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Product Development Emphasized on Design: Case of Nissan Motor Co., Ltd

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I Introduction

Some enterprises carry on restructuring organization structure while positioning design as a major factor of management strategy[1]. Then, what is product development structure which emphasizes on design? The purpose of this paper is to clarify in detail how product development organization structure changes after installing design to management strategy and to point out differences. Nissan Motor Co., Ltd. (it calls as Nissan hereafter) is taken up as an example of the organization, which changed structure to put more importance on design. In Nissan, it is after 1999 that the importance on design as a strategy has come to be recognized[2]. Therefore, changes from 1999 to 2000 are taken up in this paper, and We want to reexamine the meaning of organization structure emphasized in the existing researches by showing clearly why the structure of the present product development organization differs from the ones emphasized in the existing researches.

In recent years, the interest towards industrial design has been increased in the business world mainly based on manufacturing industry and there are many companies which preach the importance on the design strategy. However, the degree of the concern toward this subject had been lowered in academic world (Thackara, 1988; Fujimoto, 1991; Walsh, 1996). Especially, the analysis in the field of product development studies has not been in the flame work such as 'product development and design' until now.

For example, according to Clark & Fujimoto (1991), who advanced analysis of product development of automobile companies, the overlap of development stage (overlapping) and heavy weight product manager structure has been focused as an effective structure, which forms various component engineering techniques to one system within a short time but with few injection resources. The heavy weight product manager structure means here is structure which positions a concept leader [of a project], and gives a leader powerful authority and powerful responsibility for design development, and technology to further development. And this structure has been effective when it performs in the overlap of each development stage, because it promotes the common problem solutions beyond the section. This is because the frequent information exchange over the

section becomes indispensable in order to make the task of each section overlap in time and advance further development in parallel.

Furthermore, Nobeoka (1996) expanded an analysis unit from each individual project unit to plural project units, and observed the state of the organization structure, which manages efficiently the relationship during a project from a viewpoint of technology transfer. In the automobile industries in recent years, communalizing parts have come to be thought as important in order to aim at shortening of lead time, and curtailment of cost. To transfer technology efficiently among plural projects, the overlap of projects is important, and Nobeoka mentions installation of plural project administrators is as one of the effective structure. Furthermore, this paper can roughly be classified into the following two parts, according to the difference in the generalization range of the administrator; one is a center organization which makes plural project administrators generalize all functional sections that have adjustment needs mutually, such as design, and experiments, another one is called semi- center organization which puts only some functional sections of them under generalization of plural administrators.

Thus, the existing product development studies mainly analyses the product development organization, focusing the quality of manufacturing, and it clarifies efficient product development. Especially, most of automobile industries in Japan such as Nissan, equip with efficient structure and overlaps of each development stage for coherent process management and the coordination of each section such as the heavy weight product manager structure. They also clarify the organizational capability, which creates high level of manufacturing (Womac et. al, 1990; Clark & Fujimoto, 1991, Fujimoto, 1996). Then, what does the organization structure, which supports those capabilities mean in terms of utilizing strategic design? While Japanese companies maintain firmly the organization capability of advanced manufacturing structure, the weaknesses of design power or brand construction power have been pointed out (Fujimoto, 1996). Therefore, changing a viewpoint in this way may enable to make problems that have been missing in conventional researches closed up and advance product development studies further.

Therefore, this paper deals with whether the structure of the product development organization which has been seen after the organization change and was meant design consideration, is different from the heavy weight product manager structure emphasized in the existing researches, and the organization structure of a center organization. And if there is a different point from those organization structures, We want to reexamine the meaning of those organization structures focusing on the problems by paying attention to the order and reverse function of organization structure, which has been emphasized in the existing researches.

This paper consists of four paragraphs. Firstly, in II, case study of an organization change of Nissan is considered and it also tackles what the product development organization focused on

design is, which appeared in organizational structure performed from 1999 to 2000's. And also it tackles solutions of main theme such as seeking the difference of the structure, which has been emphasized in the existing researches. Then, We want to argue about a theoretical and practical suggestion obtained from case analysis in III. Lastly, in IV, subjects to which this paper was left, will be pointed.

II Case study[3]

1 Background of an organization reform

In this section, design is regarded as one of the important points of management strategy, and it focuses on product development of Nissan as an example, which has performed the organization change. Nissan is a company with the market share of the second place in the industry for years in Japan. However, from the latter half of the 1970s, market share has been loosed gradually, and after 1991, they had added up deficits 7 times in 8 years. As a result, they come to receive 585,700 million yen capital injection from Renault, the French automobile company, in May 1999[4]. Nissan is a company which has so far received high evaluation about technical freshness or its reliability as 'technical Nissan' (Ikari, 1987; Shibata, 1988). However, on the other hand, weak cost competitiveness and products power had become a neck. The products power means here is such as product planning, and design. The evaluation of design was not always high. Therefore, in Nissan, they have regarded design as one of the important points of management strategy since July 1999, and they tackle a change of the product development organization, which aimed at curtailment of the cost by strengthening of products power and communalization of platforms or parts[5].

2 Structure of product development organization, and positioning of a design section

2.1 The change of the heavy weight product manager structure

Nissan has started product development with giving powerful authority to a product manager called as a products supervisor hereafter, whose leadership could be exercised from concept creation, manufacturing, and sales, since 1987. In other words, the development of new products has been furthered under the heavy weight product manager structure (Clark & Fujimoto, 1991). To apply to above, they divide the authority which used to belong to the products supervisor, called heavy weight product manager, into three posts, 'CPS (Chief Product Specialist)', 'PD (Program Director)', and 'CVE (Chief Vehicle Engineer)' at the organizational change in July 1999.

Although CPS is a product manager under the present organization, it does not have responsibilities of guaranteeing profit and techniques such as the products supervisor. CPS is only responsible for creation of a product concept and competitive power. On the other hand, PD and CVE are responsible for the profit and for the techniques, which was removed from the products supervisor. And on the occasion of new product development, 'PCD (Product Chief Designer)' which has responsibilities of design development, joins[6]. Nissan

adapts the structure, which these 4 person's position and rank being equal, and each of them exchanges the opinions based on their responsibilities.

Conventionally, the heavy weight product manager structure, which Nissan adapts, owns characteristics such as a vague division-of-work, and an ambiguous responsibility range. This is because the heavy weight product manager structure is the structure which promotes the common problem solution over the sections by making one project into a responsibility unit under a product manager, and making the individual division-of-work ambiguous. However, it works well when there is a powerful adjustment function, but may have possibilities to cause duplication, or oversight of information because of the ambiguous whereabouts of responsibility. Nissan, when it entered into the 90s, the scale of product development organization became large and it began to be difficult for the products supervisor to adjust each functional section in product development[7]. This is because the increase of engineers associated with the increase of projects. And the specialty of each functional section was also developed and subdivision was progressed[8]. Moreover, with the conventional organization structure, the products supervisor, the leader of a project, had the last responsibility for products, so the whereabouts of responsibility might become ambiguous among members and psychological dependence might occur between project members.

Then, Nissan deals with these problems by reforming organization structure and by attaining decentralization of leadership. CPS is fully responsible for the concept of products or the competitive power of products but PCD or CVE are responsible for the part of design and hardware development. Thus, CPS can purely pursue product power, PCD can devote them to design development and CVE can concentrate on technical development and adjustment within the section. As a result, these can improve density of work of each functional sections. Especially regarding to design development, in the conventional organization, design quality was often influenced by designers' personality because the whereabouts of responsibility was ambiguous and it leads to physiological dependence between designers. In other words, in previous Nissan, the design section participated in the project with division-of-work-stance such as only being in charge of design development under the responsibility for the products supervisor. Against previous style, in the present organization, the autonomy of a design section is recovered and the responsibility of organization toward design is clear by design development, centering on PCD.

Furthermore, under the conventional heavy weight product manager structure, the projects tend to have self-conclusion since the original discretionary authority of each products supervisor was huge, and it was difficult to secure the consistency and unification of projects[9]. In other words, the difference, which depends on the project, can tend to be seen. Since the strategy as the whole design section was lacked especially about design development, design tends to be based on the trend of time or segments. It leads to produce design, which

lacks consistency. Against it, design development structure is built based on PCD in addition to decision of design strategy. The presence of the design section as a whole has been increasing, and of consistent design development has been possible in the present organization.

2.2 Maintenance and development of semi-center organization

On the other hand, regarding to the management of plural projects, Nissan has been adopted the organization structure, 'semi-center organization' since 1994. In recent years, it has begun to be important that how to adjust the projects because of the necessity of promoting communalization of parts as well as carrying out individual projects efficiently (Nobeoka, 1996). Although the management focused on the unified projects in the product development organization, the autonomy of each project becomes an obstacle in order to promote communalization of parts. However, if each functional sections gained powerful authority, it will be difficult to secure the unity by the project unit. Therefore, in order to solve these problems, it is necessary to newly prepare the administrators of projects, and to grant the powerful authority to the administrators, to generalize leaders of each projects or each functional section leaders. The range of control of the administrator becomes an important point in this case.

Nissan has adopted the organization structure, called 'semi-center organization' which limited the generalization range of projects administrator (Nobeoka, 1996). Nissan has set up a director of vehicles development, as an administrator of plural projects. However, the generalization range was narrow and was limited (see Figure.1). The director of vehicles development could not control body, chassis (called 'technology' in Figure.1), which are not integrated into the headquarters of vehicles development, and functional sections such as electronic technology, power train (called 'PT' in Figure.1), design, and manufacturing technique (called 'MT' in Figure.1). The functional section was not under direct responsibility of functional section head or administrator.

This semi-center organization has not changed after an organization change. Therefore, the design section is out of control from a director of vehicle development. However, the following two points are changed after the organization change (see Figure.2). Firstly, the position of design section has been changed. Conventionally, the design section used to belong to a products development section, but now it belongs to a planning section. Products planning and management planning also belong to a planning section despite a design section. Furthermore, vice-president Patrick Pélata manages totally this plan, and strategy such as design strategy, products strategy and management strategy are designed centered on him. Therefore, the company can form brand and design methodology and it is possible to build and perform a consistent and well-balanced strategy.

Another change is an expansion of director of vehicles development or the generalization range of CVE. After an organization change, the generalization

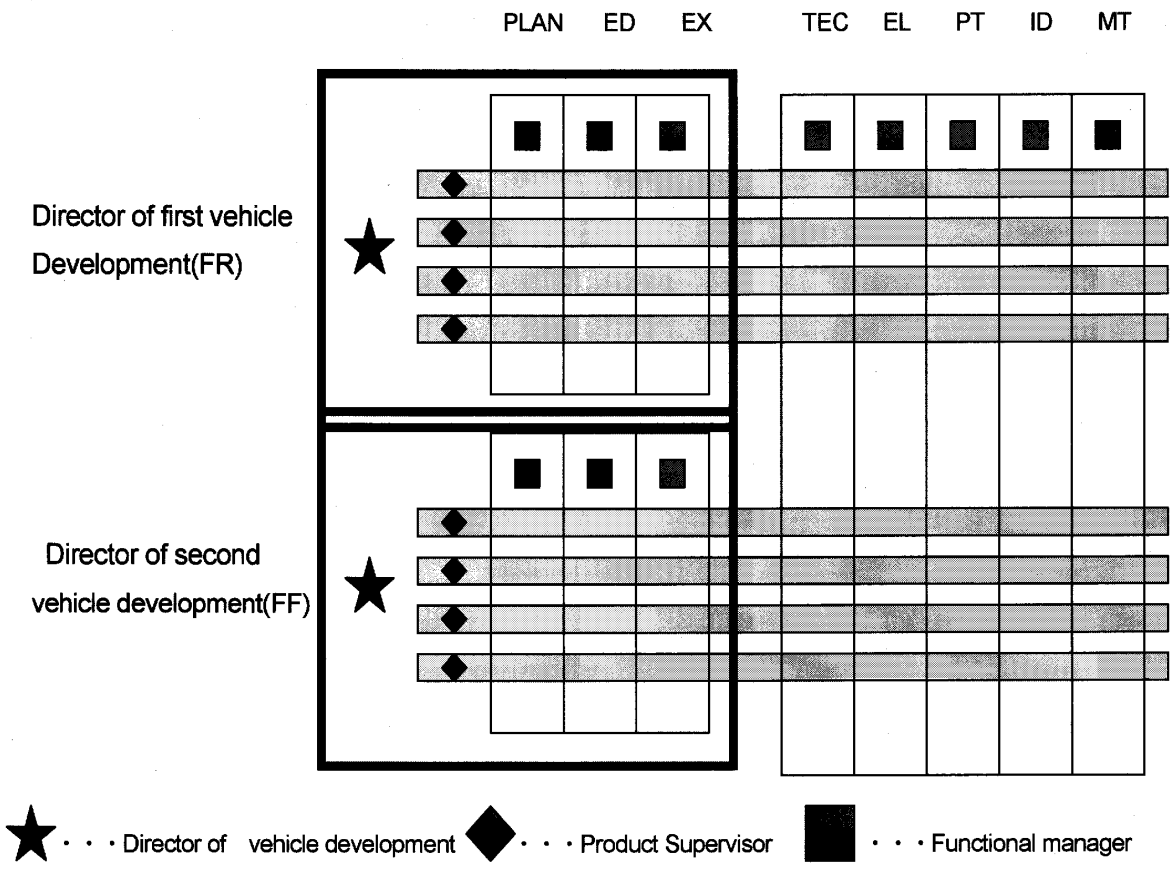

Figure.1 Product development organization (organization before July, 1999)
* 'ED' means engineering design and 'EX' means experience, 'TEC' means technology, 'EL' means electronic, 'PT' means power train, 'ID' means industrial design and 'MT' means manufacturing technique.
(Source: The author created with reference to Nobeoka (1996), 182 p)

range of CVE has been extended, and CVE has all responsibilities and authority of the hard development based on the platform. They also have the authority to control directly component development group such as chassis, body, and electrical technique except power train (PT)[10] business section. Therefore, the organizational structure of the semi-center organization is maintained, but the integrated range of a director of vehicles development or CVE has been increasing compared with before.

Thus, CVE is in charge of hard development of products group based on the platform in Nissan. Nissan reorganizes organization structure, which makes it easy to perform communalization of parts, while CPS and PCD are basically in charge of planning and design based on individual vehicles type. Especially about the design section, it was out of control from a director of vehicles development as usual and the design director manages the design development process, and all evaluations. Furthermore, because the design section became independent from past products development section and was positioned as planning section, the connection between design strategy and management strategy began to be strong.

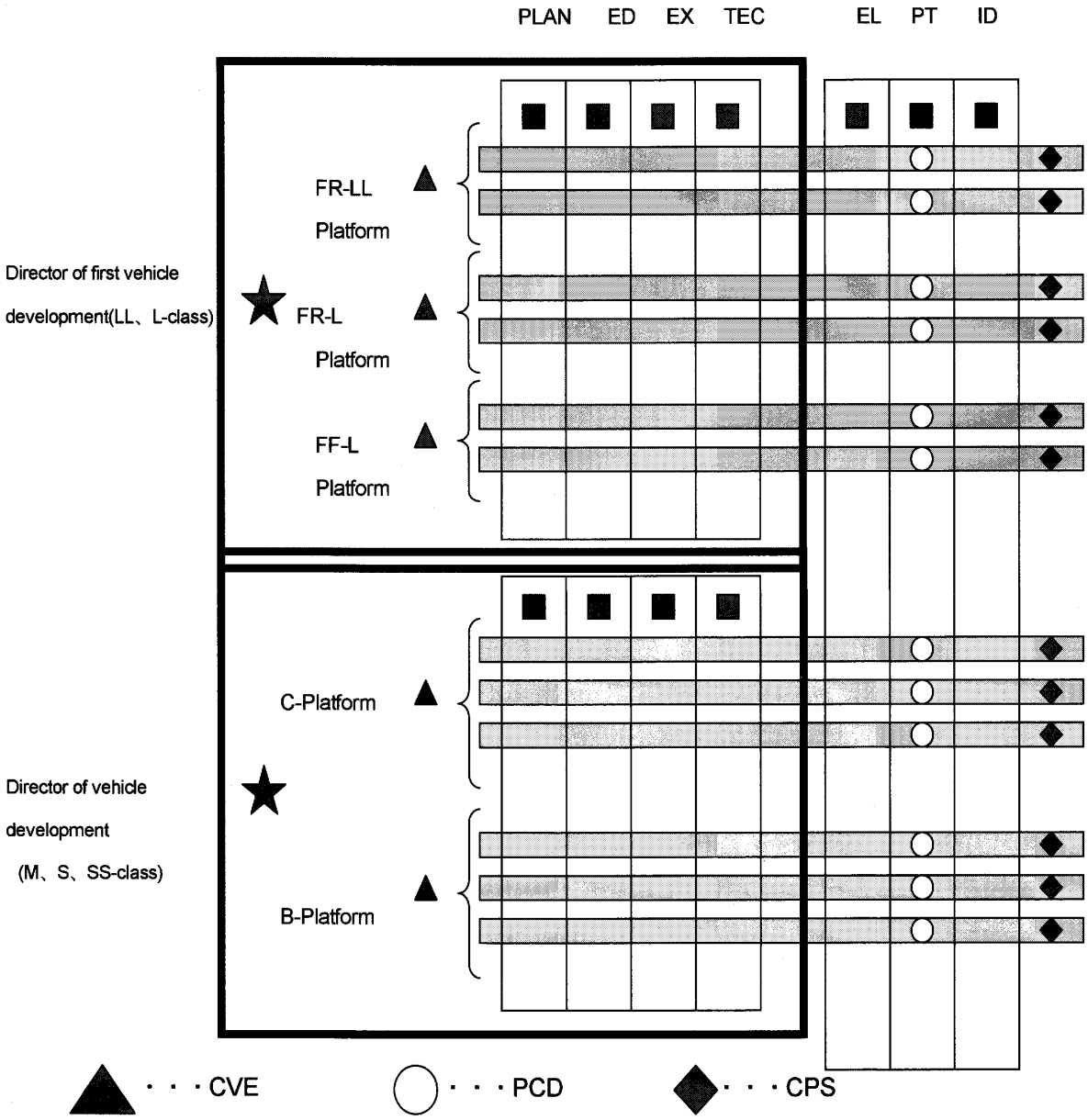

Figure.2 Product development organization (after organizational change in July, 1999)
Source: the author created it based on an interview.

2.3 The effect of an organization change

As seen above, the design section is not under control of a product manager or a project administrator in Nissan, and the design section has been independent from development section in terms of this point. By making design section to become independent and to combine as an organization, the responsibility structure of design development began to be clear in Nissan, and the unified communication aiming at design section was promoted.

In the previous organization, since the products supervisor had also responsibilities to products power such as design, it causes the ambiguity of responsibilities and may cause psychological dependence between designers. Previously, Nissan

designers often participated in the project with division-of-work-stance such as only being in charge of design development under the project head. In other words, the recognition of designers is that being in charge of a part of the product rather than building up a product. Against this, after the organizational change, the whereabouts of responsibility becomes clear and the designers' sense of responsibility and pressure are improved by the establishment of the development organization of design centering on PCD.

Moreover, after an organizational change, Nissan gave powerful authority to a design director and the design director manages the design development process or design evaluation. Nissan tries to integrate orders and directions of design section, and makes the importance of stance, which design is under control of designers. For instance, it makes them possible to adjust effectively between sections and projects but may be segmented by a platform or by a unit and may be difficult to communicate each other even though building design strategy or guidelines when the products supervisor had responsibilities for products power to such as design, and design section was under control of the administrator of projects, such as general director of vehicles development. In other words, the strategy of design section becomes weak. Against it, in the present organization, the design group is independent from the products supervisor, and own strategy of design section and the penetration of guideline was promoted by trying to unify direction and orders. In order not to waste designers' ability vainly, it is necessary to clarify the aimed direction and to issue the strategic instructions based on it, and to perform it. This is because confrontation only arises among designers and power cannot be efficiently demonstrated, if each designer has turned to different directions.

Furthermore, in Nissan after an organization change, by having made the design section become independent from the previous products and development section, and having been positioned as the plan section, the design section has the direct relation with the higher rank authority, and connection of design strategy and management strategy is stronger compared with before. Furthermore, Nissan appointed a design director as a managing director and made the design director join various meetings at executive level. Therefore, the design director can not only have a voice to the management and advance business at equal position but can tell the top decisions directly to design development field[11]. Thus, in the present organization, the design director can join decision making one step ahead compared with before, and can choose and control the design direction with designers' opinions. It can be said that motivations of designers are improved compared with before.

2.4 Newly occurred problems

As seen above, as the result of organization change, Nissan began to have not only stronger connection between design strategy and management strategy but also have clear responsibility structure of design development and have the promotion of unified communication. However,

there are not only merits about this organizational change. Since functional specialization of the design section is promoted in comparison with the conventional one, the present organization structure has a possibility of lacking integration between other sections and projects. Since design has strong relations between various parts and sections, the adjustment cost is high and there is a risk of the low integration of each product, and a form will homogenize uniform by communalization of parts if they cannot adjust these parts. As a result, characteristics of each project will be lost. In order to secure the integration nature of the whole organization in Nissan, the three following devices are set up.

2.4.1 Target setup by top-down and cooperation strengthening by a functional crossing team

Firstly, they set up well a target by top-down and cooperation strengthening by the functional crossing team. CPS draws the blueprint of competitive products and makes PCD or CVE to realize it. On the other hand, PCD and CVE take the responsibility of realizing product concept and products conditions. In Nissan, such promises are called 'commitment', and they are negotiated and signed at the meeting whose chairman is president, Carlos Ghosn. Therefore, top-down in this case does not mean that proposals are top-down, but means the bottom independently proposes, and president Mr. Ghosn and top management examine the contents of the proposals and make a decision. Although when the target management is carried out, the tendency for target set up being low to avoid risks. However, in Nissan, it needs an approval of president, Mr. Ghosn for the target set up, so it is difficult to set up the target low. Moreover, a target development is clearly stated for the concrete numerical value, so absolute liability is pursued[12].

And usually, the development target which each section sets up, cannot solve as an integration, without each of them sharing their wisdom. Because advanced adjustments are needed in many cases. For example, if they are trying to use the proposed style by designers, sometimes they face problems such as chosen parts, which clear target performance by engineers, cannot be used, or if they can use the parts, it may exceed the target cost. Therefore, each of them has to cooperate mutually for clearing the target which they committed. 'CFT (Cross Functional Team)' functions in that case. In Nissan, common problem solution is aimed between some sections, and CFT is set up to promote integration. For example, when design development starts, about five people constitute of a team including members of the products planning section, which makes CPS first in a roll, and designers. The team prepares three or four keywords not with a sketch drown by designers as a start (Katayama and Takarabe, 2000). Moreover, if they need the required budget to visualize design, CVE, CPS and designers set up a team and cooperate together (Mine, 2003).

This can be said that it functions well with the relation of three actors; CPS, PCD, and CVE being equal. That is, authority is transferred to the representative of each section. It may promote mutual study

by making the relation between them equal. Because a creative task such as products development, needs each one discussing freely what they think, and arguing about it. Thus, in Nissan, they are trying to secure an integration of the whole organization by combining horizontal cooperation by CFT and target set up by top-down.

2.4.2 Balance between authorities and Responsibility of CPS

The second device to secure the integration of the whole organization is the balance between the responsibilities of CPS and authorities. As mentioned before, CPS is wholly in charge for the competitiveness of products, PCD and CVE are in charge for the parts of design and section. CPS tells aims such as the segment of target customers, or the atmosphere of the products on the market, to designers in terms of design, and to engineers in terms of technical ability. Therefore, CPS can claim to PCD in such cases when the concept is 'friendly' but the design is proposed with small windows and aggressive design. Moreover, CPS can claim to CVE in such cases when a car is running on the test course, and a driver feels roll (inclination of the body generated at the time of cornering) and pitching (gradual shake generated at the time of running), they can tell CVE not to make this kind of way[13].

Although CPS does not interfere directly in the field of design or engineering design section, it watches from another angle to bury the gap of responsibility and authority. As a result, for example, a design section, compared with before, has stronger conscious of developing design based on the concept or products nature. In previous design development, the adjustment of a concept and design might be performed later. In other words, they discuss forms rather than 'management of the entrance' such as enough adjustment with concepts in advance. In other words, they focus on 'management of the exit' such as adjusting the forms with concepts later. Thus, although CPS does not interfere in details, it shows the big directivity of making a car as a whole, from the position of those who ride a car, and it maintains the balance of responsibility and authority to secure the integration of the whole organization.

2.4.3 Installation of PDM

The third device for securing the integration of the whole organization is new establishment of the post called 'PDM (Project Design Manager)', which mainly takes charge of technical formation and schedule management in a business allocation structure within design team. The adjustment between a design section and other sections was performed under the products supervisor, who was the heavy weight product manager in the past, but now the design is independent from development section. Therefore, the design section must mainly integrate and adjust, so compared with before, the adjustment task has been increased for a design section. Consequently, as shown below, opinions about the increase of almost 100 times of works other than design field like sketching and making models, can be heard.

'After becoming a new organization,

the number of works, we have to deal besides design filed (such as sketching and modeling*), are almost 100 times compared with before. (Omission in the middle) We are asked to discuss the relation with products concept, design concept, and with products headquarters many times and to collaborate persistently with other sections. We discuss intensively with CPS, CVE and PD to get budget, which is necessary for visualizing design. And it leads to activities involved with purchase section and supplier. We discuss very often with other sections to share problems such as which part should receive budget intensively or what the design is to improve charms of the products.'

* The author adds the inside of a parenthesis.
It quotes from Naonosuke Mine (2003, 36p) "What happens now in Nissan" (Diamond Corp.)

Thus, as a result of a design section's dissociating and being independent, designers' work is very busy compared with before, and reorganization of the task in the design section began to be necessary. Then, Nissan newly establishes the post called PDM which mainly takes charge of the technical formation and schedule management, and PCD which mainly takes charge of management of design itself, and market research (refer to Figure.3).

Generally, the design team consists of four kinds of members such as an interior designer, an exterior designer who designs the appearance of a car, the colorist who takes charge of color, and the modeler which creates a model. However, design development usually precedes plural design ideas at the same time. Therefore, design teams have to carefully adjust with engineers for mass production no matter which design is selected. Then, in Nissan, the post,called PDM is newly established in a design team, with the role and authority, which guarantee schedule management and

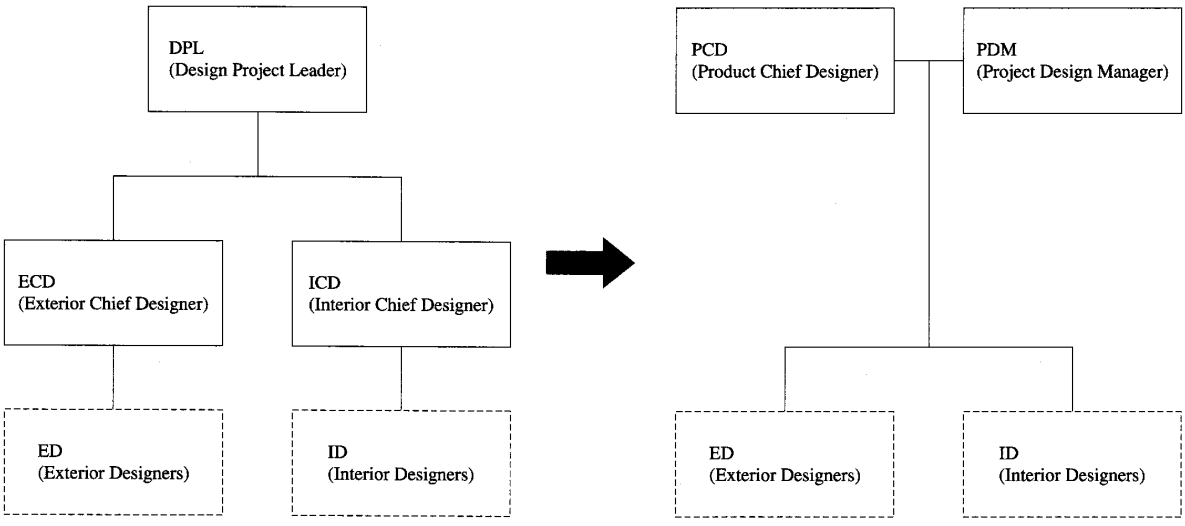

Figure.3 Change of team organization in mass-production design development
* in Nissan, the third product design section, which takes charge of color, and the model development room, which takes charge of model work, are not project oriented but take the form of project crossing. Therefore, the color list and the modeler are excepted from this figure.
Source: Author's creation based on an interview.

technical formation. And in this position, the person who has experiences in adjusting with planning section in the past and has enough knowledge of engineering, is selected.

Nissan, conventionally, the 'exterior chief designer' who is in charge of managing exterior, the 'interior design chief designer' who is in charge of managing interior, and 'Design Project Leader (DPL)' who is in charge of design development, participate the problem solution team, crossing over plural engineering design sections, and the small group organized for every part or specific problems. However, in the conventional organization, the responsibility range between three actors was not always clear, and duplication, or an oversight of information arose. Then, the problem solution cannot be effectively seen. Moreover, since one of the person in DPL have responsibilities of design management and management of visualizing design on schedule, sometimes completeness of design is sacrificed because of the priority of development schedule. Therefore, in the present organization, the responsibility range of PDM and PCD is classified clearly. In addition to the division of such tasks, they prevent compromises by committing own achievement goals in advance. However, without close cooperation of two persons, negative effects of dinarchy will be produced. Therefore, the cooperation with singleness of purpose between PCD and PDM is required.

In design development, it is getting more frequent to adjust with planning section especially at the beginning and at the end of the process. Firstly, at the beginning of the process, they hold a 'formation reviewing meeting' one time per week with planning section following the advancement of vehicles planning and creation of products planning. With the above procedure, they confirm and review the individual parts and the location. They confirm the items one by one such as which kind of conditions bumper have, the location of muffler or tail pipe.

In other words, in the meeting, designers and members in the engineering design section confirm and review what designers want and what engineers can do. PDM participates in the meeting as a representative of a design team (see Figure.4).

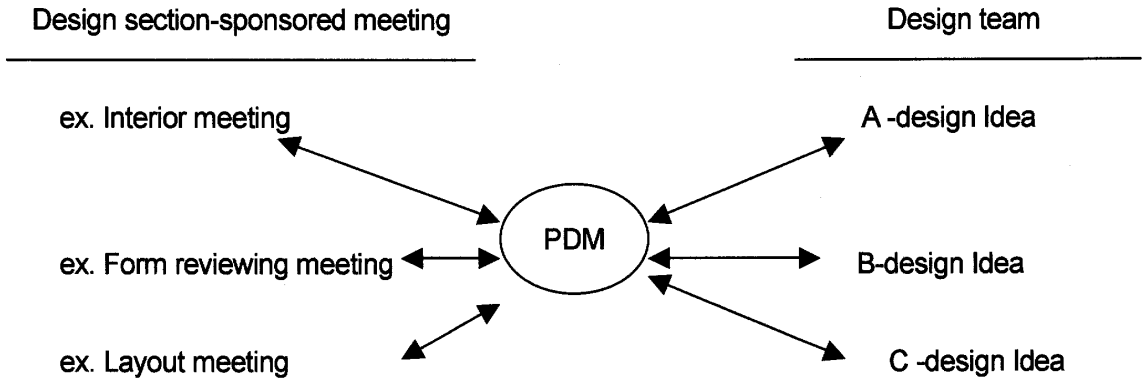

Figure.4 Functions of the project design manager
Source: Author's creation based on an interview.

On the other hand, at the end of process, the design proposals are extracted to 1 or 2 ideas, and adjustment with the design section while foreseeing commercial production, begins to be intense. And mostly, problems such as changing forms, are sent from a engineering design section continuously as a result of the review. A technical development section takes the lead and compromises the extraordinary problem solution group (planning center) in Nissan. However, it is difficult to probe a problem completely in advance because design development is always required to create new forms. Without actual creations, there are unknown things in many cases. Moreover, since the design is connected to many design elements, many problems are produced and more than 100 adjustment meetings per project may be needed in some cases.

On the other hand, PCD as a mediator, specifies subjects one after another to the designer, in order to finish the whole design attractively. However, in Nissan, before an organization change, since the designer had also responsibilities in adjustment with a planning section, fatigue of the designers or modelers reached the peak in many cases, and that might lead to compromise at the end of the process. Therefore, it became one neck how they could overcome this problem before an organization change.

Against it, PDM summarizes information, which enters from planners or manufacturing technique, and supports designers now, so that it may be easy for designers to finish the design model. Although the adjustment between engineering design sections, without spoiling designers, which can pull out functional performances, is desired. In other words, PDM may need abundant engineering knowledge and the abilities to stretch the technical requirements based on the existing knowledge are required. And Nissan is going to cope with it by newly establishing a post, called PDM in terms of this point.

III Discussion

We want to arrange examples of Nissan, which were seen above, and to examine the meaning of organization structures, such as a heavy weight product manager structure, or the center organization from the viewpoint of utilizing design strategy. Design was regarded as one of the important points of management strategy and the organization change has been performed in Nissan. The different new organization structure which differs from the product development organization emphasized in existing researches like heavy weight product manager structure or the center organization, is built.

The merits of the organizational structure emphasized in the existing researches were to be able to perform efficient manufacturing structure. When the design section has been arranged under control of a heavy weight product manager and plural project administrators, the efficient adjustment between sections and projects could be possible. Conventionally, many Japanese companies including Nissan adopt such organization structure. On the other hand, with heavy weight product manager structure, there is a possibility that the ambiguity of the responsibility range may cause

psychological dependence of designers. In other words, under such organization structure, they tend to rely on the confidential relationship and personality between the project members. Moreover, with the organization structure emphasized in existing researches like heavy weight product manager structure or the center organization, original discretionary authority of each project and of each center becomes large. Therefore, even if it decides upon the strategy and the design section guideline, it is divided per a project unit or a platform, so it becomes difficult to put strategic instructions into practice. Furthermore, it becomes more difficult to secure the direct relation with the authority of higher rank if a design section is located under a project manager and project administrator and design section is closer to development field. As a result, there is a possibility of not being able to picture a whole company and of being weak of the relationship between design strategy and management strategy.

Therefore, We can tell the following findings; there is a limit in heavy weight product manager structure or center organization from the viewpoint of utilizing design strategy, and there is basically a relationship of trade off between the organization structure which was excellent in efficient product development, and the organization structure which thought the design as important. Since it is difficult to secure consistency between design strategy and management strategy while keeping the organizational structure emphasized in the existing researches, the design section is divided to per project unit or per platform unit, it begins to be difficult to utilize design strategically. Conventionally, the weaknesses of the design power of Japanese companies or brand construction power were often pointed out (Fujimoto, 1996). The examples of this paper can explain the problem in which organization structure holds.

On the other hand, when being pointed out the present structure, the demerits produced by separating a design section such as lacking of adjustment or communication with other sections, are conquered in Nissan as well as it makes a design section separate from the control of product managers or project administrators and strengthen control of the design director. Making a design section dissociate and become independent leads to the increase of adjustment tasks between design section and other sections. As a result, it will alienate communication with other sections and there is a possibility of that designers' knowledge and abilities are not reflected to the final products. However, in Nissan, they secure to the integration of other sections by combining target setting by top down, strengthening collaboration well of CFT (cross functional team), and setting PDM in the design section, which specially performs negotiation with engineers.

These findings may lead to an opportunity which rethinks the ideas behind the existing researches such as 'being managed by one leader who has abilities leads to improve the integration' and, 'if it is promoted to separate specialties, it will make decrease the integration'. It stands on the premise that the degree of integration

is improved by being managed by the powerful integrated person such as the heavy weight product manager structure and the center organization. Moreover, in the existing researches, one of the reasons of heavy weight product manager structure and the center organization being important is because specialization makes adjustment cost increase and makes the management between sections difficult.

Furthermore, the findings of this report, which specialization can secure the high degree of integration, tell that heavy weigh product manager structure and center organization which were emphasized, can contrary be demerit. This is because the direction of the present organization structure where design can be strengthened more, is considered to stand on the predominance on a competition if the degree of integration of the same grade product as the former and the rate of communalization of parts can be attained with organization structure as shown in the examples of Nissan. Thus, from case study of this paper, one hypothesis to a future product development style can be shown.

There are two theoretical contributions of this paper obtained from the above case analysis. One is showing the problems, which cannot be cleared from the existing researches and is reexamining the meaning of the organization structure from the new viewpoint of strategic practical use of design. Another one is presenting an opportunity to rethink the ideas such as 'integration will be improved by managed an integrator who has an ability' or 'the degree of integration decreases if specialization is promoted'.

IV Conclusion

This paper deals with exploring subjects such as what the structure of product development organization is, which stresses design evolved in organizational change occurred from 1999 to the beginning of 00s, or what and the reason of the difference from the organizational structure emphasized in the existing researches is. And the meaning of the product development organization structure emphasized in the existing researches through breakthrough of these subjects is reviewed. However, this paper cannot fully discuss the structure of utilizing designers effectively and what the particular theory in design management is. This is because the argument of this paper is to clarify the reverse function-side while limiting the analysis targets to the organization structure emphasized in the existing researches. Therefore, the particular theory of design management, focused on functional sides such as why the current product development structure works well based on the expansion of the analysis items including development process and the evolved systems, will be clarified as future subjects. Furthermore, it will be necessary not to just discuss general problems such as utilizing functional knowledge in terms of product management but clarify particular subjects and distinguish particular design discussions from general discussions.

Moreover, the remaining subjects in this paper are to take up the examples of different automobile companies as a comparison. In other words, it is necessary to develop into more case studies instead of

the case of one company. Furthermore, probably, there is room in which the argument of this paper deepens and generalizes such as it may apply not only to the automobile industries but to other industries.

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1) In this paper, design means industrial design (design), and design development means activities such as creating the form and color whose satisfaction and joy are given to users, or industrial products which have good looking appearance.
2) 'Nissan Annual Report 2000, 2001'.
3) Cases in this paper use data driven by interviews to Nissan conducted by the author and from materials or magazines.
4) Capital injection in this case does not mean that Nissan is fully an affiliated company of Renault. Both companies divide activity fields (target market) and allow own activities each other. In other words, both companies adopt their styles which they individually work, called bi-company.
5) These changes are carried and collaborated with Renault as a part of 'Nissan Revival Plan'.
6) Besides these four other actors, CMM (Chief Market Manger) participates from Marketing headquarters.
7) Nissan adopts headquarters system, so individual functional section such as chassis planning section, is called 'head quarters' but not called as 'section. 'Section means wider fields including all technical development such as 'technical and development section' in Nissan. However, this article uses section name including individual functional sections as general

terms.

8) Nikkei Business 2000.

9) November 13th, 2000, Nikkei Business.

10) Power train means the system component combined with engine and transmission. The development of these components needs special task unrelated to normal product development. Also, these products have high versatility and the adjustment needs with other sections are not fully necessary. Therefore, they are separated as an independent business section. (Okubo, 2002).

11) 'Review Nissan model: Company innovation based on design' (Kensho-Nissan model: Design shudo no kigyo kaikaku) Nikkei Design, July 2003.

12) Nissan adopts an evaluation system and salary system based on people's achievements according to these innovations. (2001, Hasegawa).

13) CVE is basically responsible for the technique development. However, they set up six gate managements during the process of engineering to check whether they develop while following products requirements, set up beforehand according to a concept by CPS.