

**Management Policies and Industrial Sector Ecology in Japan's Postwar
Machine-tools Industry to the 1980s**

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ABSTRACT

This is an exploration, using Japanese language primary sources, of management policies and related industrial sector ecology of the post-World War II machine tools industry. From postwar devastation to global leader in worldwide market share by the mid-1980s, remarkably little is known of the factors that contributed to this success. Paralleling Max Holland's 1989 Burgmaster case study method of the U.S. firm's and industry failure, this study examines the history of Okuma Corporation, an Aichi Prefecture machine tools producer. The role of management leaders and government support for viable firms is shown to provide the necessary industrial ecology for machine tools producers to recover, innovate, deal with successive oil shocks, and achieve a leadership role in the machine tools sector. Comparative reflections on the parallel decline of the U.S. machine tools industrial sector conclude the paper.

At a national level, industrial policy or its absence – the politically influencing factors of the “ecology” of an industrial sector, if you will - has an impact on firm, management, employees, and other shareholders in any given sector (Richards & Person, G. (Eds), 1998). Thus, whether by intent or neglect, an industrial sector is conditioned by such policy (or absence). In turn, there are collateral effects for society and, at the relevant level, national competitiveness is at stake. This paper, submitted to the Management History Division of the 2012 Academy of Management Conference, takes up study of Japan's machine tools industry sector in reference to formal industrial policy and its interface with informal network arrangements by the main actors of the nation's employment relations system. These would be employers, employees, their respective collective organizations, and the government in its various regulatory and advisory roles (Dunlop, 1958, 1993).

The 2012 Conference theme concerns “the informal economy,” defined as, “commercial activities that occur at least partially outside a governing body’s observation, taxation, and regulation.”¹ As I hope to demonstrate, there is interesting evidence from Japanese primary sources to show that Japan's informal economy must be included as a significant factor, inclusive of supportive industrial policy, in any effort to account for the history of the nation's successful machine tools sector. These factors weave an interactive pattern, spanning decades, which involves formal government policy, but significantly also involves employer associations, employees and their labor organizations, labor law and collective-bargaining based employee participation in management prerogative, and the industry's historical development of subcontracting – itself a feature of any national informal economy. That the machine tools sector has exceptional significance is a point taken up directly below. That this topic is important for the Management History Division is clear from the Domain statement, which welcomes studies that consider, among other goals, the “importance of a historical perspective in international management.”²

¹ <http://meeting.aomonline.org/2012/77-news/69> .

² <https://www.baker.edu/departments/leadership/mgthistory/index.html> .

Why a paper on Japan's machine tools sector, or why study machine tools all? The most compelling answer concerns a historical fact that may or may not have modern relevance: a vibrant machine tools sector is positively correlated with economic success at the national level. And not only economic success. As Holland wrote, “Political primacy, economic wealth, and preeminence in machine tools production have always coincided because “mother machines” are the heart of any industrial economy” (Holland, 1989, p. 264). While this claim has been variously disputed, it does seem to contain a persisting element of truth.

What, then, are machine tools and why are they considered so important to a national economy? They are defined as, “a powered device, not handheld, which cuts, forms, or shapes metal” (Holland, 1989, p. 2) In Japanese, the sector's function and import are conveyed by the visual meaning in Chinese characters that name it: 工作機械 (kousaku kikai), fabrication tools/machines, or 母になる機械 (haha ni naru kikai), mother tools/machines. Because these tools are essential for making the tools that make anything, the machine tools industry has been persistently thought to be of critical importance in any nation's industrial development and success. Simply put, “Every manufactured product is made either by a machine tool or by a machine that was made by a machine tool” (Ibid.).

Why, then, study Japan's history of machine tools? In the aftermath of World War II, Japan's machine tools industry had, to all intents and purposes, ceased to exist. Allied bombing and the effects of the wartime naval blockade of the island nation had been increasingly successful in targeting the factories, sinking inbound raw materials, rendering domestic transport of supplies impossible, cutting off fuel supplies, and sinking the Japanese merchant ships that conveyed needed goods. The factory infrastructure was systematically destroyed by Allied bombing; what factories remained were unable to function. There were no political indications the future would ever include industrial recovery for a sector so central to war-making ends. The sector was further hampered by post-war settlement reparations of machine-tools to certain Allied nations. From this baseline, there

would be no reason to study the sector at all.

Yet, by the mid-1970s, the industry had recovered sufficiently that exports numerically began to exceed imports. Two decades later, Japan's machine tools industry output surpassed that of the United States. As Figure 1 indicates, by around 1982, Japan began to lead in world market share (Arnold, 1990). This is a circumstance, 36 years in the achievement, which shows no signs of changing anytime soon.

Consider the notable contrasting trend. U.S. machine tool global market share topped the world in 1965, with 28% of the market (Holland, 1989). By 1986, the U.S. accounted for less than 10%. Holland wrote, "In five short years, from 1981 to 1986, the number of U.S. machine tool plants shriveled by one-third because of bankruptcies, take-overs, and reductions in capacity" (Ibid., p. 2-3). A quick and easy free-market judgment might be that the U.S. workforce had simply lost competitive capacity. But that would be an incorrect conclusion. U.S. workers are not to blame. By the 1990s, the largest domestic U.S. machine tools plant would be a subsidiary of an Aichi Prefecture, Japan manufacturer: Yamazaki Mazak.

For being such an important industrial sector, there are few texts available in English, and fewer still in English on the Japanese machine tools industry. A Japan classic on industrial sector administrative guidance by the Ministry of International Trade and Industry (MITI) was written by Chalmers Johnson (Johnson, 1982). A less reliable critique of Johnson's thesis, based on a very brief study of Japan's machine tools industry, was written by Friedman (Friedman, 1988). There are few text on the U.S. machine tools sector. Max Holland's case study on the demise of the firm his father worked for is the most detailed: When the Machine Stopped (1989). His "axiom" was, "the demise of one machine tool builder may be a lens that reveals what has befallen a key industry and the manufacturing economy" (p. 264). Holland's text, although a U.S. case study, generously provides a wealth of information about the Japanese machine tools industry, relying on English language sources.

This paper was written to begin a parallel case analysis, by taking up Holland's approach and focusing on the informal network economy that developed in and around Okuma machine tools from its founding to the period when Japan's machine tools industry emerged as a significant exporting industrial sector – roughly up to the late 1980s. Okuma Corporation is an Aichi Prefecture machine tools manufacturer, the second oldest such firm in the country, and among the world's leading firms in this challenging sector. I hope to explicate significant formal and informal networking practices – subcontracting, administrative guidance, employer and other associations – to bring to an English language audience how the firm was able to recover and achieve such global success, along with other Japanese firms in the sector. Thus, the focal point will be Okuma Corporation and the Aichi Prefecture region. My own axiom is that such a case focus will be a comparison case of interest and aid identification of factors that facilitated recovery and enduring success. It is, in a sense, a study in contrasts.

For the various parties to any industrial sector performance, if national policies place specific firms at competitive advantage in domestic or international markets, or in both, then the continued viability of the firm itself becomes a significant factor in a complex reciprocal causality. Because Holland's case study was the tragic saga of individual firm, and U.S. sector, demise against the rise of Japanese competitors, we can usefully begin our study of Okuma by reviewing the key points raised by Holland in his Epilogue. Here, he indicates what his research offered by way of insight into relative success and failure.

First, despite the rise of the service sector and IT revolution just underway, he concluded that such developments ought to complement a vibrant manufacturing sector, not diminish it. He wrote, “The notion of an American economy devoid of manufacturing is a recipe for domestic impoverishment, social injustice, national insecurity, and global discord” (p 264). Perhaps, looking back upon his 1989 conclusion, there is already evidence of the merits in this insight.

Burgmaster's successful years were 1946 – 1965. The key to the firm's success was, “the

Burgs operated their enterprise on the maxim that a machine tool builder is only as good as its workers. They cultivated a quality workforce that was second to none in its productivity and dedication to quality” (p. 265). Other factors for success included a commitment to innovation - it took a firm like Burgmaster to work out economic efficiencies inherent in numerical control. Too, there was no foreign competition at the time, a solid national economy persisted, as did consistently low inflation. These factors “held” until the mid-1960s. In 1965, Houdaille bought Burgmaster, part of a pattern of mergers in the period that took up about two-thirds of the industry (Holland, 1989).

The first factor Holland noted to cause subsequent decline in the machine tool maker was “managerialism,” defined by Noble as, “management control is the *sine qua non* of efficient production, and it leads typically to the single-minded pursuit of management control as an end in itself” (Holland, 1989, p. 266). In the instance, managerialism introduced exogenous controls over a set of working rules governing employment relations in a firm that had involved employer-employee detailed knowledge of, and intimate partnership in, a machine tools production regime. Managerialism brought in a “mere ownership” taking up “management fads...in an endless and ultimately futile search for a better formula. No formula was a substitute for management involvement on the shopfloor” (Ibid., p. 266). In the end, “Managerialism had drained Burgmaster of its once-formidable capacity to innovate and its technological prowess” (p. 267).

Holland observed the following about the Japanese competition. First, the Japanese government “fostered an economic climate in which builders like Okuma and Yamazaki could thrive” (p. 267). Second, it ensured an educated workforce and soundly managed economy. Holland noted that MITI tried to “do more” but that such efforts alone would not ensure firm-specific success. Third, “The truly vital qualities were to be found inside their respective machine shops and engineering departments. 'Promote high technology and maintain good labor relations' were the bylaws at Okuma” (Ibid.). Holland continued, “It does not seem coincident that Burgmaster also thrived in the years when it followed the same precepts, and did not just mouth them” (Ibid.).

Another contrast Holland noted was the degree to which the Japanese firms studied their U.S. counterparts and U.S. market. The U.S. firms, however, devoted little energy to study of Japan, its market, or their competitors. They were, in a word, “complacent” (p. 268); “They approached business in Japan as if it were simply a more exotic version of business in the United States” (Ibid.).

Holland then listed the factors that contributed to the U.S. firm vulnerability once Japanese exports began seriously impacting U.S. market share. These were: conglomerate management practices, promotion patterns favoring executives with legal or accounting backgrounds in contrast to production expertise, failure to invest in new technology and the adverse impact of military spending on technological innovation. Here, Holland noted that Japan's best and brightest citizen engineers thought peak employment opportunities were to be found in the private sector of the machine tool makers. In the U.S., military procurement resulted in similarly qualified talent go off to more lucrative Defense contracting ends. Holland wrote, “The Pentagon functioned as a perverse and much more powerful MITI, through its procurement policies” (Ibid., pp. 269-270). He estimated that defense spending accounted for between 20 to 30% of peacetime machine tools domestic output. Finally, the 1970s also provided an economic climate of volatility that rendered the industry's small-medium size firms unable or unwilling to continue capital investment. In contrast, Japan's national response to these same economic variables reduced comparable machine tool sector vulnerability.

Holland's case-based study of the U.S. machine tools industry opens a comparative research horizon that invites a comparable effort for Japan's machine tools sector. This paper offers the beginnings of such a study, grounded in Japanese language sources, reporting a narrative of Japanese developments. We will, in the Discussion section, return to Holland's conclusions and see how they stand up in respect to Okuma Corporation's case. Next we will look at the methodology that informs the research path.

METHOD

This is an interdisciplinary, comparative research effort to better understand Japan's machine tools industrial sector and the key informal economic factors that contributed to its post-World War II recovery and rise to international dominance. Offered as a complement to Holland's case study of a U.S. manufacturer, we focus on the Aichi Prefecture region where machine tools manufacture predominates, and the case of Okuma Corporation.

The author was involved in doctoral field work in the early 1990s that looked to the machine tools industry as an exceedingly useful point of entry for study of a topic indirectly related to the industrial sector analysis of this present paper (Tackney, 1995). He was a visiting researcher at Okuma Corporation in 1992-3. The Okuma experience began an interest in the machine tools sector that continues to this day and is the remote methodological inspiration for this conference submission.³

This paper reflects that field work experience, building upon the historical information gained. It is designed to be a current update, based on Japanese language sources, to the issues of comparative industrial sector competitiveness in the period of interest for a critically important industry that has, to this day, remarkably little written about it. Following the approach of Holland, I will pursue the Okuma story as a case issue, attempting to contextualize the firm's historical competitiveness in reference to the larger informal economy networks that facilitated and conditioned its emergence and enduring leadership in the now fully internationalized field of machine tool manufacture.

This report focuses upon the Japan-sourced research available to the author since the early 1990s, covering Japan up to the 1980s, which effectively defined the comparative period of interest.

³ While Conference submission review obligations for confidentiality might preclude referencing the dissertation author, in fact the dissertation topic was, in a sense, but marginally related to the current paper on comparative industrial sector ecology. Accordingly, it seemed better to list than not, as the field work was instrumental for grasping the method of this paper. Too, the paper will stand on its own merits regardless. The author begs the indulgence of AOM reviewer's in this decision.

The narrative is grounded in leading Japanese language texts on the subject, offering in References a fairly thorough set of texts on the subject. The author was introduced to these texts while involved in field work studies in Aichi Prefecture, Japan, under the guidance of and suggestions from those involved in the industry at the time. Study of this industrial sector has continued to the present.

The narrative proceeds as an historical chronology of issues, policies, and initiatives taken as these presented themselves in the research materials. All translations from the original Japanese are the author's own. We focus on employer actions and government policies as a way to comprehend the formal and informal network that has developed in the course of Japan's postwar machine tools industry recovery and global emergence as market leader. Employment relations aspects, while also of interest, are not taken up in this study in any detailed way due to limitations of time and Conference paper length. These are, arguably, of great significance – as Holland noted in the U.S. case, with Japan's Productivity Movement being particularly interesting. But the employment relations dimension is a story best told within the context of a prior, well-understood comparative industrial sector ecology of management policies and government-level 'administrative guidance' efforts, particularly in the Japan case.

The paper proceeds by reviewing the industrial sector ecology of the firm and industry through seven distinct periods, beginning with pre-World War II legacy issues of importance, ending with the oil shocks and 1980s recession. The discussion section returns to the key comparative points raised by Holland.

RESULTS

Industrial Sector Ecology 1: The prewar legacy

Okuma Machine Tools was the first company in Japan to establish a subcontracting system (Suzuki, 1988, 1989). While it might be supposed that that subcontracting and process

manufacturing took place among machine-tool manufacturers during the Meiji (1869-1912) and Taisho (1912-1926) eras, Suzuki reported that this was not the case, based upon available evidence.⁴ There is evidence that the military arsenals engaged private sector firms in sub-contracting arrangements as procurement pressures increased beyond supply capacities.

Throughout the period between the two World Wars, there was a marked increase in the number of medium-small machine-tool makers (Suzuki, 1989). This was due to progress in specialization within the enterprise associated with developments in machine manufacture. Again, according to Suzuki, zaibatsu interest in the machine tool industry increased following the 1931 Manchuria Incident because of the obvious growth potential associated with military conflict. These industrial conglomerates – the zaibatsu - moved firms which had manufactured other lines into the industry.

Based on a review of industry surveys taken between 1936 and 1937, Suzuki identified six characteristics of sub-contracting in the industry during this period. First, there was considerable diffusion in the use of subcontracting enterprises. Second, many sub-contractors had less than 10 workmen. Third, most of the sub-contracting firm owners were machinery industry workmen (shokko) who had gone independent. Fourth, employment relations were pre-modern; the employees mostly came from family and apprenticeships. Fifth, the machinery used in sub-contracting firms was, for the most part, lathes and drilling machines. Few firms were equipped with specialty machines. Sixth, these firms did not have close, or exclusive, contractual relationships with larger firms. Floating sub-contractors were most common.

Within the field of parts processing in the middle and small-sized machinery industry, Okuma Iron Works took the first steps toward a results-oriented industrial grouping centered on one

⁴ I interviewed Professor Suzuki in the 1990s and learned, among other things, that he interviewed a number of people in the course of his research. His research conclusions are based upon both documentation and detailed oral histories.

assembly enterprise (Suzuki, 1989). This is notable because these policies dated from 1932, well in advance of Japan's wartime regulated economic measures. Okuma was the first firm to introduce exclusive subcontracting manufacture, linking micro-firms completely within Okuma manufacturing. It also engaged in unique process studies to enable development of a comprehensive subcontracting system. The efforts were successful, as Okuma became a model for policies designed to deal with the medium-small firms that proliferated in the wake of Japan's invasion of mainland China. Thus, Suzuki reports the path of causal influence on subcontracting to have been from the Okuma experience to the wartime regulated economic measures that followed.

What precisely motivated this step to subcontracting in the 1930s? Neither historical documents nor oral history provided a comprehensive answer (Suzuki, 1989). Dividend payments at the time by Okuma, already a publicly-held firm, did not indicate stellar economic performance. The national economy, in turn, was just recovering from what would later be termed the "Showa Panic" of the late 1920s.

Based on his research and interviews, Suzuki conjectured that business pressures were significant in prompting the move to subcontracting. Following the Manchu incident, Okuma management could reasonably anticipate windfall orders for munitions and related machined product. Already versed in the extremely cyclical nature of this industrial sector, subcontracting appeared a viable alternative to simple capital expansion. Suzuki characterized this step as a prudent, if innovative step, particularly in light of Okuma's formal, and first, capital expansion of plants in 1934. Against a background perception that Japanese workers in smaller firms lacked equivalent technical skills, the policy was indicative of "fairly revolutionary management" (Suzuki, 1989, p. 48). A central figure in this policy research was Muraoka Karoku, a shopfloor hire who joined management and was instrumental in Okuma personnel policy throughout the period – even and especially in the postwar firm and industrial sector recovery that came much later.

The Okuma policy obliged assessment and classification of potential subcontracting sites.

Three classes were established: firms capable of independent work (Class A), firms of mixed independent and subcontracting quality level (B), and Class C, which was for complete subcontracting arrangements. The firm had to invest in this judgment process and dispatch workers to sites for quality inspection and skills improvements. Targeted firms were invited to send workers to Okuma. Funds to improve subcontracting capacity were carefully negotiated and arranged. Suzuki wrote, "Okuma would instruct the firm with familial intimacy, trying to insure the subcontractor made an adequate profit" (Ibid., p. 49). Wage rates ran 70-80% of the parent in 1938, with subcontracting wages amounting to 70% of the total wage bill by 1939. These sites numbered between 60 and 80 and, contrary to regional clustering theory, were quite geographically dispersed for the era. Suzuki summarized Okuma's subcontracting steps by noting, "it is important to keep in mind that for Japan, the process of establishing subcontracting in large enterprises was not a natural progression; human agency was a very significant factor" (1989, p. 51).

Industrial Sector Ecology 2: The wartime legacy of the machine tools industry and reparations

A second legacy due to the wartime controlled economy carried over to the postwar Japanese machine tool industry (Sawai, 1990). First, technical competence improved in large and medium-sized machine tool firms. Second, a program to enhance national standards in machine tool production contributed to quality production advances in small and medium-sized manufacturers. Third, the influence of military procurement cost management policies improved cost accounting practices in the smaller firms. There were a series of wartime controlled economy laws that ensured these outcomes, as listed in Appendix 1.

The Japanese machine tool industry was targeted as a source of reparations by the Allies (Sawai, 1990). In December, 1945, a plan was announced to remove half of the industry's manufacturing ability. In 1946, the Far East Commission, the joint commission of Allied representatives which, in theory, set policy for the Supreme Command Allied Powers (SCAP), announced plans to remove more than 27,000 machines within the year. To this end, by August, 1946, some 90 plants

were designated as reparation sites. A November 1946 Paris reparations report called for removal of 10,000 units, while allowing enough machine tools to remain for domestic rebuilding. Until final decisions were made regarding the dispositions of machines, those designated could not be operated, moved or sold without Occupation authority approval. Overall, the impact of reparations on the already devastated postwar industrial sector was to render any long-term planning functionally impossible.

At Okuma, in August, 1946, the Ogino, Ueida, and Chioi plants of Okuma came under reparations directives (Fujii, 1986). While the Ogino plant was released in December, the Ozone and Fuike plants were then added to the list. The Ueida and Ozone plants, still under Occupation control, were permitted to resume operations. In August, 1950, the machine tools in the plants closed by reparations directives were permitted to be transferred to the Ogino and Ueida plants.

Formally, the reparations threat remained over the industry until directives governing machine tool plants were ended in 1952 (Fujii, 1986). By May, 1947, however, the issue de facto came to an end with the McCoy Declaration, which reversed reparation plans and released government arsenal machine tools for conversion to peaceful uses. This step released a flood of older machine tools into the product market. This development was both a hindrance and an opportunity for machine tool makers. While discouraging new machine purchases, some firms focused on repairing and rebuilding these older machines. Parenthetically, it is worth noting that repair of older machines was a major factor in the postwar growth of Yamazaki Mazak, another Aichi Prefecture world-leader in machine tools manufacture (Kuba, 1989). Domestic demand for machine tools in years from 1952-1955 focused upon transportation equipment, general and electrical machinery (Sawai, 1990).

Industrial Sector Ecology 3: Postwar Prefectural Organizations

On June 4, 1946, the Aichi Prefecture Industrial Association (Aichiken kogyo kyokai) was

founded, the precursor to the Aichi Prefecture Management Association (Aichiken keieisha kyokai) This association was formed to redress a perceived imbalance in the postwar circumstances. The organization's tenth anniversary memorial volume reported,

While formation of labor unions increased rapidly from the thrust of postwar democratization, there was no mechanism on the side of management to specialize in or manage labor problems. ...it would not do to just let the days pass with arms folded. There was a labor problems research mechanism, dissolved during the war, of member firms (the major firms within the Prefecture) in the All-Japan Manufacturers' Group Federation (Zennihon Sangyo Dantai Rengokai, or Zensan). Those in charge of labor management began meeting informally (hikoshiki) by the name of the "Issui kai" (One water society). Through this they pushed on with their research. Through their advocacy they became the central "brain trust" for companies. They provided adequate basic research into immediate labor problems being confronted, along with problems anticipated and the labor relations that should develop. Over and above this foundation, they repeatedly urged exchanges to establish various kinds of necessary policies, rigorous coordination mechanisms, the reciprocal exchange of innovative workmen and the development of complete cooperation, from joint goals to common plans of operation (Aichiken Keieisha Kyokai (Aichi Prefecture Manager's Association), 1956, p. 10).

There was an effort to re-establish the dissolved Zensan, the wartime employer's association, but SCAP was initially opposed to a national employers association. Organizing efforts, based upon the links from the wartime agency, then focused on a prefecture level employer organization. At a planning meeting in Aichi for the association, the preferred name was the "Aichi Prefecture Management Association". However, at the time, there was "fear that the labor movement, which had become exceedingly violent, could see in this an unwarranted provocation" (Ibid., p. 13). As happened elsewhere in the country, the word "management" was avoided and the organization named the "Aichi Prefecture Industrial Association" (Aichiken Kogyo Kyokai). It was formally established on June 4, 1946. Representatives of 100 firms assembled and elected Muraoka Karoku, of Okuma, the chairperson (Aichiken (Aichi Prefecture), 1983). This was the same shopfloor hire that had come up in the firm to establish its subcontracting regime.

The Association did not have a particular plan at the outset. The text related that members studied various aspects of labor management relations in Japan and abroad. Its goal was to "develop

a path toward cooperative labor relations in accord with principles of harmony" (Ibid., p. 14). A list of some of their 1946 research interests included the following.

1. Current status of compensation conditions.
2. Comparative list of current laws and drafts of basic laws concerned with labor protection.
3. Employee education in the United States of America.
4. Schools for workers in the United States of America.
5. Opinions on drafts of labor standards laws.
6. Labor policies associated with company rationalization involving compensation discontinuance.
7. Labor union organization conditions.
8. Comparative lists of labor union wage demands.
9. Opinion on important issues of labor protection.
10. Items on quick response to overcome food scarcity.
11. Farm activities for independent food supply policy.
12. Opinion in regard to labor contracts.
13. Outline: Hitachi Manufacturing Plant labor dispute.
14. The new organization agreement of Toho, Inc.
15. Japan Wheel Co. (Nihon Sharinsha) union dispute.
16. Studies in regard to Japanese industrial relations.
17. List of the types of labor union wage demands.
18. Comparative list of individual labor union wage demands (by industry group). (Aichiken (Aichi Prefecture), 1983).

Not until July 11, 1947, was the name changed to the Aichi Prefecture Managers Association. The purpose of the renamed Association is described in the Appendix 2 translation. In this statement of purpose the role of Nikeiren, the national level organization, is also introduced (See Appendix 2).

In addition to the activities of this Association reviewed above, it also sponsored a legal advice function specifically in response to production control actions. Production control actions were steps taken by labor unions, in the face of owner refusal to negotiate collective bargaining agreements, that involved the assumption of the means of production by organized labor while continuing production and all nominal enterprise operations, with profit payments sequestered unless and until the employer decided to negotiate (Kettler & Tackney, 1997). The Association's position was, "Production control itself may not be said to violate the law, but it certainly is accompanied by illegal actions" (Aichiken keieisha kyogikai, 1956, p. 151). The Association began sponsoring legal consultation days, twice a month, from May 15, 1948. A Managers Legal

Foundation had also started earlier the same year, offering legal advice on issues ranging from labor disputes to severance compensation.

On January 29, 1946, just days before the Okuma labor union was formally established, members of the Aichi Prefecture Labor Mediation Commission were appointed in accord with the 1945 Labor Union Law. Among those appointed as a representative of management was Muraoka Karoku, of Okuma (Aichiken, 1983). In the first half of 1946, meetings were held to deal with the food and fuel crises facing the Prefecture. On September 21, 1946, Aichi branches of the Sanbetsu and Sodomei labor federations jointly sponsored a conference for Prefecture workers on the topic of, "Basic steps in regard to the electricity and coal crisis" (Aichiken, 1983, p. 409). This conference was the first step toward a highly successful labor-management collaboration to overcome the severe postwar conditions.

The next step toward this collaboration was a Sodomei sponsored labor-management conference on December 26, 1946. The federation had called for "Establishment of Prefecture Recovery" (Aichiken, 1983, p. 409). Several local labor union federations representatives attended, as did their recently formed Aichi Prefecture Industrial Association counterparts, along with an association of small-medium firms. At this conference, the participants decided to organize an Aichi Prefecture Recovery Preparation Conference.

The Recovery Preparation Conference held its first meeting on January 10, 1947. Among those representing management was Muraoka Karoku. He was, by then, President of Okuma Industrial Enterprises. Muraoka served this conference as one of three rotating vice-presidents, the other two coming from the union side. At this meeting a basic statement regarding recovery was produced. It reads, in part, "For any economic activity, it has become impossible to do anything without the cooperation of labor unions. The time has come when the worker, together with the democratic manager, must shoulder responsibility for Japan's economic recovery" (Aichiken, 1983, p. 411).

From this meeting, a regional recovery conference was also established. Improving the amount of coal available was the conference's main activity through June (Aichiken, 1983). Beginning in late May, those appointed to the conference went about the main towns and cities of the Prefecture, meeting with regional representatives of labor and management to explain the purpose of the conference. They visited individual factories and firms pleading their case to improve supplies. With the warm weather of June, enlarging the food supply became the next goal. This conference continued into 1949, addressing different needs within the Prefecture, despite strong confrontations between management and labor, and between the different factions of the labor movement.

Industry Sector Ecology 4: institutions of recovery

In the first half of the 1950s, there was a steady increase in the number of imported machine tools. This combined with long-standing concerns about qualitative differences between domestic and foreign machine tools. The first steps toward a government policy for the machine tools industry were taken at this time, before the postwar high growth periods (Sawai, 1990). Acting in an advisory and advocacy capacity for these policies was the Japan Machine Tool Builders Association (Nihon Kosaku Kikai Kogyokai) (hereafter, JMTBA). The JMTBA was established in Tokyo in December 1, 1951 (Nihon Kosaku Kikai Kyokai, 1982). Okuma Koichi, the Okuma firm's founder, served from the outset as a Vice-Director of the Association. It established a number of standing committees to study and disseminate information to member firms on a variety of issues, ranging from machine tool specialization (such as lathes and, later, numerical control) to labor problems and automatic assembly.

A direct effort to encourage importation of machine tools essential for the nation's industrial recovery can be seen in the 1952 passage of the Machine tool Import Funding Structure Law (Kosaku kikai yunyu hojokin seido). Firms became able to purchase foreign machine tools at half

the listed price, the rest subsidized by the government. However, the machine tool industry itself was so depleted of capital that the funding established was never fully utilized. Ten of the leading machine tool firms, Okuma among them, managed to import some 26 foreign tools for factory modernization, at a total cost of 160,000,000 yen. Other machines were imported through a subsequent measure that reduced importation tax for large-scale machine tools. This step, however, was a mixed blessing for the machine tools industry, which needed access to new, foreign models, on the one hand, but then suffered from their increased availability on domestic the market.⁵

The Japan Development Bank (JDB) was established in 1951: an institution that would have a profound role in postwar Japan's industrial recovery, the growth of the machine tools industry in general, and Okuma in particular (Sawai, 1990).⁶ From 1953-1955, the JDB provided funding to 60 firms for 69 cases of testing and development. Applicant firms were carefully audited and selected on the basis of overall, long-term financial soundness. Funds would be made available to approved firms at rates that were substantially better than those available through usual commercial sources.

The measure of JDB success must be taken in terms of the impact it had on these selected firms at the early stage of the postwar machine tool industry recovery. From 1953 to 1963, for example, the entire source of long-term financing for Hitachi Seiki was the JDB (Sawai, 1990).

⁵ Remarkably, the author saw that a good number of these machines still being used in the Okuma factory in 1992. They have plates specifying purchase date and conditions, noting "tax exempt."

⁶ Friedman (1988) evaluated the role of industrial policy first by considering Japan Development Bank (JDB) loans as a percent of total capital investment in the machine tools industry and then by comparing annual JDB loans to industry output. Of the first point, he observed "If government lending activity was effective, periods of heavy loan support should correlate with growth" (p. 87). He offered no rationale for such a standard, which is, in any case, completely inappropriate to the objectives of the funding policies. Funding was explicitly targeted to a *small* number of firms having sound finances. At a time when capital was in desperately short supply, these funds, along with long-term Japan Development Bank funding, insured the survival of the best firms in the industry. Friedman, however, concluded, "Apparently government support did not create a foundation for future expansion" (p. 88). This conclusion is not warranted. On the second point, Friedman correlated JDB loans with industry output, lagged, at most, to a two-year time span. Finding no statistical correlation, he concluded the loans had no impact on industry output. The table he thoughtfully provided, however, visually suggests a compellingly high correlation when initial capital investment and subsequent industry production output are lagged at about 15 years. And that is an appropriate time span to consider when dealing with the machine tools industry, not two years. His oversight is self-evident. In any case, the comparative industrial sector ecology legacy effect is painfully obvious: Japan's firms did not disappear, but thrived In contrast, U.S. firms, finding no comparative domestic support, disappeared, along with national dominance in the marketplace.

Some 61% of that funding was derived from provisions of the Machinery Promotion Law. Okuma, too, received almost all of its long-term financing from the JDB for the years 1957-1961 .

During this critical funding period, the Japanese machine tool firms were struggling, with little in the way of capital resources, to survive against vastly superior foreign competition and the usually rigorous domestic competition. The funding made available was not vast, but carefully allotted to the more promising firms for whom even a slight financial advantage, in those years, could make the difference between bankruptcy and solvency. The JDB, for its part, did not explicitly seek to influence or effect labor relations within the approved firms.⁷ Nevertheless, JDB representatives acknowledged that the financing assistance would indirectly enhance employment security by improving a firm's survival potential.

A remarkable variety of indirect assistance was available to Okuma and the machine tools industry from 1950-1954. This ranged from financing arrangements to special depreciation rates. These arrangements tended to favor larger firms which had better balance sheets. Okuma management, for its part, treated the availability of such resources with as much circumspection as the JDB treated Okuma in its pre-approval financial analysis. Then company president Okuma recalled that the firm carefully weighed the advantages and disadvantages of the financing proposals, determined them to be the best offer on the financial markets at the time and acted accordingly.

Industrial Sector Ecology 5: High Growth and Guidance

To sustain an economy which maintains an institutionalized practice of lifetime employment, the firms which employ workers over long tenures must also continue to exist.⁸ The JDB, allotting development funds under Ministry of International Trade and Industry (MITI) guidelines, provided

⁷ This was confirmed in an interview the author had with a JDB director on June 23, 1993.

⁸ This section follows Sawai (1990), pp. 159-160.

critical support to firms that evidenced future promise in the initial postwar period. The machine tools industry, during the first and second high growth periods, evidenced sharp growth in the overall number of firms and personnel. This was true for all manner of firm size. However, the industry also experienced periods of sharp retrenchment and cutback. The number of employees in the industry, in 1965, was but 24% of the 1963 figure. In 1975, the number of employees had dropped to 31% of the 1970 figure.

This extreme cyclical pattern is typical of the industry throughout the world. In the Japanese machine tool industry, there had been very little progress made toward industry concentration. Calls for rationalization of the machine tools industry arose from MITI. Under the 1956 Temporary Measures law for the Promotion of the Machinery Industry (Kikai Kogyo Shino Rinji Sochi Ho), policy targets were established which sought to improve product quality and performance while lowering costs. These targets were periodically updated and revised from 1956 to 1970. A summary of these targets and time frames is given in Appendix 3 (Sawai, 1990).

Given this intent on the policy side of the government, the JMTBA formed the Production Field Special Council (Seisan bunya shingi tokubetsu iinkai) in 1957 to study regulation of production areas. By January, 1961, this Council had proposed a Mutual Agreement in regard to Concentration of Production (Shuchu seisan ni kan suru moshiawase) which set out to self-regulate by industry groups. June, 1964, saw a repeat of this effort. Due to the independent nature of the machine tools firms, both efforts failed to generate the expected results. The machine tool industry is essentially composed of middle - to - small sized firms; production is by many machine types in small lots. By the 1965 recession, "the relatively small scale and excessively competitive character of the MT industry could not be denied and correcting that was already a policy topic" (Sawai, 1990, p. 157). Yet, "Without concrete progress in product field coordination, the machine tools industry, in 1963 and thereafter, entered a period of recession, the actual depths of which occurred in 1965" (p. 159).

With continued MITI criticism of excessive domestic competition, the machine tools firms, through the JMTBA, formed several regional groups. These were organized to minimize the negative impact of the recession as well as to provide a means to resist MITI pressure. The first group was formed in December, 1965. It was composed of five larger firms and three smaller firms. By mid-1966 10 groups had formed, comprising 60% of the domestic machine tool production. Group activities took two forms: business and technical cooperation. The former involved efforts to improve transaction circumstances, client introductions, joint business offices, joint use of trading firms, common showrooms, advertising and catalogues. Technical efforts included common use of patents, technical collaboration, unification of standards and joint product research.

What did these plans achieve for the machine tool industry over 1956 to 1970 span? Three levels of significance can be seen (Sawai, 1990). First, the special financing cited earlier was not only important in the renovation and modernization of equipment, but also served as a "pump primer" in making civil loans easier and the tax easements effected thinking about the timing of equipment investment. Second, these measures were a great contribution to the expansion of the machine tools market by promoting equipment modernization. Third, the Machinery Promotion Law resulted in technical improvements in machine tools related industries, such as those manufacturing axles and gears. These indirectly contributed to an improvement in the technical level of the machine tools industry itself. Sawai concluded, "In this way, the government policy plans, through independent developments exceeding the estimates of those in the machine tools industry, brought about a steady growth in the machine tools industry until international competitive strength was acquired (p. 172). As Sawai noted, this guidance challenged the management function of firms, sometimes generating considerable resistance. The extent of this individual Japanese firm resistance to administrative guidance would even come to extend internationally in the 1980s; Holland reported persistent Okuma reluctance to take up a joint manufacturing deal with Houdaille (1989). MITI was, and remains, an historically important agency in the postwar machine tools

sector history.

Industry Sector Ecology 6: Growth and Recession

The rapid expansion of the industry led to a number of developments (Sawai, 1990). First, the major firms achieved parity with producers in the United States and Europe in manufacturing lot sizes for the main production line machine tools. Second, considerable progress was made in improving manufacturing methods. For example, parts manufacture began, in 1965, to use "Group Technology," in which the production of similar parts is gathered in single economic processing units. Third, work time targets and schedules were established and work standards documentation diffused. Fourth, through "little noticed, important changes in manufacturing technology" (Sawai, 1990, p. 175), improvements in grinding and cutting methods diffused throughout the industry, both in processing and assembly operations. These changes included improvements in controller devices and machines to operate attachments.

Productivity markedly increased between 1955-1961, the result of improvements in equipment modernization, design and the manufacturing technology revolution (Sawai, 1990). Another major factor was the joint management-labor cooperation occurring within the context of the Japan Productivity Centers. For firms covered by the Temporary Measures Law, three groups can be identified. There was a total of 30 firms in the machine tools industry. Twelve were small-variety volume producers and eight large-variety small volume producers. Respective percent declines in manufacturing cost per item were 14, 24 and 11 percent. Volume producers exceeded target goals.

Beginning in 1961, the industry and nation faced the first serious recession since the war's end (Kuba, 1989, Sawai, 1990). Production was slashed throughout the industry. Despite economic difficulties, the industry continued to make technical progress. In 1963, for example, Okuma completed its first OSP Numerically Controlled (NC) device (Fujii, 1986). This was the first product to be developed that reflected the firm's decision to develop NC controllers independently

of the noted FANUC program.⁹

Research and development investments yielded results at the same time that economic circumstances began to improve. In 1966, Okuma won a Japan Machinery Association Award for its new GSA style upright surface grinder (Fujii, 1986). It also displayed in-house designed and developed NC machine tools at the 3d Japan Machine Tools Exhibit.

In 1968, the firm completed construction of a headquarters building in a North Ward plant site of Nagoya (Fujii, 1986). The next year, plant construction was completed at the Oguchi site (the current #1 Assembly Building). The NC Center at the Kita Ward site was completed in 1970. In the same year, firm capitalization reached 4,000,000,000 yen.

Growth of another Aichi Prefecture machine tool maker during this period should also be mentioned. Yamazaki Mazak made its first delivery of an NC machine tool as an export item in September, 1969 (Kuba, 1989). The 700 x 2000R Mazak went to TRW, Inc., of the United States of America. This export effort reflected a strategic choice on an export focus, a decision that was K in the industry. Kuba wrote, "The policy selected in the interest of stable management was not to develop side-lines nor diversify the activities of the corporation, but rather to take the initiative in diversifying the markets (demand) for machine tools on a global basis" (1988, p. 144).

This strategy had two basic policies. First, the route of internationalized sales sought to insure a secure basis for market demand. This was necessitated by two conflicting industry features. While machine tool demand fluctuates drastically, continual investment for the next demand cycle is essential. Second, the Yamazaki Mazak management felt that nothing significant was accomplished by solely relying on others. Other Japanese firms used foreign distribution systems overseas. These were both cheaper and obliged less commitment by their Japanese patrons. Mazak went ahead with its own international distribution system, citing the following advantages. First, a

⁹ To my knowledge, Okuma is the only major producer to independently maintain research, development and production programs for these devices.

fast pace could be maintained for product sales. Second, an independent system would enable pinpoint focus on local market needs. Third, such a system would force the firm to train employees at home to be more internationally minded. Finally, this step would secure stable product demand so that management could more reasonably seek a long-term vision in policy (Kuba, 1988). The postwar boom topped in 1969. By 1970, a slow decline in machine tool orders began to impact the industry.

Industry Sector Ecology 7: Oil shock and Recession

Two factors contributed to the 1971-1976 recession in the machine tools industry, which was the worst in postwar history. First, on August 15, 1971, U.S. President Richard M. Nixon ended reliance on the gold standard for the U.S. currency. Second, on October 17, 1973, the Organization of Petroleum Exporting Countries (OPEC) decided to reduce oil production to increase the per barrel price of oil (Yergin, 1991). The economic effects of this and subsequent OPEC policies led to a severe economic crisis in the world economy. The Japanese economy, almost entirely dependent upon Middle East oil sources, plunged into an unprecedented recession.

As producers of capital intensive machinery require large amounts of cheap energy for efficiency gains, the machine tool industry led the way into the economic abyss. After November 1974, nine of the top 12 firms in the industry had reduced their workforce, on average, by 21% through solicitations of voluntary resignations (*kibo taishoku*) by the early 1980s (Nihon Kosaku Kikai Kyokai, 1982). By March 1976, the number of regular employees had been reduced 31% from the postwar peak in 1971. The oil shock recession sharply reduced demand for capital intensive, energy consuming machine tools, resulting in backlog stock in excess of six months.

These dire circumstances brought about a series of policy goals and proposals from the Machine Tools Builder's Association. They are contained in the August 1976 Machine tools

whitepaper (Kosaku kikai hakusho), published by a special whitepaper commission of the Japan Machine Tools Industry Association (Nihon kosaku kikai kogyokai kosaku hakusho tokubetsu iinkai). Before we review oil shock developments at Okuma, it will be instructive to summarily review the proposals made in the whitepaper to deal with oil shock effects.¹⁰

Six points were specified. Firms in the industry suffered from a lack of accumulated capital in contrast to firms in Europe and the United States. This, given the extreme severity of the recession, threatened many with bankruptcy. Thus, the first policy point sought to increase levels of accumulated capital in each firm. The whitepaper specified 30% of accumulated capital per firm (accumulation refers to non-borrowed funds) to be sought through such measures as increased structural limitations on firm debentures and improvements in tax structures for capital accumulation. The second point called for productivity improvements. Machine tool industry productivity had fallen below that of general machinery manufacture. Expectations for another round of a high growth economy were very low, thus the industry had to respond by support for appropriate pricing, reduction in distribution market costs, reduction in the number of technicians, increased standardization and specialization of machinery controls and development of a better sense of the need for value-added production management in order to reduce costs.

Third, the Japanese machine tools industry had to accelerate intra-industry cooperation. The continuing recession had led to repeated cycles of price-cutting. If this continued, then firms unable to cope would disappear. Should a natural "weeding out" that derives from free competition occur, the entire industry would collapse into disorder. To prevent this, intra-industry cooperation was essential. The paper noted that in the wake of the 1965 recession, firms self-arranged within 10 structured groups. In the present circumstances, however, the original significance of this had been lost. Thus, a study to restructure such an arrangement under the new circumstances was essential.

¹⁰The whitepaper is reproduced in Nihon kosaku, 1982, pp. 29-33

Fourth: demand fluctuations had to be regularized. The Japanese machine tool industry, along with its U.S. counterpart, had large domestic demand fluctuations (unlike the European industry) and low levels of order backlog. The White Paper urged development of a domestic airline industry, to compensate for the future inability of the Japanese auto industry to maintain machine tools demand levels experienced during the high growth periods and to enhance technical improvements in the machine tools industry. In addition, rationalization of excess personnel in the industry was considered one of several other important steps to reduce the negative effects of product demand fluctuation. Fifth: employment and wage levels had to be suitably adjusted. When the economy began showing signs of improvement, then expansion in employment levels needed to proceed with caution; stability for current employees should be the operative premise. The goal should be to reduce non-regular employees (*kansetsu jiin*) from the then 50% levels, increasing the direct employee ratio to 60:40. The text went on, "If wages among the leading nations are compared, an international trend toward wage level standardization can be seen. From the perspective of international competition, joint labor-management rules governing wage issues would be desirable" (p. 30). Furthermore, given the high levels of technical skills and training that are necessary for work in the industry, the paper recommended employment stability policies, such as the creation of "a basic structure for employment stability," and "structures for preparatory financing of employment adjustments." Finally, the paper called for establishment of structures in support of subcontracting and supplies. These would include improved financial arrangements between parent firm and subcontractors, stability in ordering pattern, along with increased specialization of subcontractors through parent firm support of independent technical advances within subcontractors.

This complex document reflected a trend toward interest coordination and concertation within the industry. From the perspective of an industrial sector ecology analysis, several factors are noteworthy. First, the industry association recognized the need to sustain the existence of firms by a restraint upon free competition of a magnitude that would endanger their fiscal viability. Second,

tensions were apparent between the need to reduce personnel and enhance productivity, on the one hand, and the evident willingness of the association to commit to stabilization of employment levels while seeking to achieve parity with international wage levels in the industry. Finally, the industry White Paper explicitly called for government support of domestic airline manufacture to further stabilize domestic machine tool demand, reflecting industry interest representation at a level of government policy recommendation.

DISCUSSION

This exploration of Japan's machine tools industry sector ecology sought to trace salient patterns of action by the leading actors – employers, government agencies, and (to a degree limited by research conditions, referred to in the Methods section) employees – that helped account for the sector's rapid post-World War II recovery and emergence as world leader by the 1980s. Put very simply, the paper is an effort to explain in words why Japan achieve the global dominance in market share that is visually evident in Table 1. The comparative methodology was inspired by a Burgmaster case study from Max Holland (1989), which documented the demise of the firm and U.S. industrial sector due to reasons Holland offered in his Epilogue and which we reviewed in the opening pages of this paper.

Of the factors listed, the first we might take up involves the last noted: U.S. defense spending. Japan's post-war machine tools industry did not suffer the personnel brain-drain Holland reports as a U.S. domestic pattern. If anything, the Korean war provided a coincident boom to the recovering Japanese economy. There is some anecdotal evidence, known to the author, of procurement orders for munitions taken up by Japanese machine tool makers on behalf of the U.N. efforts during the Korean war. As a side note, it would be of interest to investigate the extent to which weapons-related research draws talented Japanese citizens out of private sector industry.

Although Japan formally has only self-defense forces and keeps military spending to about 1% annual gross domestic product, the sheer size of the economy brings the nation's military spending to sixth largest in the world and not, by any means, insignificant.

Otherwise following the points Holland raised in the order presented in our Introduction, Japan's postwar industrial sector ecology began in circumstances very different from the conditions enjoyed by Burgmaster in its heyday years. The economy was devastated and machine tools were destroyed, damaged, or under reparations controls. Recovery was slow and labor relations, which we largely prescind from discussing in this paper, were extremely conflictive. Only due to the common necessity for survival in a nation lacking natural resources were Aichi Prefecture associations able to function across employer – employee lines. First adequate coals supplies were need. Then food supplies were next to be sought.

From the earliest data available about Okuma corporation – the prewar years – two basic principles of management practice were evident: commitments to technological innovation and good labor-management relations. As the machine tools industry is tough, the adjective "good" defines management that evidenced a rigorous, yet fair, paternal solicitude. While detailed study of how this was manifest in the postwar era is beyond the scope of the paper, the role of Muraoka Kaoru is evident in a range of innovative, proactive agency and consultative involvements: employer associations, regional consulting arrangements, along with industrial sector and national agency commitments. It would appear that his particular managerial sense of "good labor-management relations" manifested a singular degree of leadership in the firm, industry, and region.

Thus, despite and because of the immediate postwar hardships, the data document Holland's basic point about the Japanese government ensuring proper conditions for ecology of the machine tools industrial sector. The keiretsu approach to reciprocal shareholding, although not discussed in these pages, effectively precluded the type of corporate raiding and takeover Holland saw as endemic to the "managerialism" destructive forces at work in the U.S. This served to protect the

delicate fabric woven between machine tool producers and their, necessarily, very highly skilled workforce. As Holland reported, Okuma maintained a tradition of commitment to two things: technological innovation and good labor relations. More can be said of Okuma's labor relations history, but that will be taken up in a larger study context.

This document offers a first systematic attempt to detail, from a case-focus, the particular manner through which Japan's government took an active, if not always successful, role in trying to aid the machine tool industrial sector's postwar recovery and emerging global leadership. As Dore noted, in contrast to U.K. government efforts to persistently shore-up firms and industries in sectors doomed to fail, the Japanese approach had been to aid innovators in emerging markets (Dore, 1986). One looks in vain for similar government initiatives in the U.S. The most significant initiative – at an industry-wide level - Holland reports from the Burgmaster case perspective concerned a legal action against Japanese imports started by its later owner Houdaille. The petition, begun in 1982, was ultimately unsuccessful in that the Reagan administration did not get sufficient votes to impose penalties or tariffs on the Japanese machine tool producers. From the remove of time, we might note, ironically, the effort at sanctions was probably counterproductive in the end. The one thing it did ensure was Japan's machine tools producers, Yamazaki Mazak in particular, determined to take pro-active steps in localizing value-added manufacture in the U.S.

Holland's final point concerned the general complacency of American machine-tools manufacturers in respect to serious study of their Japanese counterparts and Japan's machine-tool industry. While historical neglect of sources and lessons to be learned from Japan in English language research cannot be undone, we can nevertheless take the time necessary to read and document findings from these sources by way of remediation and to advance knowledge of management history in different international settings. Thus paper is a modest contribution to that effort for a still vital industrial sector.

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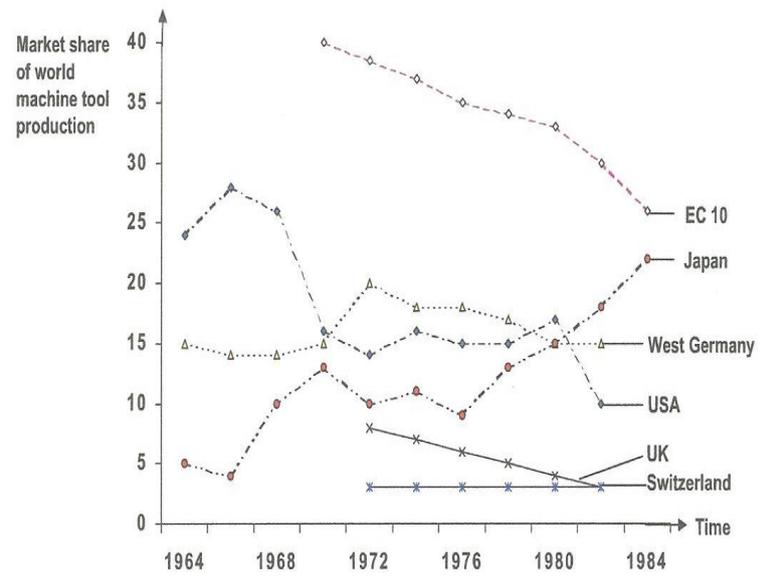
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Figure 1: Pattern of World Market Shares

4

Development of world market shares at the time of technological change



Source: Own depiction based on data from American Machinist, Feb. 3, 1984, p. 2, Metalworking Production, and own estimates

(Arnold, 2001).

Appendix 1 : Wartime Regulations in Reference to Industry Improvement (Sawai, 1990)

1.) Technical improvements:

- a. Kosaku Kikai Seizo Jigyo Ho (Machine tool manufacturing industry law) July 1938.

Promulgated: March, 1938; Effective: July, 1938. A number of guidelines derived from this law:

- b. Kosaku Kikai Shisaku Shoreikin Kifu Kisoku (Subsidy Rules for the Promotional Funding of Machine Tool Models) August 1938.

These guidelines envisioned domestic production of top-class foreign machine tools. From 1938 - 1942, 46 firms received funding for 62 test cases. The value of this funding to 1941 was approximately 1,700,000Y. In the face of a cutoff of US exports in 1940, the following research guidelines were issued:

- c. Sodojin Shiken Kenkyurei (Mobilization Orders for Testing and Research) January 1941.

These Orders aimed at commanding mid-sized producers to test imitation models of leading foreign machine tools by leading and mid-sized enterprises. By the end of 1942, 115 types were designated. Actual tests run were conducted on 78 machine types. Participating firms exceeded 31. Although conditions precluded actual production, this was a substantial contribution to the technical improvement of firms supervising these test manufacturing experiments.

2.) Establishment of national standards:

- a.) Rinji Nihon Hyojun Kikaku (Provisional Japanese Normative Standards) 1939.

These Standards served to make technical standards clear to the small/medium size firms. At the same time, when price controls (kakaku tosei) were instituted, these firms were also obliged to meet the obligations of national product standards. Further, the middle-small firms devised similar mechanisms to meet the independent and exacting standards of the military.

3.) Improvements in cost accounting:

- a.) Gunjunhin Kojo Jigyoba Kensarei (Military procurement inspection of factory enterprise) 1939.

Due to contradictions within established standards, the standards office then established:

- b.) Seizo Kogyo Genka Keizan Yoko (An outline for pricing computation in factory production) 1941.

Moreover, for uniform price computation standards among different industry types, the government next promulgated:

- c.) Kosaku Kikai Seizo Kogyo Genka Keisan Junzoku (Machine tool manufacturing price computation standards) 1943.

Appendix 2: The Purpose of the Aichi Prefecture Managers Association

The first undertaking in the democratization of Japan based upon the directive of the Far East Commission has mainly dealt with the labor problem. Since enactment of such legislation as the Labor Relations Regulation Law and the Labor Union Law, the labor union movement has become very active, with the founding of labor unions encouraged to a degree without historical precedent. In contrast, there is no liaison for managers; they have no mechanism for conducting proper research.

In light of these circumstances, the major industrialists within Aichi Prefecture gathered together on June 4, 1946, and formed the Aichi Prefecture Industrial Association. To date this organization has conducted investigative research into labor and social problems. Reflecting upon the changing times, the organization's name was changed to the Aichi Prefecture Manager's Association on July 11, 1947. Prior focus upon manufacturing plants has been broadened to include members spanning the entire range of manufacturing industries.

If we look back upon the protective policies in regard to labor unions since the end of the war, we see a reduced resumption of production accompanied by stimulation of inflation. These are both linked to and sources of increased unrest in society. The labor offensive has reached a boundary which, if things continue to change as they have, in the end it will become impossible for the appropriate exercise of management rights. It is clear that the present imperative for economic reconstruction will be ruined in a circumstance of frustrating inevitability.

Since the war's end, behind the quick development of the labor movement and the darkness of economic change, things have fallen into a state of loss of self and lack of purpose. It is an undeniable fact that in some respects managers have not been able to correctly advocate what they naturally should be advocating. According to various sources of information, the fault of managers can be said to be mainly caused by their insufficient cooperative strength. That is, in theory, due to a lack of sufficient data and policy.

Thus, from this viewpoint, there was, even by early 1946, a conception about formation of a national federation of managers associations organized on a regional and industrial basis. As it seemed too soon for this, formal action was put off. Nevertheless, communication links were closely maintained, with increased circumstantial need for completion of the organization's future mission. On May 19, 1947, the Japan Manager's Federation (Nikeieisha dantai rengokai) founding meeting was held. We now feel strongly that, as managers, a definite organization is needed to directly face the circumstances. Thus, on April 12, 1948, the Nation Manager's Association (Nikeieisha dantai rengokai) should be reorganized into the Japan Manager's Federation (Nikeiren). Through concentration of combined strength we shall strive for the establishment of the right to manage, remove labor unease and couple our determined conviction with the introduction of foreign capital to rebuild Japanese manufacturing. The major administrative activities of the Association:

1. investigative research into labor and social problems.
2. distribution and exchange of materials in regard to labor and social problems.
3. joint education of managers through talks, conferences and gatherings, in regard to labor and social problems.

4. research into labor law, presentation and proposal of opinion.

5. recommendations of committee staff practically involved in every aspect of labor relations.

(Aichiken keieisha kyogikai, 1956, pp. 17-19).

Appendix 3: Machine Tool Industry Planning Phases

Metal machine tool manufacturing basic plan

Based upon the Law for Provisional Measures in the Promotion of the Machinery Industry (Kikai kogyo shinko rinji sochi ho).

Phase 1: 1956 - 1960:

Purpose: Product quality improvement, performance gains and reduction in manufacturing costs through equipment modernization and concentration of manufactured good types.

Rationalization targets:

1. Product performance target (example): regular lathe (deviation 400 450 mm) Main axis rotation speed 900 rpm and above.
2. Reduction of production costs by at least 20 per cent.

Appropriate manufacturing scale: No entry.

Phase 2: 1961 - 1965:

Purpose: Product quality improvements and cost reductions by equipment modernization and specialization of product type (A strengthening of international competitiveness through measures to respond to free trade.)

Rationalization target:

1. Product performance target (example): regular lathe (deviation 400 450 mm) Main axis rotation speed 1,800 rpm and above.
2. Reduction of production costs by at least 15 per cent.

Appropriate manufacturing scale: By the end of 1965, manufacturing lots for (example) regular lathes (deviation to 550 mm) of at least 50.

Phase 3: 1966 - 1970:

Purpose: Product quality, efficiency improvement and cost reduction by equipment modernization, new technical developments and structural adjustments within the industry.

Rationalization target:

1. Product performance target: same as above.
2. Reduction of production costs by at least 10 per cent (the 1968 revised plan).

Appropriate manufacturing scale: (monthly): By 1970, manufacturing lots for (example) regular lathes of at least 50.