

COMPANY-BASED VOCATIONAL EDUCATION AND TRAINING: CASE STUDIES OF SHIPBUILDING INDUSTRIES IN JAPAN AND SWEDEN

Etsuo Yokoyama

Graduate School of Education and Human Development

Nagoya University

n47131a@nucc.cc.nagoya-u.ac.jp

Anders Nilsson

Department of Economic History

Lund University

anders.nilsson@ekh.lu.se

In this paper we analyze the motives, functioning, and results of vocational education and training in two companies in the shipbuilding industry in two different countries (Japan and Sweden) in different time periods. The institutional framework differs substantially in the two cases and, partly as a consequence, the responses to challenges in securing an adequate supply often varied. However, our results indicate that not only was training important for supplying the companies with skilled labor, but also that it was crucial to creating career ladders for workers. This helped to develop company loyalty, which was important for retaining skilled workers.

Introduction

A major challenge in all companies is securing a supply of adequately skilled workers. Newly hired workers need more or less extensive training in order to adapt their qualifications to company standards, and the existing workforce needs to have skills upgraded, for example when new production methods are introduced. The development of such company-specific skills is part of a company's normal activity, and issues associated with skill acquisition, such as the distribution of costs and benefits between company and workers, are in most cases determined by implicit or explicit company rules (Alison Booth and Mark L. Bryan 2005; Mark

Loewenstein and James Spletzer 1998). Some companies, however, engage much more intensely in worker training and offer extensive programs, typically to young people. In this paper we analyze two such companies in the shipbuilding industry, one Japanese and one Swedish. Their commitment to training posed particular challenges for the companies: to attract suitable candidates, to minimize the number of dropouts from the training program, and to retain the skilled workers.

A company's response to these challenges depends largely on the institutional framework: relevant parts of the legal system, labor market agreements, inter- and intra-industry rules of conduct, and relations between the general education system and vocational education and training. This suggests that company-based training differs greatly between countries with different institutional frameworks or skill formation systems. Based on "varieties of capitalism" (Peter Hall and David Soskice 2001), differences in institutional setting have been systemized into models of skill formation (Marius Busemeyer and Christine Trampusch 2012).

Japan is regarded as the most prominent example of the segmentalist system, in which the State is responsible for mandatory education, and firms offer good training opportunities and career prospects. However, this only applies to some young people. Those who are not able to enter firms' training (or to attend university) have much worse training opportunities and labor market prospects. These characteristics have been present since the late nineteenth century, even if some aspects evolved over time (Kathleen Thelen and Ikuo Kume 2001). Sweden, on the other hand, is currently a good example of the statist system, in which the State is responsible for almost all initial vocational education and training. Up to the 1960s, however, this was not quite the case. In 1938, the main actors in the Swedish labor market, the Trade Union Conference and the Employers' Federation, concluded the epoch-making *Saltsjöbad* agreement.¹ They set up negotiation mechanisms to resolve conflicts and

¹ A presentation of the *Saltsjöbad* agreement as one of the pillars of the Swedish Welfare State is found in Gösta Esping-Andersen (1990). For a more in-depth study of the agreement and its consequences, see Nils Elvander (1992).

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agreed to work jointly in important labor market areas. One of these was vocational education and training. A central element was to promote collective agreements on apprenticeships at the company level (Nilsson 2013). The labor market parties had been deeply involved in vocational education and training since the early 1940s, and the institutional settings were quite favorable to company-based training at least until the early 1960s.

Thus, the two cases we present, the Mitsubishi Nagasaki Shipyard in Japan 1899–1934 and the shipyard at Kockums Mekaniska Verkstad (henceforth called Kockums) in Sweden 1942–1968, are situated in countries with distinctly different skill formation systems. In addition, the cases take place during different time periods. Mitsubishi founded its company school in 1899, during the early phases of Japan’s industrialization. At that time, the mandatory school system was poorly developed and public industrial schools did not exist. Mitsubishi was forced to start practically from scratch with a five-year preparatory vocational school. Kockums, on the other hand, started its vocational training in 1942, when Sweden was a mature industrial country and the Swedish school system was fairly well developed; a variety of vocational schools and similar training facilities existed at the time (Jonas Olofsson and Daniel Persson Thunqvist 2014).

In short, the circumstances for company schools in the two countries were quite different in several respects. From other perspectives, things were more similar. Japan and Sweden proved to be extremely successful during the Second Industrial Revolution. In 1890, Sweden’s GDP per capita was about 60 percent of the West European average, and the corresponding figure for Japan was about 35 percent. By 1930, Sweden had caught up with other Western European countries and Japan had also improved its position to about 45 percent. By 1970, Japan’s GDP per capita was almost equal to the Western European average and Sweden’s was even a bit above that (The Maddison Project 2013). The Japanese growth rate was extremely high in the period 1950–1970 and probably also the highest in the world between 1910 and 1930; Sweden was one of the few countries that were almost on an equal growth trajectory (Angus Maddison 1995; Lennart Schön 2010). In both Japan and Sweden, mechanical engineering was an important “engine of growth” and during

certain sub-periods shipbuilding constituted one of the most important components of mechanical engineering. In Japan, shipbuilding was a very important industry 1890–1930 (Ryoichi Iwauchi 1989). In Sweden, shipbuilding expanded from the 1930s, and during the post-war boom 1950–1973 it became one of the nation’s leading industries (Schön 2010).

Both companies were facing problems recruiting skilled workers at times, in particular during the boom periods, and both responded in a similar fashion: by setting up their own schools for training. In this paper we analyze how the differences and similarities in the institutional frameworks affected the schools. We discuss the decisions to launch and operate programs for systematic vocational education and training in the two companies, how the two schools functioned, and the role of the school in the companies’ overall strategies for securing the supply of skilled workers.

The analyses have been made possible thanks to access to very rich source material from both companies. Kockums’ archive, which is stored in the Malmö City Archive, consists of about 1,600 volumes. Much of it concerns shipbuilding from a financial or technical side; there are, for example, 106 volumes with contracts for ships and 130 construction manuals, but there are also 44 volumes with annual management reports, 149 volumes on white-collar workers, and 50 volumes on blue-collar workers. For this paper, we have mainly used three volumes directly referring to vocational education, as well as the annual management reports to some extent. The Mitsubishi Nagasaki Shipyard Company archive consists of about 60 bookshelves. One bookshelf refers directly to training and education. It includes textbooks used in those days, and one file concerning the school development process. This file, “Outline of the historical development of Nagasaki Shipyard School”, is the main primary source for training at the Mitsubishi Nagasaki Shipyard.

One limitation regarding the questions posed in the initial paragraph should be pointed out: the companies used various strategies to retain skilled workers (promotion schemes, seniority rules, loyalty-building activities and so on) but we focus on the role of company-based training for retention. To discuss other possible strategies is beyond the scope of this work.

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The paper is structured as follows: in the next section we present details of the two shipyards, after which we discuss their motives to engage in vocational education and training in the following three sections. The cases are presented in the subsequent sections, starting with the different forms of company-based vocational education and training at the Mitsubishi Nagasaki Shipyard and followed by the apprenticeship and factory school at Kockums. Main findings are discussed in the penultimate section where we highlight the similarities and differences between the two companies, particularly explicit motives and, where possible, the outcomes. Concluding remarks are presented in final section.

The Mitsubishi Nagasaki Shipyard and Kockums

Both shipyards were founded during the second half of the nineteenth century. The Edo Shogunate's growing fleet of naval vessels was supplied by Western builders, and a more advanced shipyard for repair was required to accommodate the increasing tonnage of foreign vessels that were visiting Japan. The Nagasaki Shipyard started as a ship repair facility in 1857 under the name Nagasaki Engine Works. It employed Dutch engineers and shipwrights, and imported all the necessary machinery from Holland. The Nagasaki Shipyard was Japan's first western-style, full-scale ship repair facility, marking the beginning of heavy industry in Japan.² In 1868 the Meiji government took over the Nagasaki Shipyard.

Mitsubishi leased the yard from the Meiji government in 1884, and in 1887 the company became the owner of the largest private shipyard in Japan. Mitsubishi set about improving the machinery and building new iron vessels. However, the shipbuilding industry was still on a small-scale basis at the time. Mitsubishi began its shipbuilding with eight hundred men. Foreigners initially held key jobs in the shipyard and, with Japanese engineers placed under them, they had control of the technical aspects of shipbuilding. The engineers were hired from the Faculty of Technology at Tokyo University, and annual recruitment ranged between one and three

² The section on the Mitsubishi Nagasaki Shipyard is based on materials offered by Professor Nirikazu Shimizu, Kyushu International University.

engineers. Mitsubishi also hired students from the Tokyo Craftsman School.³

During the 1890s, investment in buildings and equipment increased, and machine shops were reinforced and expanded. By 1896 the shipyard was able to virtually dispense with on-site Western engineers and supervisors. A research laboratory established in 1904 made important contributions to improving imported turbine diesel engine and electric welding technologies. A diverse range of modern vessels started to be constructed at Nagasaki as well as in other Japanese shipyards. By 1901, domestic steamship production exceeded imports (You Nakanishi 2003).

The Russo-Japanese War (1904–1905) created a boom that continued for a couple of years. In this period, the Japanese shipbuilding industry grew rapidly, spurred by the need for both naval and commercial self-sufficiency at sea. In 1908, Japan's first ship with British-built turbine engines, the *Tenyo-maru* (13,454 tons), was built at the Mitsubishi shipyard. In 1904 Mitsubishi had obtained the right to produce turbines from Parsons, their British patentee, and in 1907 it established the turbine factory at its Nagasaki Shipyard. By 1910 Mitsubishi was not only using its license to construct Parsons turbines, but also was actually improving the technology by developing an advanced condenser system.

In spite of a sharp downturn in the early twentieth century Japanese shipbuilding industry,⁴ the Mitsubishi shipyard in Nagasaki was able to continue growing. Naval vessel construction and repair guaranteed a stable profit that offset some of the losses of building new commercial ships. By 1910, Japan was capable of supplying all of its requirements for naval vessels, and the Mitsubishi Nagasaki Shipyard employed more than eleven thousand workers. Japan was the world's fifth-largest owner of steamships by 1911. By 1914, though still small by British standards, Japanese shipbuilding had achieved parity in technological standards with any country in the world. The Mitsubishi Nagasaki Shipyard had been at the forefront—of both technology transfer and innovation—for over two decades. Moreover, this achievement was founded on a prolonged

³ This school was founded in 1881 with the purpose of educating foremen and teachers of craftsman schools in Japan.

⁴ The 1910 production level was less than half of that of 1908.

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preliminary phase of repair, renovation, and modification of foreign-built ships, including intensive study of foreign techniques, the use of specially commissioned foreign designs and blueprints, and the employment of engineers and supervisors from overseas. Shipbuilding was the nation's dominant and most advanced heavy industry, directly responsible for major growth in steel and other related industries.

Kockums was founded in 1840 when Frans Henrik Kockum set up an engineering workshop and a foundry in Malmö, southern Sweden.⁵ Like most engineering workshops at the time, Kockums manufactured a wide variety of goods, such as candleholders, gas lamps, pots and casseroles, stoves, iron gates, ploughs and harrows, threshing machines, steam engines, locomotives, and railway cars. The first ship, a cargo steamship named *Tage Sylvan* was built in 1873. It was to be followed by 596 more. The first naval vessel was built in 1875 and for most of its existence the company has constructed and built both civilian ships and naval vessels. As the years went by, the shipyard became the most important part of the company. In the mid-1930s, technological change took place when welding substituted riveting as the main method for building steel ships (Tobias Karlsson 2014).

Kockums' "golden years" started during the Second World War. Sweden was one of the few industrialized countries in which there was no physical destruction during the war, and there was a great demand for cargo ships during and especially after the war. In 1951, Kockums had the biggest production of all the shipyards in the world.

In the late 1960s, Kockums specialized in building super tankers for which there was a rapidly growing demand. A few years later, however, the first oil crisis (1974) caused the market to plummet. Kockums became dependent on government subsidies to survive, but the shipyard never really recovered. Together with other loss-making shipyards, it was taken over by the State in 1979, and the production of civilian ships ceased in 1987. In the 1990s, the production of naval vessels was transferred to Karlskrona and all industrial activity was stopped in Malmö. Since the

⁵ This section is based on texts provided by *Varvshistoriska föreningen i Malmö* (The association for shipyard history in Malmö), <http://www.varvshistoria.se/>.

year 2000, the vast shipyard area has been gradually developed with attractive residential buildings and offices.

The Demand for Skilled Labor in the Shipbuilding Industry

For a number of years, both Mitsubishi and Kockums were able to build ships without taking any specific measures to train their staff. Mitsubishi started its Industrial Preparatory School in 1899 and it was not until 1942 that Kockums started organized vocational training. This raises a more general question: why do companies spend time and resources on training (Regina Dionisius et.al. 2009; Paolo Neirotti and Emilio Paolucci 2013)?

Institutional theory provides reasonable points of departure for an answer, arguing that the labor market is imperfect. This has important implications for training incentives. Market imperfections, such as transaction costs and asymmetrical information, entail that the training company is able to set wages below the productivity of the trained workers. This encourages businesses to provide training that is not only company-specific but also of a more general character (Daron Acemoglu and Jörn-Steffen Pischke 1998). Institutional theory helps to understand why companies engage in vocational training, but theoretical considerations alone cannot provide answers to more specific questions such as why a company started a training program at a certain point in time, how extensive the company's involvement in training was, and why the company discontinued its training program (as in Kockums' case).

A further complication stems from the fact that companies often refer to motives other than purely financial ones for their engagement in vocational training. In the early twentieth century, many large American companies set up factory schools to increase the supply of skilled labor, but also as part of an anti-union policy. The existing apprentice-based training was to a large extent controlled by craft masters and their trade union. It was assumed that training in company schools would increase the workers' loyalty to the company and diminish the influence of the trade unions (Sanford M. Jacoby 2004).

The development in Germany at the turn of the nineteenth century shows a similar pattern. The increasing complexity of industrial production brought about an increasing demand for skilled workers, and

to resolve this some German companies derived inspiration from existing factory schools in the United States. Georg Hanf points out that these companies were exceptions, not the rule. There were special conditions, not merely the shortage of skilled workers. The companies were engaged in strong technological change. Hanf emphasizes that the management in companies that started factory schools also stressed the importance of fostering loyalty to the company among the workers; factory schools were seen as instrumental in that process (Hanf 2007). Companies explicitly mention another kind of motive for engaging in training—to increase the overall (local, regional or even national) supply of skilled labor—stating that the commitment is long-term. However, this commitment is successful only in special circumstances, such as a quasi-monopoly (Kathleen Thelen 2004) or a labor market characterized by wage compression (Pål Schøne 2006).

There is obviously a mixture of motives for companies to engage in vocational education and training, and most of them seem to be highly contextual. To obtain empirical answers to some of the questions posed above, we analyze the two companies' engagement in vocational education and training in their historical and social context.

Motives for Mitsubishi to Engage in Vocational Education and Training at the Nagasaki Shipyard

By the end of the nineteenth century, it became clear to the Mitsubishi's management that the skills demand in the shipbuilding industry could no longer be met by traditional means, i.e. apprenticeship training under the personal supervision of a master. The first step to change the traditional way was taken in 1890, when Mitsubishi introduced a system called the Apprentice Craftsman rules (*syottukou minarai kisoku*). In this new system, apprentices were hired directly by the company and received their training through a corporate apprenticeship system (Mikio Sumiya 1970). There were no rules to stipulate what kind of training the shipyard would provide, but it is believed that the contents of the training were still entrusted to the workplace or to the masters of the apprentices (Kenjiro Saito 1968).

One incident in particular was crucial for the further development of company-based training at Mitsubishi. In 1896, the government

announced the Shipbuilding Encouragement Law that provided subsidies for constructing steel ships and supported technological advancements in the shipbuilding industry. The law was enacted specifically to support the Mitsubishi Nagasaki Shipyard, which undertook the construction of large steel ships. In 1896, Mitsubishi took on the challenge of building the *Hitachi Maru*, a steamboat that would weigh 6,000 tons. However, the low levels of technology and technological skill at the time resulted in failure to finish the construction within the scheduled time. Mitsubishi came to the conclusion that existing training opportunities were insufficient and decided to invest heavily in its own training facilities. Starting in 1899, the company took several initiatives to train skilled workers during the following decades (see case study 1 below).

After the First World War, the shipbuilding industry grew considerably in Japan as well as internationally, and to be able to accept all orders of large steel ships, the company was further expanded. It thus became even more important to train skilled workers. However, another problem also emerged. Due to extremely harsh competition among shipbuilding companies at the time, a great number of employees at the Mitsubishi Shipyard left their jobs. This trend continued for several years, and some years the number of workers leaving reached three or four thousand.

To conclude, during the first decades of the twentieth century Mitsubishi faced a double challenge: a shortage of skilled workers and problems retaining workers trained in the company. The main response to both challenges was an extensive system of company-based vocational education and training.

Motives for Kockums to Operate a Factory School

For a long period of time Kockums did not make any specific training arrangements. It is not explicitly stated how the company recruited the skilled workers it needed during that period, but an informed guess is that this was done in a traditional way: a combination of on-the-job training and courses at technical schools for ambitious workers. In addition, skilled workers could be recruited from other companies.

During the Second World War, the scarcity of skilled labor became more acute. The company's assessment of the situation was that the

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shortage would also continue after the war, and to secure a lasting supply of skilled labor, in 1943 the company started a systematic training program close to the machinery workshop. Kockums was far from being the only company to launch a systematic training program in the early 1940s. The labor market actors (the Trade Union Conference and the Employers' Federation) encouraged collective agreements on training at the company level and several big companies, including Kockums, used this opportunity (Nilsson 2013). In this program, a limited number of apprentices (initially only twelve) were given theoretical instruction as well as practical training.

The rapid expansion of Kockums' shipbuilding soon rendered the supply from the training program insufficient and the difficulties to recruit a sufficient amount of skilled labor continued. For example, in 1954 it was stated, "This year, as well as in the previous ones, finding skilled labor is very difficult" (*Årsrapport* 1954, un-paginated). To increase the training capacity, the company decided to build a complete school for mechanical engineering. It was a substantial investment but the purpose was not only to provide better localities for the apprentices; the school would also take care of the company's substantial off-the-job training. In 1957, the new school was inaugurated. It became officially recognized as an "Industrial school" and as such it received government grants. In return, the school was subject to inspection by the National Board for Vocational Education.

From the mid-1960s, the company's motives for operating the factory school weakened. The Swedish school system was changing and in that process Kockums' industrial school became less popular. New education possibilities emerged; in particular, the 1965 Annual Report explicitly pointed out the continuation school (*fackskolan*⁶) as a very strong competitor to Kockums' factory school. In 1964 it was said that "[t]he apprentices that have been hired come from a fairly thinned-out student population and their prognosis is not always the best" (*Årsrapport* 1964,

⁶ This new type of school had broader theoretical content than the vocational schools, which implied that graduates from continuation school were eligible for most programmes at the tertiary level (which graduates from vocational school were not). At the same time the continuation school had practical components that made the students employable.

un-paginated). Running the school implied a considerable financial cost,⁷ which the company was willing to bear as long as the school supplied a sufficient amount of skilled labor. When the number of applicants diminished and the overall quality of the applicants decreased, the financial costs were more difficult to defend. In 1967 Kockums made the decision to close the industrial school.

Case Study 1: Company-Based Vocational Education and Training at the Mitsubishi Nagasaki Shipyard

In 1899, the basis for a well-organized system for vocational education and training was introduced. The system evolved gradually to become a complex system for vocational training, as well as a possibility to rise in rank within the company. The system had three main components: apprenticeship, basic training, and advanced courses.

Modernized apprenticeship was created with the Craftsman Trainee rules (*syottukou syugyousei kisoku*) of August 1899 and the Craftsman Apprentice regulation (*minarai syottukou kisoku*) of June 1900 (Investigation Division 1914, 60-61). About one hundred apprentices were recruited annually. Craftsman apprentices attended special courses during their training period, which lasted about three years. After completion, the apprentices became craftsmen, i.e. skilled workers. In addition, they were candidates for becoming craftsman trainees. The new craftsman trainee system was at first five years long with classroom teaching carried out for two or three years, depending on the course. The trainees were initially taught English, arithmetic, machinery, material science, steam science, shipbuilding science, electrical science and hydraulics. The Trainee Rules were adopted partly to secure the training of skilled workers, but partly to reduce the drainage of such workers from the company. The Rules introduced a system in which the company withheld a part of the wages that the trainees earned while in training. That part was returned to the craftsmen after working three years in the company. Successful craftsman

⁷ Detailed financial information is only available for the 1957–1958 school year. Total costs were estimated at 2,669,000 Swedish kronor, of which 270,000 kronor were state grants. The most important costs were the apprentices' wages that amounted to 1,070,000 kronor.

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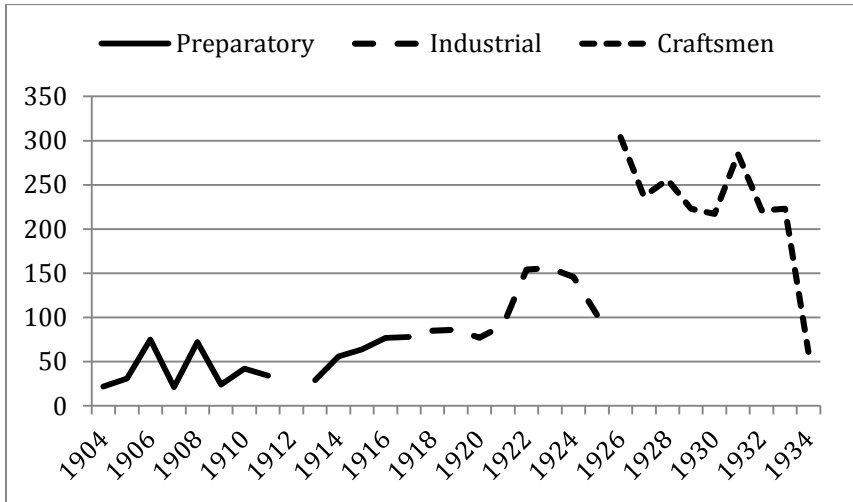
trainees were eligible to participate in the company's advanced courses (Yukihiko Yamaguchi 2009).

Basic training took place in the Main Course within the Industrial Preparatory School, which was inaugurated in June 1899. That year an Industrial School Law was passed in Japan and public industrial schools were founded in many cities. Mitsubishi, however, did not expect public schools to provide the company with the engineers and skilled workers it needed, not least because the public schools could hardly afford to operate real workshops. Instead, Mitsubishi started the first private industrial school in Japan with the purpose "to raise accomplished engineers and skilled workers enriched with academic knowledge and practical skill" (National Institute for Educational Research 1974, 258).

The training in this course was initially of a preparatory nature and lasted for five years. As the mandatory school was prolonged from four to six years, the training program was gradually shortened. From January 1908 onwards the Main Course was three years long. The expansion of the public education sector in Japan implied that the preparatory features of the industrial school were no longer appropriate. The school consequently changed its name to the Mitsubishi Industrial School in 1919. In 1923, it was replaced by the Craftsman School, which continued until 1939 when, having received state approval, it became the Mitsubishi Youth Training School. However, the length and character of the basic training remained more or less unchanged and we refer to it as the Main Course for the entire period of 1908–1934.

To be accepted into the Main Course, applicants had to possess an elementary school certificate and to pass the company's entrance examination. After a modest start with 42 pupils in 1899, the Main Course grew considerably, and from 1919 on, about 200 pupils were enrolled annually. A large proportion of the pupils were children of employees at the Nagasaki Shipyard; in the period 1913-1922 they accounted for an astonishing 64 percent (Iwauchi 1989, 223). The dropout rate from the Main Course was high during the initial years when the pupils had a poor educational background. However, the number of successful pupils tended to increase, and in particular the introduction of the Craftsman School in 1923 meant that the number of graduates from the Main Course increased substantially (see Figure 1). The vast majority of the graduates from the

Main Course (about 170) proceeded to the Practical Training Course that lasted for three years. As the name indicates, most of the time was spent on practical work. Successful completion of the Practical Training Course meant promotion to the category of skilled worker.



Note: In 1906 and 1908 two classes graduated; no graduation took place in 1912.

Source: Material from the archive of the Mitsubishi Nagasaki Shipyard.

Figure 1

Number of graduates from the Main Course at the Mitsubishi Nagasaki Shipyard, 1904–1934.

The company's system for *advanced training* was more complex and changed over time, but the basic characteristics could be summarized as follows. Between 1908 and 1918 the company had Advanced Courses over four years, to which the most promising graduates from the Main Course, some craftsmen trainees and even qualified external candidates were admitted. Successful completion implied promotion to assistant engineer. In an alternative track, craftsmen could take a three-year Supplementary course to become foremen in the company. The system was somewhat different from 1919 onwards. A few outstanding graduates from the Main Course (30 pupils) were admitted to a one-year Supplementary course

followed by a two-year Induction course. An additional 60 places in the Induction course were open to selected craftsmen trainees and to external candidates. Successful completion from the Induction course implied promotion to assistant engineer.

Case Study 2: The Factory School at Kockums

Systematic vocational training at Kockums had a modest start in 1943, with only 12 young people accepted as apprentices in the new program. The program remained small throughout the 1940s with at most 19 new apprentices annually. To be accepted into the program, the initial admission regulations in 1943 stated that an applicant had to be between 14 and 16 years old and provide evidence of having successfully completed the six-year elementary school as well as the one-year continuation school. When Sweden's school system was changed in the 1950s, admission regulations changed accordingly. The training initially took four years but this was reduced to three years in 1947.

Initially, the first year of training was common to all participants. It included practical courses in basic company skills such as welding, cutting, and filing, as well as theoretical courses on materials, industrial relations laws, and some bookkeeping, among other topics. In the mid-1950s, the apprentices spent about half the working day in school. During the other half of the day, they did practical work in which the tasks were quite simple and even monotonous. During the second year the apprentices selected a specific occupation, e.g. welder. The practical training in this occupation was intensified and the theoretical courses continued. In the third year, theoretical courses were optional and all training took place in the workshop.⁸

During the 1950s, the program expanded dramatically and it became generally known as "the factory school". The first step was taken in 1950, when training started in other occupations such as sheet metal work. Over the years more occupations were added, and in 1957 training was conducted in eight different occupations. The expansion implied that specialization started earlier. By the 1960s, some courses were common for all, including basic welding, cutting techniques, and industrial

⁸ Interview with Bengt Pålsson.

economics, but the apprentices were enrolled in specific occupations from the start. The basic training structure remained in place. About half the working day was spent in school, and during the other half the apprentices performed practical work in their occupation⁹. The quantitative expansion was stimulated by the introduction of generous State grants in 1955 and the inauguration of the new school building in 1957. At the time it was characterized as Sweden's largest and most modern workshop school (Hans Jönsson 2010). By that time, the annual intake was about 140 apprentices (see Figure 2).

The training of apprentices at the Kockums factory school had a very good reputation, and after successful completion of the program, employment at Kockums was practically guaranteed. Over the years, about 1,500 apprentices were admitted to the factory school. The dropout rates varied, but on average one third of the apprentices left the program before completion.¹⁰

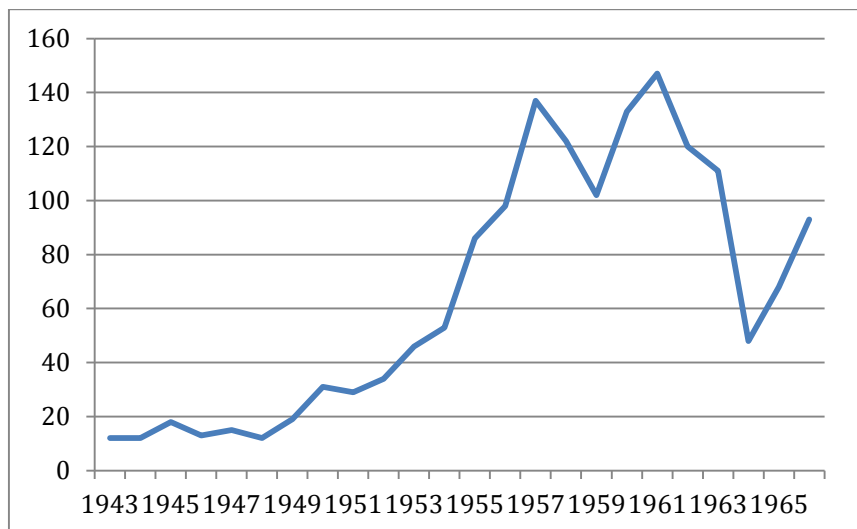
The difficulties in retaining skilled workers constituted an even bigger problem. The results from the early years must have been disappointing for the management. From 1943 to 1949, 101 apprentices in all were admitted to the program. By 1956, only 15 of them were still working at Kockums. Subsequently, the situation improved from the company's point of view: of the 153 apprentices accepted 1950–1953, 82 (54 percent) were still working at Kockums in 1956. Later documentation has not been found, but qualitative statements indicate that “a majority” of the apprentices remained at the company.¹¹

⁹ Interviews with Rauno Eberlund and Åke Sandström.

¹⁰ Calculated from *Utbildningsverksamheten*.

¹¹ Interviews with Eberlund and Sandström. Of the 10 electricians in the group to which Bengt Pålsson belonged, as many as eight left the company at some point in time. However, that is probably an effect of the difficulties that Kockums came to face in the late 1970s.

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Source: Årsrapporter 1952-1966, *Utbildningsverksamheten vid Kockums* 1957.

Figure 2

The number of new apprentices at the factory school
at Kockums 1943–1966

A considerable number of the previous apprentices continued to study throughout their working life. The existence of the factory school implied that evening classes could be held on the premises. This was quite popular since it meant a possibility of becoming an engineer in the company (Jönsson 2010). In some specialties including electricity, the company could not offer continued training, and in these cases the worker was sent to extra-mural courses. That was also the case for those workers who became foremen and industrial supervisors. In order to become works manager, Bengt Pålsson, who made a substantial career at Kockums, attended numerous courses, most of them outside the company. According to him, the company's management actively encouraged continued education and training among the workers.

The factory school experienced recruitment problems from the mid-1960s. During this decade, the entire school system in Sweden was reformed. One important consequence was that vocational training was considered to a much larger extent to be a public responsibility (SOU

1966). The factory school with the apprenticeship program was dismantled in 1969.

Discussion

The two cases presented here are examples of companies that operated on the technological frontier in the shipbuilding industry. Furthermore, the decision to launch systematic training was related to technological challenges: in Mitsubishi's case, the failure to construct modern ships on time; for Kockums, the transition from riveting to welding. Both companies tried to meet the increased demand for skilled workers by offering employment to skilled workers from competing companies or from other industries. It seems, however, that the skill pool was insufficient in both cases. To some extent, Kockums was able to overcome the problem by employing "grey labor."¹² Kockums' other partial solution was to import skilled workers from Italy and Yugoslavia in the 1950s and 1960s. In Mitsubishi's case, foreign experts and skilled workers played a crucial role in the company's initial phase.

In the long run, however, reliance on this source of labor was not an option, particularly for Mitsubishi. In the early years, that company also faced a problem that was not very serious in Kockums' case – the inadequate basic education and training of prospective workers. In other advanced countries, including Sweden, the public school system had obtained a sufficiently high quality by 1900, but when public industrial schools were founded in Japan after 1899, Mitsubishi decided that their quality was too low for the company's demands. Instead, the company started its own Preparatory Industrial School. In addition, other programs such as systematic apprenticeships and the five-year trainee program were subsequently launched. In other words, Mitsubishi and Kockums both came to the conclusion that to meet their skills demand, they had to engage in systematic vocational education and training within the company.

This decision meant that the companies would face substantial training costs, and it is to be expected that they looked for possibilities to minimize

¹² The term refers to subcontracted labor performing ordinary jobs, which, according to the prevailing legislation, was a dubious undertaking. See Jan Bohlin (1989) and Karlsson (2016).

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them. One option was for the state (or other public bodies) to subsidize training in the company, but this was very limited. In Mitsubishi's case it was non-existent since the company never received any training subsidies from the government. For Kockums, that possibility emerged in the mid-1950s when the Swedish government introduced subsidies for company-based vocational education and training. Kockums was one of several companies that took advantage of such subsidies, but they only amounted to about 10 percent of the costs. We conclude that direct cost sharing only played a marginal role for Kockums and that it was probably absent in Mitsubishi's case.

For companies, a common way to keep training costs low is to pay low apprentice's wages. It amounts to rolling over some of the training costs to the workers. Unfortunately, we do not have access to continuous wage series for apprentices, but scattered information shows a fairly consistent picture. When the Craftsman Trainee Rules were established in 1899 at Mitsubishi, Article 1 stated that a craftsman trainee received at most 10 sen during the first year. That wage increased gradually until, in the fifth year, he earned a maximum of 45 sen per day. This implies a monthly wage of 11–12 yen, which is about half the amount a craftsman would get about that time.¹³

In Kockums' case, material from the early and the later years tell very similar stories. In 1943, a new apprentice was normally 14 years old and was paid 12 Swedish kronor per week. That wage increased every six months until, at age 17, he had completed his apprenticeship period. During the last six month-period his wage increased to 32 kronor and the average apprentice wage during the four-year apprenticeship was 23 kronor (Bestämmelser 1943). This was substantially lower than the wages for young unskilled workers in the manufacturing industry. Minor workers (i.e. up to 18 years of age) in the mechanical industry, in which minor workers were relatively old, earned on average 57 kronor per week. In glass foundries (where minor workers were relatively young) they earned 51 kronor weekly (SOS Löner 1943, table 36). Thus, the Kockums apprentice wage corresponded to about 40–45 percent of the wage of an

¹³ The average monthly wage for a craftsman in the years 1899-1907 was 21.50 yen (*History of Mitsubishi Heavy Industry Company*).

unskilled minor worker in the 1940s. In the late 1960s, a new apprentice received 1.98 kronor per hour, and that wage increased to about 3.50 the final year. The wage gap between apprentices and regular workers was considerable, since the former apprentice received about 7.00 kronor per hour after the training program.¹⁴ In both Mitsubishi's and Kockums' case, not only the company but also the apprentice made a substantial investment, represented by foregone earnings during the apprenticeship period.

A third possibility for the companies to minimize training costs was to use the apprentices as low-paid workers over and above what was required for training purposes. Such a practice, however, would have been hotly contended and the trade unions strongly opposed this abuse of the apprenticeship. In Kockums in the 1960s, the most skilled apprentices could already take part in production after six months if the company's labor demand was high, but this practice was regulated. The apprentice would work alongside a senior worker and take part in the piece-rate payment system of the regular workers.¹⁵ These restrictions indicate that the main advantage for the company was not the possibility of using apprentices as cheap labor, but the ability to counter variations in labor demand internally. When demand was high, apprentices could be brought into production at an early stage; when demand was low, that practice was not used.

To conclude this part of the discussion, it is evident that the two companies used various methods and practices to lower their training costs. At the same time, both companies obviously accepted that substantial costs were unavoidable to secure the necessary supply of skilled workers.

¹⁴ Interviews with Åke Sandström and Rauno Eberlund. The reported wages are remarkably low in comparison with average wages in manufacturing industry, where minor workers were paid on average 9.25 kronor and an adult male worker earned on average 11.83 kronor per hour in 1968 (SOS Löner 1983, part 2, table C). However, the reported wages were guaranteed hourly wages and workers in production earned a substantial part of their actual wage through a piece-rate system.

¹⁵ Interview with Rauno Eberlund.

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As pointed out in the introduction, the decision to engage in vocational education and training implied that some crucial issues had to be addressed. The first was how to attract suitable candidates for training, but this does not seem to have been problematic. The companies could offer long-term secure employment and the training they offered had a very good reputation. It was not necessary to offer further advantages; on the contrary the apprentice wages offered were quite low. One exception should be noted: when the Swedish education system expanded in the 1960s and new opportunities emerged, Kockums started to face recruitment problems that eventually became so big that they were instrumental in the decision to close the factory school in 1967.

The second issue was how to retain the candidates within the training program. In both cases, the training included a substantial amount of general skills, particularly in the early stages of the training program. Thus, even incomplete training could have made the candidates attractive in the open labor market. This seems to have been a serious issue since the dropout rates were high in both companies' programs. The apprenticeship contract stated that it could only be terminated under special conditions, but there were no legal and few practical hindrances for an apprentice to leave the program. In Mitsubishi, the company withheld part of the wages for the most valuable candidates, the craftsman trainees. Article 2 in the Craftsman Trainee rules stated that when a craftsman trainee entered the factory, he had to pay a 10 yen deposit, and during the trainee period 20 percent of his wages were withheld to prevent him from moving away immediately after the training. In addition, Mitsubishi was able to enforce contractual commitments whereby the trained workers were obliged to remain in the company's employ for three years. Finally, both companies offered a bonus to apprentices who successfully completed the program.

The most serious issue, however, was the classic problem that both Mitsubishi and Kockums faced: the trained workers had good opportunities to seek employment elsewhere, which meant that parts of the investments the companies made could not be recouped. To what extent did company-based training contribute to preventing such 'leakage'? In both cases education and training seem to have been crucial in the companies' conscious efforts to build a sense of loyalty and create a "company spirit." The close connections between masters and apprentices,

“graduation ceremonies” at the end of training periods, and different bonus systems during and after the training period all helped to create such a spirit. These efforts were important in Mitsubishi’s case since the training period was very long: three to five years in the industrial school followed by five years as a trainee and three years of mandatory work within the company. It was quite important in Kockums’ case too. In the collective memoirs from Kockums, many retired workers express the pride they felt to work for the company (PerAxel Nilsson 2010). These efforts did not prevent all “leakage” of skilled labor from the companies but probably helped to reduce it.

Company schools could play an essential role in retaining skilled workers by offering substantial possibilities for education and training, which facilitated promotion. Experiences from Britain in the interwar years indicate that promotion opportunities contributed significantly to a high retention rate at the British shipyards. A British shipyard worker usually stayed until retirement in the shipyard where he was trained. Young men were hired as apprentices to become skilled workers and foremen, and to hold other supervision positions. White-collar workers were also recruited from that group; in fact there were no obstacles for promotion to high command positions (*Metallarbetaren* 1942, no.14).

Mitsubishi had a fully-fledged system for promotion through continuous courses. Craftsmen could become foremen after successful completion of so-called Supplementary courses, and promising graduates from the Main Course could be selected to participate in the Induction Course to become assistant engineers. From this pool, some of the white-collar staff was recruited.

The promotion opportunities at Kockums were far less systematic than at Mitsubishi, but they did exist. Promotion was closely tied to the factory school, where workers could enhance their skills and gain promotion. Over the years, a large number of workers already employed in the company were trained in the factory school. In the early 1960s, a total of 1,500 people were trained annually in longer and shorter courses. These off-the-job courses were mostly of shorter duration. Company management encouraged this, and the school even offered popular evening classes that provided possibilities of becoming an engineer. Workers were also sent to extra-mural courses to become foremen and industrial supervisors.

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Thus, in both enterprises the different courses and programs were used to create career paths that strengthened loyalty to the company. This was particularly strong in Mitsubishi's case after the launch of the Industrial Craftsman School. Successful completion of its training program made it easy to advance within the company.

Concluding Remarks

This study confirms earlier findings: serious difficulties in recruiting skilled labor are a necessary condition for companies to set up factory schools. By itself, however, this is not sufficient, since most companies in that situation do not launch and operate factory schools. The two cases we have discussed represent companies that were, at the time when the respective factory schools were founded, technologically advanced. This is a characteristic that our cases share with most others described in the literature. A third common factor is that the management stressed the importance of the factory school promoting loyalty among the workers, not least by providing promotion opportunities.

We consider these characteristics to be closely interconnected. Almost by definition, technologically advanced companies demand skilled workers and use various strategies to attract them, including recruitment from competitors, attracting foreign workers, and offering training and promotion. These strategies represent a significant investment that the company tries to protect in various ways. Kockums certainly used promotion strategies to retain its most valuable workers, but its strategy was basically to get payback on its investments in skills as soon as possible. The low wages paid to apprentices indicates that the company's investment in training was limited. Even skilled workers received a comparatively low wage, which suggests that the company strived to keep production costs at a minimum. Skilled workers, however, could often find better paid jobs in the vicinity, and the price Kockums had to pay was a high turnover of workers. The more stable conditions for Mitsubishi (State orders) suggest that they employed a more long-term strategy to retain skilled workers.

It also seems important that the commitment is supported by the workers, even if the support was expressed in different ways. In Sweden, strong national trade unions supported factory schools in the 1940s and

1950s, but when the country's education policy changed in the 1960s, that support weakened. This fact probably contributed to the management's decision to close the school. At the local level however, workers' support for the school continued to be strong; this brings us back to the connection with loyalty to the company. It seems that the most efficient method to retain workers trained at the school was to induce and promote a sense of loyalty among the workers. Both companies used various methods to accomplish this and the factory school was an important means. It must be concluded that Mitsubishi was more successful in promoting loyalty.

Starting a factory school is a long-term commitment with many uncertain components and this study demonstrates that special circumstances were important in the development of the schools. A benevolent attitude from the state seems indispensable. The benevolence took partly different shapes in Japan and in Sweden but it was present most of the time. The Mitsubishi Nagasaki Shipyard relied to a large extent on steady and profitable government orders for naval vessels, which allowed the company to make long-term commitments to its workers as well as to training programs. Japan developed powerful institutions to promote long-term commitments at various levels in society and this formed the core of the segmentalist skill formation system (Busemeyer and Trampusch 2012; cf. Thelen 2004).

The importance of government benevolence—and the absence thereof—is demonstrated not least when Sweden's education policy changed in the 1960s. Private company schools were compatible with the skill formation system in place in Sweden from the early 1940s to the 1960s, when the labor market parties played a very active role. Policy changes in the late 1960s left much less space for such commitment and defined initial vocational education and training as integrated parts of the upper secondary school system, with a much larger role for the State and municipalities. One of several consequences was that most factory schools including Kockums' disappeared. In the emerging statist system there was little room for company-based vocational education and training.

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Interviews

The interview with Bengt Pålsson was conducted 6 March 2013. Bengt Pålsson was accepted as an electrician's apprentice in 1955 at the age of fifteen and stayed in Kockums for his entire working life. He was promoted to first electrician in the early 1960s, and became foreman in 1968. He was later promoted to the position of works supervisor and eventually became works manager.

Rauno Eberlund and Åke Sandström were interviewed jointly on 30 March 2015. They were both accepted as apprentices in 1966, Eberlund to become a ship-builder (welder) and Sandström an electrician. Eberlund stayed at Kockums for about twenty years but shortly before the company closed their production of civilian ships in 1987 he was retrained at the company's expense to become a refrigerator technician. Sandström left Kockums after his apprenticeship period and took up employment in various companies before starting his own firm in 1979.