I, this report brings together the results of a survey of Japanese companies that forms a part of a wider survey which seeks to compare the R&D management systems of Japanese, United States and European companies. We are currently moving towards the implementation of surveys of European and United States companies, and once these surveys have been completed and the results analyzed, we shall be able to revise our present suggestions or formulate entirely new suggestions as required.

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Annexes

Annex 1 Questionnaire

INTERNATIONAL COMPARISON STUDY OF R&D MANAGEMENT SYSTEMS

Science and Technology Agency
NISTEP

- 1 We hope you are willing to participate in this research study that seeks to compare Japanese, American, and European R&D management systems. The questions seek information about your company's R&D strategy, R&D management system, and management situation. Because we would like to collect accurate data, please have this questionnaire filled out by someone who can give subjective responses - if possible, by the head officer of the R&D department.

We understand that this information is confidential, and are taking every precaution to protect you and your company. The responses to this questionnaire will be reported only in statistical reports, thereby protecting individual responses.

- 2 Upon finishing this questionnaire:
 (1) Please use the enclosed envelope to return the questionnaire.
 (2) Please return this questionnaire by *****.

Thank you in advance for your cooperation.

Your Company	TEL () -		
Your Name	Your Department		

Q. 1 Your position in your company ?

1. Officer 2. General manager 3. Others

Q. 2 In which section of your company are you involved in R&D strategy development ?

1. Overall company 2. Department
 3. Division 4. Laboratory

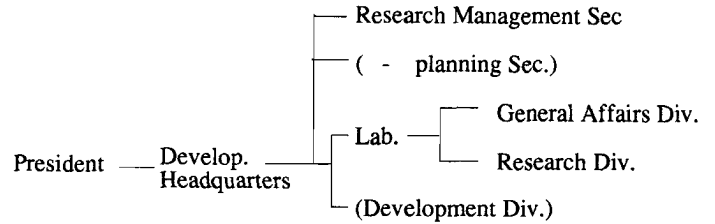
Q. 3 Which of the following patterns dose your company's R&D management system follow ?

Please choose the number of the pattern. If you cannot find the answer choices as in appropriate, please describe your company's pattern in the blank space.

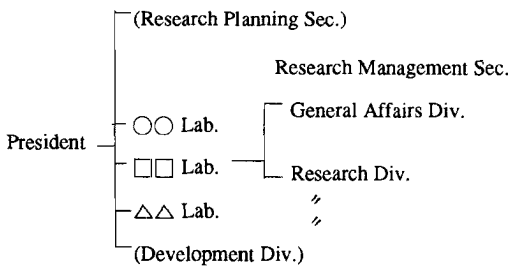
1. Independent Single Laboratory System



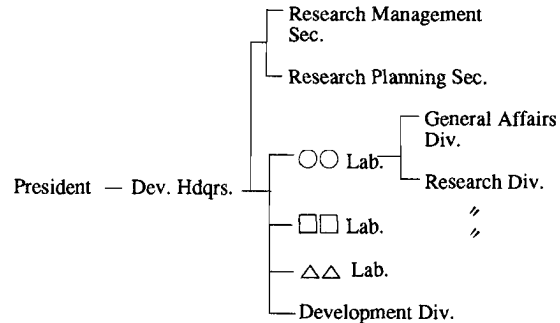
2. Independent R&D Department



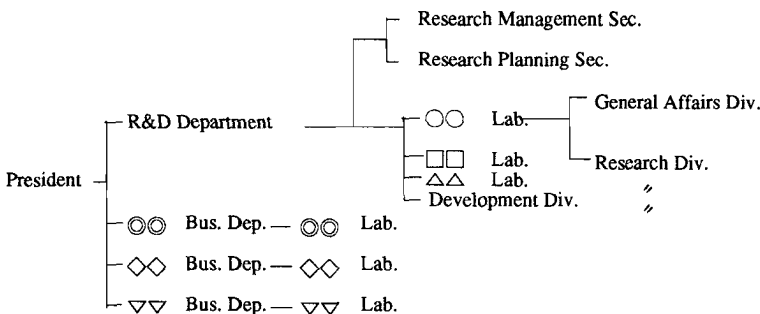
3. Independent Multiple Laboratory System



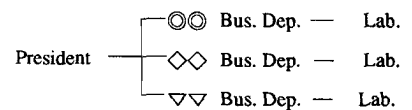
4. Independent R&D Department with Multiple Laboratories



5. Business Department Controlling Parallel Laboratory System



6. Business Department Controlling Laboratory System



7. Independent Company System

8. Other Systems

Note 1: Those in parentheses do not necessarily exist.

Note 2: The names for each section (department, division) are made to represent jobs of each.

Note 3: "Division" refers to groups involved in task enforcement, and "section" refers to groups involved in staff management.

Q. 4 What are the approximate values of your company's proceeds, the rate of ordinary profits, R&D expenditure, number of employees, number of researchers, the rate of new products, the rate of proceeds for new products, number of patent requests, number of dissertation presented.

	1985	1990
Proceeds		
R. of ordinary profits		
R&D expenditure		
Employees		
Researchers		
R. of new products*		
R. of proceeds for NP		
Patent requests		
Dissertations		

*The rate of new products = $\frac{\text{N. of variety new products}}{\text{N. of variety all products}}$ ("New products" refers to products that require new technology.)

In the case where your company already has a special accounting method, please calculate the above data upon explanation of the method.

Also, please describe what the term "new products" means in your company below.

.....

.....

.....

.....

Q. 5 Does your company have a separate division that deals only with R&D management strategy ?

1. YES 2. NO

(For those who answered "NO", Please go on to question No.6.)

SQ.1 How is that division referred to ?

SQ.2 What section does that division belong to ?

1. C.E.O. 2. Business Hdqrs. 3. Business Div. 4. Lab.

SQ.3 Please describe the history of this division in chronological below.

SQ.4 How many employees work in this division. Also, how has the budget for this division changed ?

	1980	1990
Employees		
Budget		

Q. 6 Is the research plan developed for the whole company ?

1. YES 2. NO
(Those who answered "NO", please go on to Q.7.)

SQ.1 In general, approximately how long does your company research plan cover ?

1. 3 years 2. 5 years 3. 10 years 4. More than 15 years

SQ.2 Who is the main person in charge of the research plan development process ?

1. Researcher 2. Research leader 3. Manager of research management
4. Head of the division of research management
5. Officer in the division of research management 6. C.E.O

SQ.3 Who has the power to make the final decision over the research plan ?

1. President 2. Officer in the division 3. Other officer
4. Head of the division of research management

Q. 7 Is the research strategy developed for the whole company ?

1. YES 2. NO
(Those who answered "NO", please go on to Q.8.)

SQ.1 In general, approximately how long does your company research plan cover ?

1. 3 years 2. 5 years 3. 10 years 4. More than 15 years

SQ.2 Who is the main person in charge of the research plan development process ?

1. Researcher 2. Research leader 3. Manager of research management
4. Head of the division of research management
5. Officer in the division of research management 6. C.E.O.

SQ.3 Who has the power to make the final decision over the research plan ?

1. C.E.O. 2. Officer in the division 3. Other officer
4. Head of the division of research management

Q. 8 What percentage of the R&D activity budget is used for the new theme budget ?

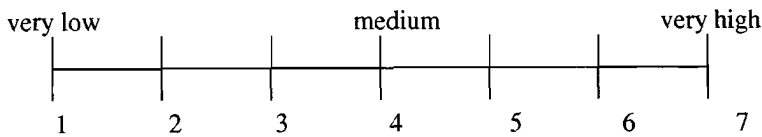
 %

Q. 9 Upon examining R&D activities in terms of efficiency of investing, which of the below applies to your company ?

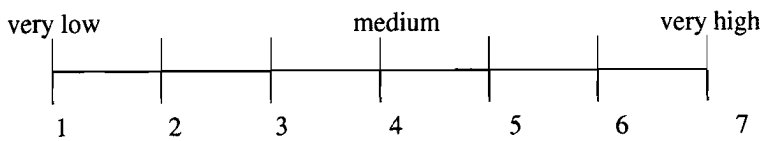
1. It is impossible to rate the efficiency of investments.
2. Our company is currently examining an effective method for checking the efficiency of investments.
3. Our company already has a system developed for checking the efficiency of investments.

(Please describe the method briefly in the space below.)

Q. 10 In the main market that your company serve, how much is the frequency per annum of new product generally ?



Q. 11 Do you feel the lineup of products handled by your company should be changed ?



Q. 14 Do you feel it is necessary to hold consortia concerning R&D ?

(Exclude those that are sponsored by government funds.)

- 1. YES
- 2. NO

SQ.1 Have you ever attended a consortium concerning R&D ?

If possible, please write the name of the project.

- 1. YES Name of project
- 2. NO

To those who answered "YES" :

SQ.2 Was the participating company Japanese or European/American ?

(If there were various consortia held, please describe the most typical one.)

- 1. Japanese
- 2. American
- 3. European
- 4. J/A
- 5. J/E
- 6. J/E/A
- 7. Other

SQ.3 What was the motivation ? Please choose from below in the order of significance.

(Multiple answers are possible.)

- 1. It costs enormous amount of money.
- 2. To expand the company's R&D capability.
- 3. To make connections overseas.
- 4. Other []

1
2
3
4

SQ.4 Did the project succeed ?

- 1. YES The reason it succeeded was...

- 2. NO The reason it failed was...

Q. 15 To what extent does each statement listed below correctly describe your company's strategies and underlying value and belief? Please circle the appropriate number.

	definitely true				definitely incorrect
1. Your company consistently seeks high market share and tries to take advantage of cost efficiencies in every market.	1	2	3	4	5
2. Your company exploits the advantage of being a "follower" and tries to reduce risks on the development of new products and/or markets.	1	2	3	4	5
3. Your company concentrates resources in a few strategic market segments.	1	2	3	4	5
4. The pursuit of stockholder benefits is thought to be the most important social responsibilities of your company.	1	2	3	4	5
5. Your company competes head-on with competitors	1	2	3	4	5
6. Your company does not hesitate to divest from questionable businesses.	1	2	3	4	5
7. The diversification targets are restricted to those product lines which have close commonality with the existing technological base.	1	2	3	4	5
8. Your company selects the market segments in which it has advantageous and pursues coexistence with competitors.	1	2	3	4	5
9. Your company has been actively developing foreign markets.	1	2	3	4	5
10. Strategy formulation in your company is based upon systematic research data and sophisticated analytical methods.	1	2	3	4	5
11. Your company is always an innovator which actively takes risks on the development of new product and/or market.	1	2	3	4	5
12. Your company has actively acquired new businesses.	1	2	3	4	5

	definitely true				definitely incorrectly
13. The recruitment of managerial personnel and technological experts are based upon long-range personnel planning rather than immediate needs.	1	2	3	4	5
14. The diversification targets are restricted to those product lines in which existing strengths in marketing can be applied.	1	2	3	4	5
15. Information is sought extensively even on markets unrelated businesses.	1	2	3	4	5
16. Your company aims to produce high quality products with high value added to rely on non-price marketing strategy.	1	2	3	4	5
17. Your company emphasizes accumulating diverse base of know-how more than making better use of existing know-how.	1	2	3	4	5
18. The basic strategy of your company is inseparable from the unique values and belief of the present C.E.O. or the original founder.	1	2	3	4	5
19. The fulfillment of various social responsibilities is clearly built into the corporate strategy of your company.	1	2	3	4	5
20. Your company has been actively investing in foreign production subsidiaries.	1	2	3	4	5
21. Voluntary recommendations made by lower-level managers are frequently followed by senior executives.	1	2	3	4	5
22. The intuitive judgment of experienced executive plays a major role in formulating strategy.	1	2	3	4	5

Q. 16 In general, how much influence and say does each of the following department have when making joint decisions that may determine the overall performance of your company.

	little or no influence	some influence	quite a bit of influence	a great deal of influence	a very great deal of influence
1. R&D	1	2	3	4	5
2. Sales · Marketing	1	2	3	4	5
3. Production	1	2	3	4	5
4. Finance · Accounting	1	2	3	4	5
5. Personnel · Labor relations	1	2	3	4	5
6. Corporate planning staff	1	2	3	4	5
7. Procurement · Purchasing	1	2	3	4	5

Q. 17 How often does the R&D dept. have a meeting with the following dept.?

	not at all	four times a year	once a month	once a week	almost daily
1. Sales · Marketing	1	2	3	4	5
2. Production	1	2	3	4	5
3. Finance · Accounting	1	2	3	4	5
4. Personnel · Labor relations	1	2	3	4	5
5. Corporate Planning staff	1	2	3	4	5
6. Procurement · Purchasing	1	2	3	4	5

Q. 18 In determining the following sections of the R&D strategy, how much influence and say do the following dept. have ?

(1) About the setting research facilities

	little or no influence	some influence	quite a bit of influence	a great deal of influence	a very great deal of influence
1. Sales · Marketing	1	2	3	4	5
2. Production	1	2	3	4	5
3. Finance · Accounting	1	2	3	4	5
4. Personnel · Labor relations	1	2	3	4	5
5. Corporate Planning staff	1	2	3	4	5
6. Procurement · Purchasing	1	2	3	4	5

(2) About the employment of new employees (out of college)

	little or no influence	some influence	quite a bit of influence	a great deal of influence	a very great deal of influence
1. Sales · Marketing	1	2	3	4	5
2. Production	1	2	3	4	5
3. Finance · Accounting	1	2	3	4	5
4. Personnel · Labor relations	1	2	3	4	5
5. Corporate Planning staff	1	2	3	4	5
6. Procurement · Purchasing	1	2	3	4	5

(3) About determining the domain of research

	little or no influence	some influence	quite a bit of influence	a great deal of influence	a very great deal of influence
1. Sales · Marketing	1	2	3	4	5
2. Production	1	2	3	4	5
3. Finance · Accounting	1	2	3	4	5
4. Personnel · Labor relations	1	2	3	4	5
5. Corporate Planning staff	1	2	3	4	5
6. Procurement · Purchasing	1	2	3	4	5

(4) About developing the research budget

	little or no influence	some influence	quite a bit of influence	a great deal of influence	a very great deal of influence
1. Sales · Marketing	1	2	3	4	5
2. Production	1	2	3	4	5
3. Finance · Accounting	1	2	3	4	5
4. Personnel · Labor relations	1	2	3	4	5
5. Corporate Planning staff	1	2	3	4	5
6. Procurement · Purchasing	1	2	3	4	5

Q. 19 How much do the following factors weigh in construction of R&D strategy ?

	most important 1	sound imp. 2	can't say which 3	not really imp. 4	not imp. 5
1. The capability of the R&D department					
2. The importance of technology for your company's future	1	2	3	4	5
3. The existence of limitation in technological know-how	1	2	3	4	5
4. Costs required for breakthrough	1	2	3	4	5
5. The possibility of breakthrough	1	2	3	4	5
6. Relative R&D resources spending in comparison with rival companies	1	2	3	4	5
7. Competition over cost of products	1	2	3	4	5
8. Times and expenses required	1	2	3	4	5
9. Willingness of the researcher	1	2	3	4	5
10. Trends of rival companies	1	2	3	4	5
11. Trends in governmental, international projects	1	2	3	4	5
12. Product line	1	2	3	4	5
13. Manufacturing technology	1	2	3	4	5
14. States in the business circle	1	2	3	4	5
15. Market needs	1	2	3	4	5
16. Societal responsibility (environmental problems)	1	2	3	4	5

Q. 26 Using the spread of employees as a reference, what percentage of the R&D activity is devoted to basic research, applied research (development of new products, modification of existing products), development of new production methods, improvement of manufacturing process?

1. Basic	(1) Academic Research Research	1	(1)	%
	(2) Research on new technology		(2)	%
2. Applied	(1) Research concerning the Research development of new products	2	(1)	%
	(2) Research concerning the modification of existing products		(2)	%
3. Innovation of product technology		3		%
4. Improvement of the manufacturing process		4		%
5. Other	[]	5		%
		T.		100 %

Q. 27 What percentage of each of the following have been involved in proposing new topics for the research handled currently?

1. The researcher himself/herself	1	%	
2. The research leader	2	%	
3. The research group	3	%	
4. R&D managing department	4	%	
5. R&D head officer	5	%	
6. Sales department	6	%	
7. Marketing department	7	%	
8. President	8	%	
		T.	100 %

Q. 28 Concerning the research themes: What is the number of total propositions and actually followed research themes?

1. Annual total research theme propositions	1	themes
2. Actually handled research themes	2	themes

Q. 29 Concerning the choices of research themes, how do you grasp the technology trends unknown from open patents or documents?

Q. 30 In order to adopt to changes in the domain (rival company trends, size of market, emergence of alternative technology), does your company re-examine it's R&D strategy ? If so what or which department is involved?

1. The researcher privately re-examines the strategy.
2. The research group leader privately re-examines the strategy.
3. The research management department gives appropriate orders.
4. The research management dept. and marketing dept. re-examine the strategy together.
5. Re-examination orders come from the top.
6. Other []

Q. 31 Does your company rely on sources outside of the company for the designing of the research strategy?

- | | | |
|----------------------------|---------------------------------|----------------------------------|
| 1. Rely on outside sources | 2. Rely on associated companies | 3. Never rely on outside sources |
|----------------------------|---------------------------------|----------------------------------|

SQ.1 To those who answered 1 or 2.

What type of R&D strategies do you depend on outside sources to design ?

1. All of the company R&D strategy
2. Long term company R&D strategy
3. R&D strategy concerning new fields of research
4. R&D strategy concerning overseas points

1
2
3
4

Q. 35 About your company's attitude towards the researchers: How much do the following statement apply to it. Please circle appropriate number.

	Absolutely true	more or less	can't say much	not really	does not apply
1. Every researcher must make it his/her job to adhere to the annual research plan.	1	2	3	4	5
2. In order to conduct innovative research, granting independence to a researcher is very important.	1	2	3	4	5
3. As long as we can get good research results, we will not care the research process.	1	2	3	4	5
4. Under-ground research should be done aggressively.	1	2	3	4	5
5. It is important to get excellent research results, even if it takes a long time.	1	2	3	4	5
6. It is the job of the researcher to gather information related to his/her appointed research plan.	1	2	3	4	5
7. Researchers and engineers are different profession and therefore should be handled differently.	1	2	3	4	5
8. Supervision over researchers impedes the ability to think up clever ideas.	1	2	3	4	5
9. Researchers must adhere to regular working hours.	1	2	3	4	5
10. Researchers and office workers should be supervised in the same manner.	1	2	3	4	5

Q. 36 Please describe the evaluation system used for selecting themes by giving examples of themes chosen in the past.

Q. 37 In your company, how is the R&D budget planned ? Please choose the answer that applies best from below.

1. Following the research plan used on the outset, each research group appropriates their own budget.
2. Each research group appropriates their own budget, and then R&D management dept. reduces or increases expenditures according to the set budget.
3. After each research group appropriates their budget, the R&D management dept. adjusts each subtlety, and further, increases the funds for especially important research.
4. The R&D management dept. takes into regard subjective data accrued over the years, and then distributes the money to each research group.
5. The R&D management does the same as above, but is greatly influenced by the opinion of the sales dept.

Q. 38 Upon comparing your company and Western company R&D management , if you have seen any differences in the treatment of R&D management by top management, please share them with us in the space below.

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Again, thank you very much for your thoughtful cooperation.

Annex 2 Simple Aggregate Tables

Table 1 Position of Respondents (Q.1)

(Figure 1)

	Total (%)	Executive officer	General manager	Others	Unclear
Overall	126	45	57	24	0
	100	35.7	45.2	19.0	0.0

Table 2 Sections Where Respondents are Involved in R&D Strategy Development (Q.2)

(Figure 2)

	Total (%)	Overall company	Department	Division	Laboratory	Unclear
Overall	126	73	16	2	33	2
	100	57.9	12.7	1.6	26.2	1.6

Table 3 Breakdown of R&D Activities (According to Number of Research Themes) (Q.22)

(Figure 3)

	Total (%)	No. of responses	1 Basic research	2 Research concerning main operations	3 Research related to main operations	4 Research for new fields of operations	5 Other research categories	Unclear
Overall	126	116	11.3	46.4	24.1	16.8	1.4	10
	100.0	92.1						7.9

Table 4 Breakdown of R&D Activities (According to Allocation of Personnel) (Q.26)

(Figure 4)

	Total (%)	No. of responses	1 (1) Academic research	1 (2) New technology	2 (1) Development of new products	2 (2) Modification of existing products	3 Development of new manufacturing methods	4 Improvement of manufacturing processes	5 Other research categories	Unclear
Overall	126	115	3.3	9.7	40.8	26.3	9.5	8.5	1.9	11
	100.0	91.3								8.7

Table 5 Allocation of R&D Personnel (Q.24)

(Figure 5)

	Total (%)	No. of responses	1 Research within one's own company	2 Research following introduction of new technology	3 Trials	4 Other research categories	Unclear
Overall	126	115	79.6	9.0	10.0	1.4	11
	100.0	91.3					8.7

Table 6 Research Format by Theme (Q.23)

(Figure 6)

	Total (%)	No. of responses	1 Individual research	2 Cooperative research	3 Group research	4 External research projects	5 Commissioned research	6 Other research formats	Unclear
Overall	126	113	7.9	9.8	66.8	6.6	8.1	0.7	13
	100.0	89.7							10.3

Table 7 Standard Research Period (Q.21)

(Figure 7)

	Total (%)	1 1-2 years	2 3 years	3 5 years	4 10 years or longer	Unclear
Overall	126	14	63	39	5	5
	100.0	11.1	50.0	31.0	4.0	4.0

Table 8 Percentage of Annual Research Budget Allocated to New Research Themes (Q.8)

	Total (%)	No. of responses (%)	Unclear (%)	Average (%)
Overall	126	101	25	21.7
	100.0	80.2	19.8	

Table 9 Frequency of New Technology (Classified by Industry Type) (Q.10)
(Figure 8)

Industry type major category	Industry type sub category	Y-axis total (%)	X-axis total (%)	1 Very low	2	3	4 Medium	5	6	7 Very high	Unclear	Average
Overall	Overall	126 100.0	126 100.0	2 1.6	4 3.2	23 18.3	41 32.5	29 23.0	12 9.5	7 5.6	8 6.3	4.31
Construction industry	Construction	4 3.2	4 100.0	0 0.0	0 0.0	2 50.0	2 50.0	0 0.0	0 0.0	0 0.0	0 0.0	3.50
Consumption-related manufacturing industries	Food	4 3.2	4 100.0	1 25.0	0 0.0	3 75.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	2.50
	Textiles	4 3.2	4 100.0	0 0.0	0 0.0	0 0.0	2 50.0	2 50.0	0 0.0	0 0.0	0 0.0	4.50
	Sub-total	8 6.3	8 100.0	1 12.5	0 0.0	3 37.5	2 25.0	2 25.0	0 0.0	0 0.0	0 0.0	3.50
Material-related manufacturing industries	Chemicals	15 11.9	15 100.0	0 0.0	1 6.7	5 33.3	6 40.0	1 6.7	0 0.0	0 0.0	2 13.3	3.54
	Pharmaceuticals	10 7.9	10 100.0	0 0.0	0 0.0	1 10.0	3 30.0	4 40.0	1 10.0	1 10.0	0 0.0	4.80
	Paints and other chemicals	3 2.4	3 100.0	0 0.0	0 0.0	0 0.0	1 33.3	2 66.7	0 0.0	0 0.0	0 0.0	4.67
	Petroleum and rubber	5 4.0	5 100.0	0 0.0	0 0.0	1 20.0	2 40.0	0 0.0	1 20.0	0 0.0	1 20.0	4.25
	Glass and other ceramics	3 2.4	3 100.0	0 0.0	0 0.0	0 0.0	1 33.3	2 66.7	0 0.0	0 0.0	0 0.0	4.67
	General steel	5 4.0	5 100.0	0 0.0	0 0.0	3 60.0	1 20.0	0 0.0	0 0.0	0 0.0	1 20.0	3.25
	Non-ferrous metals and electric wire	5 4.0	5 100.0	0 0.0	0 0.0	1 20.0	3 60.0	1 20.0	0 0.0	0 0.0	0 0.0	4.00
Sub-total	46 36.5	46 100.0	0 0.0	1 2.2	11 23.9	17 37.0	10 21.7	2 4.3	1 2.2	4 8.7	4.10	
Machinery-related manufacturing industries	Industrial and other machinery	8 6.3	8 100.0	0 0.0	2 25.0	0 0.0	3 37.5	2 25.0	1 12.5	0 0.0	0 0.0	4.00
	Heavy electrical equipment	6 4.8	6 100.0	0 0.0	0 0.0	1 16.7	2 33.3	0 0.0	1 16.7	0 0.0	2 33.3	4.25
	Communications equipment	4 3.2	4 100.0	0 0.0	0 0.0	1 25.0	1 25.0	0 0.0	1 25.0	1 25.0	0 0.0	5.00
	Domestic appliances and component parts	10 7.9	10 100.0	0 0.0	0 0.0	0 0.0	2 20.0	5 50.0	1 10.0	2 20.0	0 0.0	5.30
	Metering and other electrical equipment	5 4.0	5 100.0	0 0.0	0 0.0	0 0.0	2 40.0	1 20.0	2 40.0	0 0.0	0 0.0	5.00
	Ship-building	3 2.4	3 100.0	0 0.0	0 0.0	0 0.0	2 66.7	0 0.0	1 33.3	0 0.0	0 0.0	4.67
	Motor vehicles	14 11.1	14 100.0	0 0.0	0 0.0	4 28.6	5 35.7	4 28.6	0 0.0	1 7.1	0 0.0	4.21
	Precision machinery	6 4.8	6 100.0	0 0.0	0 0.0	0 0.0	0 0.0	3 50.0	2 33.3	1 16.7	0 0.0	5.67
Sub-total	56 44.4	56 100.0	0 0.0	2 3.6	6 10.7	17 30.4	15 26.8	9 16.1	5 8.9	2 3.6	4.70	
Other manufacturing industries	Other manufacturing	3 2.4	3 100.0	0 0.0	0 0.0	0 0.0	1 33.3	1 33.3	1 33.3	0 0.0	0 0.0	5.00
Communications and public utilities	Broadcasting, communications, electric power, gas	9 7.1	9 100.0	1 11.1	1 11.1	1 11.1	2 22.2	1 11.1	0 0.0	1 11.1	2 22.2	3.71
Unclear		0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0.00

Table 10 Need for Change in Product Line (Q.11)

(Figure 9)

	Total (%)	1 Very low	2	3	4 Medium	5	6	7 Very high	Unclear	Average
Overall	126 100.0	3 2.4	12 9.5	10 7.9	36 28.6	34 27.0	22 17.5	4 3.2	5 4.0	4.39

Table 11 Existence of Separate Division for R&D Strategy Planning (Q.5)

(Figure 10)

	Total (%)	Have	Do not have	Unclear
Overall	126 100	82 65.1	42 33.3	2 1.6

Table 12 Section to Which the Special R&D Strategy Division Belongs (Q.5)

(Figure 11)

	Total (%)	Not applicable (%)	Applicable (%)	Office of the president	Business head-quarters	Research laboratory	Unclear
Overall	126 100	44 34.9	82 65.1	49 59.8	18 22.0	8 9.8	7 8.5

Table 13 Existence of Special R&D Strategy Divisions (Q.5)

(Figure 12)

(Classified by level of R&D spending)

	Y-axis total (%)	X-axis total (%)	Have	Do not have	Unclear
Overall	126 100.0	126 100.0	82 65.1	42 33.3	2 1.6
-10 bil. yen	12 9.5	12 100.0	8 66.7	4 33.3	0 0.0
10-15 bil. yen	30 23.8	30 100.0	16 53.3	14 46.7	0 0.0
15-20 bil. yen	19 15.1	19 100.0	13 68.4	6 31.6	0 0.0
20-30 bil. yen	26 20.6	26 100.0	17 65.4	9 34.6	0 0.0
30-50 bil. yen	18 14.3	18 100.0	13 72.2	4 22.2	1 5.6
50-100 bil. yen	8 6.3	8 100.0	6 75.0	2 25.0	0 0.0
100-200 billion yen	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
more than 200 bil. yen	9 7.1	9 100.0	7 77.8	2 22.2	0 0.0
Unclear	1 0.8	1 100.0	0 0.0	0 0.0	1 100.0

Table 14 Existence of Separate Divisions for R&D Strategy Planning (Q.5)
(Figure 13) (Classified by industry)

Industry type major category	Industry type sub-category	Y-axis total (%)	X-axis total (%)	Have separate division	Do not have separate division	Unclear
Overall	Overall	126 100.0	126 100.0	82 65.1	42 33.3	2 1.6
Construction industry	Construction	4 3.2	4 100.0	2 50.0	2 50.0	0 0.0
Consumption-related manufacturing industries	Food	4 3.2	4 100.0	2 50.0	2 50.0	0 0.0
	Textiles	4 3.2	4 100.0	4 100.0	0 0.0	0 0.0
	Sub-total	8 6.3	8 100.0	6 75.0	2 25.0	0 0.0
Material-related manufacturing industries	Chemicals	15 11.9	15 100.0	9 60.0	5 33.3	1 6.7
	Pharmaceuticals	10 7.9	10 100.0	6 60.0	4 40.0	0 0.0
	Paints and other chemicals	3 2.4	3 100.0	1 33.3	2 66.7	0 0.0
	Petroleum and rubber	5 4.0	5 100.0	1 20.0	3 60.0	1 20.0
	Glass and other ceramics	3 2.4	3 100.0	3 100.0	0 0.0	0 0.0
	General steel	5 4.0	5 100.0	4 80.0	1 20.0	0 0.0
	Non-ferrous metals and electric wire	5 4.0	5 100.0	4 80.0	1 20.0	0 0.0
	Sub-total	46 36.5	46 100.0	28 60.9	16 34.8	2 4.3
Machinery-related manufacturing industries	Industrial and other machinery	8 6.3	8 100.0	4 50.0	4 50.0	0 0.0
	Heavy electrical equipment	6 4.8	6 100.0	4 66.7	2 33.3	0 0.0
	Communications equipment	4 3.2	4 100.0	3 75.0	1 25.0	0 0.0
	Domestic appliances and component parts	10 7.9	10 100.0	6 60.0	4 40.0	0 0.0
	Metering and other electrical equipment	5 4.0	5 100.0	2 40.0	3 60.0	0 0.0
	Ship-building	3 2.4	3 100.0	3 100.0	0 0.0	0 0.0
	Motor vehicles	14 11.1	14 100.0	10 71.4	4 28.6	0 0.0
	Precision machinery	6 4.8	6 100.0	3 50.0	3 50.0	0 0.0
	Sub-total	56 44.4	56 100.0	35 62.5	21 37.5	0 0.0
Other manufacturing industries	Other manufacturing	3 2.4	3 100.0	3 100.0	0 0.0	0 0.0
Communications and public utilities	Broadcasting, communications, electric power, gas	9 7.1	9 100.0	8 88.9	1 11.1	0 0.0
	Unclear	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0

Table 15 Position of the R&D Division Head - 1981 (Q.13)
(Figure 14(1))

	Total (%)	President	Vice-president	Executive director	Managing director	Director	General manager	Unclear
Overall	126 100.0	2 1.6	9 7.1	24 19.0	44 34.9	27 21.4	18 14.29	2 1.59
Companies with separate division	82 100.0	1 1.2	7 8.5	15 18.3	30 36.6	19 23.2	10 12.20	0 0.00
Companies without separate division	42 100.0	1 2.4	2 4.8	9 21.4	14 33.3	8 19.0	8 19.05	0 0.00
Unclear	2	0	0	0	0	0	0	2

Table 16 Position of the R&D Division Head - 1991 (Q.13)
(Figure 14(2))

	Total (%)	President	Vice-president	Executive director	Managing director	Director	General manager	Unclear
Overall	126 100.0	5 4.0	20 15.9	28 22.2	40 31.7	20 15.9	11 8.73	2 1.59
Companies with separate division	82 100.0	2 2.4	12 14.6	24 29.3	26 31.7	12 14.6	6 7.32	0 0.00
Companies without separate division	42 100.0	3 7.1	8 19.0	4 9.5	14 33.3	8 19.0	5 11.90	0 0.00
Unclear	2	0	0	0	0	0	0	0

Table 17 Change in the Position of the R&D Division Head (Comparison between 1981 and 1991) (Q.13)
(Figure 15)

	Total (%)	Position upgraded	Position remained the same	Position downgraded	Unclear
Overall	126 100.0	54 42.9	53 42.1	17 13.5	2 1.6
Companies with separate division	82 100.0	34 41.5	39 47.6	9 11.0	0 0.0
Companies without separate division	42 100.0	20 47.6	14 33.3	8 19.0	0 0.0
Unclear	2	0	0	0	2

Table 18 Need to Improve R&D Efficiency (Q.12)
(Figure 16)

	Total (%)	There is a need	There is no need	Unclear
Overall	126 100.0	126 100.0	0 0.0	0 0.0
Companies with separate division	82 100.0	82 100.0	0 0.0	0 0.0
Companies without separate division	42 100.0	42 100.0	0 0.0	0 0.0
Unclear	2	2	0	0

Table 19 Measures to Improve R&D Efficiency (Q.12)
(Figure 17)

	Total (%)	Evaluating marketability of research themes	Facilitating technology transfer	Limiting research fields	Setting time-limits for research projects	Other measures	Unclear
Overall	126 100.0	24 19.0	26 20.6	70 55.6	1 0.8	1 0.8	4 3.17
Companies with separate division	82 100.0	16 19.5	16 19.5	46 56.1	1 1.2	0 0.0	3 3.66
Companies without separate division	42 100.0	8 19.0	10 23.8	22 52.4	0 0.0	1 2.4	1 2.38
Unclear	2	0	0	2	0	0	0

Table 20 Evaluating Investment Effectiveness of R&D (Q.9)
(Figure 18)

	Total (%)	Impossible to evaluate	Examining effective evaluation method	Already have an effective evaluation system	Unclear
Overall	126 100.0	23 18.3	86 68.3	14 11.1	3 2.4
Companies with separate division	82 100.0	14 17.1	57 69.5	10 12.2	1 1.2
Companies without separate division	42 100.0	9 21.4	29 69.0	4 9.5	0 0.0
Unclear	2	0	0	0	2

Table 21 Influence of Each Division on Matters that Affect Overall Company Performance (Q.16)
(Figures 19 & 20)

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence		
Sales and marketing	Overall	126 100.0	0 0.0	2 1.6	20 15.9	56 44.4	47 37.3	1 0.8	4.18
	Companies with separate division	82 100.0	0 0.0	0 0.0	12 14.6	38 46.3	32 39.0	0 0.0	4.24
	Companies without separate division	42 100.0	0 0.0	2 4.8	8 19.0	17 40.5	15 35.7	0 0.0	4.07
	Unclear	2	0	0	0	1	0	1	
Manufacturing	Overall	126 100.0	0 0.0	13 10.3	37 29.4	48 38.1	23 18.3	5 4.0	3.67
	Companies with separate division	82 100.0	0 0.0	5 6.1	26 31.7	32 39.0	15 18.3	4 4.9	3.73
	Companies without separate division	42 100.0	0 0.0	8 19.0	10 23.8	16 38.1	8 19.0	0 0.0	3.57
	Unclear	2	0	0	1	0	0	1	
R&D	Overall	126 100.0	2 1.6	20 15.9	32 25.4	41 32.5	29 23.0	2 1.6	3.60
	Companies with separate division	82 100.0	0 0.0	13 15.9	23 28.0	23 28.0	22 26.8	1 1.2	3.67
	Companies without separate division	42 100.0	2 4.8	7 16.7	9 21.4	17 40.5	7 16.7	0 0.0	3.48
	Unclear	2	0	0	0	1	0	1	
President's office and planning	Overall	126 100.0	4 3.2	15 11.9	32 25.4	50 39.7	23 18.3	2 1.6	3.59
	Companies with separate division	82 100.0	1 1.2	8 9.8	20 24.4	37 45.1	16 19.5	0 0.0	3.72
	Companies without separate division	42 100.0	3 7.1	7 16.7	12 28.6	12 28.6	7 16.7	1 2.4	3.32
	Unclear	2	0	0	0	1	0	1	
Finance and accounting	Overall	126 100.0	0 0.0	23 18.3	48 38.1	45 35.7	9 7.1	1 0.8	3.32
	Companies with separate division	82 100.0	0 0.0	14 17.1	30 36.6	30 36.6	8 9.8	0 0.0	3.39
	Companies without separate division	42 100.0	0 0.0	9 21.4	18 42.9	14 33.3	1 2.4	0 0.0	3.17
	Unclear	2	0	0	0	1	0	1	
Supplies and purchasing	Overall	126 100.0	7 5.6	53 42.1	39 31.0	22 17.5	3 2.4	2 1.6	2.69
	Companies with separate division	82 100.0	4 4.9	32 39.0	27 32.9	15 18.3	3 3.7	1 1.2	2.77
	Companies without separate division	42 100.0	2 4.8	21 50.0	12 28.6	7 16.7	0 0.0	0 0.0	2.57
	Unclear	2	1	0	0	0	0	1	
General affairs, personnel, and labor management	Overall	126 100.0	11 8.7	46 36.5	51 40.5	14 11.1	3 2.4	1 0.8	2.62
	Companies with separate division	82 100.0	6 7.3	26 31.7	37 45.1	12 14.6	1 1.2	0 0.0	2.71
	Companies without separate division	42 100.0	4 9.5	20 47.6	14 33.3	2 4.8	2 4.8	0 0.0	2.48
	Unclear	2	1	0	0	0	0	1	

Table 22 Methods of Formulating R&D Budget Plans (Q.37)
(Figure 21)

	Total (%)	Each research group calculates its own budget requirements	Uniformly increased or reduced	Additional funds appropriated under a separate framework for research regarded as important	Needs evaluated based on objective data and funds allocated according to priorities	Views of marketing division are greatly reflected in funds allocation	Unclear
Overall	126 100.0	6 4.8	28 22.2	74 58.7	15 11.9	0 0.0	3 2.4
Companies with separate division	82 100.0	2 2.4	17 20.7	52 63.4	9 11.0	0 0.0	2 2.4
Companies without separate division	42 100.0	4 9.5	11 26.2	22 52.4	5 11.9	0 0.0	0 0.0
Unclear	2	0	0	0	1	0	1

Table 23 Company Research Plan (Q.6)
(Figure 22)

	Total (%)	Prepare a plan	Do not prepare a plan	Unclear
Overall	126 100.0	102 81.0	19 15.1	5 4.0
Companies with separate division	82 100.0	69 84.1	10 12.2	3 3.7
Companies without separate division	42 100.0	32 76.2	9 21.4	1 2.4
Unclear	2	1	0	1

Table 24 Period of Company Research Plan (Q.6)
(Figure 23)

	Total	Applicable (%)	3 years	5 years	10 years	15 years or more	Unclear	Not applicable
Overall	126	102 100.0	41 40.2	50 49.0	10 9.8	0 0.0	1 1.0	24
Companies with separate division	82	69 100.0	28 40.6	34 49.3	7 10.1	0 0.0	0 0.0	13
Companies without separate division	42	32 100.0	13 40.6	16 50.0	3 9.4	0 0.0	0 0.0	10
Unclear	2	1	0	0	0	0	1	1

Table 25 Responsibility for Preparation of Company Research Plan (Q.6)
(Figure 24)

	Total	Applicable (%)	Researcher	Research leader	Research management officer	Head of research management division	Research management director	Company president	Unclear	Not applicable
Overall	126	102 100.0	1 1.0	28 27.5	5 4.9	33 32.4	33 32.4	0 0.0	2 2.0	24
Companies with separate division	82	69 100.0	0 0.0	17 24.6	4 5.8	23 33.3	25 36.2	0 0.0	0 0.0	13
Companies without separate division	42	32 100.0	1 3.1	11 34.4	1 3.1	10 31.3	8 25.0	0 0.0	1 3.1	10
Unclear	2	1	0	0	0	0	0	0	1	1

Table 26 Approving Authority for Company Research Plan (Q.6)
(Figure 25)

	Total	Applicable (%)	Company president	Responsible director	Other director	Head of research management division	Unclear	Not applicable
Overall	126	102 100.0	36 35.3	58 56.9	2 2.0	6 5.9	0 0.0	24
Companies with separate division	82	69 100.0	23 33.3	41 59.4	1 1.4	4 5.8	0 0.0	13
Companies without separate division	42	32 100.0	12 37.5	17 53.1	1 3.1	2 6.3	0 0.0	10
Unclear	2	1	1	0	0	0	0	1

Table 27 Formulation of Company Research Strategy (Q.7)
(Figure 26)

	Total (%)	Formulate strategy	Do not formulate strategy	Unclear
Overall	126 100.0	95 75.4	23 18.3	8 6.3
Companies with separate division	82 100.0	73 89.0	7 8.5	2 2.4
Companies without separate division	42 100.0	21 50.0	16 38.1	5 11.9
Unclear	2	1	0	1

Table 28 Period of Company Research Strategy (Q.7)
(Figure 27)

	Total	Applicable (%)	3 years	5 years	10 years	15 years or more	Unclear	Not applicable
Overall	126	95 100.0	18 18.9	41 43.2	33 34.7	1 1.1	2 2.1	31
Companies with separate division	82	73 100.0	16 21.9	26 35.6	29 39.7	1 1.4	1 1.4	9
Companies without separate division	42	21 100.0	2 9.5	15 71.4	4 19.0	0 0.0	0 0.0	21
Unclear	2	1	0	0	0	0	1	1

Table 29 Responsibility for Formulation of Company Research Strategy (Q.7)
(Figure 28)

	Total	Applicable (%)	Researcher	Research leader	Research management officer	Head of research management division	Research management director	Company president	Unclear	Not applicable
Overall	126	95 100.0	0 0.0	6 6.3	3 3.2	31 32.6	51 53.7	2 2.1	2 2.1	31
Companies with separate division	82	73 100.0	0 0.0	4 5.5	2 2.7	25 34.2	40 54.8	2 2.7	0 0.0	9
Companies without separate division	42	21 100.0	0 0.0	2 9.5	1 4.8	6 28.6	11 52.4	0 0.0	1 4.8	21
Unclear	2	1	0	0	0	0	0	0	1	1

Table 30 Approving Authority for Company Research Strategy (Q.7)
(Figure 29)

	Total	Applicable (%)	Company president	Responsible director	Other director	Head of research management division	Unclear	Not applicable
Overall	126	95 100.0	52 54.7	39 41.1	1 1.1	2 2.1	1 1.1	31
Companies with separate division	82	73 100.0	40 54.8	31 42.5	0 0.0	2 2.7	0 0.0	9
Companies without separate division	42	21 100.0	11 52.4	8 38.1	1 4.8	0 0.0	1 4.8	21
Unclear	2	1	1	0	0	0	0	1

Table 31 Considerations in the Formulation of R&D Strategy (1) (Q.19)

(Figures 30 & 31)

Item		Total (%)	1	2	3	4	5	Unclear	Average
			Very important	Important	Cannot say either way	Not very important	Not important		
Importance of technology	Overall	126 100.0	72 57.1	49 38.9	2 1.6	1 0.8	0 0.0	2 1.6	1.45
	Companies with separate division	82 100.0	53 64.6	26 31.7	1 1.2	1 1.2	0 0.0	1 1.2	1.38
	Companies without separate division	42 100.0	18 42.9	23 54.8	1 2.4	0 0.0	0 0.0	0 0.0	1.60
	Unclear	2	1	0	0	0	0	1	
Market needs	Overall	126 100.0	59 46.8	60 47.6	5 4.0	0 0.0	0 0.0	2 1.6	1.56
	Companies with separate division	82 100.0	41 50.0	36 43.9	4 4.9	0 0.0	0 0.0	1 1.2	1.54
	Companies without separate division	42 100.0	17 40.5	24 57.1	1 2.4	0 0.0	0 0.0	0 0.0	1.62
	Unclear	2	1	0	0	0	0	1	
Capability of R&D division	Overall	126 100.0	59 46.8	57 45.2	5 4.0	4 3.2	0 0.0	1 0.8	1.63
	Companies with separate division	82 100.0	42 51.2	35 42.7	3 3.7	2 2.4	0 0.0	0 0.0	1.57
	Companies without separate division	42 100.0	17 40.5	21 50.0	2 4.8	2 4.8	0 0.0	0 0.0	1.74
	Unclear	2	0	1	0	0	0	1	
Product cost competitiveness	Overall	126 100.0	42 33.3	64 50.8	15 11.9	4 3.2	0 0.0	1 0.8	1.85
	Companies with separate division	82 100.0	32 39.0	42 51.2	5 6.1	3 3.7	0 0.0	0 0.0	1.74
	Companies without separate division	42 100.0	9 21.4	22 52.4	10 23.8	1 2.4	0 0.0	0 0.0	2.07
	Unclear	2	1	0	0	0	0	1	
Social responsibility	Overall	126 100.0	33 26.2	74 58.7	16 12.7	1 0.8	0 0.0	2 1.6	1.88
	Companies with separate division	82 100.0	26 31.7	44 53.7	11 13.4	0 0.0	0 0.0	1 1.2	1.81
	Companies without separate division	42 100.0	6 14.3	30 71.4	5 11.9	1 2.4	0 0.0	0 0.0	2.02
	Unclear	2	1	0	0	0	0	1	
Trends of competitors	Overall	126 100.0	27 21.4	85 67.5	12 9.5	1 0.8	0 0.0	1 0.8	1.90
	Companies with separate division	82 100.0	18 22.0	58 70.7	5 6.1	1 1.2	0 0.0	0 0.0	1.87
	Companies without separate division	42 100.0	9 21.4	27 64.3	6 14.3	0 0.0	0 0.0	0 0.0	1.93
	Unclear	2	0	0	1	0	0	1	
Cost and period required	Overall	126 100.0	28 22.2	80 63.5	11 8.7	5 4.0	0 0.0	2 1.6	1.94
	Companies with separate division	82 100.0	21 25.6	53 64.6	5 6.1	2 2.4	0 0.0	1 1.2	1.85
	Companies without separate division	42 100.0	7 16.7	26 61.9	6 14.3	3 7.1	0 0.0	0 0.0	2.12
	Unclear	2	0	1	0	0	0	1	
Researchers' enthusiasm	Overall	126 100.0	32 25.4	66 52.4	22 17.5	4 3.2	0 0.0	2 1.6	1.98
	Companies with separate division	82 100.0	23 28.0	44 53.7	13 15.9	2 2.4	0 0.0	0 0.0	1.93
	Companies without separate division	42 100.0	9 21.4	22 52.4	8 19.0	2 4.8	0 0.0	1 2.4	2.07
	Unclear	2	0	0	1	0	0	1	

Table 32 Considerations in the Formulation of R&D Strategy (2) (Q.19)
(Figures 30 & 31)

Item		Total (%)	1	2	3	4	5	Unclear	Average
			Very important	Important	Cannot say either way	Not very important	Not important		
Production technology	Overall	126 100.0	16 12.7	84 66.7	19 15.1	6 4.8	0 0.0	1 0.8	2.12
	Companies with separate division	82 100.0	13 15.9	54 65.9	10 12.2	5 6.1	0 0.0	0 0.0	2.09
	Companies without separate division	42 100.0	3 7.1	29 69.0	9 21.4	1 2.4	0 0.0	0 0.0	2.19
	Unclear	2	0	1	0	0	0	1	
Possibility of achieving a breakthrough	Overall	126 100.0	17 13.5	79 62.7	23 18.3	4 3.2	2 1.6	1 0.8	2.16
	Companies with separate division	82 100.0	10 12.2	57 69.5	13 15.9	2 2.4	0 0.0	0 0.0	2.09
	Companies without separate division	42 100.0	7 16.7	21 50.0	10 23.8	2 4.8	2 4.8	0 0.0	2.31
	Unclear	2	0	1	0	0	0	1	
Position in industrial circles	Overall	126 100.0	17 13.5	76 60.3	23 18.3	8 6.3	0 0.0	2 1.6	2.18
	Companies with separate division	82 100.0	9 11.0	54 65.9	13 15.9	5 6.1	0 0.0	1 1.2	2.17
	Companies without separate division	42 100.0	7 16.7	22 52.4	10 23.8	3 7.1	0 0.0	0 0.0	2.21
	Unclear	2	1	0	0	0	0	1	
Product line	Overall	126 100.0	16 12.7	68 54.0	35 27.8	4 3.2	1 0.8	2 1.6	2.24
	Companies with separate division	82 100.0	13 15.9	45 54.9	19 23.2	3 3.7	1 1.2	1 1.2	2.19
	Companies without separate division	42 100.0	3 7.1	22 52.4	16 38.1	1 2.4	0 0.0	0 0.0	2.36
	Unclear	2	0	1	0	0	0	1	
Costs required to achieve a breakthrough	Overall	126 100.0	3 2.4	62 49.2	43 34.1	16 12.7	1 0.8	1 0.8	2.60
	Companies with separate division	82 100.0	3 3.7	45 54.9	27 32.9	7 8.5	0 0.0	0 0.0	2.46
	Companies without separate division	42 100.0	0 0.0	17 40.5	15 35.7	9 21.4	1 2.4	0 0.0	2.86
	Unclear	2	0	0	1	0	0	1	
Resources spending relative to that of the competitors	Overall	126 100.0	6 4.8	55 43.7	47 37.3	13 10.3	4 3.2	1 0.8	2.63
	Companies with separate division	82 100.0	5 6.1	36 43.9	33 40.2	7 8.5	1 1.2	0 0.0	2.55
	Companies without separate division	42 100.0	1 2.4	18 42.9	14 33.3	6 14.3	3 7.1	0 0.0	2.81
	Unclear	2	0	1	0	0	0	1	
Limitations in technology	Overall	126 100.0	5 4.0	50 39.7	57 45.2	12 9.5	1 0.8	1 0.8	2.63
	Companies with separate division	82 100.0	4 4.9	36 43.9	34 41.5	8 9.8	0 0.0	0 0.0	2.56
	Companies without separate division	42 100.0	1 2.4	13 31.0	23 54.8	4 9.5	1 2.4	0 0.0	2.79
	Unclear	2	0	1	0	0	0	1	
Trends in national and international projects	Overall	126 100.0	5 4.0	49 38.9	54 42.9	16 12.7	1 0.8	1 0.8	2.67
	Companies with separate division	82 100.0	5 6.1	36 43.9	32 39.0	9 11.0	0 0.0	0 0.0	2.55
	Companies without separate division	42 100.0	0 0.0	13 31.0	22 52.4	6 14.3	1 2.4	0 0.0	2.88
	Unclear	2	0	0	0	1	0	1	

Table 33 Responsibility for Review of R&D Strategy (Q.30)

(Figure 32)

	Total (%)	Individual researcher	Research group leader	Research management division	Research management division and marketing division review R&D strategy together	Review carried out under instructions of senior management	Others	Unclear
Overall	126 100.0	1 0.8	14 11.1	28 22.2	39 31.0	19 15.1	18 14.3	7 5.6
Companies with separate division	82 100.0	0 0.0	7 8.5	21 25.6	29 35.4	13 15.9	8 9.8	4 4.9
Companies without separate division	42 100.0	1 2.4	7 16.7	7 16.7	10 23.8	6 14.3	10 23.8	1 2.4
Unclear	2	0	0	0	0	0	0	2

Table 34 Necessity of Consortia (Q.14)

(Figure 33)

	Total (%)	Necessary	Not necessary	Unclear
Overall	126 100.0	83 65.9	39 31.0	4 3.2
Companies with separate division	82 100.0	61 74.4	19 23.2	2 2.4
Companies without separate division	42 100.0	21 50.0	20 47.6	1 2.4
Unclear	2	1	0	1

Table 35 Necessity of Consortia (Classified by Scale of R&D Expenditure) (Q.14)

(Figure 34)

	Y-axis total (%)	X-axis total (%)	Necessary	Not necessary	Unclear
Overall	126 100.0	126 100.0	83 65.9	39 31.0	4 3.2
-10 bil. yen	12 9.5	12 100.0	9 75.0	2 16.7	1 8.3
10-15 bil. yen	30 23.8	30 100.0	23 76.7	7 23.3	0 0.0
15-20 bil. yen	19 15.1	19 100.0	13 68.4	6 31.6	0 0.0
20-30 bil. yen	26 20.6	26 100.0	14 53.8	11 42.3	1 3.8
30-50 bil. yen	18 14.3	18 100.0	13 72.2	5 27.8	0 0.0
50-100 bil. yen	8 6.3	8 100.0	5 62.5	3 37.5	0 0.0
100-200 billion yen	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
more than 200 bil. yen	9 7.1	9 100.0	4 44.4	4 44.4	1 11.1
Unclear	1 0.8	1 100.0	0 0.0	0 0.0	1 100.0

Table 36 Necessity of Consortia (Classified by Industry Type) (Q.14)

(Figure 35)

Industry type major category	Industry type sub-category	Y-axis total (%)	X-axis total (%)	Necessary	Not necessary	Unclear
Overall	Overall	126 100.0	126 100.0	83 65.9	39 31.0	4 3.2
Construction industry	Construction	4 3.2	4 100.0	4 100.0	0 0.0	0 0.0
Consumption-related manufacturing industries	Food	4 3.2	4 100.0	2 50.0	2 50.0	0 0.0
	Textiles	4 3.2	4 100.0	4 100.0	0 0.0	0 0.0
	Sub-total	8 6.3	8 100.0	6 75.0	2 25.0	0 0.0
Material-related manufacturing industries	Chemicals	15 11.9	15 100.0	7 46.7	8 53.3	0 0.0
	Pharmaceuticals	10 7.9	10 100.0	6 60.0	3 30.0	1 10.0
	Paints and other chemicals	3 2.4	3 100.0	3 100.0	0 0.0	0 0.0
	Petroleum and rubber	5 4.0	5 100.0	3 60.0	1 20.0	1 20.0
	Glass and other ceramics	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
	General steel	5 4.0	5 100.0	4 80.0	1 20.0	0 0.0
	Non-ferrous metals and electric wire	5 4.0	5 100.0	4 80.0	1 20.0	0 0.0
Sub-total	46 36.5	46 100.0	29 63.0	15 32.6	2 4.3	
Machinery-related manufacturing industries	Industrial and other machinery	8 6.3	8 100.0	5 62.5	3 37.5	0 0.0
	Heavy electrical equipment	6 4.8	6 100.0	5 83.3	1 16.7	0 0.0
	Communications equipment	4 3.2	4 100.0	3 75.0	1 25.0	0 0.0
	Domestic appliances and component parts	10 7.9	10 100.0	5 50.0	4 40.0	1 10.0
	Metering and other electrical equipment	5 4.0	5 100.0	0 0.0	4 80.0	1 20.0
	Ship-building	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
	Motor vehicles	14 11.1	14 100.0	9 64.3	5 35.7	0 0.0
	Precision machinery	6 4.8	6 100.0	5 83.3	1 16.7	0 0.0
Sub-total	56 44.4	56 100.0	34 60.7	20 35.7	2 3.6	
Other manufacturing industries	Other manufacturing	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
Communications and public utilities	Broadcasting, communications, electric power, gas	9 7.1	9 100.0	8 88.9	1 11.1	0 0.0
Unclear		0 0.0	0 0.0	0 0.0	0 0.0	0 0.0

Table 37 Participation in Consortia (Q.14)
(Figure 36)

	Total (%)	Have participated	Have not participated	Unclear
Overall	126 100.0	60 47.6	60 47.6	6 4.8
Companies with separate division	82 100.0	43 52.4	37 45.1	2 2.4
Companies without separate division	42 100.0	16 38.1	23 54.8	3 7.1
Unclear	2	1	0	1

Table 38 Participation in Consortia (Classified by Scale of R&D Expenditure) (Q.14)
(Figure 37)

	Y-axis total (%)	X-axis total (%)	Have participated	Have not participated	Unclear
Overall	126 100.0	126 100.0	60 47.6	60 47.6	6 4.8
-10 bil. yen	12 9.5	12 100.0	3 25.0	8 66.7	1 8.3
10-15 bil. yen	30 23.8	30 100.0	11 36.7	18 60.0	1 3.3
15-20 bil. yen	19 15.1	19 100.0	11 57.9	8 42.1	0 0.0
20-30 bil. yen	26 20.6	26 100.0	15 57.7	9 34.6	2 7.7
30-50 bil. yen	18 14.3	18 100.0	11 61.1	7 38.9	0 0.0
50-100 bil. yen	8 6.3	8 100.0	3 37.5	5 62.5	0 0.0
100-200 billion yen	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
more than 200 bil. yen	9 7.1	9 100.0	4 44.4	4 44.4	1 11.1
Unclear	1 0.8	1 100.0	0 0.0	0 0.0	1 100.0

Table 39 Participation in Consortia (Classified by Industry Type) (Q.14)
(Figure 38)

Industry type major category	Industry type sub-category	Y-axis total (%)	X-axis total (%)	Have participated	Have not participated	Unclear
Overall	Overall	126 100.0	126 100.0	60 47.6	60 47.6	6 4.8
Construction industry	Construction	4 3.2	4 100.0	3 75.0	1 25.0	0 0.0
Consumption-related manufacturing industries	Food	4 3.2	4 100.0	2 50.0	2 50.0	0 0.0
	Textiles	4 3.2	4 100.0	1 25.0	3 75.0	0 0.0
	Sub-total	8 6.3	8 100.0	3 37.5	5 62.5	0 0.0
Material-related manufacturing industries	Chemicals	15 11.9	15 100.0	5 33.3	10 66.7	0 0.0
	Pharmaceuticals	10 7.9	10 100.0	5 50.0	4 40.0	1 10.0
	Paints and other chemicals	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
	Petroleum and rubber	5 4.0	5 100.0	2 40.0	2 40.0	1 20.0
	Glass and other ceramics	3 2.4	3 100.0	1 33.3	2 66.7	0 0.0
	General steel	5 4.0	5 100.0	4 80.0	1 20.0	0 0.0
	Non-ferrous metals and electric wire	5 4.0	5 100.0	3 60.0	2 40.0	0 0.0
	Sub-total	46 36.5	46 100.0	22 47.8	22 47.8	2 4.3
Machinery-related manufacturing industries	Industrial and other machinery	8 6.3	8 100.0	1 12.5	6 75.0	1 12.5
	Heavy electrical equipment	6 4.8	6 100.0	6 100.0	0 0.0	0 0.0
	Communications equipment	4 3.2	4 100.0	1 25.0	3 75.0	0 0.0
	Domestic appliances and component parts	10 7.9	10 100.0	5 50.0	4 40.0	1 10.0
	Metering and other electrical equipment	5 4.0	5 100.0	0 0.0	4 80.0	1 20.0
	Ship-building	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
	Motor vehicles	14 11.1	14 100.0	7 50.0	7 50.0	0 0.0
	Precision machinery	6 4.8	6 100.0	3 50.0	2 33.3	1 16.7
Sub-total	56 44.4	56 100.0	25 44.6	27 48.2	4 7.1	
Other manufacturing industries	Other manufacturing	3 2.4	3 100.0	2 66.7	1 33.3	0 0.0
Communications and public utilities	Broadcasting, communications, electric power, gas	9 7.1	9 100.0	5 55.6	4 44.4	0 0.0
Unclear		0 0.0	0 0.0	0 0.0	0 0.0	0 0.0

Table 40 Motivation to Participate in Consortia (Q.14)
(Figure 39)

	Total	Applicable (%)	To expand the company's R&D capability	Independent research is too expensive	To establish an operational base overseas	Others	Unclear	Not applicable
Overall	126	60 100.0	37 61.7	15 25.0	2 3.3	2 3.3	4 6.7	66
Companies with separate division	82	43 100.0	26 60.5	12 27.9	1 2.3	1 2.3	3 7.0	39
Companies without separate division	42	16 100.0	10 62.5	3 18.8	1 6.3	1 6.3	1 6.3	26
Unclear	2	1	1	0	0	0	0	1

Table 41 Nationalities of Participating Companies (Q.14)
(Figure 40)

	Total	Applicable (%)	Japanese	American	European	Japanese & American	Japanese & European	Japanese, American & European	Others	Unclear	Not applicable
Overall	126	60 100.0	31 51.7	7 11.7	3 5.0	5 8.3	1 1.7	11 18.3	1 1.7	1 1.7	66
Companies with separate division	82	43 100.0	18 41.9	5 11.6	3 7.0	4 9.3	1 2.3	10 23.3	1 2.3	1 2.3	39
Companies without separate division	42	16 100.0	13 81.3	2 12.5	0 0.0	0 0.0	0 0.0	1 6.3	0 0.0	0 0.0	26
Unclear	2		0	0	0	1	0	0	0	0	1

Table 42 Success of Consortia (Q.14)
(Figure 41)

	Total	Applicable (%)	Succeeded	Did not succeed	Unclear	Not applicable
Overall	126	60 100.0	30 50.0	5 8.3	25 41.7	66
Companies with separate division	82	43 100.0	24 55.8	3 7.0	16 37.2	39
Companies without separate division	42	16 100.0	5 31.3	2 12.5	9 56.3	26
Unclear	2	1	1	0	0	1

Table 43 Technology Flow Between Stages (Q.33)
(Figures 42 & 43)

Item		Total (%)	1	2	3	4	5	Unclear	Average
			Very applicable	More or less applicable	Cannot say either way	Not very applicable	Not applicable		
1. The researcher steers his/her own research through the development and production stages	Overall	126 100.0	3 2.4	43 34.1	41 32.5	26 20.6	12 9.5	1 0.8	3.01
	Companies with separate division	82 100.0	2 2.4	25 30.5	24 29.3	22 26.8	9 11.0	0 0.0	3.13
	Companies without separate division	42 100.0	1 2.4	18 42.9	16 38.1	4 9.5	3 7.1	0 0.0	2.76
	Unclear	2	0	0	1	0	0	1	
2. Responsibility for the technology is passed on to a different person at each stage	Overall	126 100.0	13 10.3	49 38.9	33 26.2	29 23.0	1 0.8	1 0.8	2.65
	Companies with separate division	82 100.0	10 12.2	36 43.9	18 22.0	18 22.0	0 0.0	0 0.0	2.54
	Companies without separate division	42 100.0	3 7.1	13 31.0	14 33.3	11 26.2	1 2.4	0 0.0	2.86
	Unclear	2	0	0	1	0	0	1	
3. The views of the development, marketing and sales divisions are fully reflected in the selection of research themes to facilitate technology flow through each stage	Overall	126 100.0	9 7.1	48 38.1	43 34.1	18 14.3	6 4.8	2 1.6	2.71
	Companies with separate division	82 100.0	8 9.8	35 42.7	27 32.9	8 9.8	4 4.9	0 0.0	2.57
	Companies without separate division	42 100.0	1 2.4	12 28.6	16 38.1	10 23.8	2 4.8	1 2.4	3.00
	Unclear	2	0	1	0	0	0	1	
4. Ample time and close liaison is necessary for the smooth hand-over of the technology between stages	Overall	126 100.0	43 34.1	50 39.7	22 17.5	6 4.8	0 0.0	5 4.0	1.93
	Companies with separate division	82 100.0	33 40.2	30 36.6	15 18.3	3 3.7	0 0.0	1 1.2	1.85
	Companies without separate division	42 100.0	10 23.8	19 45.2	7 16.7	3 7.1	0 0.0	3 7.1	2.08
	Unclear	2	0	1	0	0	0	1	

Table 44 Degree of Contact Between R&D Division and Other Divisions (Q.17)
(Figures 44 & 45)

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no contact	Meetings held half-yearly	Meetings held monthly	Meetings held weekly	Contact on a daily basis		
Manufacturing	Overall	126 100.0	8 6.3	18 14.3	42 33.3	9 7.1	43 34.1	6 4.8	3.51
	Companies with separate division	82 100.0	3 3.7	14 17.1	27 32.9	5 6.1	29 35.4	4 4.9	3.55
	Companies without separate division	42 100.0	5 11.9	4 9.5	15 35.7	4 9.5	13 31.0	1 2.4	3.39
	Unclear	2	0	0	0	0	1	1	
Sales and marketing	Overall	126 100.0	14 11.1	24 19.0	39 31.0	10 7.9	36 28.6	3 2.4	3.24
	Companies with separate division	82 100.0	10 12.2	16 19.5	24 29.3	7 8.5	24 29.3	1 1.2	3.23
	Companies without separate division	42 100.0	4 9.5	8 19.0	15 35.7	3 7.1	11 26.2	1 2.4	3.22
	Unclear	2	0	0	0	0	1	1	
President's office and planning	Overall	126 100.0	8 6.3	38 30.2	38 30.2	5 4.0	33 26.2	4 3.2	3.14
	Companies with separate division	82 100.0	4 4.9	25 30.5	25 30.5	3 3.7	25 30.5	0 0.0	3.24
	Companies without separate division	42 100.0	4 9.5	13 31.0	13 31.0	2 4.8	7 16.7	3 7.1	2.87
	Unclear	2	0	0	0	0	1	1	
General affairs, personnel, and labor management	Overall	126 100.0	20 15.9	57 45.2	23 18.3	5 4.0	18 14.3	3 2.4	2.54
	Companies with separate division	82 100.0	12 14.6	41 50.0	17 20.7	3 3.7	8 9.8	1 1.2	2.43
	Companies without separate division	42 100.0	8 19.0	16 38.1	6 14.3	2 4.8	9 21.4	1 2.4	2.71
	Unclear	2	0	0	0	0	1	1	
Supplies and purchasing	Overall	126 100.0	52 41.3	36 28.6	17 13.5	6 4.8	12 9.5	3 2.4	2.11
	Companies with separate division	82 100.0	34 41.5	24 29.3	10 12.2	3 3.7	10 12.2	1 1.2	2.15
	Companies without separate division	42 100.0	17 40.5	12 28.6	7 16.7	3 7.1	2 4.8	1 2.4	2.05
	Unclear	2	1	0	0	0	0	1	
Finance and accounting	Overall	126 100.0	31 24.6	65 51.6	16 12.7	4 3.2	7 5.6	3 2.4	2.11
	Companies with separate division	82 100.0	21 25.6	45 54.9	9 11.0	3 3.7	4 4.9	0 0.0	2.07
	Companies without separate division	42 100.0	10 23.8	20 47.6	7 16.7	1 2.4	2 4.8	2 4.8	2.13
	Unclear	2	0	0	0	0	1	1	

Table 45 Influence of Other Divisions in the Formulation of R&D Strategy (Q.18)

(Figures 46 & 47)

(1) Establishment of Research Facilities

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence		
President's office and planning	Overall	126 100.0	6 4.8	11 8.7	23 18.3	49 38.9	33 26.2	4 3.2	3.75
	Companies with separate division	82 100.0	3 3.7	6 7.3	9 11.0	36 43.9	27 32.9	1 1.2	3.96
	Companies without separate division	42 100.0	3 7.1	4 9.5	14 33.3	13 31.0	6 14.3	2 4.8	3.38
	Unclear	2	0	1	0	0	0	1	
Finance and accounting	Overall	126 100.0	13 10.3	29 23.0	42 33.3	32 25.4	8 6.3	2 1.6	2.94
	Companies with separate division	82 100.0	9 11.0	20 24.4	22 26.8	24 29.3	6 7.3	1 1.2	2.98
	Companies without separate division	42 100.0	4 9.5	9 21.4	20 47.6	8 19.0	1 2.4	0 0.0	2.83
	Unclear	2	0	0	0	0	1	1	
General affairs, personnel, and labor management	Overall	126 100.0	12 9.5	46 36.5	40 31.7	24 19.0	1 0.8	3 2.4	2.64
	Companies with separate division	82 100.0	6 7.3	30 36.6	24 29.3	20 24.4	0 0.0	2 2.4	2.73
	Companies without separate division	42 100.0	6 14.3	16 38.1	15 35.7	4 9.5	1 2.4	0 0.0	2.48
	Unclear	2	0	0	1	0	0	1	
Manufacturing	Overall	126 100.0	36 28.6	40 31.7	26 20.6	19 15.1	1 0.8	4 3.2	2.25
	Companies with separate division	82 100.0	17 20.7	31 37.8	16 19.5	14 17.1	1 1.2	3 3.7	2.38
	Companies without separate division	42 100.0	19 45.2	9 21.4	10 23.8	4 9.5	0 0.0	0 0.0	1.98
	Unclear	2	0	0	0	1	0	1	
Sales and marketing	Overall	126 100.0	44 34.9	36 28.6	23 18.3	17 13.5	4 3.2	2 1.6	2.20
	Companies with separate division	82 100.0	28 34.1	25 30.5	16 19.5	9 11.0	3 3.7	1 1.2	2.19
	Companies without separate division	42 100.0	16 38.1	10 23.8	7 16.7	8 19.0	1 2.4	0 0.0	2.24
	Unclear	2	0	1	0	0	0	1	
Supplies and purchasing	Overall	126 100.0	71 56.3	38 30.2	12 9.5	2 1.6	0 0.0	3 2.4	1.55
	Companies with separate division	82 100.0	49 59.8	24 29.3	6 7.3	2 2.4	0 0.0	1 1.2	1.52
	Companies without separate division	42 100.0	21 50.0	14 33.3	6 14.3	0 0.0	0 0.0	1 2.4	1.63
	Unclear	2	1	0	0	0	0	1	

Table 46 Influence of Other Divisions in the Formulation of R&D Strategy (Q.18)
(Figures 48 & 49) (2) Hiring of New Graduates

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence		
General affairs, personnel, and labor management	Overall	126 100.0	0 0.0	9 7.1	9 7.1	54 42.9	52 41.3	2 1.6	4.20
	Companies with separate division	82 100.0	0 0.0	3 3.7	7 8.5	33 40.2	38 46.3	1 1.2	4.31
	Companies without separate division	42 100.0	0 0.0	6 14.3	2 4.8	20 47.6	14 33.3	0 0.0	4.00
	Unclear	2	0	0	0	1	0	1	
President's office and planning	Overall	126 100.0	15 11.9	23 18.3	30 23.8	46 36.5	9 7.1	3 2.4	3.09
	Companies with separate division	82 100.0	7 8.5	14 17.1	17 20.7	35 42.7	8 9.8	1 1.2	3.28
	Companies without separate division	42 100.0	8 19.0	8 19.0	13 31.0	11 26.2	1 2.4	1 2.4	2.73
	Unclear	2	0	1	0	0	0	1	
Manufacturing	Overall	126 100.0	33 26.2	44 34.9	25 19.8	15 11.9	4 3.2	5 4.0	2.28
	Companies with separate division	82 100.0	17 20.7	27 32.9	18 22.0	13 15.9	3 3.7	4 4.9	2.46
	Companies without separate division	42 100.0	16 38.1	16 38.1	7 16.7	2 4.8	1 2.4	0 0.0	1.95
	Unclear	2	0	1	0	0	0	1	
Finance and accounting	Overall	126 100.0	51 40.5	26 20.6	28 22.2	18 14.3	1 0.8	2 1.6	2.13
	Companies with separate division	82 100.0	35 42.7	15 18.3	18 22.0	13 15.9	0 0.0	1 1.2	2.11
	Companies without separate division	42 100.0	16 38.1	11 26.2	9 21.4	5 11.9	1 2.4	0 0.0	2.14
	Unclear	2	0	0	1	0	0	1	
Sales and marketing	Overall	126 100.0	45 35.7	46 36.5	23 18.3	8 6.3	2 1.6	2 1.6	2.00
	Companies with separate division	82 100.0	31 37.8	26 31.7	17 20.7	6 7.3	1 1.2	1 1.2	2.01
	Companies without separate division	42 100.0	14 33.3	19 45.2	6 14.3	2 4.8	1 2.4	0 0.0	1.98
	Unclear	2	0	1	0	0	0	1	
Supplies and purchasing	Overall	126 100.0	95 75.4	25 19.8	2 1.6	2 1.6	0 0.0	2 1.6	1.28
	Companies with separate division	82 100.0	63 76.8	15 18.3	2 2.4	1 1.2	0 0.0	1 1.2	1.27
	Companies without separate division	42 100.0	31 73.8	10 23.8	0 0.0	1 2.4	0 0.0	0 0.0	1.31
	Unclear	2	1	0	0	0	0	1	

Table 47 Influence of Other Divisions in the Formulation of R&D Strategy (Q.18)
(Figures 50 & 51) (3) Selection of Research Domains

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence		
President's office and planning	Overall	126 100.0	14 11.1	19 15.1	38 30.2	35 27.8	17 13.5	3 2.4	3.18
	Companies with separate division	82 100.0	7 8.5	15 18.3	22 26.8	25 30.5	13 15.9	0 0.0	3.27
	Companies without separate division	42 100.0	7 16.7	4 9.5	16 38.1	10 23.8	4 9.5	1 2.4	3.00
	Unclear	2	0	0	0	0	0	2	
Sales and marketing	Overall	126 100.0	10 7.9	30 23.8	36 28.6	42 33.3	7 5.6	1 0.8	3.05
	Companies with separate division	82 100.0	3 3.7	23 28.0	20 24.4	32 39.0	4 4.9	0 0.0	3.13
	Companies without separate division	42 100.0	7 16.7	7 16.7	16 38.1	9 21.4	3 7.1	0 0.0	2.86
	Unclear	2	0	0	0	1	0	1	
Manufacturing	Overall	126 100.0	20 15.9	32 25.4	36 28.6	29 23.0	5 4.0	4 3.2	2.73
	Companies with separate division	82 100.0	10 12.2	20 24.4	23 28.0	23 28.0	4 4.9	2 2.4	2.89
	Companies without separate division	42 100.0	10 23.8	11 26.2	13 31.0	6 14.3	1 2.4	1 2.4	2.44
	Unclear	2	0	1	0	0	0	1	
Finance and accounting	Overall	126 100.0	80 63.5	33 26.2	10 7.9	2 1.6	0 0.0	1 0.8	1.47
	Companies with separate division	82 100.0	52 63.4	24 29.3	4 4.9	2 2.4	0 0.0	0 0.0	1.46
	Companies without separate division	42 100.0	28 66.7	9 21.4	5 11.9	0 0.0	0 0.0	0 0.0	1.45
	Unclear	2	0	0	1	0	0	1	
General affairs, personnel, and labor management	Overall	126 100.0	79 62.7	37 29.4	6 4.8	2 1.6	0 0.0	2 1.6	1.44
	Companies with separate division	82 100.0	52 63.4	25 30.5	4 4.9	1 1.2	0 0.0	0 0.0	1.44
	Companies without separate division	42 100.0	27 64.3	12 28.6	2 4.8	1 2.4	0 0.0	0 0.0	1.45
	Unclear	2	0	0	0	0	0	2	
Supplies and purchasing	Overall	126 100.0	96 76.2	25 19.8	3 2.4	1 0.8	0 0.0	1 0.8	1.27
	Companies with separate division	82 100.0	64 78.0	15 18.3	2 2.4	1 1.2	0 0.0	0 0.0	1.27
	Companies without separate division	42 100.0	31 73.8	10 23.8	1 2.4	0 0.0	0 0.0	0 0.0	1.29
	Unclear	2	1	0	0	0	0	1	

Table 48 Influence of Other Divisions in the Formulation of R&D Strategy (Q.18)
(Figures 52 & 53) (4) Preparation of Research Budget Plans

Division		Total (%)	1	2	3	4	5	Unclear	Average
			Little or no influence	Some influence	Considerable influence	Great deal of influence	Extremely high degree of influence		
President's office and planning	Overall	126 100.0	8 6.3	20 15.9	25 19.8	47 37.3	24 19.0	2 1.6	3.48
	Companies with separate division	82 100.0	4 4.9	14 17.1	11 13.4	33 40.2	20 24.4	0 0.0	3.62
	Companies without separate division	42 100.0	4 9.5	5 11.9	14 33.3	14 33.3	4 9.5	1 2.4	3.22
	Unclear	2	0	1	0	0	0	1	
Finance and accounting	Overall	126 100.0	10 7.9	15 11.9	30 23.8	50 39.7	20 15.9	1 0.8	3.44
	Companies with separate division	82 100.0	6 7.3	10 12.2	19 23.2	33 40.2	14 17.1	0 0.0	3.48
	Companies without separate division	42 100.0	4 9.5	5 11.9	11 26.2	17 40.5	5 11.9	0 0.0	3.33
	Unclear	2	0	0	0	0	1	1	
Sales and marketing	Overall	126 100.0	40 31.7	43 34.1	25 19.8	12 9.5	5 4.0	1 0.8	2.19
	Companies with separate division	82 100.0	25 30.5	27 32.9	18 22.0	9 11.0	3 3.7	0 0.0	2.24
	Companies without separate division	42 100.0	15 35.7	15 35.7	7 16.7	3 7.1	2 4.8	0 0.0	2.10
	Unclear	2	0	1	0	0	0	1	
Manufacturing	Overall	126 100.0	46 36.5	36 28.6	26 20.6	12 9.5	3 2.4	3 2.4	2.11
	Companies with separate division	82 100.0	28 34.1	20 24.4	19 23.2	10 12.2	3 3.7	2 2.4	2.25
	Companies without separate division	42 100.0	17 40.5	16 38.1	7 16.7	2 4.8	0 0.0	0 0.0	1.86
	Unclear	2	1	0	0	0	0	1	
General affairs, personnel, and labor management	Overall	126 100.0	58 46.0	46 36.5	13 10.3	7 5.6	1 0.8	1 0.8	1.78
	Companies with separate division	82 100.0	38 46.3	30 36.6	9 11.0	4 4.9	1 1.2	0 0.0	1.78
	Companies without separate division	42 100.0	20 47.6	15 35.7	4 9.5	3 7.1	0 0.0	0 0.0	1.76
	Unclear	2	0	1	0	0	0	1	
Supplies and purchasing	Overall	126 100.0	93 73.8	27 21.4	4 3.2	1 0.8	0 0.0	1 0.8	1.30
	Companies with separate division	82 100.0	64 78.0	14 17.1	3 3.7	1 1.2	0 0.0	0 0.0	1.28
	Companies without separate division	42 100.0	28 66.7	13 31.0	1 2.4	0 0.0	0 0.0	0 0.0	1.36
	Unclear	2	1	0	0	0	0	1	

Table 49 Employment Conditions for Researchers and Engineers (Q.34)
(Figure 54)

	Total (%)	The company places researchers and engineers under the same personnel stream as administrative staff	The company has established specialist positions for researchers and engineers quite distinct from managerial positions, such as chief researcher and senior researcher	The company has established specialist positions corresponding to senior executives	Others	Unclear
Overall	126 100.0	54 42.9	65 51.6	4 3.2	2 1.6	0.8
Companies with separate division	82 100.0	30 36.6	45 54.9	4 4.9	2 2.4	1.2
Companies without separate division	42 100.0	22 52.4	20 47.6	0 0.0	0 0.0	0.0
Unclear	2	2	0	0	0	0

Table 50 Attitudes Towards Researchers and Engineers (Q.35)
(Figures 55 & 56)

Question items		Total (%)	1	2	3	4	5	Unclear	Average
			Very applicable	More or less applicable	Cannot say either way	Not very applicable	Not applicable		
In order to achieve innovative research, it is important for the company to give researchers a free hand	Overall	126 100.0	45 35.7	70 55.6	11 8.7	0 0.0	0 0.0	0 0.0	1.73
	Companies with separate division	82 100.0	31 37.8	48 58.5	3 3.7	0 0.0	0 0.0	0 0.0	1.66
	Companies without separate division	42 100.0	14 33.3	20 47.6	8 19.0	0 0.0	0 0.0	0 0.0	1.86
	Unclear	2	0	2	0	0	0	0	
Researchers must ensure that they adhere to the annual plan	Overall	126 100.0	36 28.6	74 58.7	14 11.1	0 0.0	1 0.8	1 0.8	1.85
	Companies with separate division	82 100.0	25 30.5	46 56.1	9 11.0	0 0.0	1 1.2	1 1.2	1.84
	Companies without separate division	42 100.0	10 23.8	28 66.7	4 9.5	0 0.0	0 0.0	0 0.0	1.86
	Unclear	2	1	0	1	0	0	0	
Underground research should be accepted positively	Overall	126 100.0	25 19.8	55 43.7	39 31.0	7 5.6	0 0.0	0 0.0	2.22
	Companies with separate division	82 100.0	19 23.2	38 46.3	22 26.8	3 3.7	0 0.0	0 0.0	2.11
	Companies without separate division	42 100.0	5 11.9	17 40.5	16 38.1	4 9.5	0 0.0	0 0.0	2.45
	Unclear	2	1	0	1	0	0	0	
Researchers themselves should collect the data necessary for the research plan	Overall	126 100.0	10 7.9	63 50.0	37 29.4	15 11.9	1 0.8	0 0.0	2.48
	Companies with separate division	82 100.0	8 9.8	38 46.3	23 28.0	12 14.6	1 1.2	0 0.0	2.51
	Companies without separate division	42 100.0	2 4.8	25 59.5	12 28.6	3 7.1	0 0.0	0 0.0	2.38
	Unclear	2	0	0	2	0	0	0	
The company does not concern itself with the research processes as long as good results are forthcoming	Overall	126 100.0	9 7.1	51 40.5	49 38.9	16 12.7	1 0.8	0 0.0	2.60
	Companies with separate division	82 100.0	4 4.9	32 39.0	33 40.2	12 14.6	1 1.2	0 0.0	2.68
	Companies without separate division	42 100.0	5 11.9	19 45.2	14 33.3	4 9.5	0 0.0	0 0.0	2.40
	Unclear	2	0	0	2	0	0	0	
Researchers should be clearly distinguished from engineers and employment conditions should reflect this	Overall	126 100.0	5 4.0	38 30.2	67 53.2	16 12.7	0 0.0	0 0.0	2.75
	Companies with separate division	82 100.0	2 2.4	25 30.5	43 52.4	12 14.6	0 0.0	0 0.0	2.79
	Companies without separate division	42 100.0	3 7.1	13 31.0	22 52.4	4 9.5	0 0.0	0 0.0	2.64
	Unclear	2	0	0	2	0	0	0	
Supervision of researchers impedes their ability to develop new ideas and concepts	Overall	126 100.0	2 1.6	32 25.4	70 55.6	19 15.1	3 2.4	0 0.0	2.91
	Companies with separate division	82 100.0	2 2.4	20 24.4	48 58.5	10 12.2	2 2.4	0 0.0	2.88
	Companies without separate division	42 100.0	0 0.0	12 28.6	21 50.0	8 19.0	1 2.4	0 0.0	2.95
	Unclear	2	0	0	1	1	0	0	
Researchers must adhere to set working hours	Overall	126 100.0	1 0.8	14 11.1	45 35.7	59 46.8	7 5.6	0 0.0	3.45
	Companies with separate division	82 100.0	1 1.2	8 9.8	33 40.2	34 41.5	6 7.3	0 0.0	3.44
	Companies without separate division	42 100.0	0 0.0	6 14.3	11 26.2	24 57.1	1 2.4	0 0.0	3.48
	Unclear	2	0	0	1	1	0	0	
Researchers should produce excellent research results regardless of how long it takes	Overall	126 100.0	2 1.6	6 4.8	54 42.9	48 38.1	16 12.7	0 0.0	3.56
	Companies with separate division	82 100.0	1 1.2	4 4.9	37 45.1	30 36.6	10 12.2	0 0.0	3.54
	Companies without separate division	42 100.0	1 2.4	2 4.8	17 40.5	17 40.5	5 11.9	0 0.0	3.55
	Unclear	2	0	0	0	1	1	0	
Researchers should be managed in the same way as administrative staff	Overall	126 100.0	0 0.0	3 2.4	28 22.2	66 52.4	28 22.2	1 0.8	3.95
	Companies with separate division	82 100.0	0 0.0	1 1.2	17 20.7	43 52.4	21 25.6	0 0.0	4.02
	Companies without separate division	42 100.0	0 0.0	2 4.8	11 26.2	21 50.0	7 16.7	1 2.4	3.80
	Unclear	2	0	0	0	2	0	0	

Table 51 Correlation Between New Product Ratio and New Products Sales Ratio (Q.4)
(Figure 57) (Fiscal 1990 Data)

Industry type major category	Existence of separate division	Company name	Fiscal 1990 ratio of new products	Fiscal 1990 ratio of sales for new products
Material-related manufacturing industries	*	A1	14.2	8.4
		A2	18.0	15.0
	*	A3	2.2	15.3
	*	A4	10.0	5.5
		A5	29.1	5.8
	*	A6	27.0	27.0
		A7	10.0	30.0
	*	A8	10.0	30.0
		A9	10.3	9.0
	*	A10	2.3	1.6
		A11	30.0	93.0
	*	A12	16.9	15.5
		A13	5.0	10.0
	*	A14	16.0	20.0
	*	A15	3.0	5.0
	*	A16	10.0	10.0
Machinery-related manufacturing industries		B1	36.0	36.0
		B2	15.0	6.0
	*	B3	10.0	10.0
	*	B4	20.0	25.0
	*	B5	70.0	80.0
	*	B6	30.0	40.0
		B7	43.0	43.0
	*	B8	30.0	30.0
		B9	45.0	40.0
	*	B10	30.0	34.0
		B11	32.0	17.0
	*	B12	7.0	20.0
		B13	20.0	15.0
	*	B14	20.0	10.0
	*	B15	20.0	20.0
		B16	25.0	25.0
		B17	25.0	10.9
	*	B18	20.0	50.0
	*	B19	30.0	35.0
	*	B20	2.0	0.3
		B21	5.0	10.0
Others	*	C1	5.0	20.0
	*	C2	30.0	10.0
	*	C3	0.9	0.3
	*	C4	28.0	25.0

*: Companies with a separate division

Table 52 Simple Average of Ratio of Sales for New Products (Q.4)

	Material-related manufacturing industries No. of companies	Machinery-related manufacturing industries No. of companies	Material-related plus machinery-related No. of companies	Overall No. of companies
Overall	13.9 15	26.5 21	21.3 36	20.5 40
Companies with separate division	13.8 10	29.5 12	22.4 22	21.1 26
Companies without separate division	14.0 5	22.5 9	19.5 14	19.5 14

Note: Data for company A11 in Table 51 are not included.

Table 53 Simple Average of Ratio of Sales for New Products / Ratio of New Products (Q.4)

	Material-related manufacturing industries No. of companies	Machinery-related manufacturing industries No. of companies	Material-related plus machinery-related No. of companies	Overall No. of companies
Overall	1.64 15	1.10 21	1.32 36	1.33 40
Companies with separate division	1.76 10	1.25 12	1.48 22	1.47 26
Companies without separate division	1.38 5	0.89 9	1.07 14	1.07 14

Note: Data for company A11 in Table 51 are not included.

The following tables show simple aggregate results of questions whose character was slightly different from those analysed in this report and were therefore not included (refer Annex 1 Questionnaire). All data obtained from the questionnaire are significant so we have included these tables for reference.

Q.3 R&D Organization (Classified by Scale of R&D Expenditure)

	Total (%)	Independent single laboratory system	Independent R&D Department	Independent multiple laboratory system	Independent R&D department with multiple laboratories	Business department controlling parallel laboratory system	Business department controlling laboratory system	Independent company system	Other systems	Unclear
Overall	126 100.0	8 6.3	10 7.9	20 15.9	20 15.9	33 26.2	1 0.8	0 0.0	29 23.0	5 4.0
-10 bil. yen	12 9.5	1 0.8	1 0.8	2 1.6	2 1.6	3 2.4	0 0.0	0 0.0	2 1.6	1 0.8
10-15 bil. yen	30 23.8	4 3.2	4 3.2	5 4.0	3 2.4	7 5.6	0 0.0	0 0.0	6 4.8	1 0.8
15-20 bil. yen	19 15.1	1 0.8	0 0.0	3 2.4	4 3.2	5 4.0	1 0.8	0 0.0	5 4.0	0 0.0
20-30 bil. yen	26 20.6	0 0.0	1 0.8	6 4.8	5 4.0	9 7.1	0 0.0	0 0.0	5 4.0	0 0.0
30-50 bil. yen	18 14.3	1 0.8	3 2.4	1 0.8	2 1.6	5 4.0	0 0.0	0 0.0	4 3.2	2 1.6
50-100 bil. yen	8 6.3	0 0.0	0 0.0	1 0.8	2 1.6	2 1.6	0 0.0	0 0.0	3 2.4	0 0.0
100-200 bil. yen	3 2.4	0 0.0	0 0.0	1 0.8	2 1.6	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
more than 200 bil. yen	9 7.1	1 0.8	1 0.8	1 0.8	0 0.0	2 1.6	0 0.0	0 0.0	4 3.2	0 0.0
Unclear	1 0.8	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0	1 0.8

Q.15 Business and R&D Strategies

	Total (%)	1 Very applicable	2 More or less applicable	3 Cannot say either way	4 Not very applicable	5 Not applicable	Unclear	Average
15-1 Your company pursues high market share and cost efficiency	126 100.0	20 15.9	50 39.7	24 19.0	25 19.8	5 4.0	2 1.6	2.56
15-2 Your company takes advantage of being a market "follower"	126 100.0	0 0.0	11 8.7	33 26.2	56 44.4	24 19.0	2 1.6	3.75
15-3 Your company concentrates its management resources in a few key markets	126 100.0	2 1.6	40 31.7	35 27.8	40 31.7	7 5.6	2 1.6	3.08
15-4 Your company pursues profit for its shareholders	126 100.0	8 6.3	28 22.2	46 36.5	36 28.6	5 4.0	3 2.4	3.02
15-5 Your company competes head-on with competitors	126 100.0	14 11.1	46 36.5	40 31.7	20 15.9	4 3.2	2 1.6	2.63
15-6 Your company does not hesitate to divest from poor business areas	126 100.0	3 2.4	32 25.4	52 41.3	32 25.4	4 3.2	3 2.4	3.02
15-7 Your company restricts product diversification to connected technologies	126 100.0	6 4.8	51 40.5	31 24.6	33 26.2	2 1.6	3 2.4	2.79
15-8 Your company seeks coexistence with competitors	126 100.0	8 6.3	53 42.1	46 36.5	15 11.9	2 1.6	2 1.6	2.60
15-9 Your company actively cultivates overseas markets	126 100.0	35 27.8	53 42.1	22 17.5	11 8.7	3 2.4	2 1.6	2.15
15-10 Your company formulates strategies on the basis of objective analysis	126 100.0	3 2.4	50 39.7	47 37.3	23 18.3	1 0.8	2 1.6	2.75
15-11 Your company seeks to be an innovator	126 100.0	11 8.7	48 38.1	37 29.4	27 21.4	1 0.8	2 1.6	2.67
15-12 Your company actively implements M&A	126 100.0	3 2.4	19 15.1	38 30.2	49 38.9	15 11.9	2 1.6	3.44
15-13 Personnel recruitment is based on long-term personnel plans	126 100.0	14 11.1	69 54.8	30 23.8	11 8.7	0 0.0	2 1.6	2.31
15-14 Introduction of new products is based on marketing capability	126 100.0	4 3.2	50 39.7	41 32.5	24 19.0	4 3.2	3 2.4	2.79
15-15 Your company collects wide-ranging data on unrelated markets	126 100.0	6 4.8	53 42.1	36 28.6	26 20.6	3 2.4	2 1.6	2.73
15-16 Your company pursues non-price marketing strategies	126 100.0	10 7.9	50 39.7	33 26.2	26 20.6	3 2.4	4 3.2	2.69
15-17 Your company emphasises accumulation of diverse technological know-how	126 100.0	4 3.2	57 45.2	51 40.5	10 7.9	0 0.0	4 3.2	2.55
15-18 Your company's basic strategy is inseparably related to the unique ideas of the present or former president	126 100.0	35 27.8	52 41.3	26 20.6	7 5.6	4 3.2	2 1.6	2.14
15-19 Fulfilment of social obligations is incorporated into your company's business policies	126 100.0	67 53.2	44 34.9	13 10.3	0 0.0	0 0.0	2 1.6	1.56
15-20 Your company actively invests in overseas production subsidiaries	126 100.0	22 17.5	53 42.1	31 24.6	13 10.3	3 2.4	4 3.2	2.36
15-21 Your company regularly adopts the suggestions of local managers	126 100.0	23 18.3	65 51.6	31 24.6	5 4.0	0 0.0	2 1.6	2.15
15-22 Your company places importance on the intuitive judgment of experienced managers when formulating strategies	126 100.0	4 3.2	41 32.5	58 46.0	17 13.5	4 3.2	2 1.6	2.81

Q.25 Breakdown of Research Themes by “Seeds Type” and “Needs Type” Research

	Total (%)	No. of responses	Seeds type	Needs type	Unclear
Overall	126 100.0	118 93.7	33.8	66.2	8 6.3

Q.27 Breakdown of Research Themes by Proposer

	Total (%)	No. of responses	1 Individual researcher	2 Research leader	3 Research group	4 R&D management division	5 R&D division director	6 Sales division	7 Marketing division	8 Company president	Unclear
Overall	126 100.0	104 82.5	15.5	30.1	27.7	6.9	4.8	8.3	5.8	1.0	22 17.5

Q.28 Research Themes - Number Proposed and Number Adopted

	Total (%)	No. of responses	Annual number of research theme proposals	Number adopted	Unclear
Overall	126 100.0	82 65.1	225.9	154.7	44 34.9

Q.31 Commissioning of Research Strategy Formulation Outside of Company

	Total (%)	1 Commission outside company	2 Commission to affiliated companies	3 Do not commission	Unclear
Overall	126 100.0	13 10.3	0 0.0	112 88.9	1 0.8

Q.31-SQ1 Type of Strategy Commissioned

	Total (%)	Not applicable (%)	Applicable (%)	1 All R&D strategy	2 Long-term R&D strategy	3 Strategy on new research fields	4 Strategy related to establishment of overseas R&D bases	Unclear
Priority order 1	126 100.0	113 89.7	13 10.3 100.0	1 7.7	3 23.1	7 53.8	1 7.7	1 7.7
Priority order 2	126 100.0	113 89.7	13 10.3 100.0	1 7.7	1 7.7	2 15.4	1 7.7	8 61.5
Priority order 3	126 100.0	113 89.7	13 10.3 100.0	0 0.0	0 0.0	2 15.4	1 7.7	10 76.9
Priority order 4	126 100.0	113 89.7	13 10.3 100.0	0 0.0	1 7.7	0 0.0	0 0.0	12 92.3

Q.32 Establishment of a Data Base Covering Intellectual Achievements

	Total (%)	1 Fully established	2	3	4 Adequately established	5	6	7 Not established	Unclear	Average
Overall	126 100.0	19 15.1	39 31.0	23 18.3	26 20.6	11 8.7	7 5.6	1 0.8	0 0.0	2.97

Annex 3 List of Surveyed Companies

The following is a list, in alphabetical order, of the 126 companies whose responses to the questionnaire formed the basis of this report. We should again like to express our sincere appreciation to these companies for their cooperation.

Aishin Seiki Co., Ltd.	Kirin Brewery Co., Ltd.
Ajinomoto Co., Ltd.	Kobe Steel Ltd.
Alps Electric Co., Ltd.	Kokusai Electric Co., Ltd.
Asahi Chemical Industry Co., Ltd.	Komatsu, Ltd.
Asahi Glass Co., Ltd.	Konica Corporation
Bridgestone Corporation	Kubota Corporation
Brother Industries, Ltd.	Kuraray Co., Ltd.
Calsonic Corporation	Kureha Chemical Industry Co., Ltd.
Canon Inc.	Kyosera Corporation
Chubu Electric Power Co., Ltd.	Kyushu Electric Power Co., Inc.
Dai Nippon Printing Co., Ltd.	Kyushu Matsushita Electric Co., Ltd.
Daihatsu Motor Co., Ltd.	Matsushita Communication Industrial Co., Ltd.
Daiichi Seiyaku Co., Ltd.	Matsushita Electric Industrial Co., Ltd.
Daikin Kogyo Co., Ltd.	Matsushita Electric Works, Ltd.
Dainippon Ink and Chemicals, Inc.	Mazda Motor Corporation
Dainippon Screen Mfg. Co., Ltd.	Meiji Seika Kaisha, Ltd.
Denki Kagaku Kogyo K.K.	Minolta Camera Co., Ltd.
Ebara Corporation	Mitsubishi Material Corporation
Eisai Co., Ltd.	Mitsubishi Motors Corporation
Fuji Electric Co., Ltd.	Mitsubishi Electric Corporation
Fuji Heavy Industries, Ltd.	Mitsubishi Heavy Industries Ltd.
Fujisawa Pharmaceutical Co., Ltd.	Mitsubishi Chemical Industries Ltd.
Fujitsu Ltd.	Mitsubishi Petrochemical Co., Ltd.
Furukawa Electric Co., Ltd., The	Mitsui Petrochemical Industries, Ltd.
Hino Motors, Ltd.	Mitsui Toatsu Chemicals, Inc.
Hitachi Cable, Ltd.	Murata Mfg. Co., Ltd.
Hitachi Construction Machinery Co., Ltd.	NEc Corporation
Hitachi, Ltd.	Nikon Corporation
Honda Motor Co., Ltd.	Nippon Kayaku Co., Ltd.
Ishikawajima-Harima Heavy Industries Co., Ltd.	Nippon Mining Co., Ltd.
Japan Radio Co., Ltd.	Nippon Oil Co., Ltd.
Japan Synthetic Rubber Co., Ltd.	Nippon Telegraph and Telephone Corporation
Kajima Corporation	Nippon Sheet Glass Co., Ltd.
Kanegafuchi Chemical Industry Co., Ltd.	Nippondenso Co., Ltd.
Kansai Electric Power Co., Inc.	Nissan Diesel Motor Co., Ltd.
Kao Corporation	Nissan Motor Co., Ltd.
Kawasaki Heavy Industries, Ltd.	Nisshin Steel Co., Ltd.
Kawasaki Steel Corporation	Obayashi Corporation
KDD	Oki Electric Industry Co., Ltd.

Olympus Optical Co., Ltd.
 Omron Corporation
 Ono Pharmaceutical Co., Ltd.
 Osaka Gas Co., Ltd.
 Pioneer Electronic Corporation
 Sankyou Co., Ltd.
 Sekisui Chemical Co., Ltd.
 Sharp Corporation
 Shimadzu Corporation
 Shimizu Corporation
 Shionogi & Co., Ltd.
 Shiseido Co., Ltd.
 Sony Corporation
 Sumitomo Chemical Co., Ltd.
 Sumitomo Heavy Industries, Ltd.
 Sumitomo Electric Industries, Ltd.
 Sumitomo Metal Industries, Ltd.
 Sumitomo Rubber Industries, Ltd.
 Suntry Ltd.
 Suzuki Motor Corporation
 Taisei Corporation
 Takeda Chemical Industries, Ltd.
 Tanabe Seiyaku Co., Ltd.
 TDK Corporation
 Tohoku Electric Power Co., Inc.
 Tokuyama Soda Co., Ltd.
 Tokyo Electric Co., Ltd.
 Tokyo Gas Co., Ltd.
 Tokyo Electric Power Co., Inc., The
 Tonen Sekiyu Kagaku K. K.
 Toppan Printing Co., Ltd.
 Toray Industries, Inc.
 Toshiba Corporation
 Tosoh Corporation
 Toto Ltd.
 Tóyobo Co., Ltd.
 Toyoda Automatic Loom Works, Ltd.
 Toyoda Gosei Co., Ltd.
 Toyota Motor Corporation
 Tumura & Co.
 Ube Industries, Ltd.
 Victor Company of Japan, Ltd.
 Yamaha Corporation
 Yamaha Motor Co., Ltd.
 Yamanouchi Pharmaceutical Co., Ltd.
 Yamatake-Honeywell Co., Ltd.
 Yokohama Rubber Co., Ltd., The

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For inquiries please contact:

Masaaki Sawada or Masaru Tsukamoto
2nd Policy-Oriented Research Group
National Institute of Science and Technology Policy (NISTEP)
Science and Technology Agency
1-11-39 Nagatacho, Chiyoda-ku, Tokyo 100
Tel: (03) 3581-2392
Fax: (03) 3503-3996

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