A New Global Partnering Production Model "NGP-PM" Utilizing "Advanced TPS"

Keiichi Ebioka, (E-mail: c5606019@cc.aoyama.ac.jp), Aoyama Gakuin University, Japan
Manabu Yamaji, (E-mail: yamaji@ise.aoyama.ac.jp), Aoyama Gakuin University, Japan
Hirohisa Sakai, (E-mail: h_sakai@mail.toyota.co.jp), Toyota Motor Corporation, Japan
Kakuro Amasaka, (E-mail: kakuro_amasaka@ise.aoyama.ac.jp), Aoyama Gakuin University, Japan

ABSTRACT

In order to improve quality at leading manufacturers' overseas production bases from the perspective of "global production," "a New Global Partnering Production Model, NGP-PM" - the strategic development of the "Advanced TPS" model - is proposed and its effectiveness discussed. The aim is to increase global quality by generating a synergetic effect that organically connects and promotes continual evolution of the production plants in Japan and overseas, as well as greater cooperation among production operators.

INTRODUCTION

In recent years, leading manufacturers in Japan have been deploying a new production strategy called "globally consistent levels of quality and simultaneous global launch (production at optimal locations)" in order to get ahead in the "worldwide quality competition," and "high quality assurance in manufacturing - simultaneous achievement of QCD (*Quality, Cost, Delivery*)."[1,2] This is the "key to successful global production," and has become a prerequisite for its accomplishment [3].

The greatest concern of corporate managers is the success of "overseas production strategy - local production" as well as "to bring overseas manufacturing to Japan standards." Therefore, in order to increase the skills of production workers at local manufacturing sites (hereafter referred to as production operators), "the key to successful global production" is necessary to realize manufacturing suited to the actual situation at production sites of various overseas production bases.

Against this background, the authors have focused on the strategic operation of "the evolution of production sites – the *Advanced TPS* Model" [3, 4] which strategically deploys "*Total Production System, TPS*" that is, the core technology of "*New Just In Time, New JIT*" which the authors [3, 5-8] have proposed and verified its effectiveness. The authors here propose a "*New Global Partnering Production Model, NGP-PM*" which generates a synergetic effect that organically connects and promotes continual evolution of the production plants in Japan and overseas, as well as greater cooperation among production operators. The effectiveness of this model will be verified at a leading company, Toyota.

PROBLEMS WITH SUCCESS IN "GLOBAL PRODUCTION"

It can be said that Japanese management technologies, represented by the Toyota Production System (called "*Just In Time, JIT*") and other Japanese production systems, contributed to the world in the latter half of the 20th century. For production systems that put the customer first, producing and offering only what is needed when it is needed, *JIT* is the core concept in manufacturing companies worldwide, and has been launched in many of these companies throughout Europe and the US [9-11]. Recently leading companies aim to succeed in localizing production as a global production strategy; the key to this is success in "global production."

However, it has been observed that, despite the fact that overseas plants have the relevant production systems, facilities, and materials equivalent to those that have made Japan the world leader in manufacturing, the "building up of quality - assuring of process capability (Cp)" has not reached a sufficient level due to the lack of skills of the production operators at the manufacturing sites. Under such a circumstance, there are many studies abroad for globalization and TQM [12-15].

As a countermeasure to such a problem, and in order not to lag behind the "evolution of digital engineering - the transition to advanced production systems at production plants," the Japanese manufacturers expect the production plants in Japan to serve as "mother plants." They would welcome overseas production operators to these plants, and promote "a local production program - transplanting the know-how of Japanese manufacturing [3, 4]." However, it is by no means easy to transfer the "know-how of Japanese manufacturing" directly to overseas production bases as mentioned above. In other words, there is always "an obstacle to overcome - a suitable production system for each production base," due to the difference in ability (level of skill and education) or national characteristics between the local production site and Japan.

Therefore, to cope with this situation, an environment in which the "creation of labor values - ES, advanced skills, a sense of achievement, and self development" can be realized must be urgently considered [16-18]. In order to accomplish the above, the authors surmise that it is necessary to develop a type of manufacturing which fits the local circumstances of various overseas production bases, and to advance from "Japanese mother plants" to "global mother plants."

THE STRATEGIC USE OF "*NEW JIT*", THE KEY TO GLOBAL PRODUCTION

In order to realize the key to global production, "globally consistent levels of quality and production at optimal locations," it is absolutely essential that manufacturing via "global partnering" is precisely developed to suit actual conditions and skill levels at production sites of the various overseas production bases. In working towards these urgent issues, the authors propose the use of "*New JIT* - a next generation management technology."

New JIT, as the core of management technology, is composed of "*Total Marketing System, TMS*", "*Total Development System, TDS*" and *TPS*. Among these, as shown in Figure 1, in order to handle the core elements of *TPS*, namely: (a) production based on information, (b) production based on workshop formation, (c) production based on engineering, and (d) production based on management, it is vitally important that management, control supervisors, staff members, and workers work together within the organization and in a systematized way to improve in production philosophy, production processes, production technology, and human management from a holistic perspective [3].

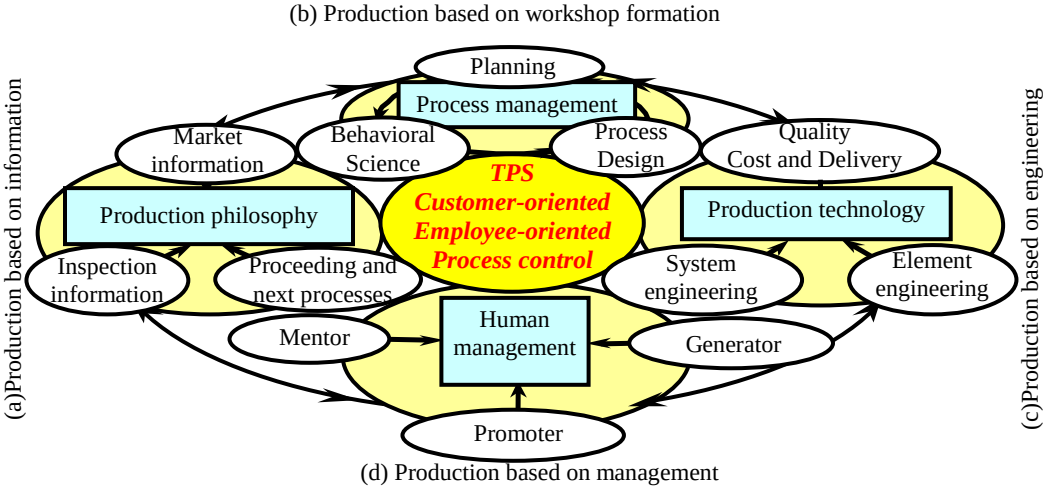

Figure 1. Total Production System, Key to "*New JIT*" [1]

ADVANCED TPS - A MODEL FOR PRODUCTION SITE EVOLUTION

Recent years have seen significant changes in manufacturing, including the evolution of digital engineering, the shortening of product lead time, and simultaneous global start-up [3, 5-8]. In order to prevent a lag in the transformation of production sites, the most critical issue has become creating superior products based on the customer-first policy of QCD. As mentioned above, in order to achieve this, a model for utilizing *TPS* in order to strategically realize the core elements of *TPS* is necessary. To this end, the authors newly propose "*Advanced TPS* - a model for production site evolution" as the "*New Japan Production Model*."

Current issues related to specific development items include: increasingly digitized production, reform of production control systems, and creating attractive workshop environments tailored to the increasing numbers of older and female workers. Some ways to address the above issues are (a) intelligence quality control system (b) a highly reliable production system, (c) renovating the work environment, and (d) education for intelligent operators. The authors therefore consider *Advanced TPS* - for evolution of manufacturing sites to be a critical foundation for "bringing overseas manufacturing to Japan standards."

THE SIGNIFICANCE OF "GLOBAL PARTNERING" RESEARCH

The authors [19] have defined "global partnering" as knowledge sharing in order to promote continual evolution of the production plants in Japan and overseas, as well as greater cooperation among production operators. In other words, global partnering means that Japanese companies no longer stick to a one-sided promotion of Japanese concepts and systems onto overseas plants as they have in the past, but that Japanese and overseas plants exchange opinions, accept each other, and share knowledge in order to continue developing the best-suited manufacturing system for each environment.

Therefore, for expedient achievement of "globally consistent levels of quality and simultaneous global launch (production at optimal locations)," the authors consider global partnering through cooperation from fresh standpoints to be the key to "achieving worldwide quality competitiveness - the simultaneous achievement of QCD."[20]

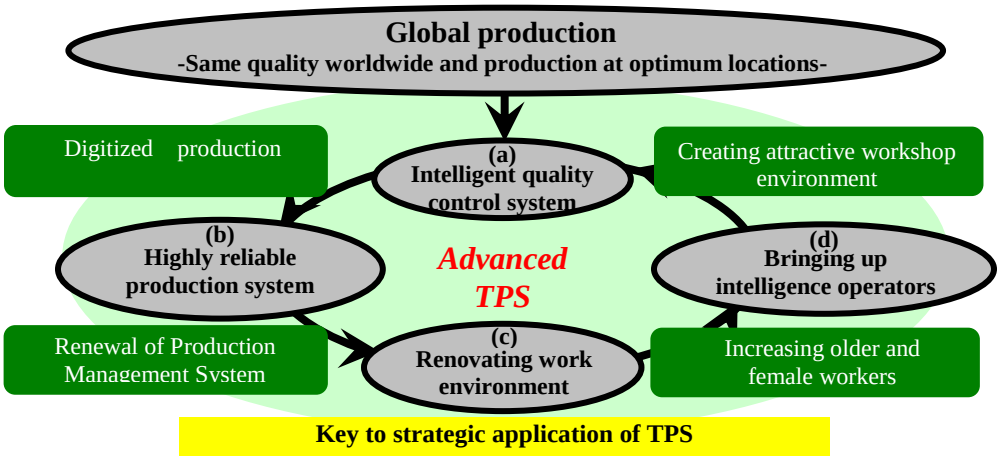

Figure 2. *Advanced TPS*, global production model [1]

"*NGP-PM*," A PROPOSAL FOR BRINGING OVERSEAS MANUFACTURING TO JAPAN STANDARDS

For advanced Japanese companies in the process of developing global production, the most important issue is how to "bring overseas manufacturing to Japan standards" at overseas plants. The authors therefore propose in Figure 3 a new idea, the *NGP-PM* which generates a synergetic effect that organically connects and promotes continual evolution of the production plants in Japan and overseas, as well as greater cooperation among production operators.

The mission of *NGP-PM* is the simultaneous achievement of QCD in order to realize high quality assurance. The essential strategic policies include the following three items: first of all, (A) the establishment of a foundation for global production, "realization of global mother plants - advancement of Japanese production sites"; second, (B) achieving the "independence of local production sites" through the incorporation of the unique characteristics (production systems, facilities, and materials) of both developing countries (Asia) and industrialized countries (US, Europe); and third, (C) the necessity of structuring of a "*Global Network System for Developing Production Operators, GNS-DPO"* to promote knowledge sharing among the production operators in Japan and overseas as well as for the promotion of higher skills and enhanced intelligence.

In order to realize this, with *Advanced TPS* model as the foundation, it is essential to create a spiraling increase in the four core elements by increasing their comprehensiveness and high cycle-ization. Specifically, in "realizing global mother plants" if Japanese and overseas manufacturing sites are to share knowledge from their respective viewpoints, the core elements must be advanced. To achieve this, a necessary measure is to design separate approaches suited to developing and industrialized countries. First, in developing countries (1), the most important issue is increasing the autonomy of local manufacturing sites. At these sites, "training for highly skilled operators (focus on manual laborers)" that is suited to the manual-labor-based manufacturing sites is the key to simultaneous achievement of QCD.

Similarly, in industrialized countries (2), where manufacturing sites are based on automatization and increasingly high-precision equipment, "training of intelligence operators [21]" resulting in "realizing highly reliable production control systems and ensuring high efficiency" is the key to simultaneous achievement of QCD.

Furthermore, production operators trained at "global mother plants" (3) can cooperate with operators at overseas production bases, and in order to generate synergistic results, can work to "localize global mother plants" in a way that is suited to the overseas production bases. *GNS-DPO* can then be effectively utilized to ensure that this contribution continues indefinitely. *GNS-DPO* is critical in ensuring the smooth exchange of essential information in order to realize overseas manufacturing at Japan standards. This essential information includes quality control information for each production base as well as facilities planning information, kaizen information, and information on the level of skill of human resources.

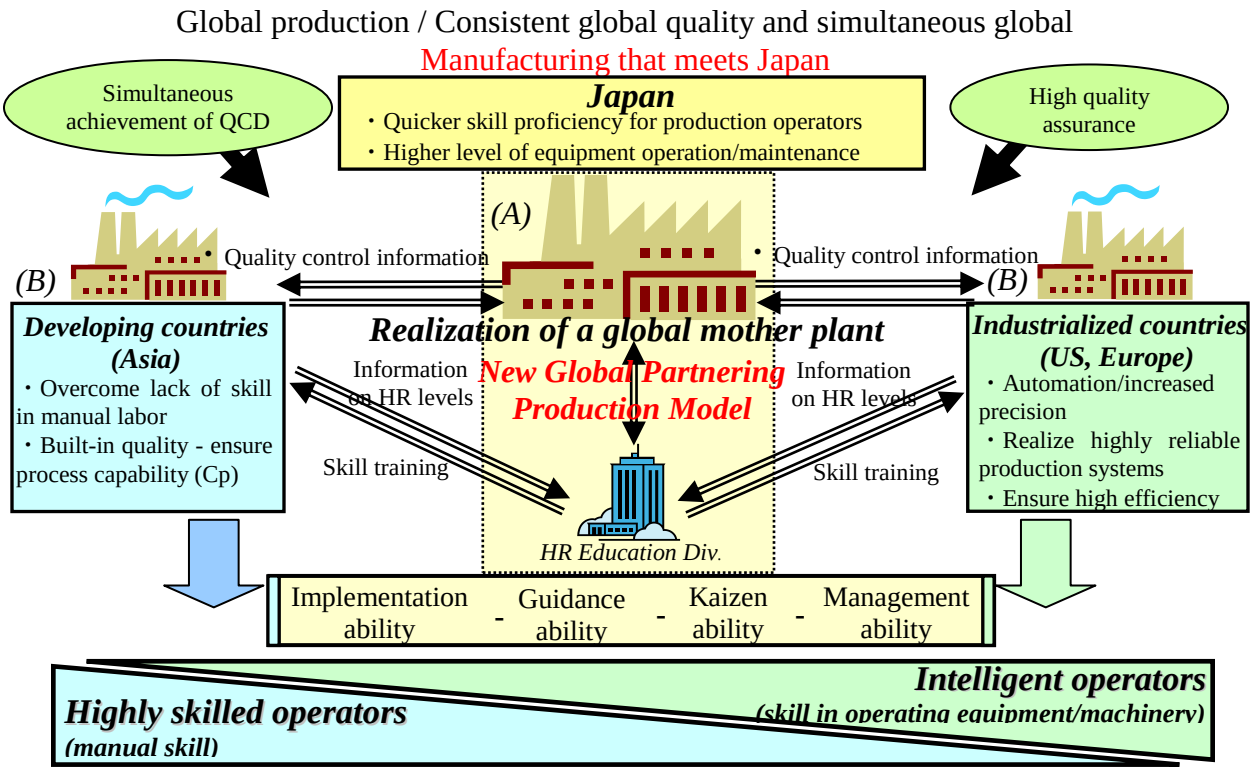

Figure 3. ***NGP-PM*, New Global Partnering Production Model**

APPLICATION EXAMPLE

The measures taken by a leading manufacturing company, Toyota, to achieve successful global production will be discussed. Toyota is taking measures through its Global Production Center (GPC) to realize global production. The GPC offers Japanese plants and its human resources education division to a global mother plant, "NGP-PM."

The authors propose "*Human Intelligence-Production Operating System, HI-POS*" [4, 21] as the "creation of a person-centered new production system" to increasingly realize improvements in skills and proficiency. An important part of this system is the "*Human Integrated Assist System, HIA*" [4, 21] which allows human wisdom to be translated into increased skills and oral tradition. Within this, the skill training curriculum for overseas production operators and the important tools will be discussed.

Skill Training Curriculum For New Overseas Production Operators

The skill training for newly hired domestic and overseas production operators, which used to take more than two weeks, has been shortened to just 5 days - less than half the time - and has ensured a stable mass production system. Specific content of the skill training curriculum for overseas production operators is shown in Figure 4. After everything from basic skills training to a competency evaluation test is completed, skills training (utilizing tools such as the Visual Manual and the HIA-Intelligent IT system) is conducted repeatedly until a certain standard is achieved on an evaluation sheet. Finally, actual training on the line is conducted, and achievement of a set skill level was shown to be achieved in half the time previously needed [22].

Furthermore, Figure 5 shows the screen setup of the Visual Manual, a communication tool that allows for increased exchange of knowledge and information regarding production processes. (1) shows the process, while the

section in (2) shows video, animation, or pictures and (3) describes the process in words. Section (3) allows the operator to follow along, clicking the continue button to turn the pages as needed. With this tool, production operators can be guided using shared content worldwide, and operators can also engage in self-study between actual skill training sessions. Through repeated image training, skill level can drastically improve at the initial stages, contributing significantly to proficiency improvement in highly skilled operators.

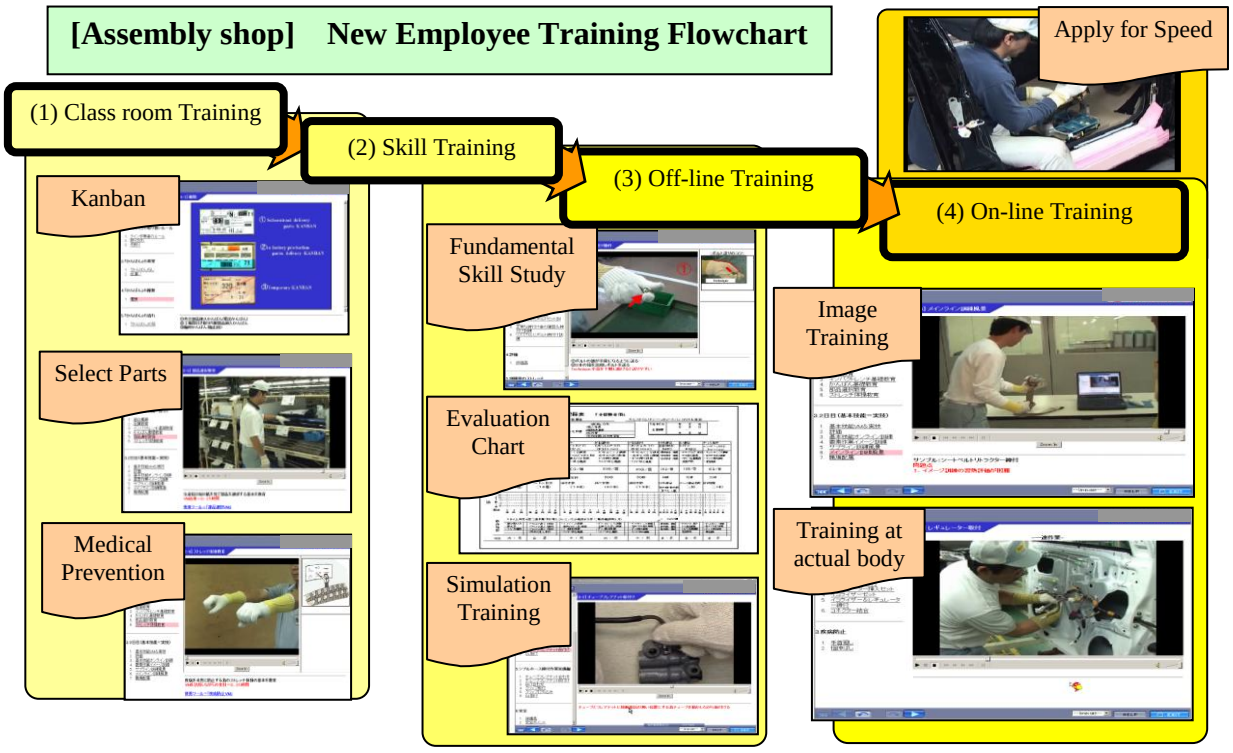

Figure 4.Operator training processes for assembly works

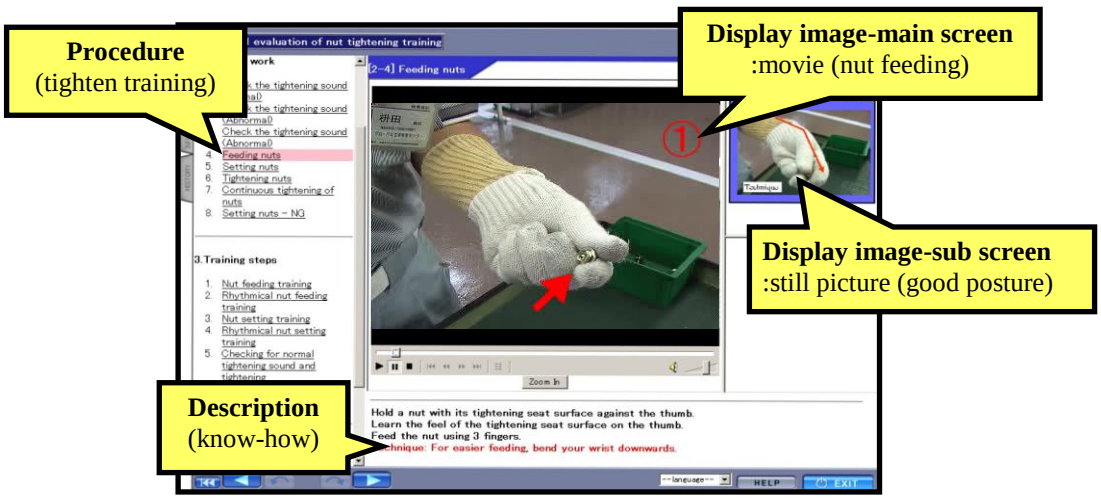

Figure 5. Example of "Hyper visual manual" concerning bolt feeding operation

CONCLUSION

This paper proposes a model and conducts verification for the strategic development of *TPS* (the core element of *New JIT*) through the use of Advanced TPS (a model for the evolution of manufacturing sites) through two case examples, with the aim of establishing basic principles and realizing a Japan standard of quality in overseas manufacturing. In the future, specific characteristics of each region and unique regional factors will be clarified with the aim of local quality improvement.

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