The New Systematization and Assetization of Information

In this chapter, great importance will be attached to new systematizations and assetizations of information for corporations, and the discussions will be based on the recognition that they form the key foundation for R&D and new product and business development. Specifically, this chapter examines proprietors and CIOs (Chief Information Officers) who seek to assure strategic management of developmental information, the analysis of the systematization and assetization of technological and R&D information that serve the executive in charge of developing and managing information, and the systematization and assetization of market development information that play a crucial role in the development of management strategies.

4.1 Systematization and Assetization of Technological and R&D Information

4.1.1 *An approach to the systematization of information*

It is possible to gather and accumulate data relating to research and development from among a voluble amount of technical intelligence and apply them to various administrative actions by effectively systematizing them. To that end, you must build a database related to information technology by grasping the progress and changes of

technology up to the present as technological information, while treating accumulated R&D information as basic intelligence.

From the time a present data analysis is made on collected technological information, R&D information will be treated as sources of information for making forecasts for the near future of two to three years ahead, the future of five to ten years ahead, and the long-term future beyond that. The R&D information for the near future will be treated as entries of the Data Base System, while information for longer periods beyond that will be treated as entries of the Knowledge Information System.

However, when seeking R&D information, you should not limit your search to the electronics field and medical product field or the information communication field in particular, but should broaden your scope to include information from all fields. For example, in the case of developing medical products, it is said that in addition to requiring more than ten-odd years to develop one drug product, a cost of tens of billions of yen needs to be spent. In such a process as seen in the development of a drug product, as indicated in Figure 4-1, if you attempt to present a medical product as R&D information, you will not be able to do without not only information related to the securing of present research materials, but also information regarding data that confirm the research subjects of two to three years' time; and furthermore, information regarding the isolation and refinement of active substances of five to ten years' time or information regarding drug designs and clinical trials.

In addition, in order to disperse the R&D risk of medical products, a large, global-scale project has been underway in recent years involving drug-company alliances. Amid such circumstances, the following factors concerning Japan, the United States, and Europe have to be evaluated within your firm or the development team: the level of development progress in each country, the degree of ease in exchanging technical know-how between the countries, the degree of difficulty in carrying out technology cooperation between the countries,

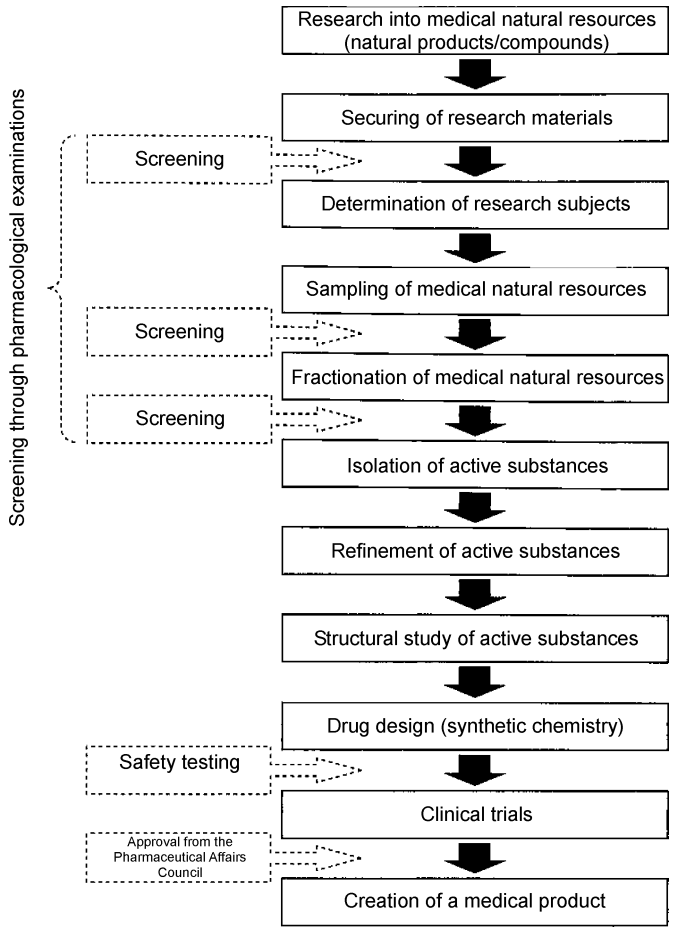

Figure 4-1: The General Flow of the Drug Development Process

and the extent of the technical level in each country. Through carrying out information management of the development phase of such a drug development process, it becomes possible to clarify screenings based on the indicators of pharmacological tests of research materials that are the focus of future researches of two to three years' time, and to confirm, abstract, and compartmentalize research subjects determined by the discovery of materials having the screened pharmacological actions.

As a result, for example, if the active substances could be isolated and refined, the structural research will be completed, and an unimaginable amount of medical-product seeds will be discovered through drug designs that make use of the technologies of synthetic chemistry. Furthermore, safety tests such as acute and chronic toxicity tests and genotoxic tests will be carried out on materials among these, and the ones that clear these tests will be the ones to be offered to clinical trials. Naturally, this drug development process represents no more than a general developmental step in the development of new medicines.

Therefore, by analyzing your firm's strengths in specific technologies through this drug development process, and the degree of usage and effectiveness of the technology cooperation conditions surrounding your firm, you must extend your firm's technological strengths as a response for the future, while adopting at an early stage countermeasures that compensate for the weak points found in the process. In addition, it should be noted that what is supporting such R&D is the knowledge information system. If this knowledge information system responds to all informational needs, an early warning for signs of weaknesses in the process can be made along with reports on the level of progress of the R&D project, helping to further realize your firm's strengths.

4.1.2 *Systematization and assetization of keywords*

Information is dependent upon various fields, processes, topics, and contents. Thus, predictions of the near future of two to three years time, the future of five to ten years time, and the long-term future of beyond five to ten years can be treated as keywords related to inventions, discoveries, and technological innovations. As indicated in Figure 4-2, the keywords could be described as personal needs in terms of the workplace, office, and occupation, or in terms of municipalities and nations.[1] Furthermore, if you associate the needs with directly or indirectly related categories, you will be able to

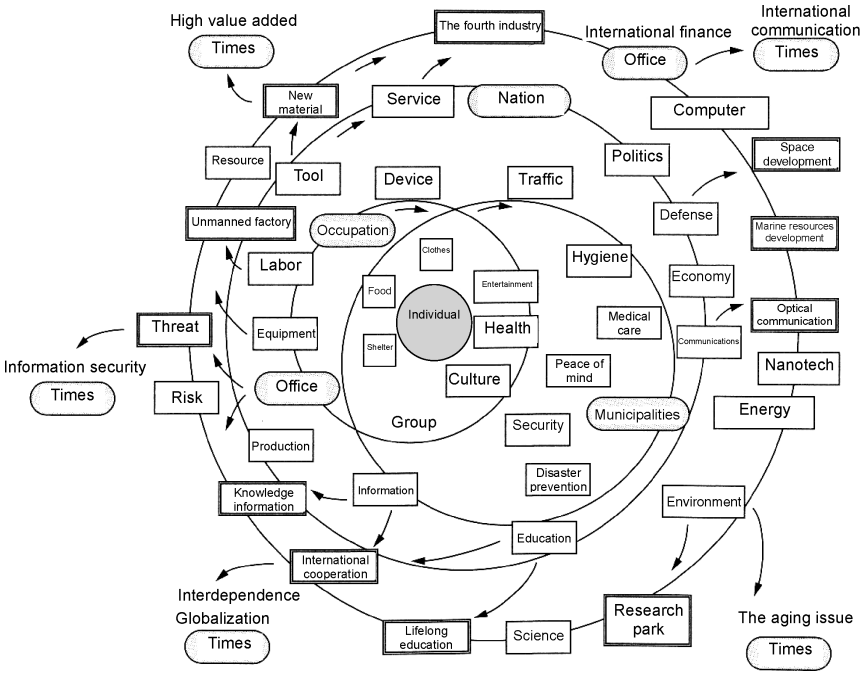

Figure 4-2: Relationships between Needs and Keywords
Source: Adapted from p. 26 of Akira Ishikawa's *The Q&A Primer to Information Searching for Developing New Products and New Businesses*, Dobunkan, 1988.

grasp all keywords not as elements that exist independently, but as elements that have interrelationships with each other.

Therefore, when classifying these needs and narrowing down their scope, it becomes possible to grasp them as inter-network related keywords considered to be concerned with inventions, discoveries, and technological innovations of five to ten years into the future. For example, terms such as nation, municipality, workplace, and individual can be positioned as inter-network related items associated with the keywords "human social system." In addition, terms such as health, hygiene, and medical care can be positioned as inter-network related items associated with the keywords "human organism system." Furthermore, terms such as energy, entropy, and natural resources can be positioned as inter-network related items associated

with the keywords "natural resources/geography system," which helps maintain the organism system. Finally, terms such as technology, science, and computers can be positioned as inter-network related items associated with the keywords "technology system," which is related to improving the human social system and the utilization of natural resources. Furthermore, each network does not exist independently, but are interdependent with each other and form an even larger network together.

In addition, to group the keywords positioned in human, environmental, social, and functional networks, one method that can be considered is to integrate the keywords assigned to the subjects of the human social system network, the organism system network, the natural resources/geography system network, and the technology system network, and further narrow these networks down into functional, environmental, human, and social categories by probing keywords that are essentially linked to inventions, discoveries, and technological innovations and by probing the project sphere as well.[1]

If you regard the keywords in accordance with networks, in the case of functional networks firstly, you will be able to subdivide them into sensory functions and work functions. On the other hand, the environmental network can be subdivided into such categories as space, time, object, plant, and animal in chronological order. In addition, the human network could be subdivided into categories ranging from spiritual (introverted) to physical (extroverted). Finally, the social network could be subdivided into such categories as secure and quality living standards, economic efficiency, and convenience.

In carrying out the systematization and assetization of keywords on the basis of the above points, the following two perspectives will prove indispensable.

1) *Identifying master keywords (categories)*

This is about grasping the overall picture of the technology field, especially the R&D field, and identifying categories that allow for

collecting, systematizing, and assetizing keywords from a macroscopic perspective.

2) *Adding quantitative expressions*

This approach is about carrying out systematization and assetization by adopting quantitative expressions drawn from a microscopic perspective for the categories drawn from a macroscopic perspective. Specifically, in the process of such an adoption, the approach will help to identify keywords that are directly connected conceptually, structurally, and constitutively, and, on the basis of their interrelatedness, systematize and assetize in accordance with their size, strength, and inclusiveness levels.

4.1.3 *Charting and patterning as means for systematizing*

When expressing the systematization and assetization of keywords, it will prove more effective if you adopt charts or patterns. Among the expressions you can develop, while there is the tree structure[1)] diagram showing keywords in a hierarchical layout, there is also the relational structure[2)] that interlinks keywords in a tabular format, and additionally, there is the network structure[3)] that shows combinations of multiple categories. Furthermore, the matrix structure,[4)] which

[1)]Tree Structure refers to the schematization of the hierarchical relationships of directories and files, designating their most basic component as a "root," from where branches grow, diverge, and spread out.
[2)]Relational Structure shows multiple items laterally and a corresponding number of data vertically within a square graph, and displays a collection of mutually related data in a tabular format.
[3)]Network Structure attempts to streamline information processing by linking multiple items to each other and having each of them share data in common as well.
[4)]The Matrix Structure signifies matrix items with mathematical expressions and displays them within a square framework. This framework is capable of expressing data in terms of the three dimensions of length, width, and height, in addition to expressing them in terms of time and other dimensions.

depicts the fusion of the technologies of different and innovative hi-tech fields, can be used as an expression of new technologies.[5]

For example, such new fusion technologies include fine chemicals,[5)] which is a fusion between the chemistry and life science fields, specialty chemicals,[6)] which is a fusion between the chemistry and materials fields, and engineering plastics,[7)] which is a fusion between the advanced materials field and other fields. In addition, the fusions have also made possible such advanced technologies as biomass,[8)] which is a fusion between the fields of natural resources, energy, and biotechnology; and artificial organs (artificial materials), which is a fusion between the fields of materials and life science. Furthermore, the fusions have also made it possible for the development of nanotechnology,[9)] which is a fusion between the fields of Information

[5)] Fine Chemicals refer to a variety of high value-added chemicals found in chemical products, such as medicines, pesticides, synthetic dyes, and perfumes. They require a high degree of processing and are produced in small quantities.

[6)] Specialty Chemicals refer to high-performance specialty chemicals such as plastic additives, functional coating materials, water treatment chemicals for manufactured paper, functional textile materials, and chemicals used in home/personal care goods.

[7)] Engineering Plastics refer to plastics used in industrial applications such as machine components and structural materials. Primarily used as metal substitutes, they are high functional polymers that have the durability and heat resistance required to withstand their application in industrial products such as automobile parts, machine components, and electronic parts.

[8)] Biomass refers to a fixed number of plant materials that can be used as energy and is created by plants through the process of photosynthesis. Biomass is also referred to as phytomass with the prefix "phyto" referring to the fact that its energy is derived from plants.

[9)] Nanotechnology is a means for manufacturing at a scale of a one-one billionth meter. One nanometer (nm) is a hyperfine unit that expresses about one-one hundred thousandth of the thickness of a strand of hair, and one-one thousandth of a red blood cell. Nanotechnology is the most researched technology today and once it becomes established, the miniaturization of various machines and electronic equipment will become successful. Furthermore, its establishment will also make the creation of unprecedented high performance advanced materials possible.

and Communication Technology (ICT) and such fields as biotechnology.

Regarding the fusion of technologies that come into being through the integration of various industrial sectors, there are the simple cases that see technology fusions arising from the merger of two industrial sectors, and there are the complex cases that see technology fusions arising from the merger between multiple sectors. With the adoption of the concept of the matrix structure, these relationships can be illustrated as technologies arising from the interrelationships between specific industrial sectors. The direction of such technology fusions of different fields, as it has been consistent with what has been discussed up to this point, is truly about the development from systematizing to assetizing the keywords that will prove essential for discovering R&D themes.

Incidentally, in our approach to information based on the systematization of keywords until now, we have understood such information on the basis of what has been directly apparent; information that revolved around established technologies and materials or products. In other words, with regard to the properties, phenomena, and discovered principles included in each of those technologies, we considered them to be part of what had already been systematized and for this reason did not make use of them as case examples.

Therefore, the technical function map (gene map), which was designed to serve as a foundation for everything, is a tool that truly helps to systematize the properties, phenomena, and principles of established technologies and materials or products and turn them into data that R&D projects can use for reference.

4.1.4 *Compiling keywords into a thesaurus*

Regarding keywords that continue to increase, if you group them by their characteristics, finding what you seek will often be made

easier. This is where the thesaurus,[10] a tool for searching databases, can play an important role. As the number of keywords increase and become more substantial, compiling them into a thesaurus will become all the more indispensable.

In the ISO 2788[11], the thesaurus is defined as "an organized and functional glossary of terms made up of semantic and comprehensive associations that cover specific spheres of knowledge." On the other hand, in the JIS X 0901[12], the thesaurus is defined as "an organized vocabulary index that is arranged in a way to show the anticipatory relationships between concepts.

Such thesauri that are indispensable in the systematization and assetization of keywords are being created in large numbers by various government bodies, institutions, academic societies, associations, groups, universities, and corporations to meet their respective purposes, and even in Japan, there exists such thesauri as the JICST

[10] A thesaurus is a glossary of terms used in searching databases and serves as a lexicon to assist in encapsulating with one word those matters that can be expressed in various ways. Thesaurus-based searches suffer from the following drawbacks; inputs of thesaurus terms need to be accurate to be able to produce hits; choosing the correct term from a vast number of words is cumbersome.

[11] The International Organization for Standardization (ISO) is an international authority formed for establishing worldwide standards. Standards are variously established by relevant bodies and are categorized into "company standards," which are standards adopted at the corporate level; "industrial association standards," which are standards adopted at the industrial level; "national standards," which are standards that are assumed to be adopted at the state level; "regional standards," which are standards established at a certain regional level, such as Europe; and "international standards," which are standards established in the expectation that they will be adopted at the international level. ISO is one of the representative international authorities formed for establishing international standards, which are considered to be the most significant standards among the standards mentioned above.

[12] The Japan Industrial Standard (JIS) refers to national standards established for all manufactured products on the basis of Japan's industrial standardization law. In JIS, there are ISO standards that have been adapted for Japan and others that have been originally created for Japan, but in either case, the Japanese Industrial Standards Committee (JISC) deliberates the original proposals of the standards, which are prepared by affiliates of regulating authorities. Upon approval, the cabinet minister in charge officially announces the proposals as JIS standards.

Thesaurus.[13] Field-specific specialist thesauri include the Nikkei Thesaurus (Nihon Keizai Shimbun), the Library Thesaurus (College Library), and the Thesaurus of Medical Terms (Japana Centra Revuo Medicina). In addition, there are many software packages of thesauri available in the market, including The Unabridged Dictionary of Synonyms, Kohjien, The Digital Thesaurus, and The Practical Thesaurus.[2]

Incidentally, as elaborated below, when creating a thesaurus, it is necessary to consider the scope, selection of descriptors, and usage.

1) *Scope of the thesaurus*

The scope of a thesaurus should not be limited to terms of a specific field and its adjacent areas, but should encompass terms that other thesauri can use. The terms to be included in the thesaurus should be ones that express concepts in their simplest and most unitary forms possible. As for compound terms, they will be disassembled into simpler words to function as index words. The disassembly will be made to the extent that the meanings remain clear for the user. In addition, where complex subjects are concerned, it is important to express them through the combination of individual terms.

2) *Selection of descriptors*

The selection of descriptors[14] as terms that have been officially approved and formulated for the thesaurus will be made on the grounds of criteria such as structure, usage objective, and usage plan of the thesaurus. The most crucial function of a thesaurus lies in its capability to expose interrelationships that exist between concepts

[13] The Japan Science and Technology Corporation (currently Japan Science and Technology Agency) has published the 1978 and 1999 editions of the "JICST Thesaurus of Science and Technology Terms."

[14] A thesaurus shows descriptors (preferred terms) and non-descriptors (reference terms) for the descriptors. For actual searches, descriptors are used.

by clearly distinguishing the basic relationships that exist between terms.

The basic relationships found in the thesaurus are the following three kinds; the synonymous relationship, which is the relationship between descriptors and non-descriptors when a number of words share a similar concept; the hierarchical relationship, which relate words according to how broadly or narrowly they are associated with each other, and the relevancy relationship, which show relationships between words other than their synonymous and hierarchical relationships.

3) *Thesaurus usage*

The thesaurus must allow a user to clearly confirm descriptor, hierarchical, and relevancy relationships of synonyms. In other words, when carrying out an index search, the thesaurus must allow for the selection of the same terms for identical concepts. This should be so because, for example, by making use of hierarchical relationships, it becomes possible to maintain a consistent index that allows one to conduct a search with a broad term (upper term) and retrieve all literature indexed by its correlated narrower terms (lower terms). In effect, such an arrangement helps to improve retrieval efficiency.

4.1.5 *Evaluating the efficiency of information retrieval systems*

For users of information, to be able to efficiently search for required information anytime is an important factor in evaluating the assetization of information. For decision makers, various information become necessary, fundamental determinants that affect the decision making process in a crucial way. What is important to point out here is that information itself does not take the place of the decision to be made by the decision maker, but is used to help in making the decision.

In evaluating the retrieval effectiveness of an information retrieval system, you should take criteria such as the following five ones into consideration.

1) *Scope and depth*

This is a criterion concerned with whether a database is sufficient in terms of the range of its data or the depth of its contents. In other words, it is concerned about what types of information are included and to what extent its contents are hierarchically structured. These attributes make it possible to efficiently search out required information from within the database via the use of keywords.

In database construction, what are needed are not only the contents that fall under category names of a particular field, but also detailed contents that cover various fields. However, realistically, it is impossible to store all necessary information beforehand. Since there are times when other necessary information become required in the middle of a search, it is necessary to design an information retrieval system with an expandability that can freely incorporate various information, which can be maintained efficiently.

2) *Relevance rate*

This criterion is concerned with the level of relevance rate or precision that should be maintained when searching a database. This is because in an information retrieval system, when searching for only relevant documents and information within this system, if you restrict search conditions, the recall rate drops, while if you relax the search conditions, the relevance rate drops.

In actuality, however, the goal that can help improve retrieval effectiveness is to suppress the number of non-relevant search hits within an allowable range, and make the search hits match as much as possible. Corporations are already constructing and operating information systems and are engaged in accumulating a large volume of

information. However, since plenty of paper-based information exists apart from the information stored in databases, the ideal setup can be said to be one that allows for the use of both types of information.

3) *Response time*

This criterion is concerned with the speed of the response of an information retrieval system. An informational retrieval system with a fast response time can be said to be a system with high operability. Since operability means being able to instruct an information retrieval system on how to search for information, with regard to recurring information whose structure are clear to a certain extent, it is also necessary to be able to edit beforehand any information you use into a format suited to those types of information.

Regarding the criterion for response times, the general practice is to assure quick searches for information required to make highly urgent decisions, while for information required for decisions that are not that urgent, the general practice is to see that response times are not designed to be immediate. In addition, it is important to arrange organizational control over response times for such levels of urgency.

4) *Cost effectiveness*

This criterion is concerned with whether the benefit of searching exceeds cost. This is because even if you construct a costly information retrieval system in the company, if the system does not prove to be helpful for users relative to the invested capital, you cannot say that you have assetized information with the introduction of the system.

With regard to benefits, users must be able to quickly grasp the significance of search results derived from an information retrieval system. An information retrieval system, along with particular benefits, must have diverse information retrieval functions that respond to the specific circumstances and issues of the user.

5) *Features*

This criterion is concerned with what type of features various users seek. This is because if there are no features that respond to various usage objectives, it will not be possible to attempt to promote the efficiency of information retrieval operations. With regard to database information features, considerations such as the following need to be made: fitness with the front, middle, and back of a text string; the efficacy of "links," which use symbols to indicate associations beforehand between relevant index words; the efficacy of "rolls," which develop links and add information on semantic relationships between terms to index words; the efficacy of "subtitles," which make specific terms have rolls; and the efficacy of "proximity searches."[15)]

Another feature sought is usability or operability, which involves clarity and ease of use. Users of information retrieval systems include all types, ranging from top management executives, who tend to be inexperienced in the use of such systems, to specialists, who have thorough knowledge of the features of such systems. In this way, since various users will be making use of an information retrieval system, you will need to equip it with features that accommodate both experienced users and novice ones in terms of ease of use.

4.1.6 *Reinforcement through the assetization of information*

To reinforce the systematization of information through assetizing it, you need to offer users information believed to be necessary for the future through applying various approaches and means. In other words, this means being able to allow users to easily and swiftly obtain valuable information that they seek to have the most whenever they need it, wherever they are.

[15)] Adjacent searches are searches for information within a certain distance in databases whose word orderings are the same throughout. Specifically, these searches are carried out when using multiple keywords.

In recent years, thanks to the development of ICT and the spread of the Internet, even without the processing power of a mainframe computer[16] or even if there is no database or knowledge information system installed in your own computer, the circumstances[17] today allow for users to be able to access various data and services inexpensively by making use of open networks. For example, in the case of information systems that have adopted ASP[18] service arrangements, since the use of rental applications makes it unnecessary to install individual applications in a user's computer, it becomes possible to reduce the cost and labor of installing, managing, and upgrading software, which have been a large burden to bear for the information system departments of corporations.

Incidentally, even if you have finished setting up an information system that can offer timely information required by users, the systematization and assetization of information have yet to be completed. In fact, the activity of assetizing information through an information system is one that is a cumulative process carried out steadily on a daily basis without any end in sight. It remains a work in progress forever.

For the user, it is ideal to be able to obtain required information anytime, anywhere, and in a timely fashion. This is a fact. However, it is not always the case that there will be a computer close at hand

[16] Mainframe refers to a large-scale, general-purpose computer used for mission-critical task systems in a company. With the mainframe, most components of the computer, including the power supply, CPU, and memory banks, are multiplexed, and performance gains in processing and preventing malfunctions are attempted through parallel processing.

[17] In this present day and age when information networks such as the Internet have become widespread, it has become possible to work or be entertained without being restricted to a particular place, thanks to the fact that access to networks have become ubiquitous, allowing anyone to access them at anytime from anywhere.

[18] An ASP is an Application Service Provider, which is a company that rents out mainly business software applications to customers via the Internet. The user uses a web browser to make use of applications installed in the ASP's server. Additionally, Rental Application refers to the service of renting out business software applications to customers via the Internet.

wherever a user may be. Besides, even if there were one, it is usually unclear whether it would be found in a circumstance that would allow you to access an information system. Therefore, offering such a usage configuration for all users is actually difficult. But even if you were able to obtain such an information usage environment, you will still have to contend with system-related risks, such as whether the information obtained from such an environment was credible; whether the source of information used was reliable; and whether there would have been different results if a different source of information had been used. Furthermore, since there is the possibility that the information that had been required by a user had actually been tampered with or had been deleted due to information security concerns, it may not have been what the user had been seeking. In addition, this same user, upon making comparisons with other information, may seek to verify the details of the obtained information.[8]

Toward this end, by rounding out the features of the information system, it becomes possible to increase the likelihood of realizing a swift resolution to such problems. Furthermore, in the event you realize reinforcement by the assetization of information, along with the introduction of such things as email, TV conferences, and the intranet,[19)] you will not be able to ignore the fact that a single user will be receiving information from multiple information providers or that multiple users will be receiving valuable information from a single information provider.

By introducing information systems through creating open networks and through decentralization, it becomes possible to have a communication mode with controllable multifunctional features that respond to needs. This in turn makes it possible to realize information assetization reinforcement.

[19)]The Intranet refers to a network system built for use within an organization. It makes use of standard Internet technology, including the TCP/IP communication protocol. Since many companies ship products that support standard Internet technologies, the Intranet has the feature of being less costly than a custom-made network.

4.2 Systematization and Assetization of Market Development Information

4.2.1 *Differences between market development information and information/R&D information*

Diverse information can be classified roughly into technological information, R&D information, and market development information. The fundamental differences between these types of information are found in the variance in domains or fields of the treated information.

Technological information and R&D information are those that include detailed content regarding technology and data on their trends. So the concerns of what field's technology gets used by what type of user in what way to produce what kind of results that will help to form what kind of market and develop in what way are of only secondary importance. In contrast, with market development information, strictly speaking, market development becomes the primary concern. Therefore, if certain products prove to be helpful in market development, technological information and R&D information become secondary concerns.

While technological information, R&D information, and market development information all ostensibly have in common primary fields and domains of study, challenges, aspirations to achieve the progress of humanity, aspirations to attain world peace and bring about an individual's happiness, they basically differ in terms of their objectives and goals and show different directionalities. Information systems that allow for exchanging data of such different meanings can be said to have content that is beneficial and different from content up to now and to be accessible only when users show a preference for it. To understand the information discussed, the following eight stages are indispensable. In addition, what should be paid attention here is the acknowledgement of what types of information exchange are the most crucial in each of the eight stages.

1) *Information-gathering stage*

The *information-gathering stage*, which sets the future direction, is a stage that begins with forecast analyses such as market forecasts or technological forecasts.

2) *Goal exploration stage*

The *goal exploration stage*, which is concerned with setting goals, is a stage for carrying out goal-oriented research through marketability research and project research.

3) *Commercialization decision-making stage*

The *commercialization decision-making stage*, which is concerned with setting the policy, is a stage where you can attempt to make appropriate alignments with policies of development requests, sales plans, and development considerations.

4) *Commercialization planning stage*

The *commercialization planning stage*, which is concerned with setting actual measures to be adopted, is a stage where adjustments are made to measures ranging from preliminary design to initial trial manufacturing and production design.

5) *Practical use stage*

The *practical use stage*, which lasts until the launch stage, is a stage where you make adjustments through actual retail prices and additional trial productions.

6) *Introduction stage*

The *introduction stage*, which is a stage for appealing, is a stage for carrying out fine adjustments for appealing through pilot sales and experimental production.

7) *Growth stage/competition stage/decline stage*

The *growth stage*, *competition stage* and *decline stage*, which prepare towards full-fledged production, is a stage for carrying out full-fledged production after coordinating the start of test marketing and the speed of trial runs.

8) *Terminal stage*

The *terminal stage*, which has the termination of production in its sight, is a stage where you can attempt continual coordination and understanding through taking the stages cleared so far into account.

Incidentally, with regard to contents that are essential to market development information, there are three types of information demanded as data that should be provided to those in charge of R&D and product development; customer desire information, customer satisfaction information, and customer attribute information.

Firstly, information should be provided on what functions potential customers seek in a product. With existing products, you should provide information on "customer desires" by grasping what kinds of inconveniences or usability problems potential customers have, and what kinds of functional products they desire to help them circumvent such issues.

Next, with regard to existing customers, you should be providing information on the details of their satisfaction levels. You should provide information on "customer satisfaction" with regard to what customers are dissatisfied with when using existing products. Such points could include information on inconveniences and usability issues, with what functions or features they are satisfied, and with what functions or features they are not satisfied.

And finally, you should provide information on whether the points of dissatisfaction are tied to any regional characteristic

or business type. You should, in effect, provide information on "customer attributes" by seeing whether the inconveniences and usability problems customers have with existing products are confined to a particular area or whether they are confined to products offered by particular businesses or whether they apply to all customers in general.

4.2.2 *Systematization and assetization of market development information*

To attempt an effective systematization of market development information, a market development strategy needs to be described as a corporation's management strategy. Generally, with a corporation's market development strategy, as indicated in Figure 4-3, the corporation itself depicts a growth matrix[20] and devises and deploys

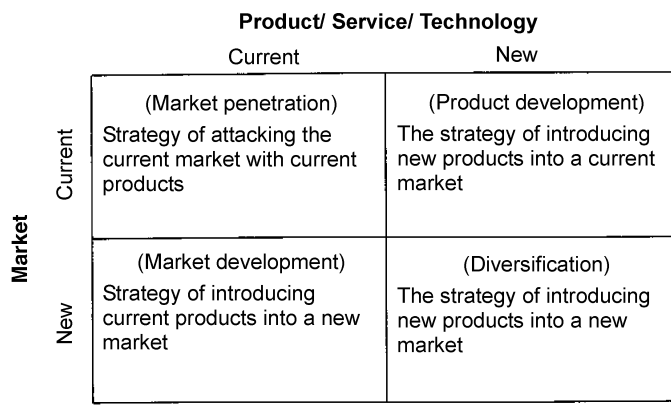

Figure 4-3: The Concept of the Growth Matrix

Source: Adapted from p. 147 of Genichi Nakamura and Tetsuhiko Kuroda's *Saishin Senryaku Keiei*, Sanno University Press, 1990. This work is a translation of H. Igor Ansoff's *The New Corporate Strategy*.

[20]The Growth Matrix is a strategy model proposed by H. Igor Ansoff. It is a tool for analysis that is used when considering a company's growth strategy. Specifically, it is used to broaden growth strategy alternatives and to discuss how to go about allocating management resources.

a management strategy.[10] The growth matrix is a measure to confirm the direction of the corporation's own growth strategy.

The growth matrix is for clearly indicating the type of management strategy to be deployed to attempt the company's growth, and the strategy is determined from the viewpoints of business domain, management environment, and management resources on the basis of the following four perspectives; market penetration, market development, product development, and diversification.

1) *Market penetration*

The market penetration strategy is a strategy for promoting growth in the current market by making use of current products/services/technologies. Some representative examples of this strategy include the strategy of Southwest Airlines, which helped the company gain an advantage by heightening its cost competitiveness through development and productivity improvements of new technologies, and the strategy of Yamato Transport, which helped the company heighten its competitiveness by raising customer satisfaction levels through making it possible to designate delivery times.

2) *Market development*

The market development strategy is a strategy for making an entry into a new market by making use of current products/services/technologies. While the average amount from a single customer transaction remains the same, the strategy involves growing sales by increasing the number of customers, and its representative examples include Starbucks' strategy, which is helping the company advance its multi-store operation by promoting expansion from urban districts to backbone cities and provincial cities, and the strategies of automobile companies, which are helping them advance their globalization strategies.

3) *Product development*

The product development strategy is a strategy for introducing new products/services/technologies into the current market. It involves broadening the assortment of a product, service, or technology lineup to raise the average amount from a single customer transaction by encouraging customers to make additional purchases. Its representative examples include Uniqlo's strategy, which helped the company offer a variety of merchandises using high-performance materials, and Mister Donut's strategy, which helped the company add Yum Cha (Chinese tea and snacks) and noodles into their product lineup.

4) *Diversification*

Diversification is a strategy for introducing new products/services/technologies into a new market. As it is an unprecedented challenge, this field's entry risk is high. Still, it is a field that promises the possibility of gaining a substantial founder's profit, since it is an unexplored area devoid of any competition. Its representative examples include the strategies of many venture corporations, such as ICT and biotech companies.

Corporations need to apply the perspectives of such growth matrices to their market development strategies and clarify what strategy field would contain the strategy that can respond to various factors, and also clarify what type of essential qualities such a strategy should have.

Therefore, the four perspectives pertaining to the growth matrix become essential items that help to put market development information in order and systematize information by responding to various properties of a strategy. Naturally, when you carry out the assetization of market development information, you select strategic attributes from the growth matrix, and, based on these attributes, determine what products/services/technologies are the most desirable.

4.2.3 *Balance between R&D information and market development information*

When you compare market development information with R&D information and technology information, until now, market development information had largely preceded and influenced other types of information. In other words, it had often been the case that the engineering and R&D departments had been coming under the influence of the administrative department or the marketing and sales departments.

In addition, in these times when the management environment is becoming more demanding and the future seems uncertain, it is no longer desirable to have a situation where market development information takes precedence over other types of information when launching a new business to develop new products. In fact, such a situation may even be inviting an outcome that sees your company being left behind in the market competition. Therefore, it is important to attempt to strike a balance between R&D information and market development information in a way that allows you to make use of your company's strengths.

To this end, your company's experts, who possess leading edge information from the technology and R&D departments, just as they possess advanced market development information from the sales department, need to understand the mutual strengths and weaknesses of the different departments and work to compensate for their weaknesses through complementation. For example, if a definitive medical product for restoring hair is developed, a company will clearly be able to dominate this field's market. For this reason, it will be easy to imagine the sales department of a pharmaceutical company requesting the technology and R&D departments to strongly engage in making developments in this field.

However, in the event that you cannot guarantee the development of such a medical product in several months' time or in several

years' time, what the sales department should nevertheless be doing is provide the technology and R&D departments with the latest market development information in a timely and continual fashion. Such information would include data on the medical-product developments of rival firms as well as data on the effects and side effects of newly launched "hair-restorers." Naturally, it will be necessary for the technology and R&D departments to convey information laterally to the sales department on such matters as the outlook and progress of new product developments being made through the adoption of new technologies, and on what are the problems and bottleneck issues standing in the way of development.

Up to now, carrying out such a form of information exchange had been impossible unless a conference was held for a limited amount of time to exchange opinions on a face-to-face basis. However, at present, it has become possible to formally or informally exchange information by making use of the information access environment of an in-house information system such as email, TV conferences, and the intranet. Moreover, in information exchange today, it has become possible to quickly obtain many opinions from not only experts within the company, but from outside the company as well, thanks to the information access environment of the open network, which connects the in-house information system to the Internet.

By making use of such an information access environment, what used to be top to down communication will become horizontal in nature, helping to realize a two-way, interactive form of communication where parties can complement each other.

4.2.4 *Assetization of market development information*

It is a top priority to see that market development information, R&D information, and technology information complement each other. However, to deploy the assetization of mainly market development

information amid such complementary relationships, you must take into consideration the following three points:

1) *Making development possibilities efficient*

This point pertains to the necessity of having market development information contribute not only to the development of new markets or the expansion of established markets, but also to the promotion of new technologies and R&D. In other words, this means "information that does not involve the promotion of efficiency in the development potential of a product is not market development information."

2) *Reducing the period for possible development*

This point pertains to the necessity of providing market development information that is technical in nature and can help in developing new products in a short period of time. In other words, information that does not help to reduce the period for possible development is not market development information.

3) *Reinforcement of the development system*

This point pertains to the necessity for building and examining the effect and impact of an organizational setup that allows for continually providing market development information to relevant departments within the company and relevant parties outside the company. In other words, "information that does not help to reinforce the product development system is not market development information."

For example, the disposable camera developed by Fujifilm[21)] is a new product that was created by a project team comprised by

[21)] In July 1986, Fujifilm released the disposable camera, "Utsurundesu," but at the outset this was not a product that had taken recycling into account. In April 1990, Fujifilm announced the intention to salvage units that had already finished being used, and at present it is a misnomer to call the product a disposable camera, as most of its components such as the body, lens, and strobe are recycled. In fact, the correct way to refer to this camera is to call it a lens-equipped film.

personnel from the Market Development Department and Technical R&D Department. In this case, the concept for the product was simply derived from the idea advocated by the sales department, which was the expert on market development at first.

This idea was one that believed that the camera, like other products, should be a "disposable good." However, the issue that actually came up in the process of commercializing the disposable camera was the issue of whether it was going to be possible to produce a single-function camera at a sufficiently low price that customers would tolerate. The camera would be premised on the idea that it would be exhaustible. In addition, after the launch of the product, there were changes detected in consumer behavior that accompanied the heightening in awareness of environmental issues. Specifically, consumers began to take interest in how products were going to be recycled and to what extent it was going to be possible to reuse them.

Therefore, drawing from the results of a market survey, it became clear that the crucial factor that would determine the success or failure of this project was whether it was technically feasible to develop below a certain price level a disposable camera that came equipped with a minimum standard of functionality. In addition, during later recycling, rival companies, who had been simply disposing their products up to then, began to exchange recovered cameras among each other and discuss whether it would be possible to engage in a collaborative recycling initiative.

If market development experts have a thorough understanding of your firm's technology, it will be possible to clearly foresee product development potential and the necessary developmental period. In addition, if there is a market development expert advocating the necessity of a product, receiving various proposals from the camp of technical developers as well will make it all the more possible to reduce a product's development potential or the time required for development.

In this way, the assetization of market development information entails the construction of an information system that can help in finding out as early as possible the development potential and feasible developmental period.

4.2.5 *Impact of systematizing management strategy (development) information*

The systematization of management strategy information or development information is having a large impact on market development information, technological information, and R&D information. Figure 4-4 shows the case of systematizing management strategy when a corporation is developing a business. In the systematization of a management strategy, a strategy can be roughly classified as either a "business strategy" or a "functional strategy," depending on whether the strategy directly links to commercialization or not.

With regard to the "business strategy," which is directly linked with your firm's business development, a strategy can be categorized as either (1) existing business strategy, or (2) new business strategy, depending on whether the strategy is focused on either an existing business or a new one. In addition, with regard to "functional strategy," which is not directly linked with your firm's business development, depending on whether a strategy attaches importance to enhancing structure or whether it attaches importance to increasing efficiency, a strategy can be categorized as either (3) structural strategy, or (4) rationalization strategy.

Furthermore, (1) an existing business strategy, depending on the field it emphasizes, can be further broken down as market expansion development strategy or product development strategy. In the case of a (2) new business strategy, depending on the targeted business, it can be further broken down as either peripheral business development or new business development. Furthermore, (3) structural strategies, depending on the type of structure emphasized, can be broken down into the following categories: decentralization strategy,

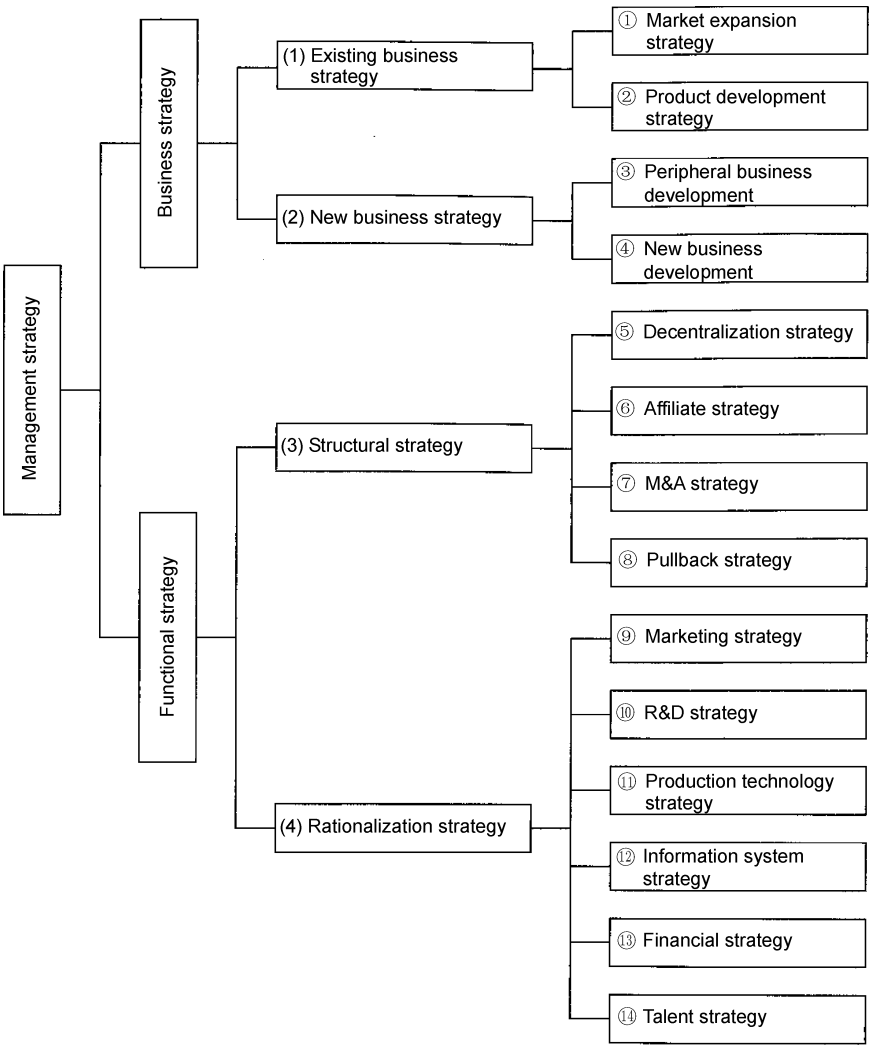

Figure 4-4: An Example of the Systematization of a Management Strategy

affiliation strategy, mergers and acquisition strategy, and pullback strategy. With regard to (4) rationalization strategies, depending on the type of efficiency emphasized, they can be broken down into the following categories: marketing strategy, R&D strategy, production/technical strategy, information system strategy, financial strategy, and organizational talent strategy. However, even though information

gets systematized in the determination of all categorized management strategies on the basis of the details and fields emphasized, it does not mean that it is acceptable to regard other details and fields as unnecessary or to ignore strategies other than those determined individually.

For this reason, the demanded product structure (product line) becomes one that is based on your firm's management strategy. In addition, where R&D is concerned, the demanded technology standard and development period will vary according to whether the aim is to create high added value for preexisting products or to create new added value through new products or to make new products that are peripheral to preexisting products. In other words, it can be seen that such management strategy information or development information are providing essential requirements for market development information, technological information, and R&D information.

Incidentally, with regard to product structure, what is demanded in the management strategy is the issue of whether it is sufficient to only provide basic requirements. Naturally, it is certainly true that the long-term business strategy of a corporation's specific product line is one of the vital factors of a management strategy.

Meanwhile, the person in charge of market development information must provide helpful information on topics such as the launch timing for new products, existing product upgrades, and the pullback timing for existing products by drawing up a management strategy that takes their company's product portfolio into account. In addition, the person in charge of technological and R&D information, must categorize and interpret the R&D strategy information contained in the management strategy by product, by function, by amount of technology investment, etc., and provide to the person in charge of the management strategy whenever necessary the feedback information on the validity, feasibility, and implementation timing of the market launch plan for new products and the upgrade or pullback plan for existing products.

In any event, in determining the management strategy, systematized chronological information is necessary. Such information will influence the market development speed and timing, and additionally, the progress of R&D and the timing for introducing new products into the market. For this reason, the more systematized the management strategy information or development information is, the more you will be able to clarify the requirements for market development information, technological information, and R&D information, and thereby raise feedback frequency, which will in turn help you to provide more appropriate requirements. Therefore, the various information systems begin to become more interconnected with each other, helping to reinforce the assetization of information in the process.

4.2.6 *From systematizing to assetizing management strategy (development) information*

To evolve from systematizing management strategy information or development information to assetizing them, you need to first of all clarify the procedures of the systematization, which will form the basis for the assetization. The procedures for systematizing management strategy or development information are as follows: (1) conduct environmental forecasting, (2) perform analysis of opportunities and risks, (3) perform analysis of your company's strengths and weaknesses, (4) perform analysis of the product line, and (5) perform analysis of matters that can be responded to or possibly responded to — i.e., SWOT analysis.

To carry out these procedures, in addition to the limited in-house knowledge information belonging to your company, it is essential to use information or databases found outside of the company. This is because the first step toward evolving from systematizing to assetizing management strategy information or development information happens when gaps in business processes are discovered after taking

various procedures into account, and correctives and countermeasures are determined.

Therefore, if there is an error in these correctives or countermeasures, your management strategy information or development information will stay at the systematized level and will not go on to develop into assets.

These correctives and countermeasures will form the basis for determining the management strategy plan. Such management strategy information or development information that have not been analyzed beforehand or that do not have any goal or direction will simply remain as information that satisfies only the person in charge.

To carry out all five of the procedures mentioned above, you must clearly show targets and completion periods by judging your company on the basis of the following points of reference; market share, relative margin, position in the product life cycle, comparisons with other firms' new products, and additionally, plans for plant and equipment investments and key-personnel training. When you are able to clearly show targets and completion periods, it will become possible to carry out a shift from systematizing to assetizing management strategy information or development information.

Incidentally, when making the transition from systematizing to assetizing management strategy information or development information, to promote an effective implementation of the procedures, the following five items are demanded:

1) *Criteria for evaluation*

This pertains to clearly showing competitive (relative) evaluation criteria in the procedures. With this item, the determination of specific correctives and countermeasures becomes possible.

2) *Order of priority*

This pertains to clarifying the order of priority in the competitive (relative) evaluation criteria of the procedures. With this item, it

becomes possible to make responses through the allocation of time and management resources.

3) *Targets and durations*

This pertains to clearly showing targets and completion times based on the order of priority of the procedures. With this item, it becomes possible to indicate specific targets and completion times.

4) *Unforeseen situation*

This pertains to preparing alternative targets and completion times upon clarifying contingencies[22)] that make the achievement of the original goals difficult. With this item, you will be required to assume the occurrence of unforeseen situations and make it possible to develop predetermined correctives and countermeasures to minimize any resulting damages and losses.

5) *Pre-adjustments*

This pertains to being fully prepared with a pre-adjusted system that can help in dealing with any difficulties arising in the course of achieving targets. With this item, it will become possible to deal with risks (uncertain factors) that pose as obstacles in running businesses and projects. The idea is to build a pre-adjusted system for the purposes of being prepared to deal with any influential risks that may surface.

4.2.7 *A means for promoting the assetization of management strategy (development) information*

Until now, along with promoting the procedures that help to assetize management strategy information or development information, we have been studying their criteria for evaluation. Logically speaking,

[22)] A contingency is something that may or may not occur and implies preparing for the possibility of an unexpected outcome. Its gist, however, is that the outcome is uncertain, regardless of whether it is good or bad.

they are sufficiently understandable. However, if you easily make management-related decisions on the basis of only a superficial set of criteria for evaluation, you will run the risk of attaching excessive importance to specific criteria.

In particular, corporations that have entered into their mature stage and are carrying out a "financial strategy" as part of a streamlining strategy are highly unlikely to think about escaping from the mature stage by carrying out R&D that strives towards implementing new technologies. But corporations that are deploying "new business development" as part of their new business strategy are more likely to lead new technologies and R&D to success, and also realize a continual pace of growth for the company. For this reason, the value of "new business development" will increase.

To this end, it is necessary to review on a fundamental level the issue of regarding a company in terms of its principal field. With respect to technology and R&D, after gaining an accurate grasp of your company's management environment and its conditions, you will have to seriously reconsider questions such as what field should your company demonstrate its technological leadership in, what type of companies should your firm attempt alliances with, and what technological goals should your company aim to achieve after covering such areas as production, raw materials, labor force, and advertising and publicity. Drawing from the answers to these questions, you will then need to develop a set of criteria for evaluation that is not partial to any specific criterion.

The development of digital wristwatches by Casio is the result of a strategy that applied the concept of the analog wristwatch, which uses the conventional long and short hands of a clock, to the digital technology the company itself possessed. This strategy is an exemplary case of bringing about a new technological architecture as a result of a fundamental reappraisal aimed at demonstrating the company's technological leadership.

Casio's core technology had seen a shift from precision-machinery processing to microelectronics, as the company became capable of

assembling through automated lines. As a result, it had begun to wield a large influence over markets and industrial structures. For example, by starting to sell Casio wristwatches through distribution channels such as discount stores, stores specializing in watches, supermarkets, and department stores, the company was able to establish its watch's position as a public product among watches.

In addition, improvements in IC technology had paved the way for the emergence of wristwatches with not only simple stopwatch functions, but with value-added features such as games and TVs as well. Furthermore, along with the rapid rate of diffusion of the watches and improvements in their functionality, the price had dropped to levels that had been formerly unforeseeable. Incidentally, in recent times, as a prerequisite for promoting the assetization of management strategy information or development information, the ability to deal with computer system risks has become crucial.[7]

After all, companies will have to bear the losses stemming from defects and inconveniences of information systems that may shut down or malfunction. Furthermore, unlawful computer uses could jeopardize the credibility or reliability of various types of information. To reduce such system risks, companies need to assume the occurrences of malfunctions and accidents and adopt countermeasures that allow for carrying out the dualization of hardware such as machinery and tools, the establishment of a computer center in a physically remote location, and the rigidification of a security system that can facilitate data backup operations.

4.2.8 *Reinforcement of the interrelationships between management strategy information, market development information, technology information, and R&D information*

To reinforce the interrelationships between management strategy information, market development information, technology information, and R&D information, it is necessary to determine a market

development strategy and a technology and R&D strategy that revolve around the management strategy.

To reinforce the interrelationships between these sets of information, you must specifically show the activities involved in each of these fields and then attempt to make mutual adjustments. As one measure toward achieving this end, the cross-impact analysis is effective. This approach helps you to foresee what information will be mutually necessary, and what information should be provided to benefit the activities of other fields. With cross-impact analysis, the series of development matters related to the process of developing a product are mutually linked to a number of events such as the probability estimates for the completion dates of the matters.

Consequently, causal relations become clarified and help to predict the impact of those matters. At the stage of making predictions, in the field of market development information "market forecasts" are carried out, and in the fields of technology and R&D, "technology forecasts" and "new product forecasts" are carried out, and in the field of management strategy, "management forecasts" are carried out. However, if these fields fail to satisfy the information requirements of other fields respectively, their directions will be scattered and disconnected. For example, in the management strategy of a certain corporation, when the entry into the biotechnology field is the primary policy in the development of a strategy, by carrying out forecasts through a cross-impact analysis, you will be able to focus the direction of forecasts, whether they may pertain to market forecasts or technology forecasts.

Therefore, from the perspective of a corporation's management strategy, with regard to making a foray into the biotechnology field, by focusing the forecast directions, the applicable technology field will expand. In addition, on the other hand, consideration must also be made for the promising technical fields where research

is still underway. They include the development of bioreactors,[23] development of mass cell culture technology, and the development of DNA recombination technology. For example, if definite goals of a plan for the next eight years are made clear to all the members of an organization, you will be able to make focused, medium to long-term market forecasts regarding what type of market is desirable in accordance with the order of priority of those goals.

Furthermore, in terms of technology and R&D, various technological forecasts will be carried out, including forecasts for the possible uses of specific technologies such as the adaptation of regenerative medicines of bioreactors, forecast for the possibility of supplying mass quantities of fine chemicals through mass cell culture technology, and forecasts for the possibility of discovering enzymatic inhibitors concerned with diseases and new microorganisms concerned with specific biologically active substances.

It is through having mutual exchanges of such forecast information between each field that concrete implementation plans of a management strategy can be devised. In addition, non-technological financial information, such as economic outlooks, market forecasts, and industry forecasts, should be treated as important forecast information and their influence at various stages must be taken into consideration, along with the influence of demand forecasts. These stages include the information-gathering stage, the information analysis stage, the target search stage, the goal setting stage, and the implementation stage.

While these sets of information exist in each of the stages mentioned above, by carrying out such mutual exchanges of information and analytical assessments, the smooth and efficient development of new products becomes possible. Furthermore, the information

[23]The prefix "bio" in bioreactor refers to "biology," and the word "reactor" in bioreactor refers to "reaction vessel." In effect, a bioreactor is a reaction apparatus that uses the catalytic action of biological organisms to synthesize and decompose materials.

system's role is to support the management strategies of each of the stages.

4.2.9 *Centralized/decentralized systems for a variety of information*

The change in the system configuration of the corporate information system from a centralized data processing system to a decentralized processing system took place when companies were abandoning the centralized data processing system of the mainframe computer and were promoting business reforms, while adopting a more offensive management style.

The transition from the centralized data processing system of the mainframe was a move to carry out measures for resolving various problems posed by such a system.[7] Such measures included: (1) improvements in processing response and performance during peak business times, (2) responses to the increase in man hours and development times that resulted from the mainframe's incapability to be flexible in the face of additional requirements of individual systems, and (3) reductions in the operational and maintenance costs incurred by an information system. The promotion of business reforms and the change to a more offensive style of management was a response to meet several needs, including (4) the need to introduce a new structure to promote business reforms within the company, and (5) the need to fulfill the requirements of new information systems for management strategy data, market development data, technology data, and R&D data, which became necessary after it became an urgent matter to reform sales strategies as companies began to switch their management strategies from defensive to offensive ones.

As one approach toward meeting those needs, companies began to switch their systems to the client-server type decentralized processing systems. With the decentralized data processing system, the workload

lightened relative to the one that had resulted from the centralization of processing in a mainframe computer. Consequently, a flexible client-server type information system was built. In addition, thanks to the ATM-LAN method,[24] the lines were streamlined and an attempt to construct an integrated information system was made, while carrying out a fundamental reexamination of the mission-critical task system.

With the decentralized data processing system, the restructuring of the R&D information processing system was carried out to help realize seamless business operations. The aim of such a system configuration was to change closed systems, which were confined within disparate departments within an organization, to open systems and realize a system environment that could be accessed by all groups within an organization.

Incidentally, in the case of upgrading the processing system concerned with this R&D information and developing it into an information system that includes various other data such as those pertaining to management strategy, market development, business strategy, human resource strategy, and financial strategy, the general approach is to basically establish and manage a large part of the management strategy information and a part or large part of other information under the centralized control of the Management Planning Department.

As for information such as those that pertain to technology and R&D, human resource strategy, financial strategy, and market development, it is necessary to establish, manage, and control them in a decentralized fashion at various departments in charge, such as the Technology and R&D Department, Human Resources Department,

[24]The Asynchronous Transfer Mode (ATM) is one of the multiplexing schemes that divide a single line into multiple logical lines (channels) for realizing simultaneous communications. This mode carries out transmissions and receptions by dividing the data of all channels into fixed-length data of 53 bytes.

Training Department, Financial Department, Marketing Department, and Sales Department. On the other hand, since all departments will require a small part, or depending on the situation, a large part of each other's information, the sharing of information through the use of mutual networks such as VAN and LAN will become necessary. It is in this way that information management systems are constructed for the development of new products through the use of computer and communications technology.

In the case of building next-generation information systems, AI and automatic translation features and even advanced search features will be introduced into the technology and R&D systems.

Regarding knowledge information systems in particular, it will be highly probable that such a system developed by your own company will be used simultaneously with databases developed by outside firms and intelligent information systems. Consequently, you will be able to access and use the latest information available and apply it for the benefit of your corporation's management strategy.

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