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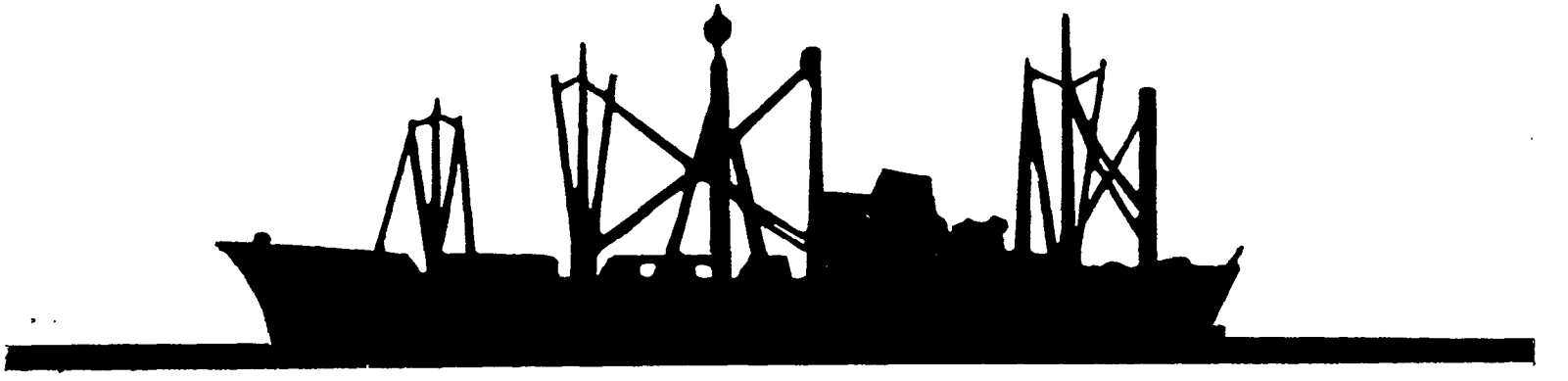

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

I R E A P S

WORKER PARTICIPATION AND ORGANIZATIONAL CHANGE IN SHIPBUILDING: AN INTERNATIONAL REVIEW

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The views, **opinions,** and conclusions expressed in this paper, unless specifically referenced in the text, are represented to be those only of the author .

Abstract

Significant innovations of a human resource nature have been introduced *to* international shipbuilding since the mid-60's. In the past few years, a number of U.S. yards have experimented with some of these practices (quality circles, semi-autonomous work groups, multi-skilled workers). this paper draws together information from several sources in an attempt to identify those underlying principles which have taken various forms in many shipyards in a number of countries.

Introduction

The expression "human resources" is heard more frequently these days in American business circles; not only in the titles of business administration courses, but also in professional and department titles within industry. In some cases the content of such coursework and industry billets is much the same as was earlier encompassed under the heading of "Personnel" (e.g. recruitment and selection, training, salary and benefits administration, industrial relations, etc.). What is new, however, is an additional dimension hinted at in this more ambitious label "human resources", one that has to do with achieving the most effective use of the workforce.

"Nothing new there," one might protest, since the traditional functions of Personnel are directed to this end as are certain elements of Industrial Engineering and every other management function that touches at a11 upon the use of the workforce.

But there is a difference, and it has to do with an expanded view of the concept of " use of the workforce." This new dimension reflects the view that an organization's workforce is not simply one other element of production, but is one of the company's most important assets -- a resource that has not been sufficiently tapped under traditional management practices and organizations of work.

that the potential of the U.S. shipbuilding workforce in particular has not been sufficiently tapped, has been proposed by A&P Appledore (1980) who conclude from' a comparision of data from a sample of American and foreign yards that labor productivity in U.S. shipbuilding is generally only half that in Scandanavia and Japan (1980:1-4). Of this total they attribute 30-35% of the difference to; '...superior organisation and systems and a more effective workforce in the foreign yards" (1980:7-10).

What is also new, is the exploration and application of a number of behavioral science-based techniques (social technologies) which alter the manner in which the workforce is employed. Such modifications may range from design (or redesign) of plant facilities and manufacturing processes, to changes at the level of individual jobs and reward systems. Such

innovations ***are*** commonly accompanied by modification of values, sometimes referred to as "corporate culture" or "management style." that is characteristic' of these new work cultures/styles and their concrete manifestations, is an expansion of responsibilities of employees and consequent improvement in their status within work organizations. In the United States, the most generic term for this assemblage of human resource innovations is "quality of work life." In Europe ***it is*** called "industrial democracy" or "organizational development," and in Japan, "jishu kanri" (voluntary management).

This paper will review the development of the human resource orientation in international shipbuilding. Considerable attention will be given to the Japanese case, not because the origin of shipbuilding human resource innovations is to be found in that country, or because Japan offers the best model for emulation; but because it has been the world's leading shipbuilding nation and the principal source of technology transfer to U.S. yards. quite .simply, we know more about shipbuilding practices in Japan than we do for Europe. ***Human*** resource practices in European shipbuilding are also noted here, especially those of the Scandanavian yards which are generally considered to be second only to Japan. The Korean approach to utilization of the shipbuilding workforce is briefly touched upon, although very little information is available on these relatively new yards which are rapidly moving into a position of international prominence. The review will also focus on workforce utilization in U.S. shipbuilding, both in traditional practice and in specific cases of recent experimentation with quality of worklife innovations.

Aptitude

As earlier indicated, innovations stemming from a quality of work life I orientation may take a number of forms (e.g. physical amenities, quality circles, gainsharing plans, semi-autonomous work groups, etc.). but central to the concept is the notion of decentralized decision-making, sometimes referred to as "worker participation" or "participatory management". Participatory management is based upon the premise that workers can often manage themselves better than they can be managed by echelons of managerial specialists. The logic which supports this ***view*** has several components.

Primary is the realization that workers -closest to the job are in many instances most knowledgeable in terms of the technical and personnel requirements of the tasks. And even if this is not always the case, any innovation or redirection in the manufacturing process is much more likely to be successfully adopted if the ***workforce*** has some ***say*** in its design and implementation.

But both of the preceeding arguments are fairly timeless ("It has always been thus"), and do *not* explain the 'frequency of participatory management innovations in recent *years*. The answer lies in a more recent phenomenon - a value change in the workforce at large. 'This attitudinal change which has been associated most particularly with the industrialized democracies has been variously identified and labeled. It is referred to by futurist Alvin Toffler as "the new *wave",* by sociologist Daniel Bell as "the *age* of entitlement", and its product, by social researcher Daniel Yankelovich0, *as* "the new breed". What is common to all these interpretations is the recognition that contemporary workers seek *more* intrinsic satisfaction from their work. than did preceeding generations for whom traditional workplace organizations and management styles were designed.

It is clear that this value shift has played *a* role in *overseas* shipbuilding. Note the comments of an American shipbuilding welding study team which visited ten Japanese yards in 1973:

> In the generally tight labor market, Japanese shipyards are finding it increasingly difficult to attract new employees. Changing attitudes of young people towards working in a shipyard environment and performing monotonous repetitive jobs such as manual and gravity welding have prompted management to explore *new* approaches to the recruitment of shipyard workers. For example, to improve the industry image with respect to both employees and the general public, the yards are giving increased attention to landscaping, recreational facilities, and subsidized food and housing. Auto mileage allowance is offered to some employees in lieu of subsidized housing. Women are employed in some yards for gravity welding welding and are often permitted to work individual schedules compatible with their family responsibilities (Brayton, et al - 1973:2).

That report is nearly ten years old; but even in the depressed market of the 80's, Japanese shipbuilding management is still faced with rising expectations of their workforce. A NKK manager states:

> We are not afraid of AWES (Association of West European Shipbuilders) and we are not afraid of the NIC's (newly industrialized countries). We are more worried that we won't be able to get the workers to do the dirty jobs in the future (Seatrade 1981:135).

Sectrade reports that the NKK view is not-atypical:

> This seems to be the common attitude in management throughout the Japanese shipbuilding industry -- give them the men and they will worry about getting the orders (1981:135).

Shipbuilders in the newly industrialized countries may also, to some degree, be experiencing the same phenomenon. the preresident of Daewoo, Korea's newest and largest shipyard, claims that; "The time for lower wage earners in Korea is over. But they do not work only for the money; they really care about searching for more efficiency, better productivity, better quality" (lOOA1 1982:12).

Although a higher educational level is only one element of the workforce profile ssociated with this *value* shift, it is interesting to note that even for shipbuilding which is not generally considered to be an industry which attracts the best and the brightest, the Asian and European yards which practice participatory management highlight the educational level of their workers.

Dr. Shinto, formerly chairman of Ishikawajima Harima Heavy Industries (IHI), points out that most of the young Japanese shipyard workers *in the* 60's, and almost all of them today, have received twelve years of education and are qualified for the university entrance examinations (Shinto l980:26). Speaking of IHI's initial experience with participatory management, Shinto says:

> At the start there *were* various inconsistencies, but the activity took root far earlier than had been expected. It was felt that the workers, who had previously no way of realizing or instituting their own proposals and thoughts, had been given a voice in *a very* useful way. (A)most all workers had a twelve year education, they had their own good sense, and their participation in the improvement of the production techniques and working conditions gave them greater satisfaction in their work. The results of this program of worker involvement exceeded our expectations (1980:27-28).

Educational level of the workforce, and its potential provision of a comparative advantage in international shipbuilding is recognized *as well* by the Norwegians. The logic which underies a *six* year, nine yard, industry/government cost-shared organizational development project in shipbuilding is *as* follows:

> If we presume that Norwegian shipyards will continue to build and equip ships and other steel constructions for maritime use, which of these factors (products, production technology, organization-human resources, administrative systems) should be our prime objective in the endeavour to increase our competitive ability? *Our answer* to this is organization/human resources. Technology as such is international in character and easily transferable between countries. Not so with human resources. The possibilities of releasing the productivity potential of human resources depend much more on national conditions. Consequently, our relative competitive ability will primarily depend on how well we succeed in doing this. In our opinion we have *a* good basis for this in Norway. The general level of education is high, and relations between the main parties in economic life are comparatively good. Therefore, we should direct our efforts towards making the most of these advantages (Westhagen and Hotvedt 1980:18).

Education as a human resource advantage in shipbuilding may not for long be the province only of the industrialized nations. As the managing director of Korea Shipbuilding and Engineering reports for his firm; "We feel that education is very important here, and all the workers have 15 minutes of English lessons each day. (W)e don't do this only to teach them shipbuilding terms; we want them to learn basic English" (lOOA1 1982:14).

By comparison, the educational level of U.S. shipyard workers is probably lower than in Japan or Scandanavia. As of 1970, 52% of American shipyard workers had completed high school and six percent were college graduates (figure 1). And this might suggest that the U.S. shipyard employee would be less inclined toward, or capable of, self management than his *overseas* counterpart. the fact that participatory management was earliest realized within Japanese and European yards (since the late 60's) may be supporting evidence. But the general population surveys upon which the notion of worker dissatisfaction is based, have been conducted *in* the United States *as* well as overseas. A study by the U.S. Chamber of Commerce shows that 80% of American workers today believe that they could improve productivity if management would only listen to their ideas (U.S. House of Representatives 1981:12).

Figure 1

EDUCATIONAL ATTAINMENT OF EMPLOYED MALES IN SELECTED INDUSTRIES, 1970

Industry	Percentage of Employed Males [a/] Completing years *or More* of:	
	High School	College
Construction	43.8	3.9
Manufacturing.	55.8	9.9
Du1rable Goods	56.5	9.6
Motor Vehicles	54.1	5.7
Aircraft	73.0	18.5
Shipbuilding and Repairing [b/]	52.3	5.7
Private Wage and Salary Workers	48.6	5.7
Government Workers	60.5	5.9
Railroad Equipment	54.5	5.7

a/ Age 16 and over.

b/ Includes boatbuilding and repairing.

Source: Bureau of the Censug

Other evidence of American worker interest in, and capability for, self management is found in the number of quality of work life programs in U.S. industries (auto, steel) whose workforce educational profiles are not unlike that for shipbuilding. Such programs are prospering, even in the U.S. construction industry which has the lowest educational profile of the industries appearing in Figure 1 (Ross 1981). What is most interesting about Figure 1, is the sizeable difference between the educational profiles of the private and naval yard workforce. Whereas only the construction industry has a lower level than private shipbuilding, the naval yards are fully 12 points higher and are exceeded in the category of manufacturing only by the aircraft industry.

Another revealing, though isolated statistic, suggests a considerable shift in the age and education of at least the naval yard workforce. Forty percent of the apprentices enrolled in Pearl Harbor Naval Shipyard's training program have completed between 2-4 years of college (Hartigan 1982). These. statistics may explain why it is that the naval yards were the first ***to*** experiment with participatory managment in U.S. shipbuilding. They may also suggest that lower educational levels may have been only a braking rather than disqualifying factor.

Within the past two years, at least three private yards (Bethlehem Sparrows Point, Lockheed, and Sun) have been experimenting with, or implementing, participatory management programs. Of the two that survive, Lockheed reports substantial success Hayes 1982) (Hayes and Swanson 1981) (Smith 1982) while Bethlehem's program is too new to call (the first meeting of the Employee Involvement Group was held this Spring). The Sun project was nearly two years old when it was discontinued by new management upon purchase of the yard. Union officials and the previous management were ***very*** enthusiastic over the results of the project, which was in the process of expansion at the time of the sale. It is reported that the local union and yard workers are encouraging the new management to reinstitute the program (Lazes and Laird 1982). These three examples are based only upon the personal knowledge of the author which does not proceed from any formal - ***or*** informal survey. There may well be other private U.S. yards that are quietly experimenting with partipatory management styles and new organizations of work.

but there is also evidence of widespread worker dissatisfaction with non-participatory management styles in American shipbuilding. The result of interview and questionnaire analysis of 13GO production workers and professionals in ten U.S. yards revealed that:

> (M)any believe that their company's management has no interest in them as persons, is unaware of what they do, and is oriented to machines rather than people. Most hourly production workers believe that they do not influence the company in any important ways. The fewer than twenty percent of the workers who believe their influence is important perceive that influence to come primarily in the way they perform their own job. The majority of workers who believe that they cannot influence the company in important ways cited that it was futile to try, that the company didn't care or was too tig or set in its ways, or that their low position. or lack of knowledge prohibited their influence (Meunch 1976:4).

> (E)ven more important to the professional group is what they believe to be an unhealthy company attitude in the sense that they perceive the company to demonstrate little interest, respect or appreciation to the professional worker (1976:3-43). (0)f all the personnel groups. fewer of the professional workers perceive that the company gives them the feeling that they are important in getting the job done, and fewer than one-half of the professional group believe that they can influence the company in any important way. The professional group has the greatest predilection *to* consider moving to another company and, along with job availability, a primary cause for this need for mobility is the professional's perception that the company doesn't care (Meunch 1976:3-45).

To briefly summarize this point, the "aptitude" logic or argument for participatory management, while perhaps stronger in Japan and Scandanavia, yet obtains for U.S. shipbuilding, even in the private sector. Forms of participatory management are now being experimented with and adopted here as well. There has been a delay, *to* be sure, but there has not been any program failure on the basis of deficiencies in the self-management inclination or capacity of American shipyard workers.

Participatory Management

One manifestation of participatory management that has received *more* U.S. attention than any other, is that of quality control circles. Quality circles have. their origin in the Japanese modification and application of Western principles of; diffuse management responsibility for quality, statistical techniques, and behavioral science concepts of organizational development. The new twist added by the Japanese was the extension of quality control jurisdiction and responsibility to every individual in an - organization through the vehicle of small study groups -- this in contrast to the traditional practice of relying upon specialist quality control engineers.

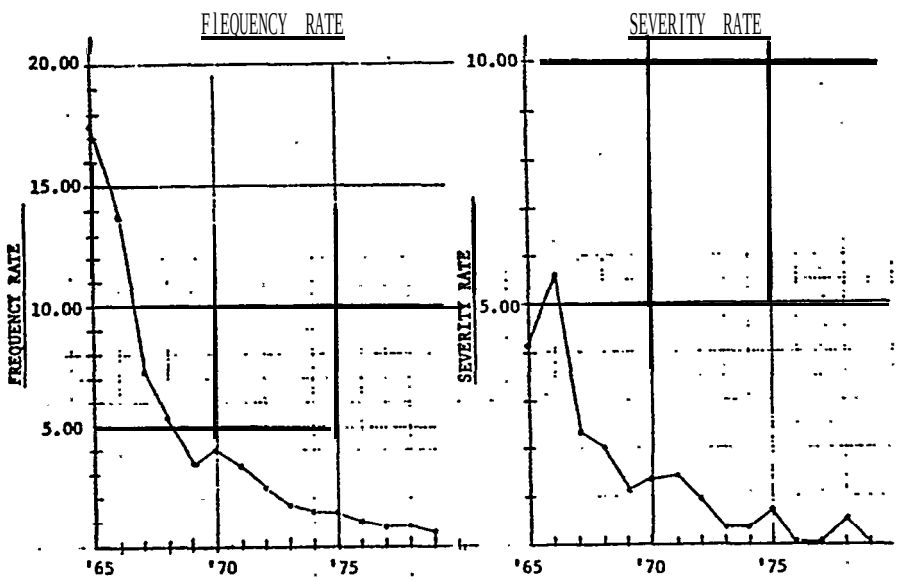
The quality circle concept was not, therefore, an element of traditional Japanese culture, but had very definite beginnings in the early 1960's as Japanese 'management moved toward adoption of worker participation in decision-making and "small-groupism" (shoshudanshugi). Similar workplace experiments in Europe were observed by the Japanese, and by the end of that decade small group participative management practices were widespread throughout Japanese industry. A 1968 survey of 850 manufacturing companies revealed that 73% were practicing some form of participatory management through small groups. The shipyards *were* among the first industries to experiment with the new technique. That same year, the president of Hitachi Shipbuilding, speaking at the Annual Meeting of the Japan Federation of Employers' Associations (Nikkeiren), could give *a* progress report on his company's experience with all-employee management participation (Cole 1979:134).

Nor did the Japanese quality control circles address quality issues only. In 1968 the Union of Japanese Scientists and Engineers reported that the existing circles were focusing only half of their attention on quality control narrowly defined. Forty percent of circle activities dealt with productivity .and cost reductions, While ten percent was devoted to safety matters (Cole 1979:134).

In shipbuilding it was "safety" and not "quality" or "productivity" that was the first concern of the newly initiated small group movement. The industry in the mid-60's was very concerned with the escalating frequency and severity of yard accidents due, in Shinto's opinion, to the fact that the expansion and competitive position of Japanese shipbuilding at that point had been "...based on the physical energy of the workers" (1980:26). Compulsory enforcement of safety measures provided only temporary improvement, and it was not until the introduction of the small groups, and management's immediate attention to the problems identified by them ("...regardless of expense...") that a steady long-term improvement of safety records was realized (Shinto 1980:22). At IHI, the success of the initial safety effort led to the expansion of the small group program to the full yard by 1972-74. This dramatic and continued safety improvement is depicted in Figure 2. Perhaps an even more dramatic statistic is that there occured in 1980 less loss-time accidents in all the Japanese yards than in one single American yard (Gilbride 1982) -- and the total tonnage delivered for all American yards that year was only about one-tenth that of Japan (maritime Administration 1981) (Naval Sea Systems Command 1981).

Figure 2

Frequency and Severity of Shipyard Accidents at IHI
1965-1980



- accident frequency in worker injuries per million working hours
- accident severity in working days lost due to accidents per thousand working hours

The small groups in shipbuilding, like their counterparts in other Japanese industries, did not limit themselves to a single problem area. As Shinto explains; "(P)roductivity is the result of the combination of three elements: safety control , quality control, and efficiency control (1980:28).

Participatory management was introduced into the Swedish Kockums yard as a result of the findings of the "Kockums Report" (1970). This self-study revealed that the root of the yards's ***severe*** personnel problems was a new piece-work standards system which was introduced in 1967 with the transition from conventional shipbuilding to the factory-shipyard concept. As a,result of organizational changes made based upon the Kockums Report, including participatory management, labor turnover rates dropped by one-half and overall productivity was improved by a third (Hill 1973:51). In Norway, worker participation (along with improved physical conditions and improved recruitment and retention) has been a central aim of the Norwegian shipbuilding industry (Westhagen and Hotvedt 1980:14).

Although the U.K. lags Europe in its experience with participatory styles of management, there has been movement in this direction. Speaking of the U.K. shiprepair industry, Nichols of the Tyne Shiprepair Group reports that a number of shiprepair companies now have joint monitoring arrangements ***or*** workforce involvement as shareholders or participants in profit-sharing schemes. In Nichols opinion:

> There cannot be lasting improvement within the (U.K.) shiprepair industry without further development of more open and participative styles of management. Industry is a joint venture, and in an ailing one like shiprepairing it is more essential than ***ever*** to ensure that everyone understands the problems and the reasons for the changes that ave to be made in the interests of survival (Flack and Nichols 1980:38).

Returning from a visit to Japan, Chalmers, General Secretary of the Boilermakers Society, observed that consultation between management and - workers could go a long way, towards helping the U.K. shipbuilding industry match the severe competition from Japanese shipyards; "We can beat the Japanese at their own game, but it has to involve greater motivation of our workforce" (Fox 1980:2).

In U.S. shipbuilding, participatory management has taken the form of several variations on the quality circle theme.

Norfolk Naval Shipyard was perhaps the first U.S. shipyard to experiment with participatory management. The 9 quality circles initiated in 1979 were also among the very first in the federal government, and the Norfolk program has been serving as a model for other government agencies and private industries. In their second year of the program, Norfolk expanded the number of circles to 62. Perhaps more appropriately named than similar groups in other shipyards and industries, the Norfolk quality circles have in fact focused primarily on "quality" rather than "safety" or "productivity". Although Norfolk, like all the other u.s. shipyard

programs, ***stresses*** that the payback has been realized most dramatically in the improved self image of the employees, a quantitative accounting has reported a 1:3.8 cost/benefit (Tweedale 1981:363). Other naval 'yards (Puget Sound, Philadelphia) have followed Norfolk's lead in installing quality circle programs (Bradley 1981).

The Sun Shipbuilding quality of work life program, initiated in 1980, also entailed "problem solving teams" involving 175 workers in three departments of the yard. An independent accounting of that program's activites by the yard's industrial engineering department identified over $600,000 in savings in the first year (Lazes and Laird 1582).

Also begun in 1980, Lockheed's new work culture (they do not consider it to be program in the sense of an experiment or application of specific techniques) has now 38 circles which are the main vehicle around which a much larger and more pervasive quality of work life environment has been formed. Eschewing tradtional Japanese quality circle training in statistical techniques, Lockheed has oriented its circle activities in the direction of work planning. What is particularly unique to the Lockheed approach (cf. other U.S. shipbuilding participatory management programs) is the relationship of the quality circles ***to the*** remainder of the organization. They do not form a separate and parallel chain of authority and responsibility within the firm (there is no labor-management program steering committee), but constitute part of Lockheed's formal management structure. What is also unique in the Lockheed program is the effort put into the development of white collar circles. One-half of this yard's circles are constituted of office, rather than production, workers. Examples of quantified results of circle activity include; a painters and scalers circle which discovered deficiencies in sandblast material which upon rectification resulted in improved steel surfaces and a $68,000 yearly savings in material costs; a pipefitters circle redesigned the layout of their shop which translated into a 20% reduction in new construction pipe-fitting man-hours; a welding circle developed a new process to use weldable zinc primer which saves the yard several thousand man-hours per year (Hayes and Swanson 1981:94)

The shipbuilding organization which has most recently introduced a participatory management program is Bethlehem Steel. The Sparrows Point facility is the pilot shipbuilding project in that corporation's much wider effort in ***a*** number of industries. The first three "employee involvement groups" were formed this past Spring.

Organizational Change

The introduction of participatory management, in itself, constitutes an organizational change; but such forms as quality circles and joint labor-management employee involvement steering committees constitute a sort of parallel structure to the principal formal hierarchy (in many instances

to increase its effectiveness) (Davidson 1982:13). However, organizations have frequently gone further in modifying the structure of formal tasks, management systems, and reward systems along the same lines of decentralization and flexibility.

One element of the orienting philosophy of the Norwegian shipbuilding organizational development project is that; "...organizational development processes have to be coordinated with other development processes within areas such as product, production technology, and production systems" (hesthagen and Hotvedt 1980:14). This highlights *a* difference between the earlier "human relations" approach to personnel development (tender Loving care) and quality of work life innovations, which *are* rooted firmly in technological and production realities.

In this respect, the Norwegian view is very similar to that of the Japanese. In that country, participatory management did not take the form only of occasional study groups, but rather was incorporated in a manner that supported changes in the larger organizational framework, the structure of shipbuilding work itself. In the Scandanavian yards, the change has consisted of a movement away from the traditional piece-work system (Westhagen and Hotvedt 1980:16) (Hill 1973:50). In Japanese shipbuilding, organizational change has taken the form of small rather than large groupings of workers.

Riesenfeld, in a survey of computer use in Japanese shipbuilding observed:

> The workforce is well organized into small working groups which *are* autonomous in the labor division within each group. These are called multi-functonal workers, and their experience indicates that these groups show increased productivity which results in better worker morale (1978,appendix 3:3-4).

This small group innovation may be viewed as an adaptation *to* - product-oriented work breakdown production processes. Shinto, in his narrative of the progress of production techniques in Japanese shipbuilding, reports that; "The new system of production in Japanese yards did not find a complementary workforce organization in place. The workers were purposefully retrained and reorganized (1980:27). "(I)eam organizations of the Workers *were* suitable altered from functional control to zone control" (Shinto 1980:16). Rather than moving individually all over a ship, workers under this arrangement remain together as a team working sequentially on similiar modules in a particular workstation. The predominance of small group organization in Japanese yards is evidenced by a comparatively higher supervisory index (1.45 supervisors to 4.5 workers at IHI vs. 1:lO.g at Levingston)(Colton and Mikami 1980:70).

The concentration of individual worker attention to a specific workstation might seem at first glance to run counter to job enlargement practices which have accompanied the introducton of small works in other manufacturing settings. In the case of shipbuilding, however, each task may consume a number of hours and gives the worker ample opportunity to exercise skill and discretion (Colton and Mikami 1980:56). Levingston reports that their experience with the small group/workstation innovation (part of a technology transfer program with IHI and MarAd) has been "...exceptionally well received by production personnel" (Colton and Mikami 1980:54-55). This same U.S. yard has attempted to stabilize the membership of workstation teams by making permanent assignment of individual workers to specific supervisors (Colton and Mikami 1980:70). Although Levingston did not report that it experimented as wel1 with participatory management at the time of introducing these organizational changes, it did state that:

> In general, the features that characterize Japanese shipbuilding technology and make it uniquely different are philosophical in nature. It is a philosophy of management and control that works very well with a group-oriented and highly motivated workforce (1980:72).

The fact that participatory management frequently takes the form of small study groups, and that this also happens to be an important direction taken in terms of shipbuilding organizational change is not unconnected. The link has to do with the fact that people frequently do their best work in small assemblies, whether that work be "head work", "hand work" or some combination of the two. In Japanese shipbuilding, the small study group and the actual working crew have the same membership.

However, the principal relationship between participatory management and organizational change (which may take a number of forms depending upon specific social and technological conditions) is to be found in the ability of organizations designed around the principle of participation to respond more easily to change. Structural provisions for participation in decision-making provide a degree of organizational flexibility that is absent in companies that structured along strict hierarchical and bureacratic lines. Participatory organizations have more ears attuned to signals of the necessity for change, and are less susceptible to delays occasioned by the "not invented here" syndrome.

These related concepts of organizational decentralization, de-bureacratization, and flexibility are quite topical in today's shipbuilding industry. Appledore and Rosenblatt make the claim that:

> One of the greatest differences in contemporary shipyards is the degree of organisation of work and its effect upon the productivity of the man. The high craft skill possessed by some shipyard workers has enabled the adoption in the appropriate companies and countries of a minimum of formal organization. This circumstance is usually accepted by the management in search of a great deal of flexibility (1980:10-3).

The characteristic organization of U.S. yards is at the other extreme in this matter of flexibility. The 1978 survey and comparison of U.S. and foreign shipbuilding technology levels included a category "Organisation and Operating Systems". Although the multi-element comparision resulted in overall similarity between U.S. and foreign levels in this category, one constitutent element of that classification showed a major divergence, the one concerning flexibility in the assignment of work and supervision of the workforce. Whereas the American yards are characterized ***as*** rigidly bound by trade structures, their foreign counterparts are described as having either "high levels of flexibility and interchangeability", or "maximum flexibility through workstation organization" (Marine Equipment Leasing 1979:111-32);

Ihis rigidity of organization is not a problem that is peculiar to American shipbuilding, but is characteristic of U.S. industrial organizations in general. It has been traced, to a large extent, to the influence of "scientific management" as developed by Frederick Taylor and institutionalized in the form of industrial engineering. It has to do with the concept of a "job". Scientific management encouraged the precise and formal description of jobs based upon techniques of task analysis and work measurement. The more circumscribed each job description, and the fewer tasks entailed, the better for purposes of assignment of standard production norms. This one-dimensional, hierarchical, and bureaucratic management approach was complemented and reinforced in the United States by the newly forming unions' interest in unambiguous and discreet job classifications for purposes of operation of a strict seniority system (Piore 1974:81).

It appears that shipbuilding in Japan may be even further advanced in this direction of Workforce flexibility than other Japanese industries. In their comparative analysis of three modernized Japanese companies (saki distillery, appliance factory, and shipyard), Marsh and Mannari ***were*** particularly struck by the emphasis on job diversification in shipbuilding. Both in their interview and questionnaire response, the majority of the shipyard workers voiced a preference for multi-skill jobs (1976:83 & 91-92). Again, as with participatory management practices, job diversification and multi-skilling are not part of traditional Japanese culture. Ihe change is more recent, as a shipyard personnel manager explains:

> Between 1950 and 1963 we made revisions in the rules of job and authority seventeen times. Then, after 1963, we gave up the attempt to rigidly specify definitions of job and authority. In practice, we threw out rigid authority over jobs (1976:48-49).

Marsh and Mannari note that flexibility extends to managerial levels as well, especially in middle management ranks. Indicative of the change in emphasis is the elimination of the title "section chief" and substitution of the term "team leader" (1976:SO).

The same researchers report that the shipyard they studied had also introduced some aspects of a matrix or task force type of organization; "...with team leaders and workers brought together on a temporary basis to solve a particular problem or accomplish a particular job, after which they are disbanded" (Marsh and Mannari 1976:5O).

Shinto, in his description of the progress of production techniques in Japanese shipbuilding, reports that the change in workforce organization from functional to zone control;

> necessitated a ***drastic*** change ***in*** the combination of worker skills in each team. Workers were retrained so that 'they could manage to do multiple jobs or at least tack weld and gas cutting in addition to their proper jobs (1980:16).

The Scandanavian shipbuilders, experiencing high labor costs, have also deve1oped a highly skilled and high productivity workforce operating under the principle of flexibility and interchangeability. Such practice makes ***most sense*** in those countries and industries in which ***a*** comparatively ***narrow*** wage range encompasses the skilled, semi-skilled, and unskilled workers (A&P Appledore 1980:3-7).

The British shipyards, who have gauged their performance against the considerably more productive European yards, refer enviously to "continental style" working arrangements based on full flexibility limited only by the competence of individuals to carry out work assignments.

> The principle of one man, one trade, one set of skills, is no longer viable. What is required of tomorrow's tradesman is that his skill and knowledge should be multi-faceted and that full use should be made of the whole range of an individual's intelligence and potential skills (Flack and Nichol 1980:37).

In the U.K., where craft demarcation lines have been rigidly drawn, a number of yards have negotiated with their unions "continental style" working practices. In the U.S., Penn-Texas' Pennsylvania yard has recently announced a contract in which the number of labor grades has been reduced from ***over*** 400 to approximately 80, with craft departments cut from 65 to 13. It is reported that work rules have been completely eliminated at the yard (Journal of Commerce 1982:12A).

Another related element of Japanese shipbuilding organizational change has to do with decentralization of professional staff functions. At IHI:

> (P)roduction engineering is a function of the production workshops, each of which has its own Production Planning and Engineering Group. 'These groups are each made up of a staff of engineers who are responsible for specific activities related to the optimum utilization of facilities, processes, and manpower on each hull construction project. This activity includes the analysis and continual improvement of procudtion processes to realize improved productivity (Colton and Mikami 1980:30).

It is this continual analysis of the production engineers working in close contact with the production workers that serves as the basis for refinement of detailed working drawings, procurement specifications, and materials lists.

> In this regard there is a great deal of collaboration between designers and workshop "staff" engineers. Production information is an integral part of the development of the working drawings and production engineers provide a continuous feed-back of data to improve the usefulness of the drawings for the production workshops (Colton and Mikami 1980:30).

Although Levinston reports an independently invented production workshop structure similar to that of IHI, the American yard has retained centralized rather than dispersed engineering staff functions (Colton and Mikami 1980:67). Avondale has moved in this direction by holding weekly meetings between engineering and production groups for the purpose of reviewing plans (Mongelluzzo 1981:llA). Although considerable interest has been generated in U.S. shipbuilding circles for design/production integration, concentration has been in the development of an electronic interface (CADCAM) rather than on organizational change.

Similarly, Colton and Mikami describe as "striking" the IHI system of decentralization of scheduling. Again, the staff engineers that perform this function are found at various levels of the hierarchy, yet manage to produce schedules of different degree of detail that agree with each other. The Levingston approach, in contrast, entails scheduling at the gross level by the Central Planning and Control Department, and at the detailed level by the Production Planning and Control Department. Levingston has announced its intent to experiment with decentralization of detail planning (Colton and Mikami 1980:57).

On this subject of flexibility, the survey of shipyard worker job satisfaction revealed that the most common spontaneous production worker complaint related to "working conditions" did not have to do with shortcomings of the physical facilities. Rather, the workers complained of poor planning, schedule coordination, and communications (both between - crafts and between production workers and staff services) (Meunch 1976:3-9)..

As might be expected, the much younger quality of work life projects in U.S. shipbuilding have not progressed so far as those of the Japanese or Europeans in this matter of organizational change. It would seem that these several programs have followed a very similar progression from early development of multi-craft study groups, to subsequent self-managing action groups constituted of continually associated workers. The brand-new employee involvement groups at Sparrows Point are mu1lti-craft affairs, and Lockheed's first circles had membership mixes of various trades, professionals, and managers. But the Lockheed circles are now evolving toward a craft and supervisor orientation. The yard reports that these newer Workgroup quality circles are beginning to pursue problems of a more

complex and company-wide nature (Hayes and Swanson 1981:94). When this happens, quality of work life becomes no longer a one hour per month activity (quality circle meeting), but is a 40 hour per week endeavor which can lead to-much more significant organizational changes and productivity gains.

Perhaps the best example of this progression is to be found in the Sun project. As a later experiment in that yard's quality of work life program, a group of production workers were given complete management control over the construction of a main deck section module. The experiment allowed this fabrication group to do its own planning and production with supervision and specialist staff intervention only as requested. Besides introducing some production innovations of an engineering nature, the workers achieved efficiencies through inter-craft cooperation. The savings in man-hours over the construction record for an earlier identical module was in the order of 50%, and absenteeism dropped from 15% to less than 2% (Sun News 1982:5). The president of the union local said of this experiment:

> Before, management told you what job ***to*** do, when to do it, and how to do it. They didn't look to input from workers. E-10 (the project deck module) was completed with very little input from supervisors, and inspectors told us it was the best quality work they could remember (Sun News 1982:5).

Summary

The preceeding studies, reports, news items, and comments, suggest strongly that participatory management and small group/multi-skill worker organization has contributed substantially to productivity improvement in overseas shipbuilding. Results of three ***years*** of experimentation with, and tentative implementation of, similar innovations in American yards indicate that they might also work well in this country.

But in U.S. shipbuilding, and in other industries, one frequently hears caveats about transfering management styles and organizational forms from ***overseas,*** especially in the case of Japan, because of cultural differences. What is often overlooked, however, is that these practices are not part of the traditional heritage of these countries and have been implemented and diffused as a result of purposeful introduction and successful tentative experimentation. As has been shown for shipbuilding, participatory management and such organizational innovations as small production teams and multi-skill workers have very clear points of practical origin in the not-to-distant past. Even the practice of lifetime employment has had a relatively short history in Japan. It developed as a solution to problems experienced by the large firms during the Mejii Restoration. The shipyards, in fact, served as the prototypes for emergent Japanese employment practices

such as the permanent employment system (Dare 1973:380). And the conceptual origins of these practices is frequently to be found in Western, or even American, behavioral science. It is ironic to hear that there are voices in Japan critical of unreflective borrowing of European concepts of worker participation (Cole 1979:8).

A related view is that it is not these new techniques, but rather the underlying elements of social organization that result in high levels of performance (e.g. Japanese paternalism, company housing, participation in company activities, company identification). Marsh and Mannari's study found, however, that these distinctly Japanese Social organizational variables have less causal impact on performance than do the more universal social organizational variables such ***as*** employee status in the company, job satisfaction, etc. Their conclusion is that; "Performance in Japanese firms appears to have the same causal sources as in Western firms" (1976:335).

But in rejecting the view that these human resource practices are 60 culture-bound that they are not transferable to the U.S. (and that the distinctly foreign patterns of the larger social organizations are critical to the success of these industrial practices), the opposite error should not be made -- that these innovations were institutionalized overseas as isolated "events". Industry management styles and organizational forms in Europe and in Asia have indeed been altered in the direction of greater worker participation, small production groups, and organizational flexibility. But it has ***occured*** as a "process" by means of which theories and practices (whether of foreign or domestic origin) have been experimented with, modified, and melded into various social, political, economic, and technical environments. It did not occur by means of extracting out of context single elements or social technologies (quality circles, autonomous work groups, etc.) from other nations or other industries. Ihe degree and forms of worker participation in the United States will not take shape overnight, and will quite likely be easily distinguishable from those in Northwest Europe and from those in Japan. At the same time, the particular form of work groups in U.S. shipbuilding may have more in common with shipbuilders abroad than it will resemble what is developing in U.S. steelmaking or auto.

Perhaps indicative of the culture of U.S. shipbuilding, is the very considerable difference between U.S. and overseas attention to the physical environment and amenities of the yard. It was in this category "Environment and Amenities" that the 1978 survey and international comparison of shipbuilding technology levels revealed the largest U.S./foreign disparity. While some of the large-scale environmental deficiencies of the U.S. yards may be attributed to their age, Lowry, Stevens, and Cragg note that inferior amenities such as canteens, washrooms, toilets, lockers, etc., could be fairly easily remedied by local management initiative (1980:164,162). In contrast, they point out that the high standard of amenities provided Japanese and European shipyard workers ***are*** either demanded by the workforce, ". ..or are provided by the company for other reasons" (1980:164). As has been demonstrated, those "other reasons" have to do with attracting and retaining ***a*** high quality laborforce, one suited to new ways of working.

Hood, in a review of the Lowry, Stevens, and Cragg analysis of the Appledore survey, rises to the defense of the U.S. shipyards, pointing out that industry has actually done quite well in technology upgrading in spite of political; social, and environmental factors over which the industry has little control. He gives three specifics:

1) costly U.S. regulations and standards, more stringent than those found abroad,

2) the comparative negligence of government stimulus and assistance in the United States, and

3) the differences in shipyard work practices, motivation, and ethics (Lowry, Stevens, and Cragg 1980:169).

Granted, the first two problem areas may be of a sort that do not lend themselves to unilateral action on the part of industry. It is not so clear in the latter cases, however, that industry cannot on its own, and without need of larger coalitions, modify its own work practices and improve the motivation of its own workforce. To the contrary, industry leadership may innovate in the way the workforce is organized and used -- through individual initiatives, joint labor-management experiments, and collective bargaining.

The alternative is to continue with the traditional arrangement in which:

engineering, planning, and scheduling are accomplished only by centralized specialists,

development of safety improvements is the exclusive responsbility of safety engineers,

quality is the reserved function of the quality assurance department,

production workers (and even professionals) perform only a limited range of tasks and no others, and

problem solving and decision making remain the sole preserve of full-time managers,

The record thus far suggests that individual competence, and not bureaucratic boundaries, should set the limits of employee participation in technical and management tasks. It appears that this may be the key to turning a workforce into a human resource.

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