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JAPANESE SUBCONTRACTING:  
A "POST-COMMODITY" CONTRACTING MODEL

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## Problem Setting

Traditionally, the problem of manufacturing has been understood in terms of a narrow range of technical indicators: economies of scale, production cost, scheduling, factory lay-outs, inventory management, and so on. While each of these indicators may constitute an important part in the business school curriculum as well as day-to-day factory operations, technical knowledge alone does not lead to an insightful understanding as to what the present-day manufacturing is all about. Even if the problem of manufacturing is discussed in broader academic terms, it still tends to be looked at in the light of a simplistic facet such as labour process control, transaction cost, culture or technology.

I argue instead that the current successes or crises of manufacturing activity in industrial societies can be fully understood only when they are placed in the context of historical evolution through which various institutions in each society have emerged and disappeared. I argue further that when a structural mismatch between existing institutions and changing externalities develops in a society, its viability is at stake.

History has shown us numerous examples of once dominant industrial powers being superceded by new entrants. When we look closer at them, we invariably find institutional rigidities being irrevocably developed in defeated models. The current crises of many industrial societies may thus be understood as organizational impotence to change.

I claim, more specifically, that the characteristics of the final product market define production organization. Should the former change, the latter must also adapt to that change. If there persists a mismatch between the market and production organization in a firm or an

economy, the viability of the firm or the economy itself is at stake. This is what we see today in many firms or economies in the industrial world. Their current crises are structurally defined.

Galbraith's once popular claim (1972) that the market can be controlled by large firms' demand management, particularly by the art of advertisement working on 'the mass' (p.213), has lost its ground. This is because phenomena from the last two decades or so have turned the concept of the mass itself dubious. Large industrial corporations, once hailed as 'accomplishments themselves', have been found utterly impotent in the face of the emergence of the 'micromasses' -- defined by Fujioka (1986) as relatively small social groupings with unique but internally uniform purchasing patterns. Affluence in advanced societies has disaggregated the final product market to the degree that characteristics of large-firm industrial systems -- such as large-scale technology, dedicated manpower, planning and long lead times -- can in fact be counterproductive. Many firms which have continued to rely on the Galbraithian prescription of demand management and advertisement manipulation alone have been in crisis. Their plight is not so much due to the failure of their marketing techniques as to the lack of structural adaptation of their production organization to external change. Tendencies towards volatile, fragmented markets have been increasingly requiring flexible productive responses. Today, manufacturers must provide large variety in small volumes in much shorter lead times and product cycles than in the past. Only those who have understood this and altered their production organization to this end can survive competition successfully.

Having thus set out a larger context in which manufacturing activity takes place today, I now proceed to my central question: the evolution of Japanese subcontracting. This issue is specifically selected because it not only exemplifies an evolutionary adaptation to ever-changing environments but also represents a successful model that has responded well to the present-day disaggregation of the final product market, while retaining competition, innovation and flexibility.

As will be demonstrated, my evolutionary approach to the problem covers what other paradigms have missed -- be they dualism (Edwards, 1979; Berger & Piore, 1980), cultural preferences (Dore, 1987), transaction cost economics (Williamson, 1985) or flexible specialization (Piore & Sabel, 1984).

Furthermore, results of my international research suggest that the evolution of Japanese subcontracting is not so specific a problem to Japan as is generally thought. Rather, it entails a range of universal issues relevant to all industrial societies today, once looked at as an alternative organizational response to changing environments.

In what follows, I will provide a brief review and critique of the four major arguments -- which I have just mentioned -- pertinent to my inquiry: dualism, transaction cost economics, cultural preferences and flexible specialization. Then, I will give a summary of my alternative evolutionary account induced from historical evidence from Japan.

First, there are familiar arguments of dualism (Berger & Piore, 1980, and many others). Large firms utilize small subcontractors as a buffer against fluctuations in demand. When the economy contracts, the former internalize outside operations so as to protect their own business and regular workers at the cost of subcontractors. Cheap

labour and lack of unionization in the latter sustain the system. There always remains unequal treatment of economic agents in different sectors of the economy irrespective of their objective worth. A radical twist of this dualist approach (Edwards, 1979) claims that managers of large firms exploit subcontractors so as to fracture the working class; that opportunities to exploit advanced technology are limited to large firms; and that there will be a decline of the small, peripheral sector due to large firms' spillover into new markets and new industries.

Evidence from Japan indicates, however, that, while the 'shock absorber' elements of subcontracting can by no means be negated, parts of the above argument are not tenable. Small firms have not declined. They continue to account for more than two-thirds of the working population and one-third of the total industrial value added (Figure 1). The availability of advanced technology has not been restricted to large firms. The diffusion of microchip technology as exemplified by numerically controlled (NC) machines has narrowed the gap between large and small firms. Interscale wage differentials have substantially narrowed to the international average as well (Figure 2), making it less attractive to use subcontractors for cheap labour reasons alone. Subcontractors were not indiscriminately forced out of business even during the hardest recessions. The dualist account provides little analytical leverage for these facts. There must be extra-dualist factors to be taken into account.

The second argument of transaction cost economics (Williamson, 1985) claims that, due to human nature's proclivity to opportunism and bounded rationality, recourse to hierarchies or vertical integration is an appropriate measure to foreclose market failure and to economize on

transaction costs. This being so, the only major reason for the continuation of obligational contracting is asset specificity, defined as durable investments in support of specific transactions. Without asset specificity, however, there is no logic for continuous contracting relations which are prone to be dysfunctional. This view, however, simply reiterates what is observable ex post. It does not explicate why in the first place such risky investments of a durable kind should be made by, allegedly, intrinsically opportunistic economic agents. Nor does it provide sufficient evidence to support the claimed dysfunctionality of obligational contracting.

The third argument of cultural preferences (Dore, 1987) proposes that it is a Japanese trait of a non-opportunistic kind -- their predisposition to goodwill and benevolence -- that accounts for the prevalence of relational contracting in Japan, and that it is this cultural quality that explains moralized trading relationships and lower degrees of transaction costs and opportunism in Japan. There are four concomitants: collective risk-sharing and long-term advantage; dutifulness, in that benevolence is perceived and performed as a duty; friendliness, because of Japanese predisposition to shun adverse bargaining relationships; and economic efficiency of a non-allocative kind that compensates for price distortion. A more popular version of such a cultural view (particularly strong in Europe) holds that the inclination of the Japanese to accept a greater degree of obedience to a superior power has resulted in strikingly pervasive and hierarchical subcontracting structures.

Interesting as these claims may be, historical evidence shows that subcontracting was not an essential part of the Japanese economy earlier



in the twentieth century. It was only after the explosion of munitions demand concomitant with the progress of the Manchurian Incident, the Sino-Japan Incident and World War II that subcontracting for the first time emerged -- promoted by the state -- as a prominent part of the wartime economy. It then largely disappeared with the end of World War II. It took the Korean War economic boom to see the resurgence of subcontracting, and dualism at large, in Japan. Although the predisposition of the Japanese may or may not have played a nontrivial role in the diffusion of subcontracting, there is no convincing evidence which suggests that it is so powerful as to constitute a consistent prerequisite regardless of context. It seems to me imperative, then, that the issue should be examined in broader socioeconomic and historical perspectives.

The fourth argument of flexible specialization (Piore & Sabel, 1984) provides a larger view: mass production principles and technologies based on special-purpose, product-specific machines and semi-skilled labour to produce standardized goods are crumbling, because they have lost their adaptability to external change. Instead, 'flexible specialization' should provide a viable alternative -- which is derived from the once-lost craft mode of production and which draws on skilled workers using general-purpose machinery flexibly to turn out goods for shifting markets. Thus, there are two crises for the international economy today: a mismatch between existing regulatory institutions and their ability to connect production and consumption, and the choice of the technology itself. What is increasingly observable in industrial societies is the emergence of a new industrial order, as exemplified by the 'Third Italy' and other regions in Europe,

in which there is the reversal of roles between small and large firms, the former with the might of flexible specialization upturning the latter's traditional superiority.

This argument directly addresses an important question concerning linkages between the final product market and production methods and draws our attention to the fact that adaptation takes place in a macro socioeconomic context. It further emphasizes that the deliberate choice of production technology is the key to relaunch growth in advanced economies. Their argumentative plane is thus broader than the aforementioned approaches and deserves close examination.

However, evidence from Japan, again, may cast doubt on the sustainability of the claimed reversal of roles between small and large firms. If we ask whether high volume producers such as Toyota, Nissan and Hitachi are breaking up due to the emergence of flexibly specialized small businesses, the answer is clearly no. Moreover, the dichotomous characterization of mass production vs. flexible specialization principles and/or methods does not stand up to careful empirical examination, which suggests that these two models are in fact often usefully combined as a pragmatic corporate response to shifting markets.

Traditional accounts thus told, let me now turn to a summary of the major findings of my research. This summary itself constitutes a self-explanatory refutation of the existing paradigms and proposes an alternative evolutionary account.

### **Major Findings and Arguments**

Gradually in the 1960s and decisively after the mid-1970s, tendencies towards the fragmentation of final product markets in Japan

-- concomitant with her rapid arrival at affluence and fierce interfirm competition -- necessitated a fundamental productive adaptation: from mass production to 'post-commodity' production (a term I will explicate below). While such adaptation may or may not be equally observed in other industrial societies, Japanese historical specificity produced some intriguing consequences. Traditional subcontracting institutions -- originally developed as a temporary measure in the dualistic context -- began to assume a new, long-term role for organizing various manufacturing units to provide large variety in small volumes in the final market. Extensive conversion of the existing mechanisms to this end took place. And this change crucially influenced the subsequent evolution of Japanese subcontracting. I shall come back to this point shortly.

'Post-commodity' production can be defined as a productive response to a final market situation where, due to saturation and diminished marginal utility, commodities are no longer marketable without useful product differentiation. The advantage of product differentiation can be maintained only when a product is provided for the market in limited quantities for a relatively short period. Commodities -- or standardized goods as in the traditional mass market -- are thus fractured, assuming new essential attributes of variety and volatility. Massive investments in facilities for a long production run of a single product, suitable for a stable mass market, are now replaced by intelligent investments on smaller manufacturing units -- often involving subcontractors -- that are better suited for flexible production of large variety in small volumes. Evidence indicates, however, that this shift neither points to the end of mass production

nor a return to the craft mode of production. Rather, what we see today in competitive firms or economies is a pragmatic synthesis of the two, a third form of production organization which combines the principles of repetitive manufacturing with the elements of flexible specialization in adaptation to the rise of the post-commodity markets.

As stated, Japanese subcontracting systems -- historically generated from wartime political needs and dualistic infrastructure of Japanese economy -- went through a marked evolution after the 1960s -- although it did not happen overnight. The original purpose of Japanese manufacturers during the period of postwar growth (and in this regard during the period of World War II as well) may have been an attempt to imitate American mass production. But they had no luxury of having the same mass markets as in the U.S. What they had, instead, was much smaller domestic markets where competition was fiercely fought amongst many producers. Capacity problems in the booming economy after the Korean War (through to the early 1960s) were resolved by resorting to subcontractors and temporary workers. The resurgence of postwar dualism after the mid-1950s helped this. A historical irony, however, is that what seemed like a temporary arrangement turned out to become almost a permanent characteristic of the Japanese economy.

On the one hand, Japanese prime contractors invested heavily on their own mass production facilities from the late 1950s onwards. On the other hand, in order to manage increasing variety in small volumes and retain market share, and yet to maintain flexibility, they began to delegate their small-lot assembly and subassembly operations -- and not merely partial machining or surface treatment -- to outside manufacturers. Having seen the viability of this strategy, they then

started to transfer their internal operations on a larger scale intact to external manufacturing units. Contract assembly and, further, contract product development came increasingly to play an important role in subcontracting relations. (For a long-term trend of this, see Fuji Electric's case in Table 1.)

In the automotive industry, for example, contract assembly of small-lot, specialty motor vehicles (e.g., sports cars, special-purpose vans) by auto body suppliers for volume-oriented assemblers such as Toyota and Nissan, became an essential feature of their production organizations. (For Toyota's contract assembly, see Table 2.) Furthermore, contract development of these specialty products also came to be undertaken by contract assemblers. Components fabrication and subassembly went through a similar organizational evolution. Components suppliers were increasingly assigned responsibilities for the development and manufacture of systems components.

In the electrical appliances and electronics industries, change was more dramatic. A typical television set factory in the late 1950s, for example, had long assembly lines staffed with many female assembly workers at the prime contractor (Figure 3). Over time, however, the assembly lines and workers largely disappeared from the prime contractor. They were found instead in much smaller units elsewhere; the main firm's subsidiaries and subcontractors were turned into contract assemblers, each responsible for a narrow and specialized range of models. By contrast, the prime contractor's own factory, with more engineers but fewer workers, now focused on product development, process innovation and production of highly value-added or state-of-the-art products (Figure 4). The general rule was that, when new products were

developed and all the teething problems with early production lots and new processes were resolved on the in-house experimental line (or were 'dried out' as the industry terminology says), the actual assembly, testing, packaging and shipping operations tended to be transferred to contract assemblers. The domain of production operations that the prime contractor retained in-house was for strategic products entailing expertise of a highly proprietary kind or for genuinely mass produced items which yielded straightforward economies of scale. Clear division of labour and 'locked-in' subcontracting relations emerged. Since contract assemblers (and to a lesser extent systems components suppliers) were by definition concerned with customer specific products, contract specific investments naturally spread and became a high proportion of assets. Consequently, subcontracting relations became more long-term and symbiotic.

This new system relieved the prime contractor from managing a large part of increasingly complex operational and administrative tasks concomitant with its rapid growth. The firm could allocate its internal resources to more strategic use including, as mentioned above, product development, process innovation and state-of-the-art manufacturing. The system also allowed the firm to proliferate its product lines without incurring the level of costs involved in all in-house operations. The simultaneous diffusion of various development and production activities to external units shortened lead times and product cycles on the whole. This greatly helped the prime contractor adjust to shifting demands and get ahead of the competition, all the while maintaining overall flexibility.

One extreme example which illustrates the magnitude of contract assembly is that by the mid-1980s there remained only one monochrome television set manufacturer in Japan which exclusively contract-assembled for about ten customers under their brand names without producing any of its own!(1)

One significant consequence of the foregoing is that, over time, reasons for subcontracting became more varied than at the outset. Contract assembly and systems components manufacture obviously required higher technical capabilities of a coordinating kind than simple machining, surface treatment or 'preforming'. Therefore, the overall technical capabilities of subcontractors, in addition to price and other indicators of performance, came to be systematically monitored by the prime contractor. Periodic checking made those with inferior capabilities obliged to become second- or lower-tier subcontractors -- or otherwise to change or go out of their business. Here, elements of dualism persisted. Periodic checking, however, also institutionalized inter-tier mobilities. Those with good records were promoted to a better tier status or expanded business. A well-defined tiering structure based on all-round performance and capabilities was thus brought into subcontracting mechanisms.

Furthermore, the above changes in subcontracting mechanisms entailed unexpected effects. They fostered entrepreneurship and innovation, placed the right technology in the right place, diffused transaction costs, promoted group loyalty and information sharing, stimulated competition while keeping it coordinated, and changed the function of the prime contractor's purchasing organization. Further,

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(1) Interview with Professor M. Ikeda of Chuo University, spring 1986.

they even spread the wealth in society at large and promoted more progressive human relations. All these effects were embedded in the mechanisms of the new subcontracting systems. Let me explain these in seriatim.

It was in the interest of subcontractors to innovate. Their newly defined enriched status stirred their entrepreneurship. The more they innovated, the greater the chance for growth and profitability. As 'locked in' subcontracting spread, their proposals for new methods, components and products or for improvements on existing ones came to be regularly encouraged and monitored by their customers. Those with good records became preferentially treated and expanded their business in the long run. Over time, fair profit-sharing rules became established for such innovations.

In this process, subcontractors came to find their own niches in the choice of technologies. Unlike Galbraith's (and to some extent Edwards') predictions, not all technologies became large-scale, technocratic and expensive even in the most advanced industries. There always remained a domain of production activities better performed by simple technologies in which smaller firms excelled. Drawing on Galbraith's example of superhighway construction (1972:42), it is unrealistic to assume that every construction activity can be performed by bulldozers and heavy earth-moving equipment. There always are tasks suitable for picks and shovels -- i.e., inexpensive, highly mobile & redeployable, general-purpose tools readily available from the market. Would not small subcontractors with scant capital have incentives to resort to and specialize in such simple tools?



In the world of the post-commodity market where frequent design changes, small quantities per product line, shortened lead times and product cycles are the norm, some recourse to picks and shovels may turn out to be far better than an exclusive reliance on an array of bulldozers and heavy equipment -- depending of course on purposes and applications. Furthermore, if the simple technology were usefully combined with the large-scale, complex technology -- which has its own place in large firms, the end result would be far more viable in a world of increasing uncertainty than single-minded devotion to one technology. This is exactly what the new subcontracting systems in Japan have achieved.

It was the responsibility of first-tier suppliers and subcontractors to coordinate second-tier subcontractors, for the latter to coordinate third-tier subcontractors, and so on. In general, the lower the tier, the smaller the size of firm and the simpler the technology employed. In this system, control and coordination functions were hierarchically delegated through these semi-autonomous tiering clusters. Such mechanisms may be called 'hierarchical cluster control' in contrast with 'arms length control'. Transaction costs for the prime contractor were thus gradationally transferred to its external partners. With prime contractors on top, many first-tier suppliers and subcontractors below cross-serving multiple customers, and far many more lower-tier subcontractors occupying the lower niches, the whole subcontracting structure resembled a range of pyramids or mountains overlapping one another. Hence, the 'Alps' structure which yields -- with its semi-autonomous manufacturing constituents -- organizational flexibility as a whole (Figures 5 & 6).

The fine-tuned division of labour amongst subcontractors and their relatively stable memberships within 'clusters' promoted group loyalty. They were organized into a subcontractors' association under a single customer, which fostered information sharing. Serving other customers with a varying degree of dependence helped these subcontractors maintain their bargaining power too. Organized competition was also brought in through periodic checking on subcontractors' performance and preferential treatment of better performers. The key function of the prime contractor's purchasing organization shifted from cost haggling to coordinating, checking and fostering subcontractors. The attention to human relations was promoted in this process. Lastly, a more pervasive spread of the wealth in society at large was brought about. In the interest of symbiosis, large firms did not crush small firms. They used them, and vice versa. The end result was a fairly synergistic economy, with multiple players flexibly adjusting to changing externalities without sacrificing control, freedom, autonomy, competition, trust, innovation and entrepreneurship.

Government policy -- which was promoted by a desire of the ruling Liberal Democratic Party (LDP) to secure electoral constituencies -- to support small businesses and to ameliorate unfair treatment of subcontractors, helped the above mechanisms sustain and reinforce themselves. Government-backed small business financing organizations and the institution of small business cooperatives provided infrastructure for the survival and continuation of small firms and subcontractors -- a large part of which might have otherwise disappeared.

The marked prevalence and prosperity of subcontracting in Japan can thus be understood as an evolutionary product of a complex interaction amongst historical, socioeconomic, organizational, technological and political factors. The foregoing review of my study suggests that mechanisms of the present Japanese subcontracting systems cannot be meaningfully analyzed in terms of dualism, bargaining relations, technology or culture alone.

How specific, then, is the Japanese experience? The last several decades have seen a remarkable diffusion of Japanese products all over the world. The general image of Japanese products as 'cheap and bad' has turned into 'high quality'. Simultaneously, the competitiveness and flexibility of Japanese production organizations have become an object of international attention. Given this, do tendencies towards the post-commodity markets -- which appear to be prevalent amongst advanced economies -- also indicate that non-Japanese competitors can benefit from adopting Japanese production organization? More specifically, are Japanese subcontracting institutions -- a curious product of the idiosyncratic trajectory of Japanese capitalism and common properties of capitalism in general -- transferable to other industrial societies? Does it make sense to do so? Do competitors want to do that? Or do they have their own solutions and alternatives?

These are both hypothetical and empirical questions. As yet, they are open questions too. Recent evidence on international encounters in the automotive industry -- through the increasing number of joint ventures and 'transplants' -- indicates that the answer to these questions is probably yes -- with qualifications, however.

Across industrial societies there are of course substantial differences in unionization, the degree of dualism, subcontracting institutions, government policy on small businesses, availability of technologies, and other infrastructural factors. To be sure, these differences seriously affect, circumscribe or promote cross-fertilization. Moreover, the constitution of capitalism itself -- be it neocorporatist, 'statist' or 'laissez-fairist' -- critically defines the viability of subcontracting institutions.

Given these qualifications, however, results from my international field research on automotive components supply indicate that adaptations to the hierarchical cluster control model, with its purposively redefined division of labour moving away from arms length relationships, are -- or are going to be -- fairly widespread. (For example, compare Fuji Electric with Daimler-Benz in Figures 7 & 8.) Even if manufacturers are not currently achieving all the desired results, they are striving for them. These observable tendencies suggest that, once stripped of idiosyncratic attributes and cultural myths, so-called Japanese production and subcontracting organizations may indeed represent a fairly universal response to changing environments that industrial societies face today.

In this connection, Kenny and Florida (1988:147) note:

[Japan] currently stands at the center of a far-reaching process of technological and economic restructuring that will affect both the future trajectory of the international economy and the position of nation-states within it as well as the role and well-being of workers in yet another phase of capitalist development.

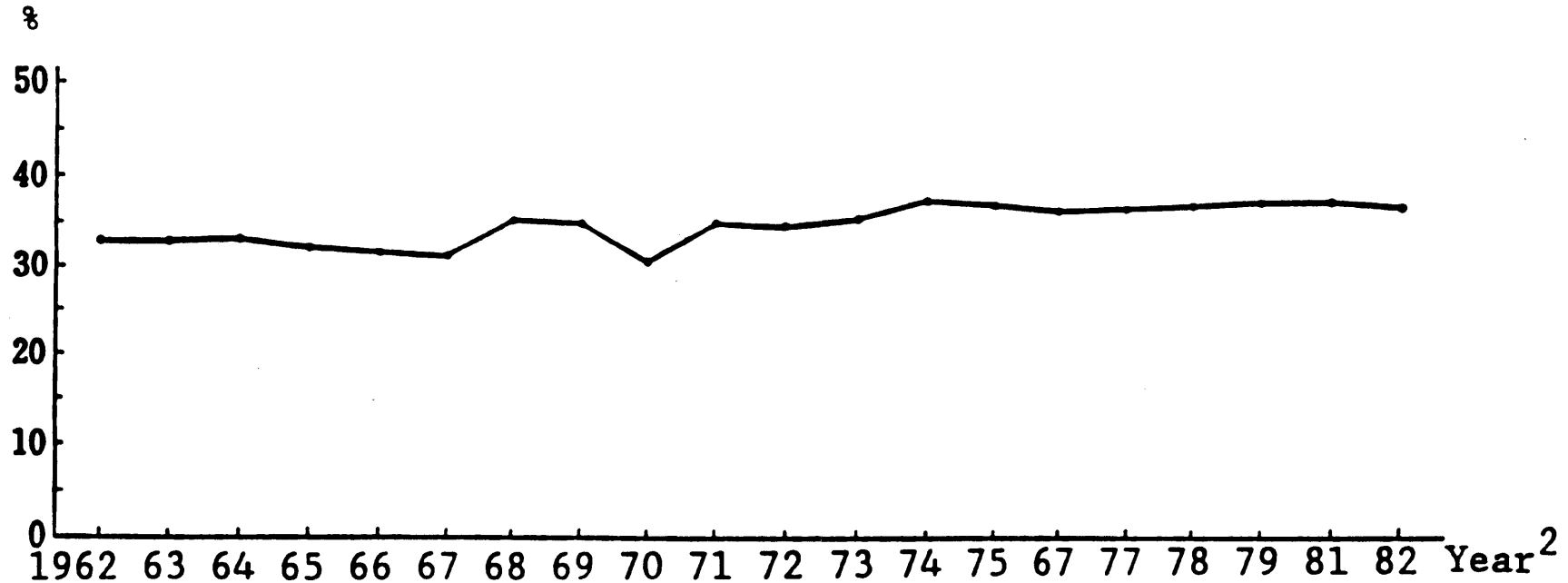
Or, perhaps, it is too early to claim such a thing, while too late to discuss the subject matter merely in terms of narrow analytical theories such as dualism, transaction cost economics, and the like.(2)

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(2) Professor Charles F. Sabel of the Massachusetts Institute of Technology once commented in private communication: 'It is too late to write off dualism, but too early to write on a new system'.

Figure 1.

Share of Value Added by Small Firms (1962-1982)<sup>1</sup>

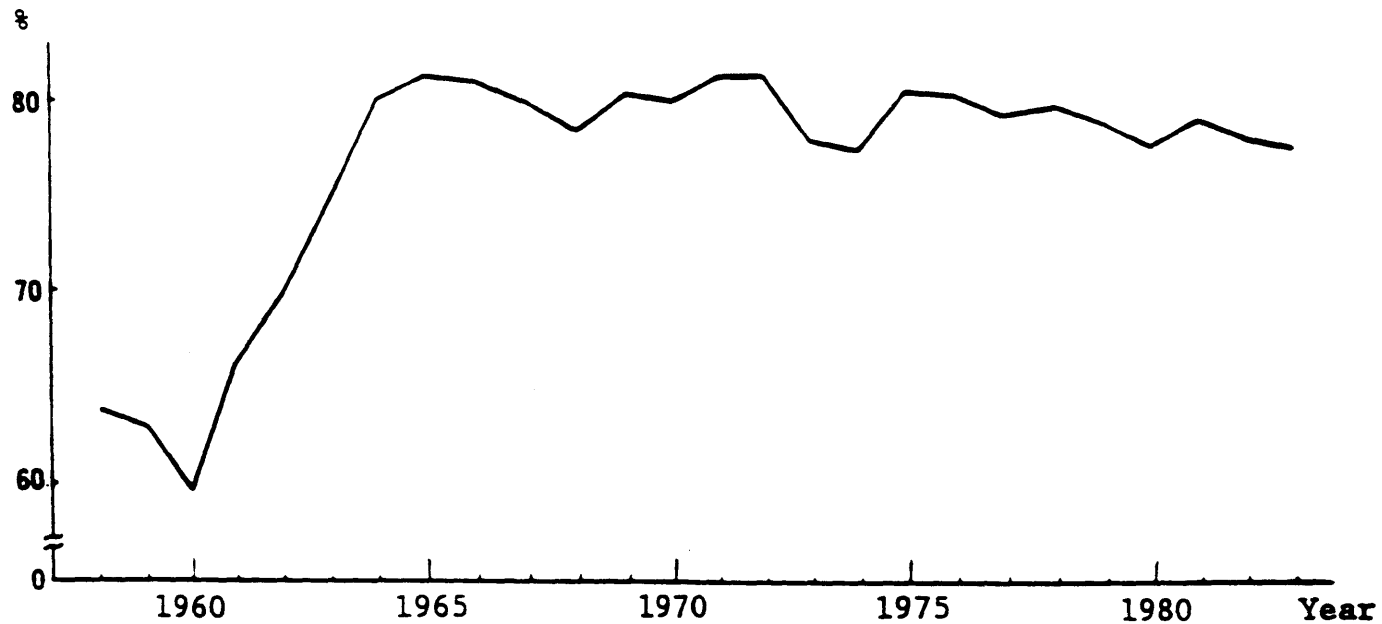


<sup>1</sup> Small firms refer to firms with 20-299 employees.

<sup>2</sup> The year 1980 is missing in the source.

Source: Small and Medium Enterprise Agency (SMEA), the Ministry of International Trade and Industry (MITI) (1985a:97), Chusho Kigyo Hakusho (Small and Medium Enterprise White Paper). Original Source: MITI, Kogyo Tokei Hyo: Kigyo Hen (Statistics on Industries: Enterprise Edition).

Figure 2. Interscale Wage Differentials<sup>1</sup> in Manufacturing Industries (1958-83)



<sup>1</sup> Refer to a percentage of average regular salary in cash for males at firms with 10-99 employees as opposed to the same at firms with 1,000 or more employees (-100).

Source: Small and Medium Enterprise Agency (SMEA), the Ministry of International Trade and Industry (MITI) (1985b:23), Small Businesses in Japan. Original Source: The Ministry of Labour, Basic Statistical Research on Wage Structure.

Table 1.

BREAKDOWNS OF SUBCONTRACTING AT FUJI ELECTRIC'S TOKYO PLANT  
(1965-90)

(Percentage/Value Based)

<u>Years</u>	<u>Processes*</u>	<u>Subassembly**</u>	<u>Finished Products Assembly</u>
1965***	45	28	27
74	23.7	31.6	44.7
80	19.0	40.5	27.8
85	18.3	33.7	48.1
90****	15.0	24.3	60.7

\* Machining, stamping, sheet metals, and surface treatment (e.g., painting, plating).

\*\* Primarily, electrical boards subassembly.

\*\*\* Figures for this year are estimates.

\*\*\*\* Projected.

Source: Fuji Electric's Tokyo Plant, 1986.



Table 2.

TOYOTA'S CONTRACT ASSEMBLY (1987)

<u>Cars</u> (incl. Vans)	<u>Assemblers</u>								
	<u>TMC</u>	<u>TAL</u>	<u>TAB</u>	<u>KAW</u>	<u>Cen</u>	<u>HNM</u>	<u>Dai</u>	<u>AAB</u>	<u>GAB</u>
Century				C					
Crown	Csh			Csvw					
Mark II	Cshvw			Csh					
Chaser				C					
Cresta				C					
Camry	C								
Vista	C								
Corona	Cscl		Csvwr5		Cs				
Carina	Ch		Cs		Cvwr5				
Celica	C								
Soarer	C								
Supra	C								
Corolla	Cscw2	Cl		Csc			Csvw		
Sprinter		Cl		Csc					
Tercel/Corsa	C35						C345		
Caribu	C								
Starlet		C							
Publica P/U		C							
MR2					C				
<hr/>									
<u>Mini Vans</u>									
Hi Ace			C						
Town/Master Ace			C				C		
Lite Ace			C						
<hr/>									
<u>Trucks</u>									
Dyna 2t	F		CB					CB	CB
Toyo Ace 1.5t	F		CB						
Hi Ace	F		CB					CB	
Town/Lite Ace	F		CB						
Hi Lux	Cpm					Cp			
Land Cruiser	F							CB	
Big Truck	F		CB						
Blizzard							C		
Stout	F								CB
Coaster	F							CB	

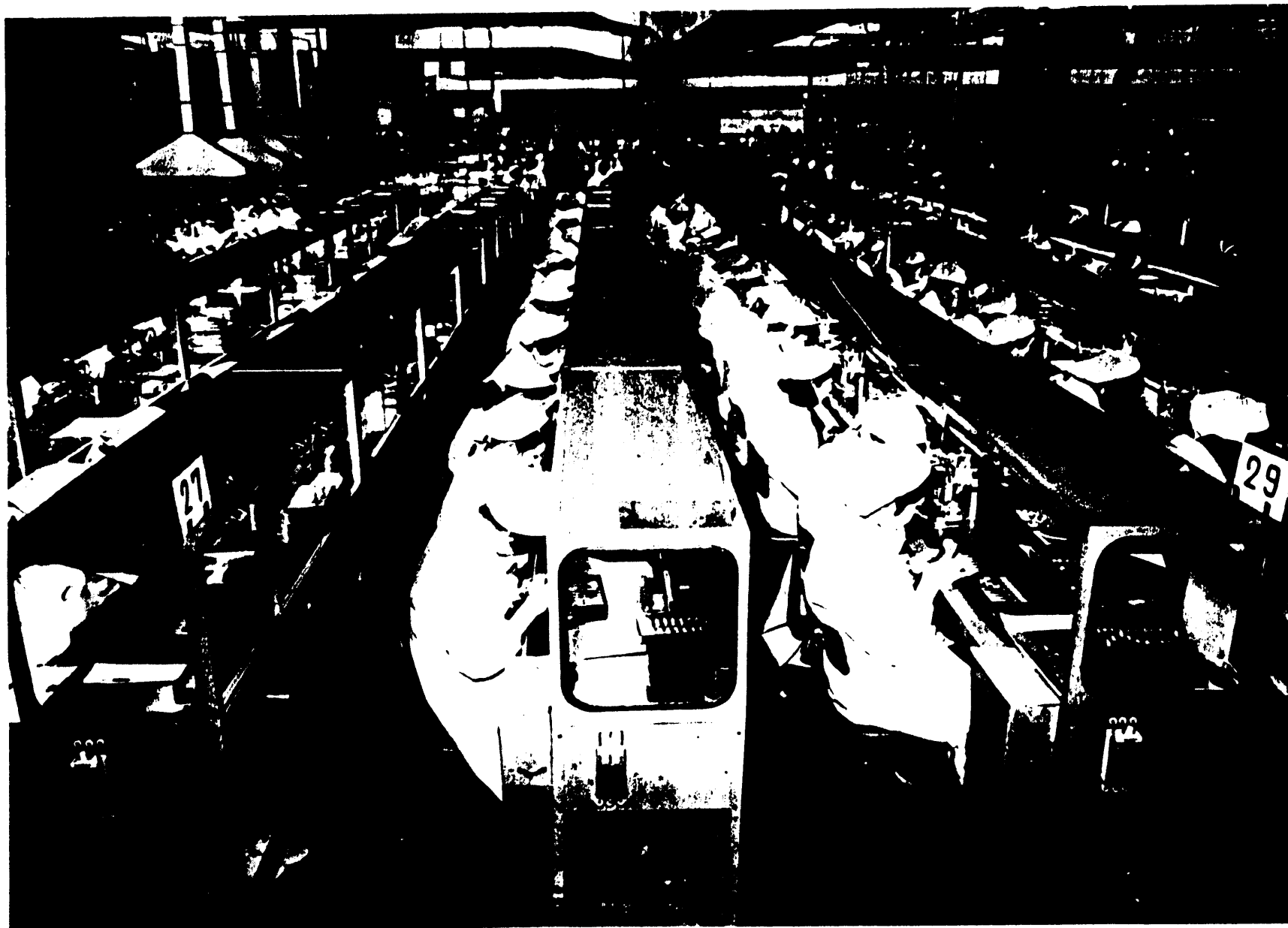
C: Complete Assembly. F: Final Assembly. CB: Cab Assembly.

TMC: Toyota Motor Corp. TAL: Toyoda Automatic Loom Works.  
 TAB: Toyota Auto Body. KAW: Kanto Auto Works. Cen: Central  
 Car. HNM: Hino Motors. Dai: Daihatsu Motors. AAB: Arakawa  
 Auto Body. GAB: Gifu Auto Body.

s: sedan. h: hardtop. c: coupe. v: van. w: station wagon. l:  
 liftback. p: pickup. m: multi-purpose. 345: no. of doors.  
 r: rear wheel drive.

Source: Toyota Motor Corporation, 1987.

Figure 3. Hitachi's Electron Tube Shop in the Late 1950s



Source: Hitachi (1960), Hitachi Seisakushoshi (History of Hitachi), Vol.2.

Figure 4. Hitachi's Automated Video Cassette Recorder  
Mechanism Assembly Line in the Mid-1980s



Source: Hitachi (1986), Guide to the Tokai Works, pp.10-11.

Figure 5.

The 'Alps' Structure of Japanese Subcontracting

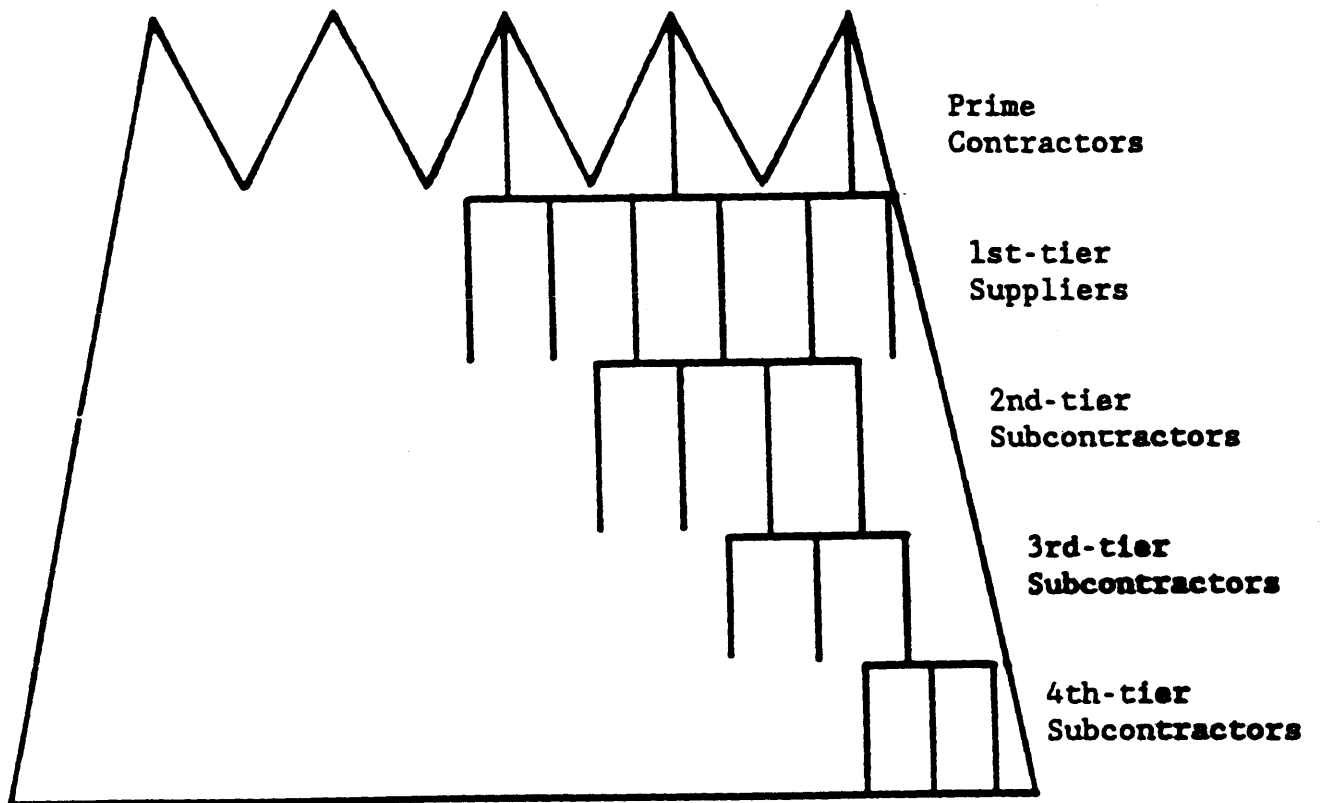


Figure 6.

# THE "ALPS" STRUCTURE ©

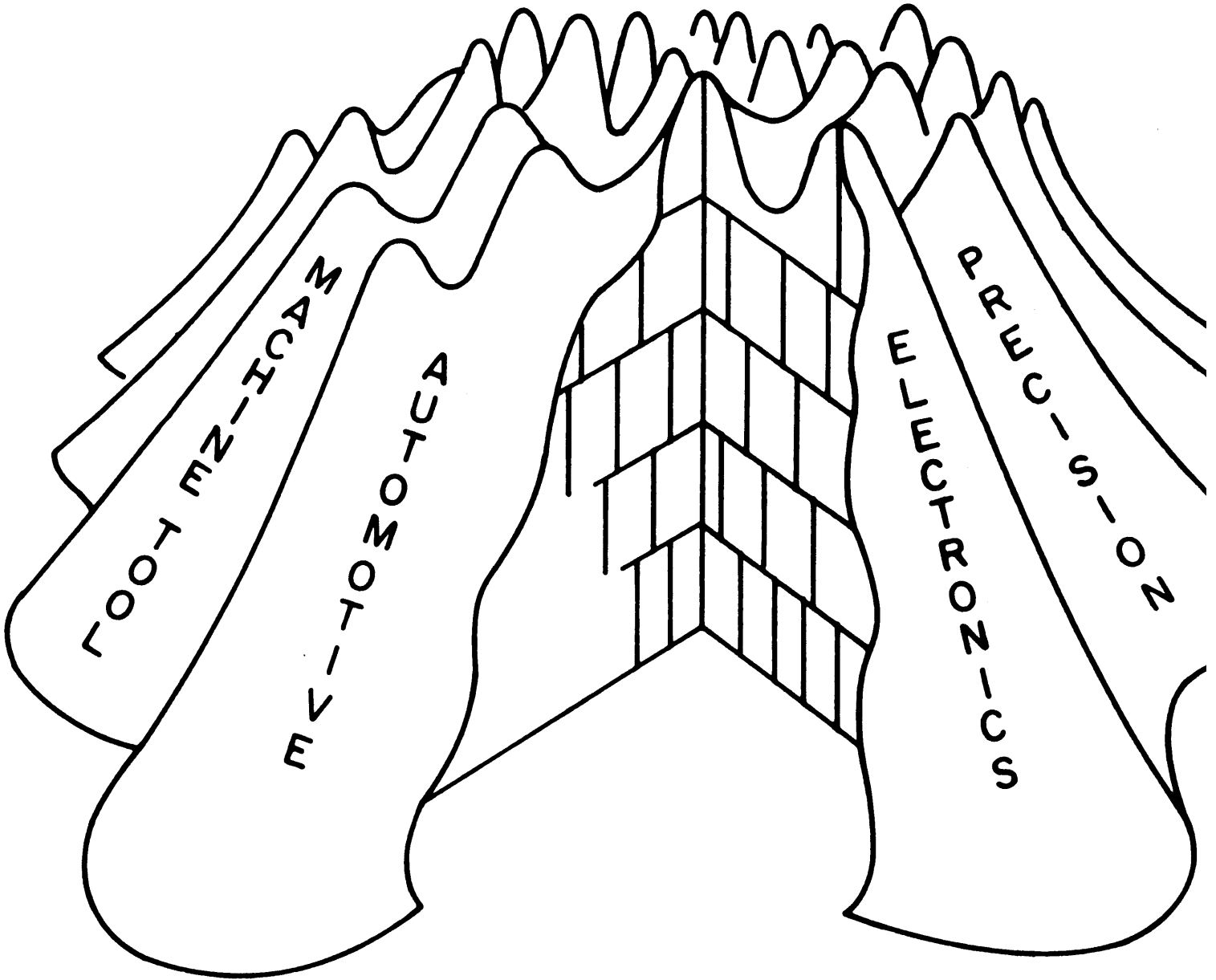
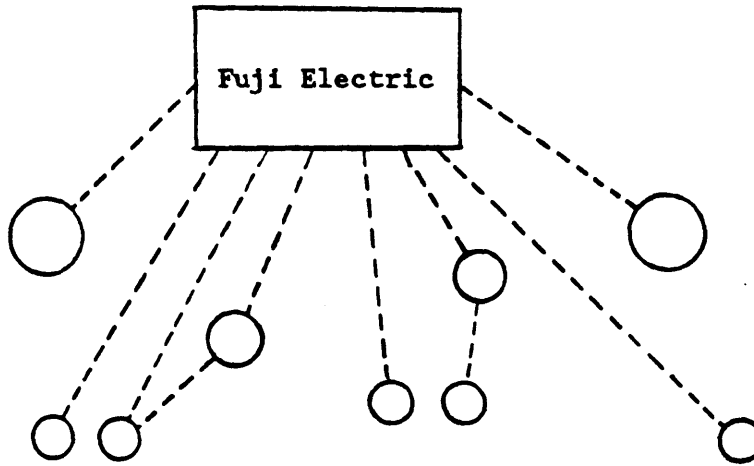


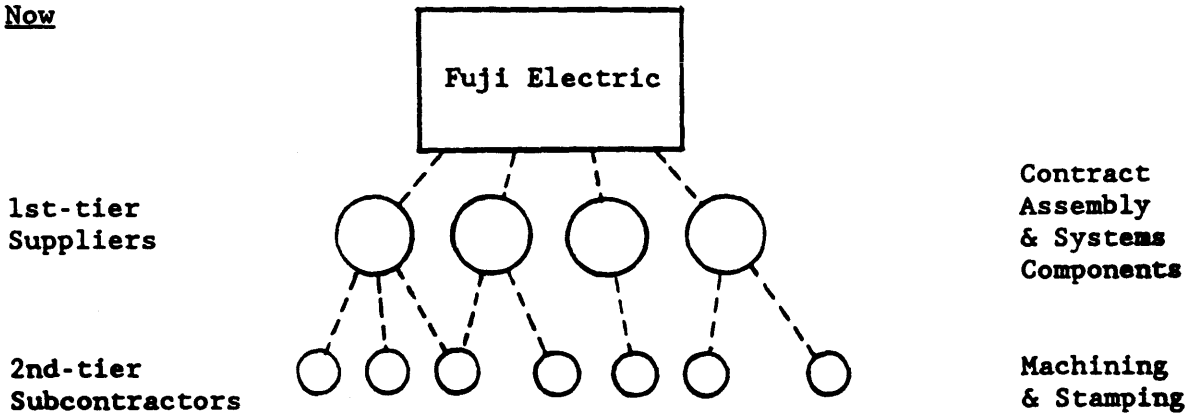
Figure 7. Hierarchical Cluster Control: Fuji Electric (1986)

Past



Individual Relationships

Now

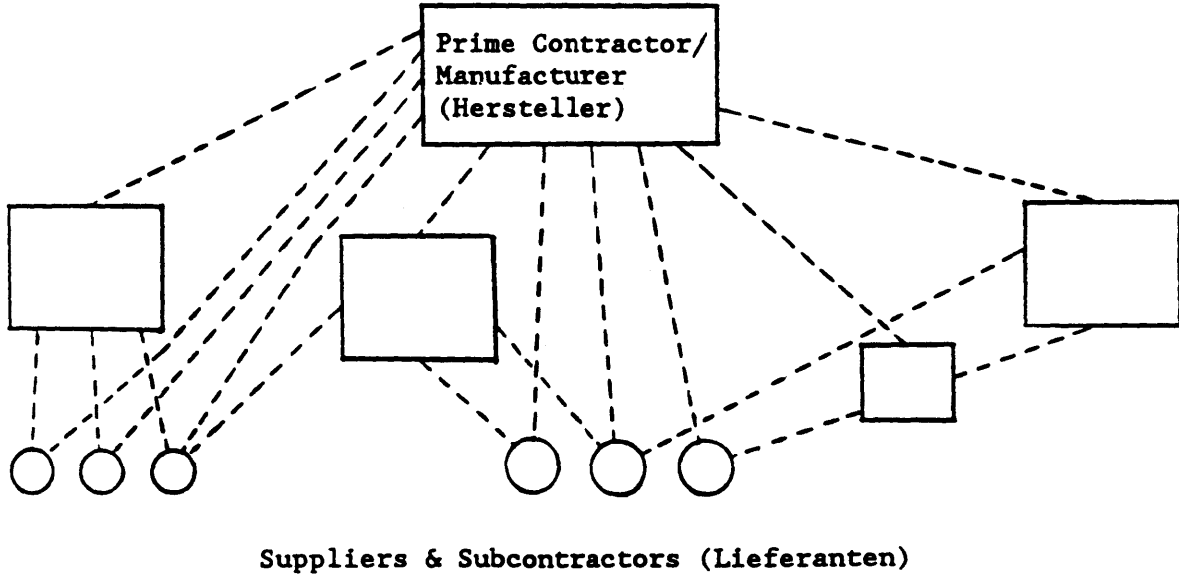


Hierarchical Networking  
 Reduction in Direct Contacts  
 1st-tiers Control 2nd-tiers  
 Externalizing 'Dried Out' Production

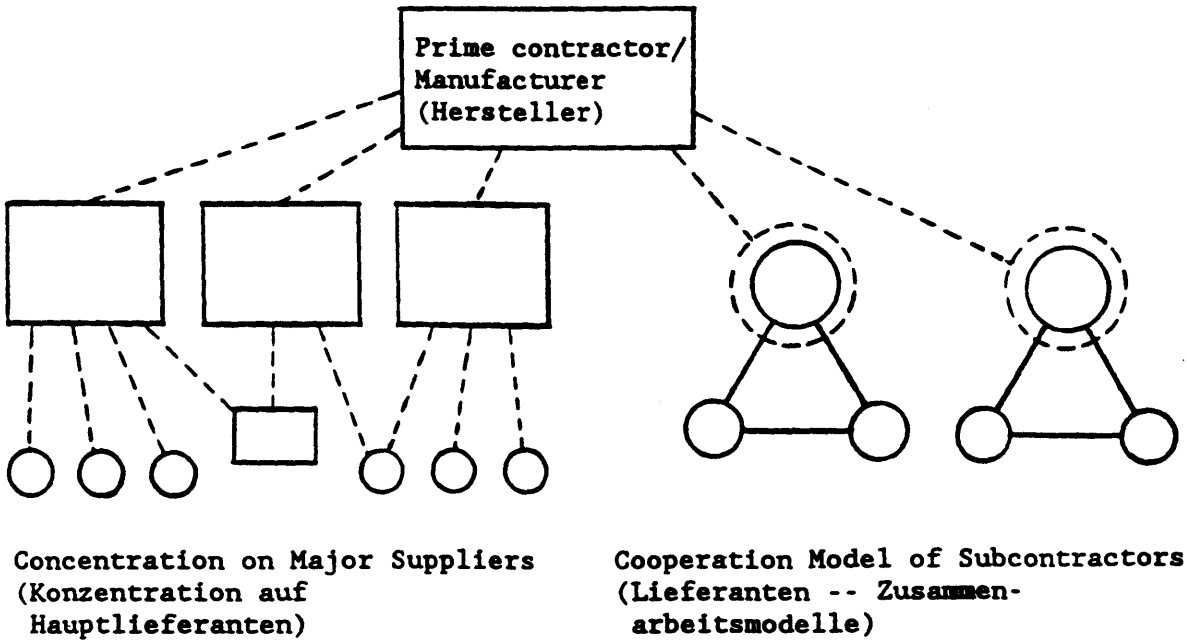
Source: Interviews at Subcontracting Control Section, Materials Department, Fuji Electric's Headquarters, and Subcontracting Section, Materials Department, Fuji Electric's Tokyo Plant, 3 April 1986.

Figure 8. Changing Supplier Relations at Daimler-Benz  
(Veränderung der Zulieferbeziehungen) (1988)

Before (Ist)



After (Wird)



Source: Interviews at the Department of Materials Management  
 (Materialwirtschaft)/Procurement Logistics (Beschaffungslogistik),  
 Daimler-Benz AG, Stuttgart, 14 September 1988.

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