

WHERE HAS THE JAPANESE CORE OF “MONODZUKURI” COME FROM, AND WHERE IS IT GOING?

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Abstract

"Monodzukuri" is a buzzword in Japan. It is believed that this "Monodzukuri" could hold the key to relieve the Japanese economy from the current stagnation. The aim of this paper lies in examining this problem. This paper is based on the theoretical framework of evolutionary economics. The paper, first, explains the basic concepts and concerns the analytical perspective and technical terms applied in this study. Second, the historical birth of the Spirit of "Monodzukuri" is analyzed from the viewpoint of effects by the innovation of Japanese new Buddhism. Next it clarifies what kind of social technologies are appropriate for the Spirit of "Monodzukuri", explaining the prototype of integral architecture type of production/product, giving a clear picture that the industrialization after the Meiji Restoration was based on the integral architecture type of production. And finally it identifies that the modern integral architecture type of production emerged and crystallized due to various constraints that the corporate management faced during the postwar economic growth period. The conclusion considers whether "Monodzukuri" in Japan can maintain its competitiveness further in the global market in the future.

Preface

"Monodzukuri" and "spirit of hospitality" are buzzwords in Japan now. However, these terms do not have a proper definition, containing a wide variety of nuances. What can be affirmed now is that many Japanese people believe that "Monodzukuri" has led Japan to a dominant position in the world market. Or they expect a desire that this "Monodzukuri" could hold the key to relieve the Japanese economy from the current stagnation. Is such expectation appropriate? If so, in what sense is it appropriate? The aim of this paper lies in examining this problem and finding the solution or key to solve it.¹ This paper is not based on the academic discipline of studies on Japanese economic and management history, but rather on the theoretical framework of evolutionary economics.

This paper consists of five sections: Section 1 explains the basic concepts and concerns the analytical perspective and technical terms applied in this study for the following elucidation of the Japanese core of "Monodzukuri". Section 2 proceeds to analyze the historical birth of the spirit of "Monodzukuri", which was effected by the innovation of Japanese Buddhism. Section 3 clarifies what kind of social technologies are appropriate for the spirit of "Monodzukuri", explaining the prototype of integral

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¹ The original idea concerning this issue was already presented at the International Conference in Romanian American University on May 19th 2017. This paper is completed based on performing of major corrections and additions to what was presented there. There is no sufficient space to discuss the literature review in this paper.

architecture type of production/product. Section 4 gives a clear picture that the industrialization after the Meiji Restoration was based on an integral type of production. And Section 5 identifies that the modern integral architecture type of production emerged and crystallized due to various constraints that the corporate management faced during the postwar economic growth period. Finally, Conclusion, instead of summarizing, considers whether “Monodzukuri” in Japan can maintain its competitiveness further in the global market in the future of the 21st century.

Section 1 “Monodzukuri” as social technologies : its core and the integral type of production architecture

First, approaching Japan's “Monodzukuri” issues requires us to confirm one important view: “Monodzukuri” is not a natural and ultra-historical ethnic phenomenon, but a historically structured and backed-up substantive one. In order to understand it, we would have to elucidate the historical substance that gave rise to, developed and established “Monodzukuri”, and conform historically developed a production system suitable for it. Confirming this for elucidation needs to start with understanding “Monodzukuri” as social technologies below.

According to my understanding of Beinhocker (2006), an economic and business space is a place of combination of social technologies, business plans and physical technologies. Physical technologies are what we usually refer to as the term ‘technology’. Technologies are designs and processes to convert substances, media, energy and information in a way that they can become useful for human purposes. Physical technologies are physical means to create design information related to production/products and to transfer design information to the medium.

Social technologies are ways to design and mobilize people by organizing them for one or more goals. Social technologies include all the elements related to organization, such as processes and rules. They are close to institutions that have intensively studied institutional economics. They include both institutions and cultures. However, they do not include strategies in business administration. According to Shiozawa (2010), social technologies cover the structure of enterprise, its role, its behavior, cultural norm, job description, documentation and explicit or tacit rules.

A Business plan plays the critical role in melding both social technologies and physical technologies. This melding is executed under a business strategy. A Business plan seems to be close to what we call a production/management system. The Business plan is chosen for economic reasons, while the other two technologies evolve for their own other purposes. Each of them exists in a unique design space. They have their own fitness functions. Both technologies interact with each other through some business plan. Social technologies and physical technologies, evolving themselves, produce fitness relationships suitable for their own different purposes.

Understanding the above social technologies, business plan, and physical technologies permit us to approach the core of “Monodzukuri”, which is considered as the most important constituent of social technologies. Next, for that purpose, it would be important to consider about what production and product are (Fujimoto 2003). The pivot to solve this problem lies in understanding of design information.

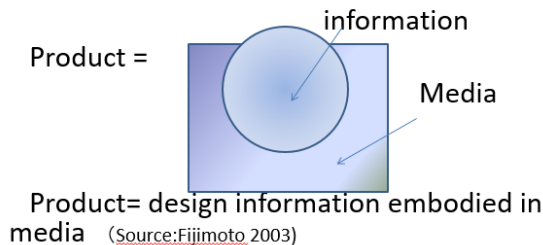
Hidalgo defines production as crystallize imagination and create objects that were born as works of fiction (Hidalgo 2015). The imagination and objects that were born as works of fiction correspond to design information.

Defining production based on this concept tells us as follows (See Figure 1); Production is to create design information and transcript it to specific media (materials). This means physical embodiment of information and crystallization of imagination in Hidalgo's terms. Created design information is transferred from a process to a product. In this way, the product is the design information embedded in the media. This definition of production/product concurrently changes production operation (work), product development, production organization, sale, and consumption into new concepts as follows (Fujimoto 2003).

Production operation as a process is to repeatedly transfer design information. Product development is to create and verify design information. Production organization is to carry out consistent procedures from procurement of media to creation of information on production, and to transfer them to the final product. Consumption is defined as follows; What consumers consume is not physical media, but a bundle of design information (or its system) being carried on specific media. Sale means to transmit design information to consumers. One side of "Monozukuri" could be defined as creating a smooth flow of design information moving towards consumers as customers, and to make this flow circulate efficiently and precisely without distraction.

Figure 1

A new view: production: to transcript design information into a particular medium or transmission DI from process to product

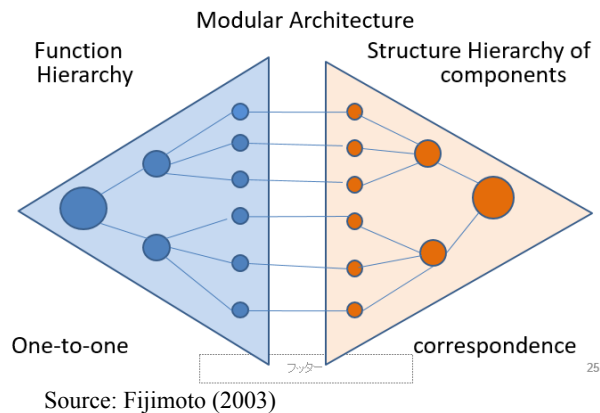


This framework of production/product definition causes us to consider that architecture design is a very important term: Architecture is a specific artificial system, meaning the fundamental approach to mapping the relationship between the function of a system and its structure. The fundamental approach to mapping is to divide the product into components/parts and divide the production into a smaller operation process of production, and then to establish relationship between the divided parts, relationship between the divided operations, and interface between each divided component/part and each divided operation. This relationship and interface between them would be different depending on how to design the architecture. The image of a personal computer (PC) and a passenger car makes it easier for us to understand the differences in designing the architecture.

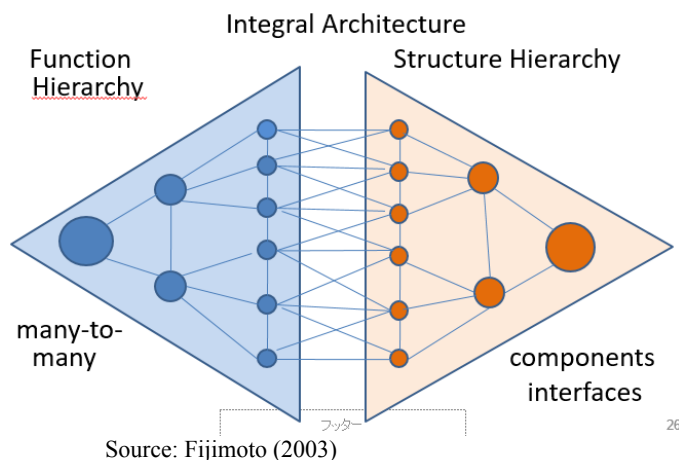
It should be noted that the nature, form and performance of the product with the same item name would differ if the architecture of production would be different: There are two types of architecture designs: One is a modular type (e.g. PC) while the other is an integral type (e.g. passenger car). Even if PC and a passenger car are compared as a typical type here, they do not mean a real type, but an ideal type abstracted from the real ones.

Figure 2 shows a modular architecture of production/product, while Figure 3 an integral architecture of production/product. The circles inside the triangles on the left half of these two figures depict the overall function – subfunction – sub·subfunction respectively. Those inside the triangle on the right half express the whole product - subcomponent – sub·subcomponent respectively. The line shows the relationship between functions, the relationship between components, and the interface between sub·subfunctions and sub·subcomponents. The lines showing the relationship between the subcomponent and the subfunction are not displayed in these Figures, because they are complicated and difficult to illustrate.

Figure 2



Let's look at Figure 2; the modular architecture. This line connects one sub·subfunction to one sub·subcomponent with a single line. This means that the interface between the sub·subcomponents and sub·subfunction is simple. This component is called a modular, containing one function within itself. In the process/operation of such a modular architecture production, it is a simple skill with which workers are required to be equipped. Next, we would like you to look at the integral architecture (Figure 3). That line is complexly mixed, expressing that many sub·subcomponents correspond to many sub·subfunctions. This mixture results in the relationship between the subcomponent and the subcomponent, the relationship between the subfunction and the subcomponent, and the interface between the subfunction and the subcomponent becomes complicated.

Figure 3

In the process/operation of integral architecture production, it is multi-skills with which workers are required to be equipped. In this case product developers are constantly required to confirm and verify that interfaces crossing between subfunctions and subcomponents could acquire and maintain fitness. Understanding the difference between integral architecture production and modular architecture production could induce us to recognize that it is not modular architecture production, but integral architecture production that have made Japanese industrial products competitive in the world market,

However, unlike modular architecture production, works based on integral architecture production require "a tenacious and dogged" attitude toward production. This attitude could not be produced easily by economic interest; price, wage, reward or superficial competition. It could be created, selected and retained by organizational routines embedded in production, which are reproduced and sustained at the deepest layers of the enterprise organizations. It could be expressed as organizational capability of evolutionarily developing production. The essential core of what we call "Monozukuri" in Japan lies in the organizational capability to create and ensure integral architecture production. Japanese type of "Monozukuri" could be defined as creating a smooth flow of integral architecture production type of design information moving towards consumers as customers, and to make this flow circulate with possibly less distraction, more efficiently and more precisely. This is the Japanese core of "Monozukuri"

The above explanation could permit us to interpret buzzword: Japanese "spirit of hospitality" that is mentioned in "Preface" as follows: "Spirit of hospitality" is related not with a modular architecture type, but with an integral architecture type of service. Service means design information directly directed and transcribed from the service provider to the service recipient without the media. Transcription is immediate consumption in service. An integral architecture type of service means that the design information of the service created by service provider is very complicated and multilayered, and it is difficult to transfer this design information to the service recipient. An integral architecture type of service refers to a state in

which design information that should be directly transferred and immediately disappear is recursively reproduced in the body and brain of the service recipient.

However, when we return to the main subject, the following question arises immediately: How and when was this integral architecture type of evolutionary organizational capability born in Japan? It is not yet sufficient for economics and business administration to historically and consistently elucidate this issue². This elucidation was one of my intentions of completing this study and paper. Economics treats such organizational capability as accumulated knowledge and knowhow, while business administration understands such organizational capability as "corporate culture". "Corporate culture" cannot be copied easily, and is difficult to transfer across firms and companies. However, the difficulty of transcription and replication of heterogeneous organizational capabilities is not a marvel limited to firms/companies. There are unequally as well as unevenly distributed heterogeneous organizational capabilities as "local culture" among regions and localities, and as "national culture" among national economies.

Then, there further arises the following question: How does the core of "Monodzukuri" as a corporate culture emerge in corporate organizations? It is convenient here to discuss only concerning organizational capabilities between enterprises in order not to spread the problem further. There is one hypothesis as follows (Fujimoto 2003, 198): It is shared strong intentionality, or collective preparedness that nearly all members of one organization are willing to improve their organization's outcome and performance over a period. This attitude of shared collective preparedness is very important. Let's call it the Spirit of "Monodzukuri". Then, the next question give rise further; Where, when and how the secular, daily production/work activities necessary (forced) for the maintenance and reproduction of livelihood/human body is transformed into production with the Spirit of "Monodzukuri" in Japan? This is a big question as well³). Let's approach this question in Section 2.

Section 2 Historical Birth of the Spirit of 'Monodzukuri': Innovations in Buddhism

It is in the period from the end of the Heian era to the Kamakura era that historical opportunity and possibility to create the Spirit of "Monodzukuri" came in the Japanese economic history⁴. In the end of the Heian era, natural disasters, huge bad crops, large famine, heavy casualties broken out with epidemics, and much starvation had frequently occurred in various places, in parallel with which the ancient state nation under Ritsuryo system collapsed, and the aristocratic power weakened, resulting in transformation to the manorial system, privatization of the state-owned workshops, and emergence of local market-oriented commerce and industry (Teranishi 2016). People experienced radical changes not only in the

² This topic has been studied and researched under the title of 'Japanese style of management' (nihonteki keiei). We can find 2050 articles with titles that include the term 'nihonteki keiei' in CiNii (<http://ci.nii.jp>; June 28, 2017)

³ Economics has defined labor as an endeavor with feeling of mental or physical pains since Adam Smith.

⁴ This section is mainly based on Teranishi (2016).

political economic system, but also in spiritual culture, religion and ethics. Under such circumstances New Buddhism had been born out of the Old Buddhism, being systematized to propagate a new Buddhist way of relief among not only oppressed poor, socially vulnerable people, but also newly emerging warrior class and individual residents of urban space.

The New Buddhism had three characteristics; (i)易行(igyo): the easy path via Nenbutsu (Buddhist invocation) to attain enlightenment; (ii)選択(senchaku): Buddhist choice to pick out only Nembutsu from among many teachings shown by Buddha; (iii)専修(senju): to keep a specific Buddhist practice earnestly without mastering the other practices. The New Buddhism, as reformation of Mahayanist Buddhism, making the above innovations of religious activities, introduced the following two major changes in the common people's daily livelihoods by re-combination with not only affirmative feeling for this present world, but also views to see affinity and continuity between this world and the next world, penetrated in the ancient times of Japan:

(1) The innovation and the re-combination gave people a space in a degree to change occupational life, works and labors of people into a place of training and practice for simulated Buddhist beliefs. Then, adversely, people started to become conscious of seeking Buddhist relief in the improvement of skills and their performance in daily livelihood. Partial dismantling of state-owned workplaces allowed accumulation and diffusion of production techniques and technologies by aristocrats and temples. This was a small, but historical moment when secular production and concentration of consciousness to work combined with individualism aiming for self-realization.

(2) As is mentioned before, in the period after the end of the Heian era, privatization of state-run workshops started, which begun to disperse and spread advanced technologies, and markets at the local levels emerged, while pursuing of pseudo-training was carried out in a narrow living space where others' faces can be seen directly. Emergence of local markets and pursuit of pseudo-training allowed producers to be constantly conscious of others in these narrow spaces. This made people work according to specific requests and wishes given by those living in close in proximity, giving possibilities, to an extension, to realize individualized production and work aiming at self-fulfillment under demand-driven marketization.

However, the small world in the range of "visible face" had a danger of stagnating the quality of production. But this small world was not completely autarchy. Regarding specific goods items, there emerged remote distribution networks that could connect Kyoto and local districts directly and local distribution networks connecting directly between remote places not via Kyoto. It was the merchants who took over these emergences. They could, insufficiently, switch distant customers directly for producers to immediate customers whom producers could see "faces" in daily livelihoods. This connection with remote markets had become a new social technology as well.

Powerful pursuit of self-realization through this secular relief under the development of markets had been fruitful in two areas of producers' activities. One was handicraft industries, like industrial arts and mass production of matchlock "Tanegashima". Another was the provision of services like martial arts and

entertainment such as tea ceremony and flower arrangement. Many of what are called traditional cultures and crafts in modern Japan have their origins in this era.

Section 3 Emerging of Social Technologies suitable for the development of the Spirit of “Monodzukuri”

In the previous section, the emergence of Spirit of “Monodzukuri”, and its impact on developing of handicraft industries and service sectors like martial arts and entertainment was examined. However, the large-scale land ownership, the collective responsibility system, and the traditions of production based on large family system, indisposition of people working hard, had disturbed the Spirit of “Monodzukuri” to crystalize entirely on its own features to become concrete. Producers even with the Spirit of “Monodzukuri” could not directly verify the results of realizing their own Spirit of “Monodzukuri”-induced production activities, and, then, could not confirm their final performance each time, whenever their works were completed. A family-based small-scale production system is social technology most suitable for the Spirit of “Monodzukuri”. The large family system in rural areas was dismantled in the latter half of the Edo era, while the small-scale family system rapidly progressed (Nakagawa1981). The small family production unit as social technology is called ‘Ie’ type system in Japan (Okamoto 1979). The ‘Ie’ type system in the Edo era has been frequently argued and studied from the viewpoint of domestic affairs; especially inheritance of property assets and production means. We will examine it here, however, from the viewpoint of inheritance of production technologies below:

This ‘Ie’ type of agriculture production system in the Edo era⁵ included no employment, no domestic animals, having only a small agricultural land parcel. It consisted of not only agriculture as a main production, but also handicraft and commerce activities as side-work. And despite the small-scale agriculture, they had grown many kinds of agricultural products throughout the year. The combination of upbringing diversified kinds of agricultural products, and handicraft/commercial activities as side-work required detailed adjustments and adaptations between work processes and working times. This combination could be called a family-based integral architecture type of production.

This architecture was possible because the members of the family had the same motivation, concentration, knowledge and autonomy. This self-discipline had become advantageous for the combination between agricultural production and family handicraft/commerce. Therefore, small families were the best unit for a market economy and exchange economy, and could have a strong responsibility to the result and final performance of their works. In such an integral architecture production system, the importance was not time, but time flow. Time flow had key roles. The crucial of management of time flow was to master an efficient way to use time by planning, savings, flexible working time extension. Time flow was not an individual thing, but was understood as belonging to a group or village in which producer families lived.

By the way, there is a doubt about the view that the location of such an ‘Ie’

⁵ The information below is quoted mainly from Thomas C. Smith (2002)

type of production system was limited only to the space of agriculture and rural areas (Amino 2006)). The producers who lived and worked in rural space were called not farmer nor peasant, but Hyakusho (百姓). This term of Hyakusho, is a symbolic representation to clearly depict an economic actor who was responsible for and performing many occupations, jobs, functions according to time and season, weather and climate, depending on degree of marketization of those products, and refining their multi-level skills,

On the other hand, let's look at the integral architecture production from the perspective of the technologies of highly developed handmade industry in the Edo era. The representative handmade industry in the late Edo era was a striped cotton industry, where there was no qualitative breakthrough in physical technologies. According to Nakaoka (2006) based on Uchida Hoshi's fieldwork research, "technologies complex" could be found in this industry, indicating social technologies combining existing physical technologies, taking full advantage of the social division of labor as is outlined; cotton cultivation by farmers, hand spinning with spinning wheels, indigo cultivation by farmers, indigo dyeing by dye-houses, weaving design by farmers, standardization of small width fabric by shops dealing in kimono fabrics and standard cutting of Japanese clothing at home. This "technologies complex" had realized one smooth flow from production to consumption. The excellent manufacturing technologies, which led to diversified livelihoods, were cultivated not only in a few small number of professional craft groups in urban space, but also in an extremely broad farmer's space. Here is the other evidence that a prototype of integral architecture production was born and expanded in both agriculture and handicraft industries in the Edo era.

Some researchers claim that in the Edo era when such social technologies were created, 'industrious revolution' rather than 'industrial revolution' occurred. However, it did not happen that the development of this handicraft exceeded its technological limits. Nor did it become transfer to modern machinery industry which is the next stage of handicraft industry in terms of physical technologies. The transition to the age of modern machinery industry was impeded by, first, the national seclusion and interruption of international exchanges with the other nations, and, second, the control over production and consumption by the Bakufu-domain system.

What must be noted here is what is called 'Popularized morals' (Maruyama 1999, 2012) that occurred in parallel with the historical birth of the prototype of integral architecture production. 'Popularized morals' used to be diligence, saving, frugality, honesty, good faith, and devoutness under the mixture of Confucianism and others. They drew moral legitimacy, limitless faith and aggressiveness in the place of the activities of daily livelihoods of the people; agricultural, industrial and commercial activities. These morals were the most suitable for small-scale production management where a family owned a means of production, giving rise to norms regulating a daily livelihood in family-based small-scale management. While squeezing with the market economy, family-based small-scale managements became established with independence to survive themselves. On the one hand, these morals became a logic of independence and autonomy of the people based on a paternalistic family system, despite the early modern age the activities of families were constrained by villages and the intermediate organizations as the larger group with

the same family name, while, on the other hand, they also played a significant role in maintaining and supporting the existing Bakufu-domain system. It is claimed that the influential town-people in the early-modern Edo era were initially aware of ‘popularized morals’, and, then, were accepted in the village communities under the initiative of the wealthy farmers in the late Edo period, and, finally, they spread to more lower-class people in the Meiji era. It would be appropriate to call these morals Ie-type of ‘popularized morals’.

Section 4 Traditions of "Monozukuri" established after Meiji Restoration

The previous section elucidated that before the Meiji Restoration Japan could prepare the historical birth of the prototype of integral architecture production with the spirit of “Monozukuri”, ‘Ie’ type of production system conformable to this prototype, and ‘popularized morals’ suitable for it.

However, they had critical obstacles to further develop in the late Edo era: in order to break through these constraints, the Meiji Restoration Government had to liberalize various controls and regulations, cancel the national seclusion, and import materials, technologies and capital goods related to modernization-related information from overseas by cancelling interruption of international exchanges with the other nations. The new measures started to create environments to develop the three integral types of industrialization as follows;

First, by acquiring new industrial materials and domestically produced inexpensive new equipment, handicrafts already developed highly in the Edo era developed in-house based handicraft workshop producing various kinds of small quantity product. This was a mixture of old and new physical technologies, social technologies and business plan, resulting in a full-scale industrialization with profound influence comparable to the industrial revolution (Nakaoka 2013, 26-29,259).

The characteristic of this industrialization was that it required almost no imports of capital goods from abroad, but, on the contrary, it not only satisfied domestic demands, but also could cover the export market from Japan, resulting in mitigation of the contradictions brought about by deterioration in the international and trade balance during the late industrialization. It supported the Japanese economy for about two decades before the modern economy sector started functioning on the base of transplanted technologies by introduction of modern machineries and large capital investments. These traditional industries had close links with the transplanted modern production sectors as upstream industries and the modern infrastructure area. This mutual complementing was an important characteristic of the industrialization in the Meiji era. These links, however, did not give rise to creation of modern mechanical engineering nor modern steelmaking industries.

Second, alongside this national industrialization, the spinning industry as a transplanted industry developed during this period (Nakaoka 2006,420). Transplanting was a combination of imported mechanical equipment (physical technologies), technical instruction and advised by Western European technical advisers (social technologies), and modern company system (business plan) introduced from Western Europe. Infrastructural areas such as transportation, communication, gas, and electricity were also constructed by these connections besides an upstream of manufacturing such as spinning.

Then, how transplanted industries were fostered in complementary relations with traditional social technologies, business plan and physical technologies come into question. There were two important flows of improvement of the technology training and education system from the viewpoint of manufacturing development. First, the starting point for the establishment of transplanted industries was the military industry under the threat of strong Western Great Powers. Ran gakusha, Dutch scholars who studied western sciences and technologies through Dutch language, and were mainly samurai in the late Edo era, played a significant role in modernization of military industry (p. 433). But they soon noticed the limitations of partial Dutch Scholars' studies, which compelled influential providential clans and the Edo Shogunate to attempt introduction of full-fledged and systematic technology acquisition through Western-style learning systems and study-abroad systems. Second, these traditions were inherited under the new Meiji government as well: technological schools and supplementary business schools were introduced besides the universities, establishing them as a unique pyramid-shaped system with a large base in Japan. These led to provide empirical-like technicians and experts (groups) trained based on the combination of conventional technologies, workshop experiences in the early Meiji era, and modern transplanted technologies. It is interesting that among them university graduates who were educated based on studying foreign original books entered the industry and manufacturing sectors as engineering engineers without operational experiences, while they became professional technicians who instructed and guided the technical process of production and manufacturing (p.446)

Third, "production site-based principle" management were created. According to Nakagawa (1997), a great gap between modern industrial technologies and traditional industrial technologies developed the original " production site-based principle" management, which is characterized as a basic factor to develop the post-war Japanese corporate management. This principle means to solve problems occurring in the production line/spot through sharing information with engineering supervisors and exchanging them among workers and supervisors on production site, and cooperation among them.

The main task of companies in this era was not how to newly develop modern technologies, but how to introduce, catch up and fix advanced technologies at the factory site. The companies, adopted graduates from industrial/technological schools as apprentice workers and worked on fixing introduced technologies, united with young workers at the work site. Here a unique work method to incorporate collective ingenuities of introducing modern technologies was born. Companies, aggressively adopted university graduate students of engineering, training younger employees as engineers at the cost of the companies, cultivating them as core workers in their manufacturing sectors. The skills acquired here became contextual ones and could not be available across companies. Promotion and raising salary by seniority system, establishment of lifetime employment enhanced Japan's specific employment pattern with technological inequalities among companies, collective ingenuities, and accumulation of skills on "work site principle". This "work site-oriented" management suggests that technologies management information was born and accumulated among production sites. This resulted in gradual abolishment of boss contracting system and the intra-firm subcontracting system born in the early Meiji era. However, it is said that workplace practices/routines, and conventional structures

depending on finishing-workers created during this era remained deeply rooted in the Japanese machinery industry.

Let's think again about the 'Ie-type' of popularized morals established at the end of the Edo era: Modernization and industrialization of the Japanese economy had contracted the role and function of family as an 'Ie system' unit of producer, which means that popularized morals disappeared in the long run. However, on the other hand, it should be noticed that the role and function of family as a unit of small community to maintain their lives and daily livelihoods were not compressed directly and to the same degree in parallel with its contract as a producer. A production site in one company substituted part of the functions and roles of the family. "Production site-based principle" management revived part of 'Ie-type' of popularized morals to maintain producers' lives and daily livelihoods in the production sites, not within a company as a framework of capital ownership.

Japanese modern technologies reached their peak of achievement around 1910s, when Japanese-style manufacturing was established before WWI. It was in this period that Japanese "Monozukuri" grew the consciousness that it had already caught up with the developed industrialized countries in terms of physical technological level. It, however, had three defects;

First, it had strong dependence on foreign technologies that had spread through the bottom of the Japanese economy. In this case, space of factories and production sites in the foreign countries were the origin to bring about the idea and imagination for the first-grade technician (p. 466). Second, there was a delay in the development of compatibility production in the machine manufacturing sector. Third, there was a definite weakness in the technological development capacity in the newly emerging industries (Nakaoka 2006, 466-467). These defects and problems continued to remain until the defeat of WWII: It became rather worse along with the transition to the wartime economic system of WWII.

Section 5 “Monozukuri” and successful injuries in the Post-war Period

Reconstruction of the post-war manufacturing sectors, beginning with the introduction of physical technologies and business plan from the United States, was a big trial and error to compress the differences between Japan and the Western world, especially, the United States in the technological level. This compression was different in a sense from the industrialization after the Meiji Restoration. The process promoted explosive economic growth of Japanese manufacturing sectors with full establishment of the Japanese style of social technologies; Japanese style production and management system, and development of corporate-centered morals. It is claimed that they prepared full-scale development of integral architecture production, which became gradually more competitive in the world market after the 1970s on. Almost all factors of these Japanese of social technologies were established on a full scale in the High Economic Growth period in spite that some of their historical origins and prototypes which already appeared in the period prior to them, as are studied above. It is not necessary to trace them again here. Rather, it is of value to focus on the various constraints that might be thought before to bother the postwar economic recovery, but finally proved that they were successful injuries.

They gave rise to the integral architecture production as social technologies. These constraint conditions were as follows;

First, potential demands rapidly expanded during the postwar reconstruction, and required quantitative expansion of products in a brief period, while lack of capitals, economic and management resources under the post war period prevented introduction of a US type of division of labor and factory system.

Second, chronic shortage of capital goods prevented the way to choose technologies that would lead to investment of excessive capital equipment.

Third, economic growth under the presence of people’s low incomes and income disparities demanded a diversity of product models even within a single sector, urging firms to create a new kind of design information of product appropriate rather for poor consumers. The typical case was the design of ‘light vehicle’ only in Japan.

Fourth, rapid industrialization after the WWII induced traditional family-run workplaces of cottage industries workplaces with diverse types of small-lot production into small and medium-sized enterprises equipped with modern machineries. Assembly companies as controlling company could make effective use of them as a parts-producing factory. In addition, weakness of management capacities, which used to be the flip of "production site-based principle" management ", promoted, as social technologies, spinning-off some part of companies into a separate company and managing them as an affiliated company.

Conclusion

Late in the 20th century and early in the 21st century, families modernized in the process of Rapid Economic Growth period are going to rapidly disassemble, while production sites are rapidly moving overseas, or began to be managed under a corporate management and governance with a short-term perspective. People are confronted with a harsh reality, like further marketization, globalization and mobilization of labor forces, restructuring and so-called black companies.

Thus, however, in the 21st century, there are expectations to transit from modern families to individual families, where the society holds that a family should accept an image that the main actors of the selection and responsibility should be changed into an individual, while the government supplementarily and complimentary supports an individual’s family and socially vulnerable in institutional and administrative ways. However, neither family nor firms/companies can successfully produce and provide solid and mature living norms and morals appropriate for the new century. Even Japan’s conservatism has not succeeded in it. The Great East Japan Earthquake and Fukushima 3.11 disaster made us aware of the importance of ties, especially that of families and small communities. It seems, however, that many Japanese are trying to come through harsh realities by continuing to shut in the current difficulties in their own families.

Let’s return to a consideration as to the first issue; whether it is possible to maintain competitiveness of Japanese manufacturing industries in the world market in the future. The beginning of the 21st century of Japan was confronted with such discussions that the Japanese style of ‘Monozukuri’ began to face limitations, as symbolized in the recession of Japanese electronics industries and home electronics manufacturers in the world market.

In other words, it seems that the industrial production in the world has shifted to a new phase of greater prosperity of modular architecture production, which is symbolized by development of network-type international division of labor, fragmentation of production, worldwide division of production process, global value chain (GVC), IoT and Industry 4.0 and so on. Are these trends disadvantages to the integral architecture production/products?

We cannot, however, prospect if these trends would go straight to the simplification of the manufacturing industries and services into the modular architecture production/products in the next few decades of the 21st century. It would make sense that in parallel with this type of simplifying trend, we would be up against increasing sophistication and maturity of the environment, increasing strictness, severity and limitation of the global and the social/regional environment⁶). They would make further evolution of production/product complexity and more constraints imposed on production. More increased constraints call for more need of new kinds of integral architecture production/product as follows:

- 1) Relatively rich consumers in emerging market countries as well as individual customers in developed countries will seek higher functionality and more maturity;
- 2) The desire for people seeking more safety and peace of mind, local environments and global environments in product and service production would impose more stringent constraints on production and products;
- 3) There are required for more sustainability of production of products and services.

These, surely, lead to the markets being compelled to offer more various kinds of higher quality of integral architecture products and services, where a tenacious and dogged attitude towards production and service would be required at a higher level. We have not yet, however, found a prospect to a new kind of living norms and morals appropriate for higher qualitative and mature type of integral architecture production/product.

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⁶ See the discussion in Tsuru and Morishima (2012)

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