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"Democratic Taylorism": The Toyota Production System at NUMMI

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The human aspects of Japanese manufacturing, in particular those techniques embodied in the Toyota production system, are currently under intense debate. Do they represent a positive model for the future of the American workplace? Some observers applaud the approach's reliance on teamwork, workers' problem-solving and multi-skilling. Other observers denounce what they see as work intensification, management by stress, and ultra-Taylorism.

The present chapter contributes to this debate with a discussion of the New United Motors Manufacturing, Inc. (NUMMI) assembly plant in Fremont, California. NUMMI, a joint venture between General Motors and Toyota, has implemented the Toyota approach with but little dilution. The plant is unusual in that its workforce is composed primarily of workers who had been laid off when the GM-Fremont plant closed in 1982. Moreover, the UAW has retained bargaining rights and exercises considerable influence in the operation of the plant.[1]

The examination of this case begins with a summary of the plant's background, followed by a description of some of the key policies governing NUMMI's production system and its labor relations. After reviewing the data on NUMMI's exceptional productivity and quality performance, I

then turn to workers' assessments of the quality of work life at NUMMI. Some puzzling paradoxes emerge from this characterization, which I attempt to resolve by suggesting that NUMMI's production system can be understood as an unusual but potentially important form of organization that I call "democratic Taylorism."

Background

NUMMI was formed in 1983 as a joint venture between General Motors and Toyota. For its part, Toyota hoped that setting up plants in the U.S. would alleviate some of the growing political pressure on Japanese automakers to reduce their sizable trade surplus. NUMMI was conceived as the first step in that strategy, designed to help Toyota learn about U.S. suppliers and labor. General Motors, on the other hand, wanted to learn about Japanese manufacturing systems, and they needed a small car to fill a gap in the low end of their product line. Toyota contributed $100 million, and took responsibility for setting up the plant's day-to-day operations and designing the plant's primary product, the Nova, a variant of the Corolla. (NUMMI later changed the name to Geo Prizm, and would also produce Corollas and Toyota compact pick-up trucks.) GM contributed the facility and was responsible for marketing the Nova/Prizm.

The decision was made to house the new company at the old GM-Fremont plant, which had been shut down in 1982. Politically, it was inconceivable that the plant reopen without UAW involvement. A Letter of Intent was therefore signed with the union in September 1983 stipulating that NUMMI would recognize the UAW as the bargaining agent for the venture's employees. The letter further indicated that the company would pay prevailing U.S. auto industry wages and benefits, and that a majority of the workforce would be hired from among the three thousand workers laid off from GM-Fremont; however, seniority would not be a factor in their recall to the successor operation. In return, the UAW agreed to support the implementation of a new production system and to negotiate a new contract. The collective bargaining agreement was subsequently signed in June 1985.

NUMMI began hiring in May 1984. Of fifty-three hundred applications sent to former GM-Fremont employees, thirty-two hundred were returned. Over the next twenty months, the company hired twenty-two hundred hourly team members, approximately 85 percent of them from the old GM-Fremont workforce, including the entire union hierarchy. Some 300 salaried employees were also hired. The applicants for hourly jobs—

team leaders and team members—were evaluated jointly by managers and union officials.

NUMMI's overall business strategy was to build its cars at the lowest cost and the highest quality. The following sections highlight management policies that contributed to that goal in two areas: the production system, and the labor relations system.

The Production System

NUMMI's production management was modeled directly on the Toyota system. The key elements were the following:

Kanban. NUMMI did not use a computerized scheduling system. Instead, signs—or *kanban*—were passed to the upstream department whenever inventory pallets or dollies needed to be replaced. If no *kanban* arrived, the upstream department stopped production to prevent the build up of inventory.

Production leveling. In Big Three plants, line speeds remain fixed even as production schedules are constantly changing. Factory managers make the necessary adjustments in output by adding and subtracting overtime and taking on and laying off shifts. By contrast, NUMMI leveled the schedule over several months, and made periodic adjustments to output levels by varying the line speed. The leveling policy also shaped the day's build schedule: different models were mixed evenly throughout, rather than batched.

Kaizen. NUMMI paid enormous attention to *kaizen*—the continuous improvement of all aspects of production. Accordingly, all NUMMI workers were trained in problem-solving techniques, and management regarded worker participation in the suggestion program as a key measure of the plant's performance.

Visual control. This policy emphasized the use of visual indicators to signal abnormal conditions as rapidly and automatically as possible. *Kanban* is one form of visual control, signaling the need to replenish an inventory pallet. Another key element of visual control at NUMMI was the "andon" board, which signaled quality problems on the line with flashing lights.

Jidoka. This meant assuring quality in the production process itself rather than relying on inspections at the end of the process to detect problems. Workers pulled a "line stop" cord when they encountered a quality problem, triggering the andon board signal that alerted the team leader and

the group leader. Unless the problem could be resolved within sixty seconds, the line would stop. *Poka-yoke*, or error-proofing, was another element of *jidoka*: parts packaging, equipment designs, and tool setups were specified so as to make inadvertent error almost impossible.

Team concept. At NUMMI, team concept encompassed both the cooperative labor relations system described below and the organization of small teams of four to six workers. Workers in each team were cross-trained to perform several tasks and most workers rotated between work stations. (Rotation was not practiced in Toyota's Japanese plants, but it was written into NUMMI's collective bargaining agreement.)

Standardized work. This practice was, in the words of a NUMMI manager, "the intelligent interpretation and application of Taylor's time and motion studies." Each job was analyzed down to its constituent gestures, and the sequence of movements was refined and optimized for maximum performance. Every task was planned in great detail, and each worker was expected to perform that task in the prescribed manner.

The combination of these policies created an extraordinarily disciplined organization.

Labor Relations

NUMMI's labor relations policies reflected a commitment to what former NUMMI president and CEO Kan Higashi calls the "team concept": "The team concept is not just the small groups on the shop floor. It also applies to the plant as a whole. The bigger team is the workers, managers, engineers and staff all working together to constantly improve our product. This way, the workers see that the company isn't the property of management, but of everyone together. And the key to this team concept is trust and respect."[2]

This policy was reflected in NUMMI's dress code—at least in the production function, everyone from the senior manager down wore the same uniform—as well as in the absence of management cafeterias and reserved parking. More substantively, it was reflected in a range of opportunities for worker representatives not only to give voice to workers' concerns, but also to help shape the company's response to those concerns. Every week, month, and quarter various levels of the union leadership met with the corresponding levels of management, and the union was consulted in advance on major operating and strategic decisions.

Management saw NUMMI's no-layoff policy as part of its commitment to the team concept. The collective bargaining agreement of 1985 stated:

> New United Motor Manufacturing, Inc. recognizes that job security is essential to an employee's well being and acknowledges that it has a responsibility, with the cooperation of the Union, to provide stable employment to its workers. The Union's commitments in Article II of this Agreement are a significant step towards the realization of stable employment. Hence, the Company agrees that it will not lay off employees unless compelled to do so by severe economic conditions that threaten the long term viability of the Company. The Company will take affirmative measures before laying off any employees, including such measures as the reduction of salaries of its officers and management, assigning previously subcontracted work to bargaining unit employees capable of performing this work, seeking voluntary layoffs, and other cost saving measures.[3]

The no-layoff policy was not without some sacrifice for workers. Not only did the union have to agree to many changes in operating philosophy, but in exchange for NUMMI's commitment to avoid layoffs, the contract exempted NUMMI from contributing to GM's Supplemental Unemployment Benefits plan. SUB benefits assured GM workers that if they were laid off they would receive close to full pay. Without this SUB pay, laid-off workers would get unemployment insurance at levels that were substantially lower.

NUMMI's "team concept" was also reflected in its organizational structure. There was only one classification for Division 1 personnel, as opposed to over eighty in the GM-Fremont contract. The number of skilled trades classifications had also been reduced from eighteen to two—general maintenance and tool and die.

Team leaders were hourly employees who played a role somewhere between the old-style "utility man" (a multi-skilled worker able to fill in for a broad range of positions) and foreman. The team leader filled in for absent workers, trained new workers, assisted workers having difficulty in their jobs, recorded attendance, assigned work when the line stopped, assisted team members in minor maintenance and housekeeping, assessed new team members, led *kaizen* efforts, and organized social events outside the plant. In March 1988, in response to workers' concerns with favoritism in the selection of team leaders, management agreed to a joint union/management selection process based on explicit and primarily objective criteria.

TABLE 11.1
NUMMI Productivity Comparisons

	Framingham	GM-Fremont	NUMMI	Takaoka
Uncorrected productivity (hrs/unit)				
• hourly*	36.1	38.2	17.5	15.5
• salaried	4.6	4.9	3.3	2.5
• total	40.7	43.1	20.8	18.0
Corrected Productivity** (hrs/unit)				
• hourly*	26.2	24.2	16.3	15.5
• salaried	4.6	4.9	3.3	2.5
• total	30.8	29.1	19.6	18.0

*excluding stamping, molding, and seat assembly personnel
**corrected for number of welds, welding automation, product size, relief time, and option content
[Source: Krafcik, 1986]

Performance

The productivity of the NUMMI plant has been extensively analyzed by John Krafcik; some key indicators of NUMMI's performance are summarized in table 11.1. Labor productivity, both corrected and uncorrected for differences in product and technology, was much higher at NUMMI than at the old GM-Fremont plant and at the GM-Framingham plant. (Krafcik chose Framingham because it was a GM plant somewhat comparable in product and technology mix to NUMMI.) By 1986, NUMMI was almost as productive as its sister plant in Takaoka and more productive than any other GM plant. This performance is all the more impressive when it is recalled that the NUMMI workforce was on average some ten years older than Takaoka's, and younger workers are in general better equipped to deal with the pressures of assembly-line work.[4]

The comparisons with the Takaoka plant are particularly useful because one of the factors contributing to NUMMI's productivity and quality performance was the "producibility" ("manufacturability") of their vehicles' designs. Not only were the designs already in production—which meant that most of the producibility problems that the original designs may have had were already ironed out—but Toyota was renowned for its ability to assure a high level of producibility in its original designs. The fact that NUMMI's overall performance had reached a level so close to Takaoka's suggests that this performance level was not due exclusively to the products' producibility.

More recent data indicate that these extraordinary results persisted into 1992. The J. D. Power and Associates Initial Quality Study of the number of problems per one hundred vehicles experienced by customers within ninety days of purchase show that NUMMI progressed from 116 per 100 vehicles in 1989 (compared to an industry average of 148 for all cars sold in the U.S.) to 93 in 1991, and to 83 in 1992 (versus an industry average of 125 for all cars sold in the U.S., an average of 105 for Asian nameplates, 136 for U.S. nameplates, and 158 for Europeans.)[5]

The Quality of Work Life at NUMMI

The key question is whether these efficiency and quality outcomes were obtained at the expense of workers' well-being. Certainly, NUMMI's extraordinary productivity clearly had something to do with the intensity of work. Standard task times at GM-Fremont had been set to occupy the experienced worker for approximately forty-five seconds out of a hypothetical cycle time of sixty seconds. NUMMI, in contrast, aimed to occupy the worker sixty seconds out of sixty and in practice averaged about fifty-seven seconds out of sixty.

This work intensity was the direct result of the Toyota production system and the organization of work it specified: no buffer inventories, detailed work methods closely calibrated to the real work situation, level production, rapid response to any breakdowns, and error-proofing of the process. The work organization embedded in this system was almost the mirror image of the Volvo model, which has become for many, especially in the labor movement, the yardstick for quality of work life. The Volvo model is best known through the innovations introduced in the company's Swedish operations, first at the Kalmar plant and then in a more radical form at the Uddevalla plant, before both facilities were closed due to a collapse of Volvo's sales.[6]

NUMMI's operations contrasted most directly with Volvo in the degree of autonomy experienced by workers. A key feature of the Volvo model was the idea that the work team should be as independent as possible. Teams were therefore accorded considerable discretion in how they performed their work and how they scheduled their work time, with buffers of in-process inventory provided upstream and downstream to facilitate this autonomy. Teams were also given extensive management responsibilities in such domains as scheduling overtime and ordering supplies. At NUMMI, in contrast, the emphasis on standardized methods meant that

workers had no autonomy whatsoever in how they performed their tasks. The *kanban* principle also meant that there were no buffers upstream or downstream, and therefore no discretion in how the teams scheduled their work. And NUMMI's team concept gave team members only a narrow range of managerial responsibilities.

What evidence do we have, then, of workers' reactions to NUMMI's intensely disciplined and regimented environment? There is no doubt that workers had complaints. Assembling automobiles at NUMMI was enormously demanding work physically, and some workers I have interviewed were angry at what they perceived to be management's reluctance to recognize work-related injuries. Some team leaders and some management personnel were seen as "playing favorites" or as simply incompetent, and some workers expressed frustration because they felt they had been unfairly overlooked for special projects or promotions.

But how did workers evaluate their overall experience at NUMMI? Taken individually, none of the available indicators are, in my opinion, compelling. But they all seem to point in a common, favorable direction:

- In numerous interviews conducted between 1987 and 1993, I have yet to find anyone who would rather work in the GM-Fremont system.
- NUMMI surveys workers' opinions every two years. "Overall work satisfaction" grew from 76 percent in 1987 to 90 percent in 1991. Satisfaction with job security grew even more dramatically. In 1987, only 70 percent of team members expressed satisfaction with this dimension of their work experience. At the time, sales of the Nova were very sluggish—capacity utilization rates fell to under 60 percent—and workers weren't sure they could trust management's commitment to the no-layoff clause in the collective bargaining agreement. But management lived up to that commitment by redeploying workers into training classes, maintenance tasks, and *kaizen* teams. By 1991, satisfaction with job security had reached 89 percent.
- Participation in the suggestion program grew from 26 percent in 1986 to 94 percent in 1992. By that year, workers were contributing an average of nearly six suggestions a year.
- Absenteeism rates held steady at an exceptionally low level of approximately 3 percent, and turnover remained very low at less that 6 percent.

Democratic Taylorism

Why, then, would workers respond positively to a production system characterized by such high levels of regimentation? I believe that at least

part of the answer lies in the feeling among workers that this regimentation was not imposed from above, but came from the joint deliberations of company engineers and union workers seeking the best way to accomplish a difficult task.

GM-Fremont had some eighty industrial engineers who worked in a remote office environment developing work methods and standards from company handbooks. By contrast, at NUMMI there were no industrial engineers performing such duties. Team members and team leaders were taught how to analyze their own jobs using a stop watch and assessing alternative work procedures proposed by their colleagues. Each team would compare notes with the teams upstream and downstream to assure the best allocation of tasks and line balancing, and then compare the result with similar analyses performed on the opposing shift. The resulting methods had to be applied with great consistency, but workers were strongly encouraged to suggest improvements for efficiency, quality, or safety, and management typically responded to such suggestions very promptly. Standardized work was seen as a better way to do the job, as evidenced by the remarks of a UAW team leader during one of the interview sessions I conducted with NUMMI employees:

> The GM system relied on authority. People with rank, the managers, ruled regardless of their competence or the validity of what they were saying. It was basically a military hierarchy. At NUMMI rank doesn't mean a damn thing. Standardized work means we all work out the objectively best way to do the job, and everyone does it that way. I might make some minor adjustments because of my height, for example, but I follow the procedure as laid out because it makes sense. We're more like a special forces unit than the regular military hierarchy. Management's delegated responsibility to the people who do the work, and that gives workers a sense of pride in their jobs.

This does indeed sound like "the intelligent interpretation and application of Taylor's time and motion studies." I submit that NUMMI's standardized work process represents something we might call "democratic Taylorism," in contrast to the more traditional "despotic" form of Taylorism. The contrast can be described along a number of dimensions:

- At NUMMI, workers actively participated in defining work methods; traditional Taylorism assumed that the methods would be imposed by the Methods Department.
- NUMMI's standardized work process focused on work methods and assumed that better time standards would emerge from the discovery of better methods; traditional Taylorism focused on time standards, and as-

sumed that failure to meet them was due not to inadequate methods but to insufficient effort by the worker.

- NUMMI taught the standardized work techniques in the same program as the *kaizen* process because NUMMI's Taylorism was devoted to collective learning in the plant; traditional Taylorism was designed to coerce work effort from a recalcitrant workforce, and the resulting methods and standards were rigidly fixed, prisoners of the balance of power on the shop floor.
- At NUMMI, the central role of workers in the standardized work process forced management to share power with workers; traditional Taylorism was often a means for asserting management's power over the shop floor.

Precedents for such a vision of "democratic Taylorism" can perhaps be found in the Amalgamated Clothing Workers under Sidney Hillman. This version of Taylor's doctrine of Scientific Management was advanced by Taylorites such as Morris L. Cooke, intellectuals such as J. R. Commons, and socialists such as the young Walter Lippmann. It was also perhaps what Lenin was gesturing towards when he suggested that the Soviets should learn Taylorism and apply it to their collective goals.[7]

This view suggests that we should see Taylorism as a kind of organizational technology, and like equipment technology, it can be designed and implemented so as to empower or to enslave. Management's traditional assumption is that employees are recalcitrant and irresponsible. As a result, managers design both equipment technologies and organizational technologies to ensure compliance, minimize employees' scope of discretion, and reduce the company's reliance on employees' skills. Management should then not be surprised when employees respond to such an environment with apathy and antagonism—a result which in turn comforts management in their initial assumption that employees are recalcitrant and irresponsible.[8]

The NUMMI example suggests that if management begins with the assumption that workers want to contribute to the goals of the organization, they can design organizational technologies that invite, capture, and diffuse suggested improvements to standard practices. In that way, an organization can maintain and elicit a high level of commitment on the part of the workforce—a result which in turn comforts this alternative initial assumption.

How does an organization create and sustain these initial conditions, so workers want to contribute? What are the conditions under which this democratic version of Taylorism is feasible? I would highlight three prerequisites.

First, there has to be a shift in management attitudes and behavior. The criteria used to select the initial group of sixteen GM managers at NUMMI

tell us something about the prerequisite changes. A pool of candidates was created from GM personnel files, selecting individuals with the appropriate experience, education, work evaluations, and age, and these candidates were invited to interview sessions in Detroit. Eric Jacobson, quoting from two GM managers responsible for conducting these interviews, summarizes the key selection criteria: "honesty, humility, groupism [group orientation], sensitivity, listening ability, and communication ability."[9]

A second prerequisite would seem to be a commensurate set of changes in workers' attitudes and behavior. One of the managers I interviewed assessed the issue in the following terms:

> The production people bought into standardized work very easily. They understood the technique, because it had been done to them for years; and they liked the idea, because now they had a chance to do it for themselves. Their biggest problem was that many of them don't have a lot of education, so some of the math [for statistical quality control, for example] is a bit challenging and maybe threatening. So you have to work on that. A second challenge comes from the fact that you're changing things. At NUMMI, we want people to constantly improve their standardized work and a lot of people just aren't used to that much change. So you have to work with people so they come to see that change not just as a disturbance but as an opportunity to improve things. That's hard sometimes.

The third prerequisite condition for democratic Taylorism is more structural. George Nano, the head of the Bargaining Committee, expressed his views on the matter this way: "Standardized work gives workers the right to set up their own jobs and that means that management has to share power and cooperate with us. . . . The key to NUMMI's success is that management gave up some of its power, some of its traditional prerogatives. If managers want to motivate workers to contribute and learn, they have to give up some of their power. If management wants workers to trust them, we need to be fifty-fifty in making the decisions with them. Don't just make the decision and say 'trust me.' " If managers want the powerful apparatus of Taylorism to serve learning ends rather than coercive ends, they will need to reconcile themselves to some real loss of power.

Which leads to the question: why should managers relinquish power? And if managers have no incentive to relinquish power, is not democratic Taylorism a temporary epiphenomenon? There are indeed many structural and institutional forces that should make us less sanguine about the prospects for democratic Taylorism, such as the overall configuration of power in the U.S. today and the peculiarities of the inherited institutional framework (of labor law in particular). But NUMMI's successes incline me to

modest optimism: the loss of management's *power over* workers seems to be more than compensated by the competitive benefits of the associated increase in the organization's *power to* accomplish joint goals.

Conclusion

This essay has attempted to tease out of the NUMMI case some elements of a new model of work organization. I have proposed calling the kind of work organization that we find in this combination of lean production with a strong union presence "democratic Taylorism." I do not believe that NUMMI lives up to this model every day in every way. Nor is this model the only useful way of describing NUMMI's overall characteristics. But if it helps account for NUMMI's combination of world-class productivity and quality and high worker morale and commitment, it is a model that deserves our attention.

Notes

1. For detailed assessments of NUMMI see Paul Adler, "The Learning Bureaucracy: New United Motors Manufacturing, Inc.," in *Research in Organizational Behavior* 15, ed. Barry Staw and Larry Cummings (Greenwich, CT: JAI Press, 1993): 111–194; Paul Adler, "Time-and-Motion Regained," *Harvard Business Review* (Jan.-Feb. 1993): 97–108; Paul Adler and Robert Cole, "Designed for Learning: A Tale of Two Auto Plants," *Sloan Management Review* 34, no. 3 (spring 1993): 85–94.

2. This and quotes that follow are, as indicated, from interviews I conducted with NUMMI employees between 1987 and 1993.

3. UAW-NUMMI, *Collective Bargaining Agreement* (1985), Article III, p. 4.

4. John Krafcik, "Learning from NUMMI," MIT International Motor Vehicle Program, 1986.

5. J. D. Power and Associates, *The J.D. Power Report* (June 1992). Revised data for earlier years provided by J. D. Power and Associates.

6. Christian Berggren, *Alternatives to Lean Production: Work Organization in the Swedish Auto Industry* (Ithaca, NY: ILR Press, 1992).

7. Steven Fraser, *Labor Will Rule: Sidney Hillman and the Rise of American Labor* (New York, Free Press, 1991), 187. For unsympathetic surveys of liberal-left interpretations of Taylorism, see Samuel Haber, *Efficiency and Uplift: Scientific Management in the Progressive Era* (Chicago: University of Chicago Press, 1964); Judith A. Merkle, *Management and Ideology: The Legacy of the International Scientific Management Movement* (Berkeley: University of California Press, 1980); Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870–1970* (New York: Viking, 1989); Sanford Jacoby, "Union-Management Cooperation in the United States: Lessons from the 1920s," *Industrial and Labor Relations Review* 37 (October 1983): 18–33. For Lenin's assessment of Taylorism, see Vladamir Lenin, "The Immediate Tasks of the Soviet Government," *Izvestia* (28 Apr. 1918), translated in *Selected Works*, Vol. 2 (Moscow: Progressive Publishers, 1967).

8. Richard Walton, *Up and Running: Integrating Information Technology and Organization* (Boston: Harvard Business School Press, 1989).

9. Eric K. Jacobson, *NUMMI: A Model in Human Relations* (BSIE thesis, General Motors Engineering and Management Institute, 1986).