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# ECONOMIC ANALYSIS OF BUSINESS ORGANIZATIONS\*

## —UNCERTAINTY, ENTREPRENEURSHIP AND HIERARCHY—

By Banri ASANUMA\*\*

### I Introduction

In the standard theory of the firm, it is supposed that the activity of the entrepreneur has already ended when the cost curves or the production possibility sets are drawn, so that he does not come to the fore in the theory. In parallel with this, a firm does not have a hierarchic structure and is regarded as a point of mass.

Such a concept of firm lacks relevancy for at least several purposes. Take comparative systems, for example. From Lange to Arrow and Hurwicz, the central concern was search for a system which can locate an efficient production configuration in an informationally efficient way, and a traditional concept of firm as a production unit was used as a necessary building block. However, pursuit of static efficiency has only a limited meaning. It seems that at the present stage, whether in a socialist economy or in a capitalistic economy, it has become a more urgent task to assure such kind of progressiveness as to be able to satisfy the needs of consumers<sup>1)</sup> and to deal with various negative effects produced by the hierarchy within a firm. It would be necessary to introduce entrepreneurship and hierarchies explicitly into the theory in order to analyze such kind of problems.

From late 1960's to 1970's, in the United States, theoretical study of internal organization has been emerging as an important area.<sup>2)</sup> As is pointed out by Spence [9], the theory of internal organization is a development of the theory of the firm, which puts emphasis on internal allocation mechanisms. What has served as a background for this development is an article of Coase [3] published in 1937. The work of Oliver

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- 1) The whole argument of Kornai [5] is based on his recognition that the most pressing problem for Hungarian economy is to secure progressiveness so as to be able to meet the needs of consumers.
- 2) Arrow took a step toward theoretical study of organization including both internal organization and the market in [2]. As an introduction to the theory of internal organization, see Chap. 1 of Williamson [10]. See also Spence [9].

Williamson [10], who carries the banner in the new development of the theory of internal organization, can be considered as a development of the work of Coase. On the other hand, Knight [4] had made an original argument in as early as 1921 on entrepreneurship and hierarchy in relation to uncertainty. In the first part of this paper, theoretical structures of the works of Knight, Coase and Williamson are analyzed. In the second part of this paper, using interesting findings by Nakaoka as a stepping-stone, an attempt is made to extract an implication from the work of March and Simon [6] that analyzed how people deal with uncertainty in an organization. In the present author's view, we can draw from the analysis of March and Simon a sequence of predictions, which is a refinement of Knight's argument on the evolution of the vertical division of labor. It also suggests the importance of supplementing the framework of the analysis of Williamson from another point of view.

## II Frank Knight

### 1. The Three-Stage Theory of Knight

As Aoki [1] showed brilliantly, Knight presented at an early stage an unique argument on the relationship of uncertainty with entrepreneurship and hierarchy within a firm. I shall summarize here his argument as a three-stage theory, for it seems to clarify understanding of his notion of entrepreneur.

As is well known, what Knight called "true uncertainty" is uncertainty concerning phenomena to which statistical grouping cannot be applied because of their heterogeneity and uniqueness. He called it "unmeasurable uncertainty" as distinguished from "measurable uncertainty" ("risk") which allows statistical grouping and the estimation of "statistical probability". So as to judge the likelihood of occurrence of such phenomena, we cannot but depend on the "estimate" or opinion. In business both "measurable uncertainties" and "unmeasurable uncertainties" come into existence. But it is the latter that gives a characteristic form of an "enterprise" to an economic organization and explains the peculiar income of the entrepreneur.<sup>3)</sup>

In order to explain this, Knight extracts from the same large-enterprise economy of the United States in the twentieth century three different stages by logical abstraction. He pursued his discussion step by step from the simplest and most abstract stage to the more complex and concrete.

In the world where there are no true uncertainties and where progress is absent, perfect competition takes place. It is a world of independent small producers who are engaged in "production for a market". There may be some primary division of labor but no hierarchy within a firm, for there is no need for responsible management or control where there are absolutely no uncertainties. Even marketing operations will not exist there, for the flow from raw materials and productive services through production processes to the consumer is quite automatic. We need not assume omniscience,

3) Knight [4], Chap. VII.

and adjustment through trial and error may exist. There may also exist a manager or a supervisor who will coordinate the activities of several individuals. However, it would be a purely routine function and would not demand responsibility.<sup>4)</sup>

When uncertainty is introduced into this world, goods are produced for a market based on forecasting. Along with this, the responsibility to predict consumers' wants, and the technological direction and control of production are concentrated into a narrow class of producers, which gives rise to a new economic functionary of the entrepreneur. Since there exist uncertainties, the task of deciding what and how to do comes to take a primary place, while execution takes a secondary place. Therefore, such specialization becomes inevitable. This specialization is based on 1) the knowledge and judgment, 2) the ability to forecast, 3) the ability to manage, and 4) the confidence in one's own judgment and the attitude to back it up by risk-taking. The items 3) and 4) work inter-dependently. For the human nature makes it impracticable for one man to guarantee a definite income to another without acquiring power to direct his work, nor is it likely for the second party to subject oneself to the direction of the first without such guarantee. Hence, with uncertainty introduced, differentiation of producers into the entrepreneur and into suppliers of other productive services takes place on the basis of the attitude toward risk. Along with this emerges differentiation of income into profit as residual income and into contractual income. Now, what is primarily important for judgment in business is that on the ability of judgment of other people. To "control" means to choose someone who shall undertake "controlling". If this proceeds gradually downward, there emerges the vertical division of labor. Although even the labor of an unskilled worker at the bottom involves in some sense meeting uncertainty, as long as the ability to perform such duties is judged precisely, their duties can be dealt with effectively as a routine from the standpoint of an organization. In other words, let a worker be selected to assume a given job, and let him appeal to his superior for judgment and ability in case of unexpected situations. Then, the responsibility to deal with uncertainty beyond the boundary of the job will be transferred to the superior, and the worker does not have to take the responsibility. This is why he receives a fixed wage. The same thing can be said about the levels of superiors. If we repeat this argument in order, the true responsibility is gradually transferred upward, concentrating at the top. The top is the true entrepreneur in a large organization.<sup>5)</sup>

With the introduction of the factors of progress as well as uncertainty, we come back to the concrete reality of large enterprise economy. Among the factors of progress Knight attached special importance to the accumulation of capital goods. To decide what forms of capital goods shall be created, where, by what methods, etc. is "an exercise of judgment of far the highest type called for in the business world"<sup>6)</sup> and demands special knowledge and foresight of future conditions. Thus, along the same line as the

4) *Ibid.*, pp. 76-80, p. 244, pp. 264-268.

5) *Ibid.*, pp. 268-272, pp. 279-290, pp. 291-300.

6) *Ibid.*, p. 325.

specialization of the function of the entrepreneur in the field of production, the evolution of specialization in this operation also becomes inevitable. Therefore, also in the field of investment the specialization into the entrepreneur and into more passive suppliers of productive services takes place. However, Knight does not necessarily conceive here a hierarchy within an organization. Rather, he calls risk-taking participants in an organized capital market entrepreneurs as distinguished from those who participate merely in return for the contractual income.<sup>7)</sup> Thus, in the argument of Knight, the entrepreneur at first presents himself in the field of production on the second stage, and again in the field of investment on the third stage. What are the relationships between these two entrepreneurs? This is our next subject.

## 2. The Nature of the Entrepreneur and the Diffusion of the Entrepreneurship

The central philosophy of Knight [4] is to explain profit as based on the activity of the entrepreneur under uncertainty. The corollary is the proposition that profit should not be explained by progress or growth distinguished from uncertainty. Therefore, the entrepreneur in the field of production on the second stage of the above mentioned three stages must be the one who shows the very nature of the entrepreneur conceived by Knight. What is the essential function which is performed by this entrepreneur? It is to perform the commitment of various factors of production on the basis of forecasting prior to the generation of actual demand and to take the responsibility for the result. According to Knight, there are two elements of uncertainty which must be coped with by a producer. The one is technological uncertainty about the quality and the quantity of the output from the expenditure of given resources. The other is uncertainty concerning consumers' wants which must be satisfied by the products in the future.<sup>8)</sup> From the standpoint of purposive behavior, obviously the latter precedes. Under uncertainty of demand, a producer must first decide on the quality and the quantity of goods to be produced. Why, however, is consumers' demand uncertain? The fundamental assumption laid in the argument of Knight is as follows. Firstly, production takes time. Here Knight was explicit.<sup>9)</sup> Secondly, a producer undertakes a mass-production, or production on anticipation for a large number of general consumers. This was tacitly assumed. The consumer "does not know what he will want, and how much, and how badly; consequently he leaves it to producers to create goods and hold them ready for his decision when the time comes".<sup>10)</sup> The producer can take the initiative against consumers, because, owing to the law of large numbers, he can estimate wants of the multitude more easily than those of an individual and can combine risks.<sup>11)</sup> Thus, for Knight the essential uncertainty is the uncertainty of demand due to the specific type of structure of the relationship between production and consumption, in which a large volume of factors of production must be committed prior to the generation of actual

7) *Ibid.*, pp. 314-327.

8) *Ibid.*, pp. 237-238.

9) *Ibid.*, p. 237.

10) *Ibid.*, p. 241.

11) *Ibid.*, p. 241.

demand. To perform forecasting against this uncertainty is one of the constituents of the essential function of the entrepreneur, and to take responsibility for this forecasting is another; these two are the dual links which constitute the essence of entrepreneurship.

What does it mean, then, to take responsibility for forecasting of demand? There is one more related question. Previously we have observed that the responsibility for control is gradually transferred upward along the scale of an organization in a large organization, and concentrates at the top. Where does this responsibility ultimately go in a typical corporation which is not under a single ownership? Knight argues that the true responsibility is to guarantee the payment of contractual income even in the case of unexpected situations. Consequently, so as to be able to assume the responsibility, the entrepreneur needs to possess either transferable assets or future productive capacity. This makes it natural that the control in an enterprise comes to the hands of a person (or several persons) who possesses part of the productive services in the enterprise that can be disposed to guarantee contractual income. However the entrepreneurship rarely comes out in a pure form. In a typical modern business organization, it takes a form of a complicated division and diffusion of entrepreneurship distributed by a hierarchy of security issues which vary greatly in the degree of the right to control and in the degree of the guarantee of income.<sup>12)</sup> Thus, the entrepreneur in the field of investment on the third stage in the three-stage theory of Knight is the actual or phenomenal form of the entrepreneur in a modern corporation. The entrepreneurship is not concentrated in a single person, but is diffused over a large number of people.

Thus Knight considers that suppliers of productive services are differentiated into the side that guarantees contractual income and into the side that is guaranteed; he primarily calls the former group the entrepreneur, whose typical form is conceived as the owner of monetary assets. However, the guarantee function based on ownership should not be taken as the sole element of the entrepreneurship conceived by Knight. For Knight argues: if a man who has proficient ability to direct but who lacks in the ability to guarantee income finds someone who lacks in ability or willingness to direct but is able to offer security for the former's contract of employment, so that they can act in cooperation, there emerges the entrepreneurship in partnership, and between the two takes place a variety of sharing of profit.<sup>13)</sup> In sum, according to Knight, the entrepreneurship consists of the combination of the two elements, i.e., the function to forecast, to lead and to control, and the function to guarantee contractual income on the basis of ownership. And these two elements are thought to be diffused over different groups of people.

### III Ronald Coase

The aim of Coase [3] was to propose a concept of firm, which on the one hand is

12) *Ibid.*, pp. 299-300.

13) *Ibid.*, pp. 289-290.

tractable by the tools of marginal analysis, and on the other hand can regain reality by explaining an important phenomenon usually overlooked.

Economic systems are generally thought to be coordinated by the price mechanism, but it does not apply within a firm. It is not by a change of relative prices but by an order of the entrepreneur that the production factor A moves from Y to X in a firm. Thus "the distinguished mark of the firm is the supersession of the price mechanism".<sup>14)</sup> Why in some cases does a coordination of production through the price mechanism appear and in other cases does a coordination through the conscious power of the entrepreneur take place? The task which Coase assigned to himself was to elucidate the basis on which the choice is made out of these two alternative methods of coordination.

Coase found that the existence of the cost of using the price mechanism was the main reason why it was more profitable to establish a firm<sup>15)</sup>. The most distinct form of it is the cost of discovering what the relevant prices are. Also there are costs of negotiating and concluding a separate contract for each exchange transaction. A firm can save these costs, because, when contracts are made between the entrepreneur and the factors of production, a single contract may take the place of a series of contracts. The characteristic of employment contracts of production factors and especially of labour contracts is to define only the boundary of the power of the entrepreneur and to allow him to direct production factors within this boundary. It may be a view to saving the cost of renewal of contracts, or it may be due to the risk attitude of the seller. However, more essentially it is attributed to the following fact: "owing to the difficulty of forecasting, the longer the period of the contract is for the supply of the commodity or service, the less possible, and indeed, the less desirable it is for the person purchasing to specify what the other contracting party is expected to do".<sup>16)</sup> A contract with the above mentioned characteristic is concluded, when it is indifferent for the seller what course of action is to be specified out of several courses, and when it is desirable for the buyer to put off specifying it. Coase considered that such a type of contract is the sign of the emergence of a firm<sup>17)</sup>.

As is seen, the central principle of explanation introduced by Coase was the "cost of using the price mechanism". He applied this concept not only to labor but also to a transaction of intermediate goods. In this case, he introduced the "cost of organizing a transaction within the firm"<sup>18)</sup> which is to be compared with the "cost of using the price mechanism". As long as the cost of organizing another unit of transaction is below the cost required for a transaction in an open market or below the cost of organizing the transaction within another firm, a firm will continue horizontal or vertical integration. In this way the explanation of the size and the degree of integration of a firm is subsumed

14) Coase [3], p. 334.

15) *Ibid.*, p. 336.

16) *Ibid.*, p. 337.

17) According to Simon, the authority relation emerges when such a contract is made. See Simon [8].

18) Coase, *op. cit.*, p. 340.

within the framework of marginal analysis.

Thus Coase introduced the “cost of using the price mechanism” and the “cost of organizing a transaction within the firm”. The former is the cost originating in a transaction in a market, while the latter is the cost originating in a transaction within an internal organization. The basic contribution of Coase is that he introduced in fact the concept of transactions cost into the explanation of the firm. However, he did not analyze further the contents and the constitution of the cost of using the price mechanism. Especially the relationship of uncertainty with other factors was not made clear.

#### IV Oliver Williamson

##### 1. The Organizational Failures Framework

What Coase tried to extract is the condition by which markets are substituted by internal organizations. Williamson [10] further distinguishes several forms or development stages of internal organization and tries to extract the condition by which one form of internal organization is substituted by another. When we compare the method which Williamson has taken with that of Coase, we may conclude that Williamson has pushed forward Coase’s approach in several points and has overcome insufficiency in Coase’s argument. We shall observe these points in order in the following.

As we have previously mentioned, what Coase has introduced is the concept of transactions cost. In common with Coase, Williamson puts his focus on transaction and bases his analysis on the viewpoint that a mode of transaction is chosen with considerations of relative efficiency of alternative modes of transaction. However, Williamson’s unique contribution is that he has analyzed the structure of transactions more deeply than Coase. Williamson selects two factors respectively for environmental factors of transaction and for human factors of transaction. He then makes a framework of analysis composed of the combination of these factors, which he calls the Organizational Failures Framework.

What he notices is the fact that human beings as the agents of transaction cannot have unbounded capacity of perception and of communication, although they may be regarded as rational. He calls this human factor “bounded rationality.” This is the factor Simon has greatly emphasized, and on this point Williamson follows Simon’s suit. Bounded rationality comes from neurophysiological limits of human beings as well as from language limits.

Another human factor is what is called “opportunism.” It is the extension of the conventional assumption in economics that human beings seek for self-interest, but the concept rather actively emphasizes the aspect that human beings do selective or distorted information disclosure and make false promises about future conducts.

On the other hand, the first factor which is extracted as to the environment of transactions is uncertainty. In chess, while rules and elements of the game themselves are certain, it is quite a complicated and enormous task to develop a complete decision



tree. As is shown by this example, what is practically unmanageable for human ability is equivalent to uncertainty. So Williamson treats “uncertainty/complexity” as a single factor. This will become significant only when it is paired with bounded rationality. For the latter would not become effective as a constraint in a stationary world; and if rationality were not bounded, it would be possible to build up a complete decision tree and to calculate the optimal solution within proper time for decision for every uncertainty/complexity.

The second factor in the environment of transaction is the condition of “small numbers.” This also become interesting only when it is paired with opportunism. For, if in a transaction we can select the other party out of many competitors, rivalry among them will hinder opportunistic inclinations from becoming effective; and if there is no opportunism, we can trust information or promises of the other party of a transaction and we have no difficulties in the transaction even though we have to select the party out of few.

There exist circumstances in which one party of a transaction possesses true information about the basic underlying conditions relevant to the transaction, while the other cannot acquire it except at great cost. In such circumstances Williamson says that there is “information impactedness.” It is a derivative from bounded rationality. Coupled with opportunism, this may bring difficulties in a transaction. An especially interesting case is as follows. If information impactedness arises from learning by doing associated with the execution of the contract, the condition of small numbers comes into effect at the time of contract renewal. Then opportunistic inclinations can become effective even if there may have been large number of competitors for bidding at the time of the first contract.

In sum, according to Williamson, (1) bounded rationality, (2) opportunism, (3) uncertainty/complexity, (4) small numbers, and (5) information impactedness are the fundamental structural factors of transaction. When combinations of these factors bring difficulties to some type of transactions across the market, then such type of transactions will be shifted from the market to an internal organization. Furthermore, when combinations of these factors bring difficulties to transactions within a type or form of internal organization, then another type or form of internal organization will be sought. Thus not only the substitution of the market by an internal organization but also the evolution of the internal organization from a simple form to a highly developed form is explained<sup>19)</sup>.

## 2. Sequential Adaptations to Uncertainty

Then what is the activator which makes these structural factors bring up difficulties to a transaction? And what kind of transaction poses the problem? Coase was not clear on these points. Williamson’s second contribution is that he gives explicit answers to these questions. Firstly, uncertainty of the future is the basic premise. Secondly, a long-term business relation is assumed. The proper formulation of the choice problem involved here is as follows: what mode of transaction is the most efficient in terms of transactions

19) Williamson [10], Chap. 2.

cost to keep a long-term business relation while making repeated sequential adaptations to the frequent changes under uncertainty?<sup>20)</sup> Therefore, it is not fair to compare a single sales contract with an employment contract as Coase and Simon did.<sup>21)</sup> Rather, what should be compared is the following three items: (1) contingent claims contracts, (2) sequential spot contracts, and (3) internal organization. Owing to bounded rationality, contingent claims contracts are practically infeasible for complex uncertainty which the parties surely have to face when they try to keep a long-term business relation under variable conditions. Sequential spot contracts are impaired by opportunism when a small-numbers bargaining situation arises and causes excessive bargaining costs or distorted allocation of resources. These difficulties can be solved by forming an internal organization.

### 3. Incentive-Control Mechanism in Internal Organizations

According to Coase, the shift to the internal organization is equivalent to the shift to the employment contract or the authority relation. The shift to the authority relation itself guarantees a saving of the transactions cost, until the firm becomes of a certain size. According to Williamson, however, an internal organization does not necessarily mean a hierarchic organization, but it includes groups of equal members who jointly possess an indivisible equipment or information and who share its service. Williamson calls them peer groups.<sup>22)</sup> Secondly, the existence of the authority relation in itself fails to guarantee fully a smooth sequential adaptation to uncertainty.<sup>23)</sup> The degree to which this adaptation may be smoothly undertaken depends on the concrete way how incentive-control mechanism is in the internal organization.

Thus according to Williamson, when compared with market transactions where an indivisible equipment or information is possessed by a certain individual and its services are sold to many other individuals, peer groups have an advantage in that they give rise to an incentive of joint income maximization and to a control mechanism in the form of group pressure, which may prevent opportunism from coming into effect. On the other hand, when compared with hierarchic organizations, peer groups have two disadvantages. The first is that both the cost of decision-making and that of communication are larger. The second is that peer groups have a looser structure in metering individual contribution to the organization. When combined with opportunism this may bring about the issue of free rider. From the viewpoint of efficiency, therefore, there arises a tendency toward hierarchic organizations. However, the story does not end with the shift to the employment relation. If the job is of such kind that it has the incumbents acquire some idiosyncratic knowledge or skill, the condition of small numbers arises. When this is combined with opportunism, adaptation to uncertainty gives rise to conflict and bargaining

20) Although Williamson does not explicitly state the formulation of the problem, as I have summarized here, he in fact meant the above formulation here and there. For example, see *ibid.*, p. 82.

21) *Ibid.*, pp. 71-72. Note that a single sales contract includes as a special case a contract for a labor service provided by an independent agent who is not an employee.

22) *Ibid.*, Chap. 3.

23) *Ibid.*, p. 72.

each time even under the authority relation. Williamson regards internal labor market as a device which was contrived in order to solve this difficulty. In other words, he interprets it as a device firstly to remove individual negotiations by giving an objective structure to promotion rules and wage rates under collective agreements and secondly to induce substantial cooperation as distinguished from perfunctory one of workers by introducing incentive-control mechanism in the form of promotion based on experience-rating.<sup>24)</sup>

#### 4. Atmosphere

Previously mentioned factors of the organizational failures framework are factors which underlie the efficiency of adaptation to uncertainty. Another contribution of Williamson is that he points out the existence of atmosphere as another variable besides efficiency. Efficiency and atmosphere are two variables which determine the desirability of a mode of transaction. Parties of a transaction may attach various levels of value to the various modes of transaction themselves. Williamson called such an aspect of transaction "atmosphere".<sup>25)</sup> For example, peer groups may be inferior to hierarchic organizations from the viewpoint of efficiency. From the viewpoint of atmosphere, however, they create among participants such moral involvement as will not arise in a market transaction, and at the same time they do not have those negative effects to attitude which are caused by severe monitoring and minute control under hierarchic organizations.<sup>26)</sup> Hence, the preference of a mode of transaction from the viewpoint of atmosphere and that from the viewpoint of efficiency may act in opposite directions. With such a reservation, Williamson places primary emphasis on efficiency to explain the development of alternative modes of transaction.

### V Hierarchy of Work

#### 1. Nakaoka's findings

By means of the organizational failures framework, Williamson is able to explain the ground for the emergence of internal labor market, vertical integration, and internal capital market in the form of the multidivisional structure. Moreover, he does not overlook the aspect of atmosphere. These are clearly his contributions. However, in explaining the emergence of internal labor market, he first assumes that workers have idiosyncratic skills and knowledge and then derives internal labor market as the result. If this gives an impression that the content of the work itself of a typical job in a modern corporation is fairly rich or is characterized as skilled, it may be misleading. We have to ascertain the actual transition of the structures and contents of industrial jobs in a historical perspective.

Although Nakaoka's work [7] is not a historical study, it is based on observations of

24) *Ibid.*, Chap. 4.

25) *Ibid.*, pp. 37-38.

26) *Ibid.*, pp. 44-45, pp. 54-56.

works in a variety of types of factories and offices including surgical operations. Applying keen analysis to the facts, he puts forth several interesting findings. The book has too rich content to permit a brief summary, but the most interesting points for us are as follows.

(1) In such kind of operation as smelting by electric furnace, something like the classical type of skill still remains. There, skill takes the form of that of a team, and the foreman occupies a position which is central to the operation. On the other hand, each worker can still perceive the fact that work in itself is an interaction between man and nature *via* the equipment. The worker judges from various signs like the color of the flame and so forth and takes actions necessary for the control of the process. The skill of a worker consists of quickness and exactness of a sequence from reading of a sign to taking an action. Each worker has something like a unique view of nature concerning the meanings of various signs and the relationship between the signs and underlying factors. This often acts as a spring of desire to develop more systematic understanding.

(2) Automation does not easily prevail in every kind of process. In many areas manual operations remain. The very essence of a factory lies not so much in dominance of automatic machines as in the technique of organization, which prescribes division of labor by process on the mechanistic principle. Each of the manual operations thus organized is fragmental and monotone. And when the sending of materials is automatized, the situation becomes worst. It is hard for the worker engaging in such kind of operation to develop an organic view concerning the relationship between himself and the nature and the society.

(3) Even in an automated factory such as a petrochemical plant, it cannot be simply asserted that automation improves skill. Rather, there develops a vertical division of labor between patrol-men, maintenance workers, technical staff and engineers. The crucial decision in a plant is the decision on a change of the conditions of operation such as target values for control, which requires high skill. This type of decision is concentrated to engineers. Workers as a collective can be said to acquire a certain level of skill, which is the basis of the productivity level of a plant. However, each individual worker does not necessarily acquire a significant skill. For example, the work of patrol-men is of such a character that requires tension and makes their nervous system tired but does not provide them with impetus to develop an organic understanding of the whole process of control of the plant. Thus although it is true that automation brings forth certain new types of skill, it does not necessarily mean that each individual worker becomes skilled. And the process of automatization itself is always a process by which skills previously held by workers are absorbed into equipments.

(4) When there are uncertain elements, operations become both tense and alive. Surgical operation is an example. In a factory such a phenomenon is observed only in the case of pilot-plant operation and starting of a new plant.

## 2. The Framework of March and Simon

Many elements which we see in Nakaoka's findings well correspond to the structure

conceived by March and Simon [6] by which rational men or administrative men cope with uncertainty.

According to March and Simon, a human being is comprehended as an organism. The behavior of an organism at a time point  $t$  and the internal state at  $t+1$  can be explained by the internal state at  $t$  and the environment. When the central nervous system receives stimuli from the environment, it evokes a proper program of responses from the memory and responds according to the program. The memory includes most of internal states and all sorts of partial and modified records of past experiences. The content of the memory is gradually revised through learning. When compared with the learning process, however, the process in which an established program is evoked by a stimulus is a rapid process.<sup>27)</sup>

In an analysis of such an individual human being lies a clue for analyzing the form and the role of information in an organization. Stimuli are information and the content of the memory is also information. Moreover we should notice the fact that the evoking or the revising of a program is an informational activity.

According to March and Simon, most behavior, and particularly most behavior in an organization is governed by performance programs. A program does not necessarily mean completely fixed content and it may be limited to designating a certain rule for decision, in which case there remains a room for choice although the degree of complexity of the choice is varied. We regard a set of activities as routinized to the degree that choice has been simplified by developing fixed responses to the defined stimuli. Inversely, we regard activities as unroutinized to the extent that they have to be preceded by program-developing activities of a problem-solving kind. A program is generated from past experience and in expectation of future experience in a given situation. Consequently, the greater the repetitiveness of individual activities is, the greater the programming. Thus programming becomes most complete for clerical and factory jobs, especially when they are organized mainly by process.<sup>28)</sup>

The economies of individual specialization arise principally from opportunities for using programs repetitively. Since programming needs investment, economies of specialization are to be derived from assigning the work so as to minimizing this investment cost per unit of program execution. The more stable the environment is, the more possible it becomes to decompose a program into subprograms and to assign each one of them as a special task. Also it becomes possible to interconnect programs beforehand. Standardization, interchangeable parts and buffer inventories are devices to bring about this stability.<sup>29)</sup>

March and Simon explain the organizational structure from the viewpoint of bounded rationality that human intellectual ability is limited when compared with the complexity of problems which are faced by individuals and organizations. Human beings

27) March and Simon [6], pp. 9-11.

28) *Ibid.*, pp. 142-143.

29) *Ibid.*, pp. 158-161.

can work on only a limited number of factors at a time. In order to adapt to changes, therefore, they require some patterns of behavior that are relatively stable and change only slowly. They are like the fulcrum of Archimedes. This forms an organizational structure. In the organizational structure, procedures which are used for program development, completion, implementation and revision are the most stable; switching rules that determine when one program should be applied come next in stability; programs for performing each task are the least stable. Seen from another viewpoint, short-run adaptations are made by selecting an appropriate program from the repertory, while long-run adaptations are made by addition and revision of programs. Thus the length of the horizon of adaptation corresponds to the hierarchy of stability in the organizational structure.<sup>30)</sup>

Change of programs is an innovation. As it involves sunk costs, a program once generated tends to last as long as the present course of action is satisfactory. However, if we choose a rate of change such as annual growth rate of sales or that of profits as the criterion of satisfaction, stimuli for continual innovations are themselves programmed.<sup>31)</sup>

### 3. Vertical Division of Labor

If we assemble the propositions of March and Simon and the findings by Nakaoka which we have seen, we may be able to draw following predictions on a tendency that exists within a business organization.

In a business organization, two kinds of activities, that is, execution of programmed activities and innovations, simultaneously proceed. The former constitutes short-run adaptations of the organization and the latter has longer time horizons. Desire for achieving economies by minimizing investment cost per unit of program execution brings about division of labor and specialization. The higher the level is in an organization, the larger proportions of an employee's task consist of innovative activities. The lower the level is, the more specialized an employee is in execution of programs.

Note that the very essence of skill of a worker described by Nakaoka exactly corresponds to a program or a bundle of performance programs coupled with programs for evoking. Thus the repertory of an organization consists of not only written manuals and programs embodied in equipments, both of which directly belong to the organization, but also programs that the workers have in their nervous systems. However, to the extent that the organization succeeds in stabilizing the environment of work thus enabling itself to achieve further economies of specialization, part of the programs previously held by individual workers are shifted to the organization. Automatization has similar effects.

In a multidivisional firm based on profit center concept, pressure for continual innovation may be programmed at the division manager level. The same criterion of divisional profit can also act as pressure for achieving economies of specialization. Thus the tendency towards vertical division of labor and shift of skills to the organization

30) *Ibid.*, pp. 169-171.

31) *Ibid.*, pp. 173-174, p. 184.

can be particularly strong in a multidivisional firm, other things being equal. Of course such a tendency is not wholly inevitable and attempts of job enrichment, responsible work groups and participation are efforts to attenuate the effect of the tendency described above. These attempts themselves are the signs of existence of such a tendency as the underlying factor.

As to the optimal choice of the mode of transaction, Williamson points out that there could be a contradiction or a trade-off between efficiency and atmosphere. The present author would like to slightly modify Williamson's formulation. In a choice of a form of business organization, the basic problem one has to face is the possible contradiction between efficiency and the needs for securing a path for individual development of the participants within the organization.

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#### Postscript:

Owing to the limitation of space, there are some curtailments of argument in this paper. A fuller treatment will appear in Japanese in an article entitled as "Kigyō Soshiki no Keizai Bunseki" ("Economic Analysis of Business Organizations") contributed to Masahiko Aoki (ed.), *Keizai Taisei Ron I—Keizaigakuteki Kiso* (*Theory of Comparative Economic Systems I—Economic Foundations*) (in Japanese) (Toyōkeizaishinpōsha, Tokyo, forthcoming).