TOYOTA MOTOR MANUFACTURING AUSTRALIA IN 1995: AN EMERGENT GLOBAL STRATEGY

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The purpose of this paper is to describe and analyze the manufacturing operations of Toyota Motor Manufacturing Australia Ltd., an Australian subsidiary of Toyota Motor Corporation, from the point of view of "emergent global strategy". It is based on an exploratory case study.

In the field of strategic management, the notion of "strategy as plan" has been a prevalent idea for many years, in which strategic intent precedes strategic implementation (Andrews, 1980, Hofer and Schendel, 1978, etc.). There has been another concept of strategy concepts, "strategy as pattern", which assumes the possibility that competitive strategy may be formed even without a prior intention to be competitively rational (Mintzberg and Waters, 1985). Mintzberg and his colleagues call a strategy that was unintended but realized "emergent strategy"[1].

Such arguments for emergent strategies can be applied to global operations. There has been, of course, a mountain of literature on global strategies of manufacturing firms in the field of international management. The transnational strategy (Bartlett and Ghoshal, 1989), which tries to link international operations with distinctive resources and capabilities by a network of people, materials, money, technology, and knowledge, for example, has attracted much attention. International Motor Vehicle Program of MIT (Womack, et al., 1990) also advocated a similar global network. The existing works on global strategic management, however, tend to be explained by the "strategy as plan" concept, driven by a prior grand design and deliberate decision making at the headquarters. Rational decisions do more or less guide international operations of manufacturing firms, but it is also possible that the global network may evolve into what the original intention did not predict. This paper pays a special attention to te latter aspect, or "emergent global strategies" that result from a series of crises and responses.

As a case study, this paper describes and analyzes Toyota Motor Manufacturing Australia Ltd. (TMCA). In this company, a strategy of overseas manufacturing capability-building and global networking of managerial resources has

[1] For a related concept in sociology, «latent function», which refers to when a function turned out to contributed to a system's survival but was out motivated by prior intention, see Merton, 1968.

emerged as a result of inevitable responses to intensifying local competition in Australia. TMCA, originally established as a local-market-oriented operation that fit the Australian government's import substitution policies and the protected domestic market, evolved into an important node of Toyota's global manufacturing network as it struggled to survive in a series of crises. This process may be seen as an interesting example of an emergent strategy, in which day-to-day local manufacturing operations for survival and global strategy formation are virtually inseparable, unlike deliberate strategies based only on articulated global visions.

Before analyzing the case, let me explain the background - the Australian automobile industry and its transformation. In the 1980s, the Australian government abandoned its protectionist automobile industry policy that it had supported for many years. This can be regarded as a pioneering case of a government's effort to rationalize an inefficient local industry created by protectionism.

From the Australian local makers' point of view, however, such a drastic change of industrial policy inevitably created a serious crisis. Facing fierce competition from imported vehicles, one local auto maker has already closed down its Australian manufacturing operation. The surviving local makers are set to continue to face very severe competitive environments.

In the middle of this crisis, TMCA has explored its way toward a relatively autonomous overseas operation with a mid-size manufacturing facility. In fact, it appears to have accumulated capabilities as an important node of Toyota's global manufacturing network through rather aggressive capital investments, the consolidation of local manufacturing facilities, the rationalization of production systems, improvements in human resource management, the formation of vehicle-parts complementary networks, strategic alliances with other makers and so on. This paper describes the above process as a kind of emergent global strategy formation.

Compared with the overseas operations of Japanese auto firms in Asean and other Asian countries, the Australian operations may be much less known to the public. However, the case of TMCA may be regarded as a pioneering example of how an internationalized manufacturing firm strengthens its overseas operations vis-a-vis a flood of imports into the host market after the protectionist policy of a local government is lifted.

It is also important to note that a crisis situation tends to reveal inter-firm differences in interpreting environments and forming strategies. It is thus possible that the intensifying competition in the Australian auto market may reveal "Toyota-ness", or a distinctive competence of this high-performing manufacturer. Against this background, let's investigate Toyota's Australian operations.

AUTOMOBILE MARKET, INDUSTRY AND INDUSTRIAL POLICIES IN AUSTRALIA

Market Trend

For various economic and geographical reasons, the car ownership ratio in Australia is quite high. As of the mid 1990s, there were about 10 million cars and trucks in operation while its population was only 18 million (60 million vehicles and 130 million people in Japan). The ownership ratio itself has been almost saturated, however. Average age of the vehicles (about 10 years) and average life expectancy (about 20 years) are both quite long. People tend to keep old cars. As a result, the domestic market (mostly replacement demand) is rather small and saturated at around half a million units per year. (see table 1)

The market structure is somewhat similar to that of the U. K. in that about half of the passenger car demand in Australia is for so called "company cars", which companies own and lend to their employees as a part of their fringe benefits. Since the companies also pay for gasoline, the drivers (?employees) do not care much about fuel efficiency. Thus, company cars occupy 80% of the large car market in Australia. By contrast, individuals tend to buy inexpensive small cars or used cars.

Car leases have begun rather recently, but are rapidly expanding. There may be volume discounts on the lease fee. Lease periods are typically three years, after which ex-lease vehicles are sold to used car markets. People in Australia, a former British colony, tend to regard themselves as European-style car users. The fraction of cars equipped with automatic transmissions (AT), for example, is 60% in the case of the Toyota Corolla, which is much lower than the level in the US market, if not in Europe.

Table 1: *Outline of the Australian Automobile Industry*

	Production		Production		Import		In Use
	Passenger	Commercial	Passenger	Commercial	Passenger	Commercial	Total
'60	259340	66910	244818	65541	7807	692	2813300
'70	391946	81844	413061	88537	42362	16255	4783300
'80	318048	47179	453378	121486	150218	102759	7263100
'87	309962	20279	369335	81469			9022600
'88	317367	29661	418699	118238	108289	101204	9221100
'89	356898	28786	464322	131946	174692	132632	9489500
'90	360919	22737	486947	127793	170338	110291	9776600
'91	278423	15372	416783	81322	176260	87467	9814741
'92	270170	14932	453214	138499	189421	102254	9954500
'93	285076	20093	455911	91859	199824	102254	10139800
'94	285900	13800	502011	106359			10407400
'95	293631	25405	527132	106351			10638200

Source: JAMA, Nikkan Jidosha Shinbun (Automobile Daily News), etc.

Since the government's protectionist policy was relaxed, complete vehicles have been imported from various countries. Imports from Korean and Spanish-built vehicles were growing particularly rapidly as of the mid 1990s.

Transformation of the Automobile Industrial Policy

From the 1930s through the 1980s, Australia's automobile industrial policies had consistently been projectionist in nature, with such import-substitution measures as high import tariffs, import quotas for complete vehicles, local content regulations, and so on.

Behind such a policy was, apparently, the doctrine of so-called "infant industry protection", which insists on temporary protection of a domestic industry in order to buy time for its take-off in terms of international competitiveness. Typical examples include the Japanese and Korean auto industries, which followed the path of protection - establishment of international competitiveness - relaxation of the protection, although the net effects of the industrial policy are not clear.

The Australian auto industry, however, was apparently suffering from the vicious cycle of chronic protectionism and retention of inefficient sectors, a typical trap of import substitution policies. The fact that the Australian domestic market is small and saturated amplified this problem through the chronic high-cost structure of small volume producers.

This industrial policy changed completely in 1988, however, when the trade minister Button announced a drastic conversion of the policy toward the relaxation of protectionism and the promotion of exports--the so-called "Button plan". The new policy, targeting passenger car producers and specialist component producers (but excluding commercial vehicle producers and replacement parts suppliers) consisted of the following elements:

- Gradual reduction of tariffs for complete vehicles (see figure1: 15% in 2000)
- Abolishment of import quotas (1988)
- Penalties against small volume production models (regulation of minimum annual production volumes by models)
- Export promotion measures
- Imported parts concession

The above policy aimed at promoting competition by trade liberalization and thereby rationalizing the product mixes and production systems of local producers, as well as improving quality and productivity and lowering prices. In order to alleviate the damages to the local producers, however, such measures would be

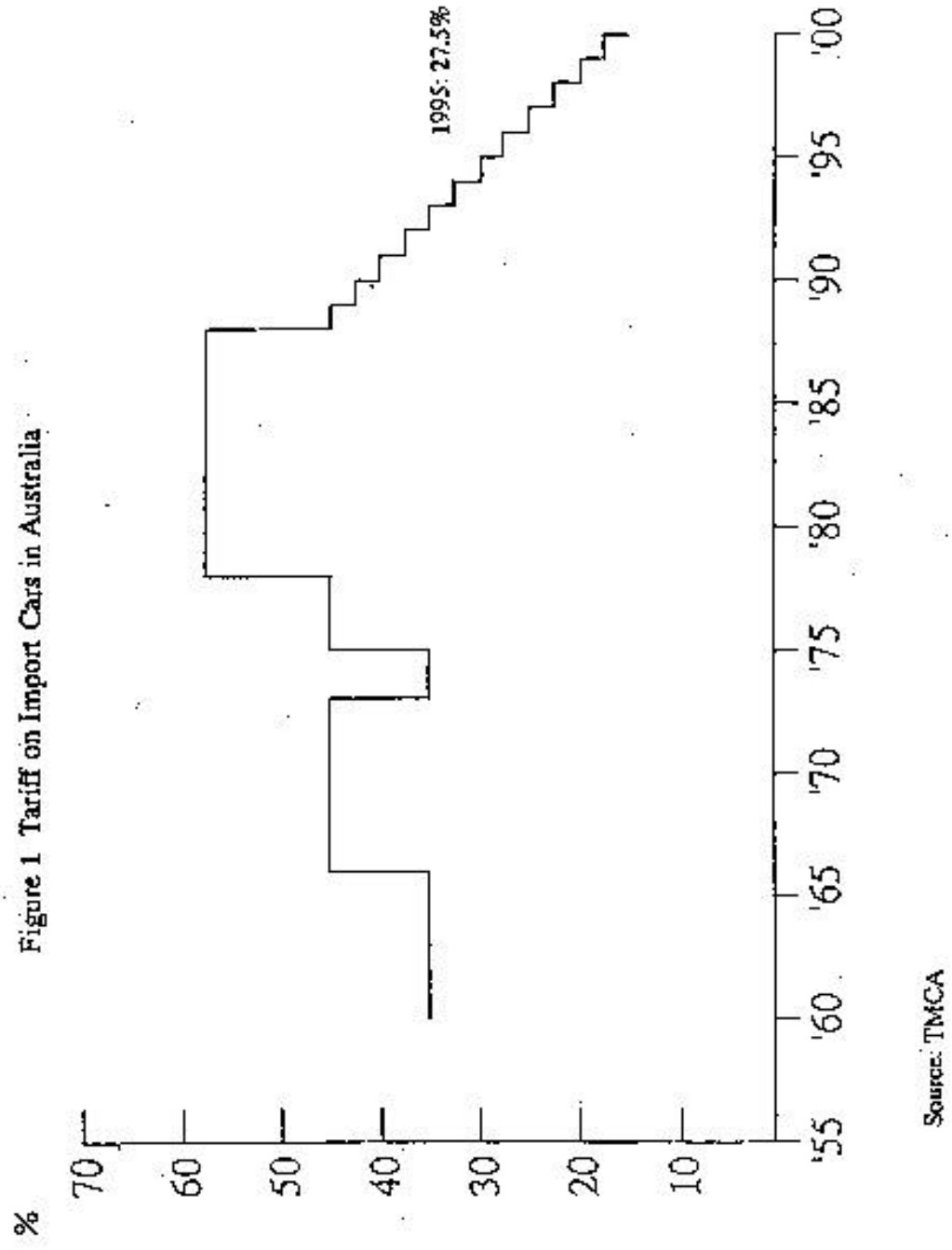


Figure 1 Tariff on Import Cars in Australia

Source: TMCA

introduced gradually with micro-level supports for the local makers.

It is rather generally observed that a country with import-substitution policies shifts its emphasis to export promotion while keeping some forms of protectionism in place. The present Australian case, however, is characterized by a more compressed schedule of shifting to export promotion and lifting protection (although step-by-step) simultaneously. Such a drastic policy change is rather rare in the world auto industry.

Note also that the new policy virtually restricts the number of domestically produced models (consolidation of product mix), which is different from restriction of new entrants (historically observed in Korea, for example). This policy tends to result in exchanges of models and other tie-ups between firms aiming at product-level economies of scale.

The Automobile Industry in Australia

The Australian automobile industry has a fairly long history, originating back in 1925, when both Ford and GM started local assembly operations. Both firms also started local knock-down assembly in Japan at roughly the same period.

After World War II, domestic demands of the automobile continued to grow until the 1960s, and this, together with protectionist-localization policies by the government, induced new entry of such foreign auto makers as VW (newly establishing MPL in 1957), Toyota (starting consign production at Australian Motor; 10% capital participation in 1968; 50% in 1970; 100% in 1988), and Chrysler (acquisition of Roots Motors in 1965). Then Nissan purchased the VW subsidiary in 1976, and Mitsubishi bought out Chrysler's position in 1979, creating a five company regime with two American and three Japanese auto makers.(see table 2 and figure 2).

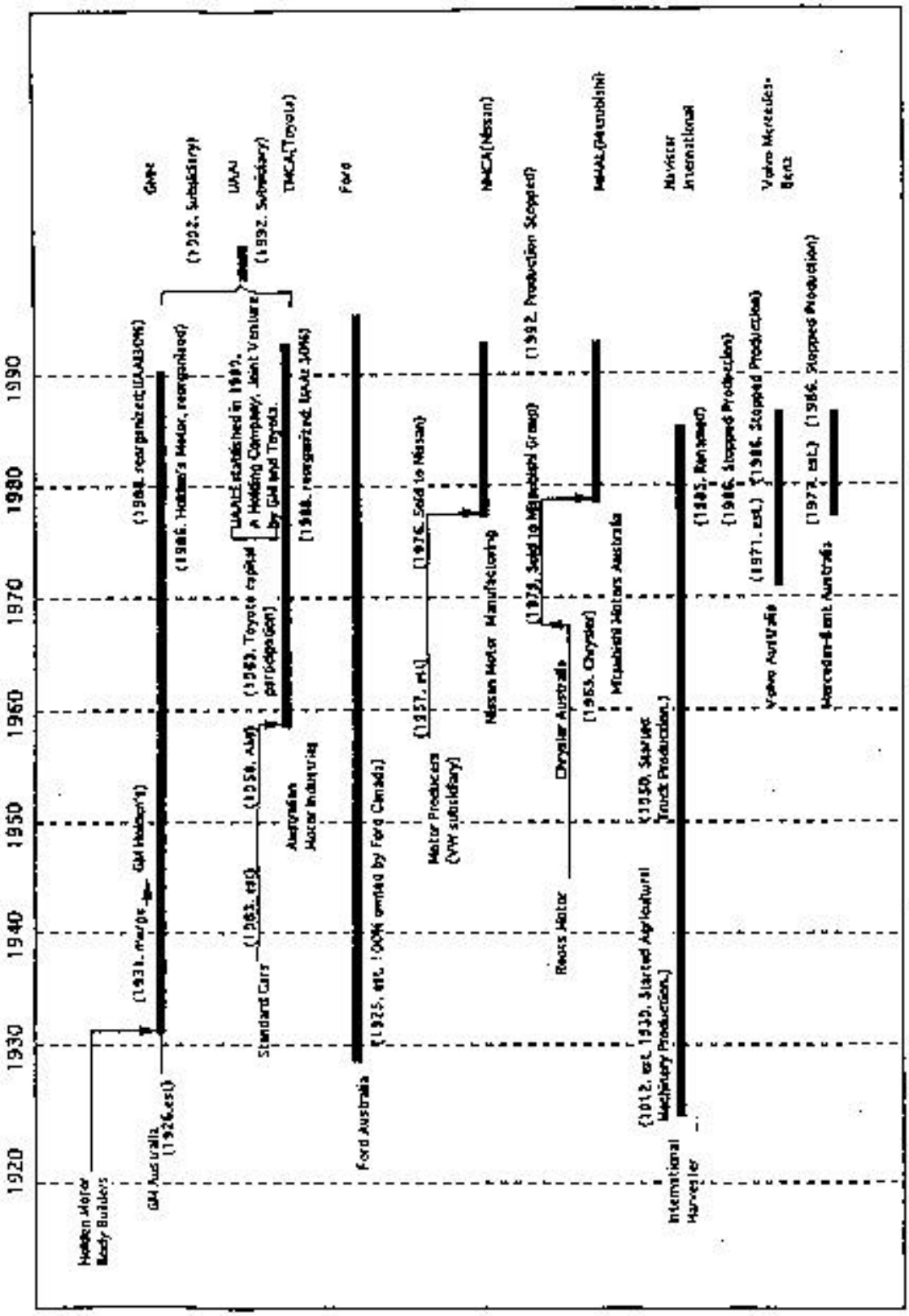
In 1992, Nissan divested from Australia, leaving four local passenger car producers, Ford, GM (Holden), Mitsubishi, and Toyota as of the late 1990s.

Local production facilities are concentrated in South Australia State (near Adelaide; GM and Mitsubishi) and in Victoria State (Melbourne; Ford and Toyota).

Table 2. *Australian Motor Vehicle Production (Incluging Export)*

	Ford	GM-Holden	Mistubishi	Nissan	Toyota	total
1987	129,899	99,060	45,691	36,730	46,221	357,601
1988	130,049	87,753	53,220	46,851	55,134	373,007
1989	157,578	110,831	50,754	52,357	59,474	430,994
1990	156,686	103,918	36,547	57,918	72,131	427,200
1991	123,634	78,640	30,948	35,359	59,244	327,825
1992	112,801	90,845	39,024	20,231	50,021	312,922
1993	126,409	97,543	52,350	nil	67,400	343,702
1994	130,058	122,046	48,063	nil	77,741	377,908

Source : TMCA

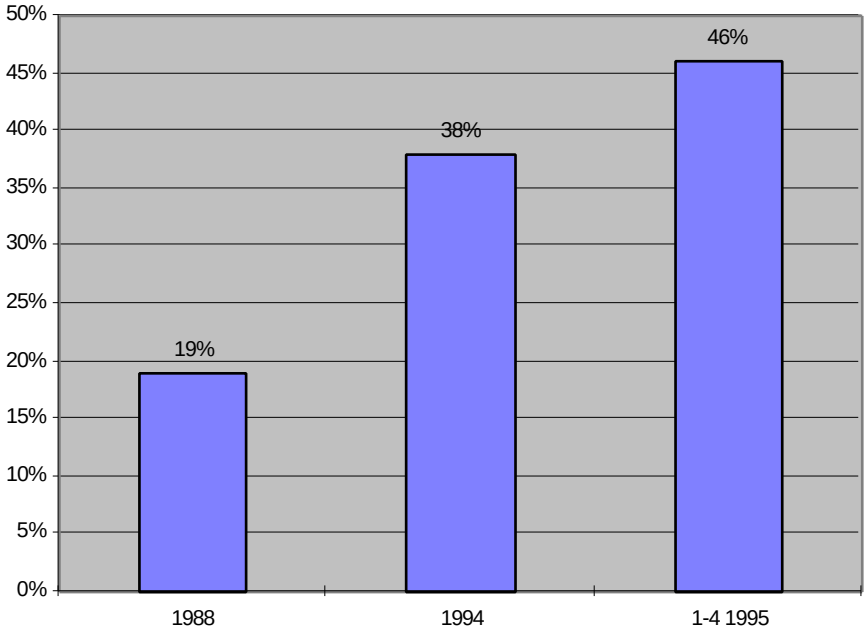


Source: JAMA, Nikkan Jidosha Shinbun (Automobile Daily News).

Competition against imports has intensified in recent years. As of 1995, for example, when the tariff on imported vehicles was 27.5%, the share of import vehicles had already reached 40% (see figure 3). The tariff will further decrease to 15% in the year 2000, which should further push up the import share. Accordingly, the variety of domestically sold vehicles increased dramatically from 200 in 1978 to 550 in 1995-good news for Australian consumers, but a bad news for local producers.

US Makers: Annual production of the two US makers has been fluctuating at level of roughly 100K~150K each since the late 1980s. Both firms have autonomous operations with product development, production and sales functions, as well as Australia-specific models in the large car segment. Both GM and Ford are estimated to have 600 to 700 people in their respective product development groups.

Figure 3 Share of Car Imports in Australia



Although the US makers develop and produce unique models (GM Comodore and Ford Falcon), they are more like derivative models which made use of the companies' global networks. For example, the Comodore, a large car of GM-Holden, has a unique floor panel design, but its door design was derived from a vehicle from Opel, GM's European subsidiary, and many other component designs were carried over from those of GM in the US.

Because of the small volume of local production per model (less than 100K units annually), the two US makers have tried to lower depreciation costs by making their chassis-platform change cycles quite long. Body exteriors receive minor modifications year by year, as in the traditional annual model change policy of the American auto makers, but the platforms themselves have remained unchanged for as long as 20 years. As a result, some component technologies of the GM and Ford models have become quite obsolete. As of 1995, for example, the Ford Falcon was still using rigid suspension, and the GM Comodore was propelled by an overhead valve (OHV) engine, when independent suspensions and overhead camshaft (OHC) engines were the prevalent mode worldwide. Down-sizing of the large cars has not made significant progress. Thus, the large models by the US auto makers tended to be good only for the Australian domestic market.

By 1995, GM had decided to concentrate only on the large Comodore in local production, and received the OEM-supply of Corolla (Nova) and Camry (Apollo) from Toyota (TMCA), as well as receiving Opel's compact car, Corsa, from its Spanish factory, creating a "patch-work" full line product mix. The Nova and Apollo shared their chassis and exteriors with the Corolla and Camry respectively, but they had modified front grilles, head lamps, and rear combination lamps for superficial product differentiation.

Ford was reconsidering its strategy in Australia in 1996, taking into account the Australian government's industrial policies after the year 2000. As of 1995, no budget for new capital investment in Australia had been approved by Ford's US headquarters.

Mitsubishi: Mitsubishi's Australian subsidiary (MMAL), was formed in 1979 through the purchased of Chrysler's Australian subsidiary. Its annual production volume has remained between 30K to 50K units in the late 1980s and the early 1990s. The facility has produced the "Magna", a fairly large sedan, which was originally an enlarged derivative model of Mitsubishi's Japanese model "Gallant". The 1995 Magna was a modification of Mitsubishi's larger model in Japan, "Diamante" (previous generation) with its "B-pillar" design changed. Although it is generally difficult for auto makers to change models simultaneously in Japan and Australia, it is true that Mitsubishi was renewing its locally produced models much more frequently than the US-based makers.

Auto Parts Industry in Australia: The Australian auto parts industry consists mostly of local subcontractors producing non-functional parts and the Australian operations of large US and European parts suppliers making functional parts. There are only a few Japanese parts suppliers operating in Australia[1]. In other words, unlike US transplants, Japanese transplants in Australia are unable to rely much upon local facilities of Japanese parts suppliers.

[1] Exceptions include Denso (locally producing radiator, air conditioner and meter), Toyo Rubber (instrument panel pad), and Bridgestone (tire and steering wheel).

The Impact of Industrial Policy Changes on the Companies' Strategies

The strategic responses of the local auto makers to the new industrial policy that relaxed protectionism can be summarized as a combination of the following four measures: (i) consolidation of models and factories; (ii) inter-firm coalition building; (iii) improvements of competitive performance at the plant level; (iv) divestment moves.

Consolidation of models: Due mostly to the Button plan, the number of domestically produced models decreased from 13 in 1984 to only 5 in 1994, while the number of assembly plants and assembly firms decreased from 7 to 4 and from 5 to 4 respectively (see table 3). Thus, the rationalization of the local model line-up was rather significant.

The model consolidation was particularly drastic in the case of the US makers. GM, for example, reduced its number of models from 4 to 1 between 1984 and 1994, and Ford from 3 to 1 during the same period. Thus, the Button plan made the U.S. makers virtually single-model-firms. This was a direct response to the new policy of imposing prohibitive tariffs on import parts when a model's annual production fails to reach 30K units. Among the Japanese firms, Nissan closed down its assembly transplant, and Mitsubishi reduced its number of models from 2 to 1, while Toyota has kept its two-model line-up (Camry and Corolla) as of the mid 1990s. The contrast between Toyota and US makers may come from their manufacturing strategies: the US makers apparently follow their traditional mass-production strategy for cost competitiveness; Toyota is more oriented to flexible production system by which it tries to enhance competitiveness of medium-size overseas operations.

Alliance among Local Subsidiaries : In order to maintain the full-line policy in the show room while consolidating locally produced models, the auto makers have to either import cars from their other factories outside of Australia, or buy complete vehicles from domestic competitors. In fact, since the announcement of Button plan in 1988, local auto assemblers in Australia have begun to form alliances with each other by mutually adjusting local models, commonizing parts and vehicle designs between them, and exchanging OEM supplies of complimentary

Table 3 : *Reduction of Production Models in Australia*

		1984	1994
GM-Holden		WB (Statesman/Caprice) Commodore Camira Gemini	Commodore
Ford		Falcon Telstar Lase/Meteor	Falcon
Toyota		Corona Corolla	Camry Corolla
Mitsubishi		Sigma Colt	Magna
Nissan		Bluebird Pulsar/Astra	
Total	Model	13	5
	Maker	5	4
	Plant	7	4

Source : TMCA

models. GM and Nissan originally had such a tie-up relationship, but Nissan switched to an alliance with Ford when Toyota and GM set up a joint venture.

Improvements of Productivity and Quality: One of the major objectives of the Button plan was to improve competitiveness of domestic auto makers. Indeed, according to the data of AIA (the government authority), manufacturing quality of Australian models has steadily increased since 1988 (see Figure 4). Among the local models, those of Japanese firms tended to enjoy higher quality during this period, but GM and Ford models were also improving. Overall, local models were narrowing quality gaps vis-a-vis imports.

The improvements in assembly productivity (person-hours per vehicle) was not as obvious as in the above case of quality, but it did improve from 40 person-hours per vehicle in 1988 to about 35 in 1993 (see Figure 5). This level is still far behind the world class assembly plants (less than 20 person-hours per vehicle, according to MIT's International Motor Vehicle Program), but nevertheless it is clear that significant progress has been made on this point.

To sum up, Australian assemblers were still lagging behind world class players in terms of manufacturing quality, design quality and assembly productivity, but they were steadily getting better, from which the government was convinced that its new industrial policy was successful as of the mid 1990s.

Strategic Differences Across Firms: The drastic government policy change inevitably had a major impact on the strategies of the local auto makers which had formerly been protected. They were forced to choose between exiting from Australian manufacturing operations or managing to survive by enhancing their products' competitiveness against imports. The government obviously tried to induce local makers to the latter solution, but there was also the risk of a total collapse of Australian car making. The Button plan, in this sense, was dangerous shock treatment.

Figure 4 AIA Quality Index

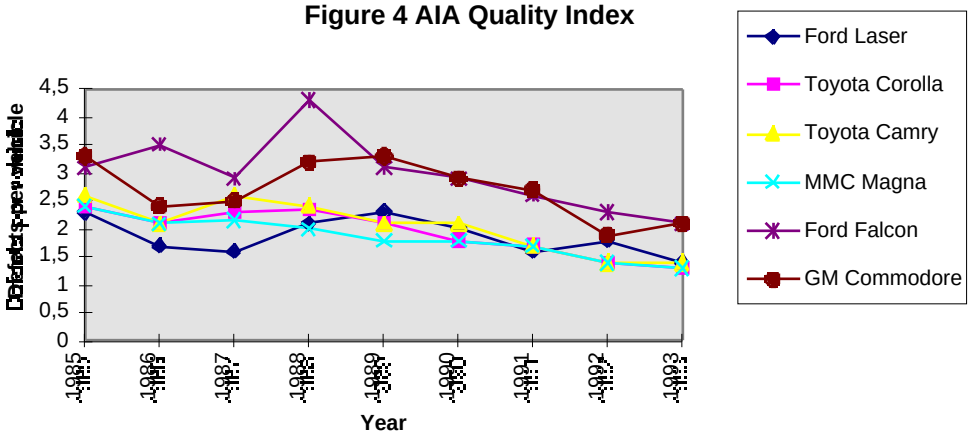
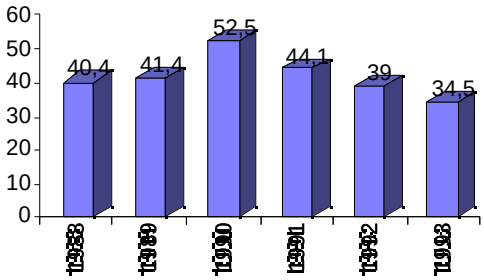


Figure 5 Assembly Productivity of Australian Plants (Average)



In fact, the local producers responded to the new policy differently. Nissan gave up local production and closed its plant in 1992. GM and Ford were trying to survive mainly by such defensive measures as model consolidation and plant consolidation, but they had not launched any significant strategies to renew their models in an effort to dramatically improve competitive performance.

By contrast, Toyota (TMCA) was the only local producer that was obviously making major efforts to upgrade competitive performance of its local operations. This is obvious from the fact that, as late as 1994, Toyota built its new Altona assembly plant with its state-of-the-art production system designs when the competition against imports had already been intensified. Although one cannot be overly optimistic about the future of TMCA as of the mid 1990s, it should be noted that Toyota was the only company that expressed its clear strategic intent to build up a core manufacturing capability in Australia as an important node of the company's global vehicle-parts network, rather than simply have an inward-looking local operation.

Mitsubishi was also trying to make its Australian plant an export center of the Diamante wagon and V-6 engines, but it was trying to do so through rather defensive measures: consolidating models and rationalizing production without much additional investment.

TOYOTA MOTOR MANUFACTURING AUSTRALIA (TMCA): OUTLINE

Basic Strategies of TMCA

Toward a Middle-Size Center for the Southern Hemisphere: The overall vision of President Nakagawa and VP Sakaue, as of 1995, was to make TMCA one of the mid-size hubs in Toyota's global manufacturing network. Compared with Toyota's large-size facilities in Japan and US, a medium-volume production lines such as TMCA may add significant flexibility to its global operations in terms of knockdown exports and production of Asian models. TMCA, in this sense, is meant to be a center of Camry production, covering not only Oceania but also South-East Asia and South Africa as export markets.

President Nakagawa has had a unique career, beginning with inspection duties and then participating in various overseas manufacturing operations such as Nummi in the US and Indonesia. VP Sakaue is a veteran expert of manufacturing engineering. Coordinator Shimizu has worked in the overseas planning division at the corporate headquarters, designing Toyota's global parts-vehicle network. Toyota might have appointed these three talents deliberately, taking into account TMCA's strategic role as a semi-autonomous hub in its global network.

The Profile of TMCA: Although TMCA is a relatively small overseas facility compared with the large operations in the US (e.g., Kentucky plant = TMM), it is a uniquely self-sufficient unit, unlike its US counterparts, with all the main functions including production, sales, product development, finance, and general administration. It is one of Toyota's oldest overseas operations, having started in the early 1960s. As mentioned above, TMCA's managers have a vision of growing it into one of the core production centers for the Camry with medium volume capacity, coordinating it's operations on an international scale with the two other Camry factories, the Tsutsumi plant in Japan and TMM in Kentucky, US.

Another distinctive feature of TMCA is its high degree of localization of managers. There were only three Japanese expatriates in TMCA itself: President (Nakagawa), Vice President in Manufacturing and Technology (Sakaue), and Vice President in finance; the other managers, engineers and workers were all Australians in principle. In general, President Nakagawa highly evaluates the Australian managers. Although they may not be as good at teamwork as their counterparts at the Japanese headquarters, the Australian managers tend to be capable as individuals, dealing with wider task assignment than their Japanese managers, and did an excellent job during the 1994-95 new plant construction, according to Nakagawa. Note, however that there are also Japanese "coordinators" dispatched from the Toyota headquarters, who are stationed at TMCA as long-term expatriates. Mr. Shimizu, Chief Coordinating Executive, for example, was not counted as an employee of TMCA. There were about 20 such coordinators (including 10 executives), linking TMCA and Toyota headquarters in accounting, finance, sales, purchasing, personnel, service, parts, technology, and production.

Besides TMCA, there is a separate Toyota Motor Corporation's Australia Office, a branch unit of the Product Technology group at the Toyota headquarters. President Nakagawa of TMCA is also head of this TMC Australia Office. There are about 10 expatriates working at this office, conducting such jobs as engineering administration, product design, testing, and coordination. Toyota is trying to balance centralization and local decentralization through this dual structure of local subsidiary (TMCA) and the headquarters' branch office. In this way, such decisions as the selection of local content parts can be made at TMCA without intervention from the headquarters, but certain technically sensitive issues can also be decided quickly through close collaboration with Toyota headquarters.

TMCA had about 4000 employees as of 1995, of which about 3000 were in production (2000 direct workers and 1000 indirect workers), 800 in sales, and 400 in general administration. It has tried to size down administration and indirect units in order to survive in the increasingly competitive environments.

Outline of Production and Technological Operations

Production: There were 2875 employees in the production group of TMCA as of 1995, of which 2221 belonged to the Altona and Port Melbourne

factories, 316 were in production control, 171 in quality control, 83 in production engineering, and 84 in product development. There were 1925 direct and 950 indirect employees (Figure 6, Table 4). TMCA produces two basic models: Camry and Corolla. The other models that Toyota sells in Australia are either imported from Japan or bought from GM Holden on OEM basis (sold under the Toyota brand). Production in 1994 was 52K for the Camry and 25K for the Corolla-78K all told, which includes OEM supply to GM (10K) and the exported Camry's (5K) (see Table 5).

- There used to be three production facilities in TMCA: Port Melbourne plant (Assembly and parts production for Camry), Altona Plant (press and engine), and Dandenon (Assembly for Corolla). Dandenon and Port Melborune Plants were closed in 1994 and 1995 respectively, however, which resulted in the concentration of TMCA's press, welding, painting and final assembly processes in Altona.
- *Port Melbourne Plant* was an old facility built in the 1950s and was first owned by AMC and then by Mercedes Benz. It had assembled and manufactured Toyota products since 1963. Since this plant is located only 10km from Altona, 80% of the workers at Port Melbourne moved to the Altona Plant rather than quit TMCA. After the shut down of the assembly shop, the parts production shops (small presses, seat frame, door trim, fuel tank, etc. 559 workers as of 1995) remained as the largest source of components for Altona Assembly Plant. Some parts are exported to other Toyota factories (e.g., bumpers and air cleaners for the Corolla to Toyota's Turkish plant.
- *Dandenon Plant* was owned by GM, but it shut down operation in 1988 in response to the government's new policy. Toyota then borrowed this facility between 1989 and 1994 for the assembly of Corolla. Since Dandenon is 50 km away from Altona, only 20% of its workers stayed in TMCA and moved to the Altona plant when Dandenon was shut down.
- *Altona Plant* is a relatively new facility: Engine machining / assembling and aluminum casting operations began in 1979; press operations followed in 1981. Altona's assembly plant did not open until 1994, though. In the new assembly plant, the Camry and Corolla welding lines are separate, but they share one line in metal finishing, painting, and final assembly processes. There are 440 employees (230 direct workers) in press, engine and aluminum casting; 1222 in assembly including welding, painting and final assembly (980 direct workers). There is also an administration building containing production control, purchasing, finance, personnel, etc., as well as quality test trucks, a shopping yard, and CKD container yard. There was no plan to expand Altona's capacity as of 1996.

Engineering: Both product and process engineers are included in the production area. Roughly speaking, there are 100 product engineers and 100 process engineers. The product engineering department includes product planning, engineering design, prototyping, testing, and engineering administration. Process engineering consists of facility engineering, tool & jig engineering, and process & equipment engineering. Part of TMCA's prototyping and styling is done using GM facilities.

Outline of Sales & Marketing

Product Line-up: TMCA's line-up centers around the two locally produced models, Camry and Corolla, which are supplemented by commercial vehicles, minivans and sports utility vehicles imported from Japan, as well as a large model OEM-supplied by GM Australia. The problem was that after the appreciation of yen in the mid 1990s no models at the low end could be imported at an economically justifiable cost.

Therefore, the Corolla was the lowest priced passenger model of TMCA (24000 Australian dollars as of 1995, when 1 dollar equaled 70 yen). In other words, Toyota's weakness at that point was that there was no overseas facilities which could export the low end passenger cars to the Australian market at economically feasible cost, which created a big hole at the lower part of Toyota's price offering range.

Sales: Although about 70% of Toyota dealers were dedicated solely to Toyota, the fraction of multiple franchise dealers were increasing, partly because TMCA's product line-up lacked low price products at the entry level. Thus, Toyota dealers tended also to sell such economy models as Daihatsu, Suzuki, or Hyundai and Daewoo of

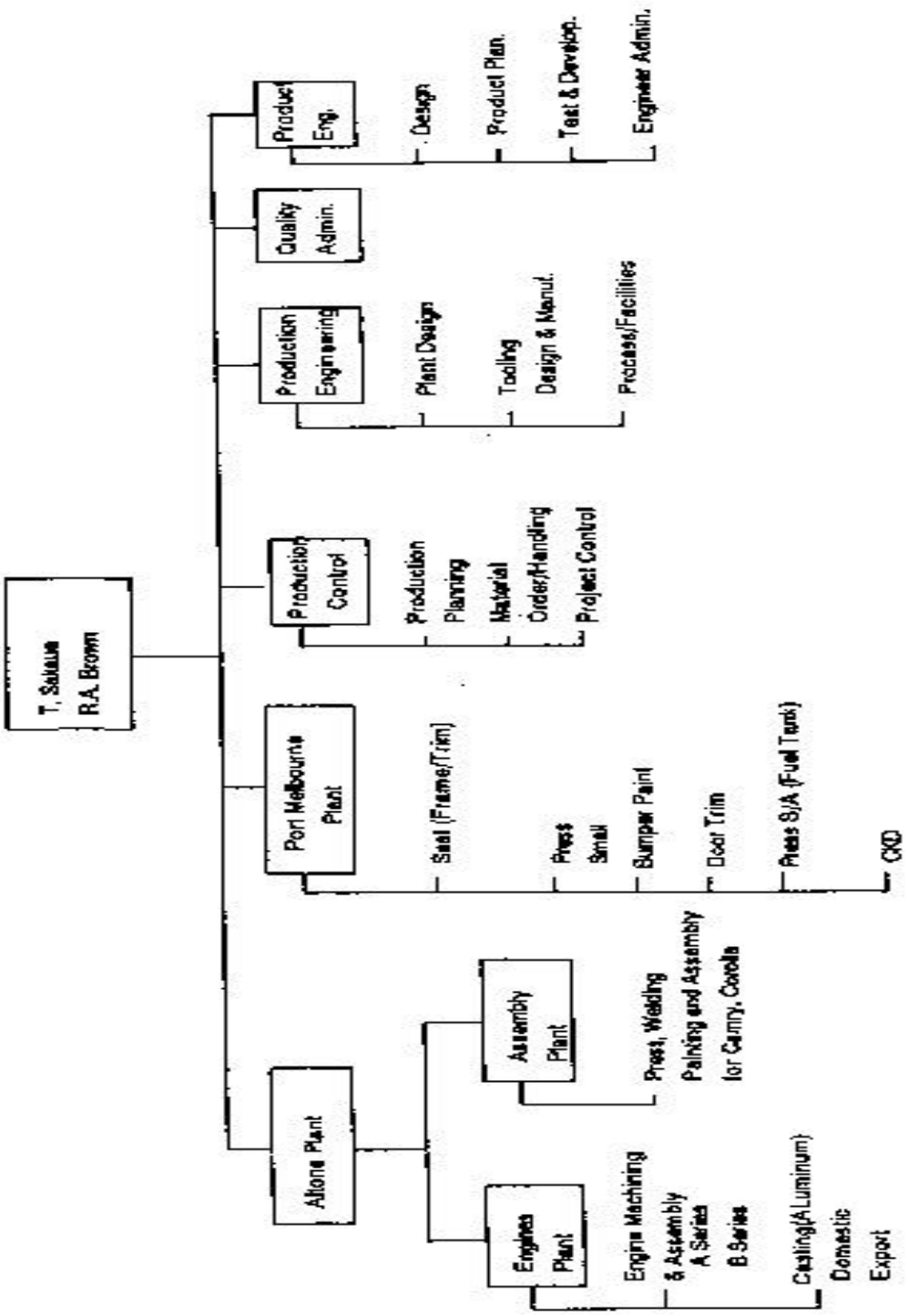
Korea (the market for micro-mini cars is not popular yet).

Table 4. Employees

		1991	1992	1993	1994	1995
Manufacturing	Total	3036	2940	3120	3166	2875
	Direct	1708	1634	1778	2035	1925
	Indirect	1328	1306	1342	1121	950
Sales		894	846	789	794	755
Finances Admin		607	607	556	459	445
Total		4537	4407	4465	4419	4075

Table 5 Production results

	1992	1993	1994
Corolla	22213	23990	21731
Nova (GM)	3697	3016	3581
Sub Total	25910	27006	25312
Camry	25621	31999	42164
Export		2745	4746
Apollo (GM)	4490	5314	5519
Sub Total	30111	40058	52429
Total	56021	67064	77741


T. Sakaue
R.A. Brown
Product Eng.
. Design
Product Plan.
Test & Develop.
Engineer Admin.
Quality Admin.
Production Engineering
Plant Design
Tooling
Design & Manuf.
Process/Facilities
Production Control
Production Planning
Material Order/Handling
Project Control
Port Melbourne Plant
Steel (Frame/Trim)
Press Small
Bumper Paint
Door Trim
Press S/A (Fuel Tank)
CKD
Altona Plant
Assembly Plant
Pressl, Welding
Painting and Assembly for Camry, Corolla
Engines Plant
Engine Machining & Assembly
A Series
B Series
Casting(ALuminum)
Domestic
Export

Alliance With GM

In 1989, GM and Toyota set up a joint venture in Australia, UAAI, in order to mutually adjust their local production models. TMCA supplied the Corolla-based "Nova" (3600 units in 1994) and the Camry-based "Apollo" (5500 units in 1994) to GM. All told, about 10K units out of TMCA's 80K production volume were supplied to GM on an OEM basis. These GM brand models shared platforms and exterior body panels with the original Toyota Models, with only minor changes in front grilles, head lamps, and rear lamps. On the other hand, GM supplied its Commodore-based large model to TMCA.

As of 1995, TMCA was expecting the Toyota-GM Cooperation in 1995 to be continued, in the form of cross-utilization of each other's platforms, and the creation of derivative models with cosmetic exterior changes for each brand. In addition, TMCA is renting GM's styling facilities and prototype shop in order to save costs.

By contrast, the GM-Toyota alliance in production, production technology, purchasing, and logistics was expected to be limited. For example, once the GM-Holden had already introduced the Kanban system, there were not many things on which Toyota could cooperate with GM. Thus, the GM-Toyota alliance was expected to be limited to mutual OEM-supplies of derivative models.

OPERATIONS MANAGEMENT IN ALTONA PLANT

Engine

The Altona engine shop, built in 1979, is the oldest factory at this site (Figure 7). The plant machines and assembles two types of engines, four cylinder 2.2 liter for the Camry and another four cylinder engine for the Corolla. There are two machining lines each dedicated to one of the two engines, but they are merged into one assembly line with randomized mixed production. There are 94 direct workers in two shifts for both machining and assembly. There is a multi-skilled training program, using a skill profile table (a matrix indicating who has mastered which jobs).

Engine casts for the two types of engine blocks are purchased from Holden Engine, a subsidiary of GM. However, the 6 cylinder engine, or about 15% of the Camry engines are imported from Toyota in Japan.

On the other hand, some of the complete engines are exported, as knock-down kits in wooden boxes, to Malaysia, South Africa and New Zealand. As of 1995, TMCA is the only overseas facility at Toyota which engages in knock -down exports to other countries- -a pioneering case of Toyota's global network of complementary parts production. (For example, Toyota's South African plant producing the Camry imports 2 liter 4 cylinder and 3 liter 6 cylinder engines from Japan, and 2.2 liter 4 cylinder engines from TMCA.)

Aluminum Casting Shop

Located inside the engine shop, this foundary produces cylinder heads, intake manifolds and other aluminum parts for engines.

Unfinished aluminum cylinder heads are exported from here to Toyota's South African facility. Some parts are also shipped to Japan for machining, and then re-exported to Toyota's Indonesian plant.

Press Shop

TMCA's press shop, located next to the engine shop, started up in 1981. There are 147 direct workers (two shifts), 31 press machines, and 448 dies (i.e., over 10 dies per machine), producing 330 vehicle-equivalent press parts per day as of 1995, with a vehicle-equivalent production capacity of 400. About 90% of the body panels for TMCA are made here. The speed of the press machines (e.g., 250strokes per hour in the case of 1000 plus ton machines) is already as high as that of the Japanese press shops, but the average die set-up times have not reached the typical Japanese level (i.e., within ten minutes.)

There are six press lines (2 large, 1 medium, and 3 small), all of which are tandem lines with 4 to 5 machines per line. There are no transfer press lines, the latest press technology. The two large press lines use Japanese (Komatsu) press machines; the other lines consist of second-hand press machines, made in Japan or Germany, that were moved from Toyota's domestic plants (Australian machines are not used).

Automation levels of the press lines are as follows.

	Material feeding	panel ejection
large line	automation	automation
Medium line	manual	automation
Small 1 line	manual	automation
Small 2 line	automation	automation
Small 3 line	automation	automation

Panel ejection is done automatically in all the press lines, but material feeding is done manually in two lines (panel transfer between the machines is carried out by conveyers). For example, the medium-size press line has manual feeding operation because its workload is still low, and it does not need to speed up its strokes per hour (automatic feeders are often adopted for the purpose of speed increase.) In the case of small-size presses, manual feeding tends to bring about higher production speed than does automatic feeding. Generally speaking, a relatively low wage rate compared with equipment cost tends to make automation less attractive, which is one of the reasons why the press automation ratio is lower at TMCA than at Toyota's Japanese plants.

60% of the sheet steel purchased is made in Japan; 40% in Australia as of 1995. Toyota is planning to increase the fraction of Australian steel, including such high grade materials as high tension steel and anti-corrosion steel.

As for set-up change operations, dies are first moved to the line side by crane (external set-up); moving bolsters then push the dies into the press line automatically. Interestingly enough, many of the set-up workers are female employees. Unlike Japan, where late night work by female workers was strictly prohibited by law as of 1995, female workers play an important part in the Australian plants, where there is no such regulatory restriction.

Body Welding Shop

Body, paint, and final assembly shops (three separate buildings) were newly built in July 1994. There are two body welding lines one each dedicated to the Corolla and Camry respectively. The two lines are merged into one mixed model line for metal finishing, painting, and the final assembly process.

Complementary Production in Body Shops: Body parts are complementarily produced through Toyota's international plant network. For example, because the production volume of the Camry station wagon (about 20% of overall Camry sales in Australia) is not large enough for efficient in-house press operations, TMCA imports panels (rear side, roof, lift gate, etc.) for the Camry wagon from Toyota's Kentucky plant in the U.S. (TMM), which produces the same model in large volumes.

On the other hand, TMCA exports welded side panels and other panel assemblies of the Camry to Toyota's Malaysian plant, where this model is assembled on a knock-down basis in small volume. In this way the Malaysian plant only needs to invest in the downstream welding processes such as the body framing process.

Equipment and Automation: Spot welding automation ratios are lower than the typical Japanese levels (over 90%) as of 1995.

Table 6 : *exemple of equipment & automation*

	Nber of spots	Nber of robots	automation ratio	Cycle time
Camry Welding line	4000	35	38%	3'20''
Corolla Welding Line	3500	36	65%	6'50''

The automation ratio of the Camry welding line was also increased to over 60% by 1997 in order to improve welding quality and to flexibly deal with different

sheet steel for different markets. Considering the fact that the automation ratios at the old plant used to be around 5%, the current levels of over 60% means that there have been significant investments in welding robots. TMCA has made a lot of effort to train its maintenance workers in order to deal with the automated equipment.

The welding robots and the body parts transfer devices were made in Japan, but the other jigs and equipment for welding were made in Australia. Overall, 75 to 80% of welding tools and equipment, as well as over 90% of the welding shop facilities, were made locally in Australia.

Choice of Body Frame Equip: TMCA's main bomentdy framing process for the Corolla and Camry have adopted the so called Flexible Body Line (FBL), a robotized system originally developed by Toyota's production engineers. However, unlike the full-scale version with

automated jig-pallets for side body transfer and alignment, TMCA introduced a simplified version of FBL without such mechanisms, yet which can still deal with two different under bodies and three different upper bodies with one set up change time. This equipment was made locally. Interestingly enough, TMCA decided to get technical assistance not from Toyota headquarter but from Central, another Japanese company that assembles Toyota products under a consignment agreement. This choice was based on the judgment that Central's equipment, designed for smaller volume production, would better fit TMCA's typical production volume (i.e., 30,000 to 40,000 annually) than Toyota's own FBL system designed for large volume production. This example shows how production technologies of consigned assemblers for Toyota Japan are sometimes applied effectively to certain overseas operations with relatively small production volume such as TMCA.

Work Organization: A work group, each specialized in a particular module or function, at the body shop consists of 17 to 18 workers. This group size is smaller than the case of the final assembly shop, which is more labor-intensive. There is a formal training program for multi-skilling, which aims at creating workers who can each handle three different jobs, as well as training at least three workers who can carry out a given job.

Metal Finish Line: After the main body respite welding process, the Camry line (3'20" cycle) and the Corolla line (6'50" cycle) are merged into one mixed-model metal finish line (2'30" cycle). In this merged line, the bodies go through further inspection, rework, respot welding, attachment of doors, hood and lid, as well as surface finishing. The automation ratio of this line is lower than that of the Japanese plants.

Two Types of Andon Sign Boards: The basic design of the Andon boards are the same as that at Toyota plants in Japan, in that the light representing a particular work station blinks when a problem occurs there. Because the TMCA body shop is less automated (i.e., less equipment) than the Japanese high-volume plants, however, the Andon here tends to be simple and more compact.

There are two types of Andon boards. In the metal finish lines (8 teams per shift), for example, there is a "team Andon board" for each team, and then an "overall Andon" that group leaders, general foremen, and maintenance workers monitor.

For example, the Andon board for the right-hand-side hemming team consists of nine lamps each representing a particular work station, while the overall Andon board has lamps each representing a team (e.g., hemming team, respot team, etc). The overall Andon is also equipped with lamps which indicate the type of trouble (e.g., conveyer break down, body shortage, downstream jamming), so that the group leaders, general foremen and maintenance staff can get real-time information as to what kind of trouble happened and when.

Quality Control: There is an audit system at the welding shop, in which a welded component is sampled once every two hours and thoroughly checked. This audit is rotated between the welding section and the quality control department. The audit results are displayed on the shop floor.

Paint Shop

There is only one painting line, which is able to deal with both the Camry and Corolla in a random order. In order to improve the work environment and paint quality, the shop has adopted robots for the under body sealing and anti-corrosion plastic application processes, and mini-bell electrostatic paint for the primer and top coating process. The surface finish quality of the Altona paint shop is now said to be as good as Toyota's main factories in Japan. The sealer process is the most labor-intensive. The underbody water polishing process is also automated in order to alleviate the problem of the demanding work posture.

All of the seven metallic paints, which are popular in the Australian market, have already been switched to water-based for environmental protection, while the remaining two solid paints were still solvent-based as of 1995.

Final Assembly Shop

There is only one final assembly line, where 450 people work in two shifts. There are seven work groups per shift (i.e., about 30 workers per group), each of which consists of five teams (i.e.,6 workers per team).

Process Design: The main assembly line is divided into seven line segments (3 trim - 2 chassis - 2 final line segments), which go back and forth in

a zigzag way. Each line segment corresponds to one work group. In addition, there are some sub-assembly lines for instrument panels, seats and so on. There are small body buffer storage areas between the main line segments, each of which can carry up to five to seven unfinished bodies. These buffers give each line segment (i.e., work group) a certain level of autonomy; even if one of the line segments stops due to some trouble, the other segments do not have to stop immediately. The buffers also enable group leaders to stop his order line briefly, to conduct small experiments on the shop floor. Besides, a set of functionally related tasks are assigned to each work group, so that workers can grasp the meaning of their work more easily in the context of overall automobile production. That is, each of the segments, or work groups, tends to be functionally autonomous or comlete.

This kind of functionally segmented assembly line can also improve the process for building in quality; By setting up a quality assurance station at the end of each segment, each work group can detect problems and defects for themselves and autonomously implement corrective actions before the bodies reach the final inspection area at the end of the assembly process. On the trim segment, for example, workers assemble wire harnesses, instrument panels, lamps, and so on, and then check the functionality of these parts by getting electric power from a separate source(batteries are not yet installed at this stage). The work group feeds back the inspection results whenever they detect problems, seeks to find their root causes, and tries to solve the problems for themselves. In the past, such inspections were done only in the final inspection area, but this practice tended to create time-consuming reworks, and even secondary defects in the rework process. Workers also tended to regard these defects as “their prblem”,--not “ours”. Thus, the new in-line inspection system not only improved quality but also enhanced morale and the sense of ownership among the workers, according to Sakaue.

The above findings indicate that the new Altona assembly line had already adopted Toyota’s new assembly line concept that had emerged in the early 1990s and materialized at Toyota Kyushu Miyata plant (1993) and Toyota Motomachi plant (1994). That is, even though TMCA adopted automation and other hardware production technologies only partially from Toyota Motor Corporation, it absorbed the latest concepts of Toyota’s assembly process design and work organization. In fact, both Nakagawa and Sakaue said that they learned from Toyota Kyushu when they built the Altona assembly line.

As for the hardware equipment, there is nothing new in the Altona assembly line, except the body buffer zones between the segments. It is a conventional conveyer line; the floor does not move together with overhead hangers; there are no tilted hangers for ergonomic purposes; there is no major robot assembly system.

There are, however, various low cost devices, such as power assist mechanisms for heavy parts, synchronized wagon carts carrying parts and jigs, improvements of body hangers, and so on, which can improve work posture and work environments without major capital investments. These simple and low-cost measures reflect Toyota’s latest assembly concept that tries to balance cost-competitiveness and worker-friendliness, as opposed to heavy high-tech automation that creates a heavy fixed cost burden to the assembly factories.

Final Inspection and Defect Prevention: There is a buffer zone for rework in the final inspection area, similar to Toyota’s plants in Japan. The rework zone is designed to carry a maximum of 100 cars. As of the mid 1995, however, because the assembly shop had started up only recently, there were still about 160 cars in the rework area. The lighting system on the inspection line was much improved compared with the previous plant.

Instructions to the workers showing product specifications are printed out from the assembly line computer file and are attached to the hood or front grille of each car. Color labels are used to prevent mistakes in assembly (i.e., “management by visualization”), but little investment had been made in special tools and equipment for this purpose. The managers did not want to rely too much on hardware for defect prevention.

Positive Effect of Line Segmentation on Problem Recognition: The division of the assembly line into seven segments created a positive effect on the recognition mechanism built into the Andon line-stop system.

Generally speaking, the rule that workers can stop the line whenever they find defects and problems is based on the Toyota Production System’s philosophy of revealing problems on the

spot. The basic rule of Andon line-stop was as follows:

- Workers pull the Andon cord (switch) located at each work station whenever they find problems. This action turns the Andon lamp on and flashing, as well as a music tape, indicating that an abnormality has happened.
- The team leader comes to the troubling station as soon as he or she sees the lamp, identifies the problem, and tries to solve it within the cycle time. If the problem is solved in time, the leader turns the Andon lamp off, and the line does not stop.
- If the problem is not solved within the cycle time, then the entire assembly line stops automatically, with the Andon lamp pointing to the troubled station.
- In this case the group leader supervising this team comes to the station concerned and tackles the problem. Plant engineers and maintenance workers may also be dispatched when necessary. In any case, the line stops until the problem is solved.
- If the lamp of the same work station is turned on frequently, causing many line stops, then the section head or general foreman supervising that station needs to find a fundamental solution to the problem, because the root cause of the trouble has not yet been removed.

In principle, the above rule is consistent with the philosophy of so called “jidoka”, or automatic problem detection and machine-stops, in that the line-stop dramatically reveals and visualizes the manufacturing problems and thereby forces employees to face the problems and solve them quickly. So, in theory, this is an important element of Toyota Production System. In practice, however, there are tremendous psychological pressures for the workers not to stop the entire assembly line (1 km or longer), so they tend to hesitate to turn on the Andon switches when they should do so. This was the case even though there was only 5 to 10% chance that the assembly line actually stopped when a worker turned on one of the Andon switches.

In fact, the frequency of both Andon switch-on and subsequent assembly line-stops significantly increased since the segmented-buffered assembly line was introduced to Altona plant, according to Brown, director of TMCA in manufacturing and engineering. This implies that workers were more willing to turn on the Andon switches and thereby reveal manufacturing problems when they only had to stop their own line segment (i.e., work group).

Component Material Handling: The level of part inventories beside the assembly line was kept reasonably low. The Altona plant also adopted the so-called “door-less” method (i.e., removing doors at the beginning of the line and re-attaching them at the end) to create extra space in the assembly line side.

In-coming parts for the final assembly line are received from both ends of the assembly shop building. Sophisticated material handling equipment such as AGV (automatic guided vehicles) were not used as of 1995.

Large trucks were used as a primary mode for inbound parts transportation. About a half of these trucks were chartered by the parts suppliers; the rest, chartered by TMCA, circulated from supplier to supplier, picking up parts like a “milk run”.

TMCA’s Port Melbourne plant, producing floor sub-frames, colored bunpers, fuel tanks, seat frames, and seat covers, is the largest parts supplier for the Altona assembly plant. Seat and instrument panel subassembly are conducted in-house. A sequential delivery system, in which components are delivered from the suppliers in the same sequence as that of the car bodies, is applied to such bulky and variant-specific parts as bumpers and door trims (from TMCA Port Melbourne plant), radiators and oil cleaners (from Denso’s Australian plant), and window glasses (from a local supplier).

The other parts from local suppliers are all delivered through the Kanban system, which contributed to a reduction of inventories. Also, the recent consolidation of the TMCA plants resulted in increases of parts order volume per supplier, and thus increases in the frequency of parts delivery per item, which also contributed to inventory reduction.

Production plans are managed on a monthly basis. TMCA determines the aggregated production volume and orders the necessary amount of CKD parts three months prior to production (month N-3). The mix of body types and options are fixed two months prior to production (month N-2), after which changes of the production plan is limited only to exterior body colors.

Environment and Community

Because Altona plant is located next to a residential area in the suburb of Melbourne, TMCA carefully dealt with potential environmental problems. It created large banks around the boarder of the plant site, and planted trees in order to alleviate noise problems for the surrounding community; most of the paint materials were switched to water-based; a dedicated water treatment facility was built at the paint shop; and TMCA's training center at the Altona site was opened to the community on weekends for various purposes.

HUMAN RESOURCE MANAGEMENT AND SUPPLIER MANAGEMENT

Human Resource Management at TMCA

TMCA's turn-over ratio has normally been stable at around 6 to 7 % per year, which is not particularly high even compared with that of a typical Toyota plant in Japan, although it did experience an increase due to the transition to the new Altona plant in 1994. TMCA's absenteeism ratio is 5 to 6%, and Kaizen suggestions number around 10,000 per year (Table 7).

Table 7 *Human Relations*

	1991 Actual	1992 Actual	1993 Actual	1994 Actual
Turnover (%)	6.0	3.2	7.4	32.27
Absenteeism (%)	5.1	5.3	5.8	6.4
Suggestions	8661	9982	13480	10794
Industrial Action (%)	0.6	0.7	0.2	0.2
Safety (LTI)	217	191	102	161
Quality Circles	71	108	114	53

Source : TMCA

Blue collar jobs, such as automobile production have typically been done by immigrant workers. Their image and compensation have been relatively low. For example, the average wage of assembly workers has been about 10% lower than average wage, which contrasts the case of American automobile workers (UAW participants) who have enjoyed roughly double the average wage rate.

Workers of 50 different races and cultures were working at TMCA. Its standard operating procedures are written in English, but the shop floor management is based on the assumption that there are many who do not understand English. For example, workers can make kaizen suggestions without using verbal language (e.g., by using pictures). The training canter at Altona provides English education courses. Surveys for the workers are written in five different languages.

Since Toyota's Australian factories has been in operation for over 30 years, racial backgrounds have become increasingly diversified not only for workers but also at the supervisor level. There are group leaders who are originally from Vietnam and Cambodia, for example.

The plant is normally operated in two shifts (three shift operations exists in some busy sections). The shift assignment is fixed, unlike Japanese plants where workers periodically rotate between day and night shifts.

As for work rules, TMCA has established a new system that is different from typical practices in Australia which are as follows:

- Multiple labor unions for each company. (Although labor agreements are made separately with each company, the bargaining power of the labor unions is not as strong as that of the American auto worker union, or UAW.)
- Overtime is allowed only on voluntary basis. (The ratio of overtime compensation is 50% for up to 3 hours, which is significantly higher than the Japanese counterpart.)

- There are 219 work days per year and 38 work hours per week, or about 5% less than in the Japanese case.

However, the new TMCA system consists of:

- A single labor union.
- 229 work days per year and 38 hours per week[1].
- The company being able to order compulsory overtime for up to 20 hours per month (Table X).

TMCA's shop floor organization consists of the following 5 layers:

Manager

- General Foreman (head of about 90 workers = team members)
- Group Leader (head of about 30 workers = team members)
- Team Leader (head of 5 ~ 7 workers = team members)
- Team Member

Similar to Toyota's factories in Japan, general foremen, group leaders, team leaders and team members are all union members.

Standard Operating Procedures (SOPs) tend to be written more simply than their Japanese counterparts. Revisions of the SOPs are made primarily by group leaders and plant engineers, just as in the case of Toyota's factories in Japan.

Strengthening the Competitiveness of TMCA's Supplier System

As of 1995, TMCA was trying to rationalize its parts supplier system to lower costs and improve quality in response to the liberalization of vehicle imports. For example, TMCA decided to reduce the number of its first-tier suppliers from 230 to a mere 100. Because many of those first-tier suppliers which were screened out became TMCA's second-tier suppliers, this consolidation of supplier base also meant the emergence of taller (i.e., multi-layered) hierarchies of suppliers. The consolidation, or concentration of parts orders to a smaller number of larger suppliers, also brought about the delivery of sub-assembled modules, as well as single sourcing (one supplier for a particular component variant). In Japan, this kind of consolidation of the supplier base was observed mostly during the 1960s, when the liberalization of automobile trade was thought to be imminent. In the Australian auto industry, a somewhat similar response was observed in the 1990s.

While consolidating its first-tier supplier base, TMCA also strengthened both its evaluation and assistance support for the surviving first-tier parts makers. As for evaluation, TMCA introduced a formal system called T.S.A (Toyota Supplier Assessment), which enabled the auto company to evaluate its suppliers from multiple perspectives including cost, quality, delivery, and so on. The final evaluation results were mad only after both TMCA and the suppliers discussed the tentative evaluation results. TMCA also gave annual awards to its best suppliers according to this criterion (e.g., the quality award). TMCA also created best practice standards for the suppliers and let the suppliers compete for achieving the target.

On the assistance side, TMCA also strengthened its supplier development system. For example, TMCA classified its first tier suppliers into four levels and a "specialist" category based upon the company’s assessment of the suppliers' capabilities, and then provided different training for each category. TMCA also created its regional supplier network, which held Toyota Production System seminars and other study groups. TMCA and Toyota Motor Corporation also selected and grew some "show-case suppliers," as model cases for other suppliers. TMCA also created International Competitiveness Indicators, which became targets for each supplier. Necessary funds for such supplier development programs came both from TMCA's internal funds and from Australian government subsidies.

As for the suppliers' product development capabilities, it should be noted that most of the functional parts specialists in Australia were of American and European capital while subcontractors were of local capital as of the mid 1990s. This means that, unlike the case of North America, where more than 200 Japanese suppliers

[1] Workers actually work 8 hours per day and 5 dsays a week. In order to fill the gap between 40 and 38 hours per week, workers take a day off (minus 8 hours) every four weeks.

Table 8 *Human Relations*

	Japan (TMC)	Australia (TMCA)
Industrial Relations		
Unions (N0/Type)	Single/Enterprise	Multi/Industry
Agreements	Enterprise	Enterprise
Wage Fixing	Enterprise	Central + Enterprise
Profile		
Manufacturing Image	High	Low
Employee Quality	Med → High	Low → Med
Compensation/Benefits (Manuf)		
(Supplier)	High	Low (0.9 Awe)
	Medium	Low (0.85 Awe)
Employee Relations		
Employee Profile	Homogenious	Multicultural
Employee Participation	High	Low → Medium
Safety	High Priority	Medium Priority
Tenure	30 YRS	5-6 YRS
Working Conditions		
Basic condition	40 HRS Week	38 HRS Week
Employee Work Days (Plant)		
Working Time (Mins/Shift)	232 + (244)	219 (229)
Attendance	460	454
Overtime	No Sick Leave (98+%)	Sick Leave (95 - %)
Shifts	Mandatory	Voluntary
	Rotating	Fixed

had built up their transplants by the end of the 1980s, Toyota in Australia could not rely much on the Japan-based suppliers which tend to possess higher component development capabilities (see, for example, Clark and Fujimoto, 1991). Among the 100 first tier suppliers that would survive, only 15 to 20 functional parts specialists would likely possess sufficient organizational capabilities to cope with "design-in" or so called "black box parts transactions." Thus, it will take significant time, compared with the case of North America, for the Australian auto makers to diffuse the black box parts practice, or to increase the suppliers' involvement in product development.

Localization and Globalization of Production

Parts Production: Local content ratios (i.e., ratios of locally added value per wholesale price) were 69% for the Corolla and 66% for the Camry as of 1995. In response to the extreme appreciation of yen between 1993 and 1995, TMCA was reducing yen-based procurement of parts from Japan. Some of these Japanese parts were switched to locally produced parts: TMCA was planning to localize 130 parts as it predicted the yen to further appreciate from 85 yen per Australian dollar to 75 yen.

At the same time, TMCA was increasingly relying on its global network of parts procurement. For example, body panels for the Camry Wagon were imported from Toyota's Kentucky plant (TMM) to TMCA; Its steering gears were bought from GM's Saginaugh(?) division in the U.S.; Some of its audio components were procured from Thailand and Malaysia (See Figure 8). Toyota was planning to strengthen its global procurement network by increasing imports of various components from Toyota's U. S., and U. K. plants and their suppliers. On the other hand, component exports from TMCA, using the global network, were also expanding. It was, for instance, exporting some components for the Corolla (e.g., bumpers and air cleaners) to Toyota's assembly plants in Turky and

New Zealand; Camry's body panel subassemblies to its Malaysian plant; 2.2 liter engines for the Camry to South Africa and Malaysia. In fact, to Toyota's Malaysian plant, TMCA was exporting a full package of CKD parts, including not only body panels and engines but also other inhouse components and those parts purchased from local suppliers in Australia. Also, casted cylinder heads were exported from TMCA to Toyota's engine plant in Japan, which re-exported them to Indonesia after machining operations there.

Complete Vehicles: Toyota's global network of imports / exports expanded not only for components but also complete vehicles. TMCA had already started to export about 5000 Camrys since 1994 (about 9% of Camry production at TMCA) to Thailand, Malaysia, New Zealand, Fissy(?), Papua New Guinia(?), Brunei(?), etc. To Malaysia, TMCA exported CKD kits for 4-cylinder engine models, and complete vehicles for 6-cylinder models. Besides this, the origin of Camry exports to Gulf countries (e.g., Saudi Arabia) was switched from Japan to TMCA in 1996, a move which contributed to the latter's profit. Thus, TMCA's basic strategy of becoming one of the Camry export centers was gradually materializing as of the mid 1990s.

To sum up, the expansion of Toyota's global network, as well as enhancement of local suppliers in Australia, resulted in increases in both imports and exports of vehicles and components between Australia (TMCA) and other non-Japanese countries.

TECHNOLOGY TRANSFER AND COMPETITIVE PERFORMANCE

Technology Transfers From Toyota Headquarters

While technology transfers from Toyota's headquarters (TMC) are carried out selectively, TMCA was gradually increasing its technological autonomy (Table 9). Let's briefly examine the situation as of 1995 at three separate stages: product development, production preparation and commercial production.

- *Product Development*: Although design and development of basic models will continue to be carried out at Toyota's central vehicle development centers in Japan, design modification for local regulation compliance and product differentiation for local needs is to be increasingly decentralized to TMCA's product development division (about 100 engineers and technicians as of 1995). That is, Australian local models would be developed based on global platforms. Testing functions for locally produced parts are also to be transferred to TMCA.
- Value analysis and value engineering for cost reduction were jointly conducted by product development units at both headquarters and TMCA. Toyota was planning to set up an international CAD (computer-aided design) network between TMCA and the headquarters, although as of 1995, information on designs was still being delivered in the form of drawings between the two organizations.
- *Production Preparation*: the manufacturing capabilities of TMCA's production engineering and tooling departments, as well as those of local tool and equipment makers in Australia, were relatively high. For example, 70% of the press dies for large body panels used to be made in Japan, but the composition had shifted to 40% Japanese, 40% Australian and 20% others by 1995. Dies not only for inner structural panels, but also for surface panels such as fenders, roofs and hoods were made locally. Production of welding jigs and fixtures was also switched to TMCA's production engineering unit (about 100 employees). A larger portion of process design has been carried out by TMCA in recent years. Most of TMCA's production equipment (except large press machines by Komatsu, welding robots by Kawasaki, etc.) were made in Australia.
- *Launching and Training*: Training for blue collar workers is jointly conducted by Toyota headquarters (TMC) and TMCA. The same arrangement applies for managers and staff. The basic techniques of the Toyota Production System and Kaizen system had already been transferred to TMCA, although supplementary assistance may be made from the headquarters for refresher purposes when necessary.

Table 9 : *Technology Transfer*

	Past	Present (1995)	Future
Product Design			
Basic Product	TMC	TMC	TMC
Regulations Compliance	TMC	TMC/TMCA	TMCA
Product Differentiation	TMC	TMCA	TMCA
VA/VE	TMC	TMC/TMCA	TMC/TMCA
Drawing	Paper	Paper	CAD
Production Preparation			
Local Parts Testing	TMC	TMC/TMCA	TMCA
Component Tooling	TMC/Local	Local	Local
Example: Large Press Tools			
($M 30/Model) Japan	70%	40%	25%
Local	20%	40%	45%
Other	10%	20%	30%
Jigs/Fixture Tooling	TMC/TMCA	TMCA	TMCA
Equipment	TMC/Local	Local	Local
Process Design	TMC/TMCA	TMCA	TMCA
Training	TMC	TMC/TMCA	TMC/TMCA
Production Operations			
A. Training TPS	TMCA ←→ TMC	TMC →TMCA (Refresh)	
Kaizen	↑	↑	←
Management	↑	TMCA←→TMC	
Specialist	↑		←

To sum up as of the mid 1990s, a significant amount of technologies had already been transferred from Japan as TMCA increased its autonomy. At the detailed operational level, however, coordination and task divisions between TMC and TMCA were carefully designated. The pattern of recent transition was never as simple as that of unilateral decentralization to a autonomous local unit.

Quality and Productivity

Manufacturing Quality: TMCA's average manufacturing quality of its products is among the best in the Australian auto industry as of the mid 1990s. Its pace of quality improvements had also been remarkable: The numbers of defects per vehicle, for both the Camry and Corolla, dramatically decreased from the level of about 20-defects in 1990 to about 2 in 1994.[1] According to TMCA, practices employed for quality control and improvements include the reinforcement of quality assurance organizations for building in quality and on-the-spot inspections; the use of Quality Assurance Matrices (tables for checking degrees of quality assurance by part, by process, and by critical check points) involving parts suppliers; the reinforcement of a system for customer feed back; capability building of the local parts suppliers; company-wide Kaizen (continuous improvements)

[1] The definition of manufacturing quality follows that of Toyota headquarter (TMC). Usually local quality assurance staff, trained at TMC, check TMCA's manufacturing quality. Also, quality management staff from TMC visit TMCA once a year.

activities, and so on. Although temporary drops of quality levels are inevitable in this industry when new products or plants are introduced, the lead times needed for recovery had gotten shorter in recent years (Figure 9).

Assembly Productivity: Physical productivity at the TMCA assembly plant had also been increasing in the early 1990s. TMCA's assembly productivity (welding, painting and final assembly processes) was about 35 person-hours per vehicle in 1990, but it had improved to about 25 person-hours per vehicle (i.e., near the level of American assembly plants of U.S. makers) by 1994. It should be noted that this remarkable productivity increase was achieved primarily at the old plant. Incidentally, average assembly productivity of the Australian auto makers in general remained to be about 35 person-hours per vehicle as of 1993.

TMCA's staff point out that this remarkable improvement was caused mainly by (i) a reduction of rectification work, (ii) a higher automation ratio, (iii) plant-level monthly plans for productivity improvements, (iv) and enhanced line balancing.

At the new Altona assembly plant, TMCA's tentative goal was 21 person-hours per vehicle for the Camry and 18 person-hours per vehicle for the Corolla. This would still be far behind the level of the most productive Toyota plants in Japan, estimated to be roughly at 13-person-hours per vehicle, but was close to the average of Japanese transplants in North America (see Womack, et al., 1990). Considering the fact that Altona is a mixed-model plant with annual production of less than 100,000 vehicles, this goal still seemed to be rather ambitious.

SUMMARY AND FUTURE PROSPECTS

Toyota Australia (TMCA), a medium-sized overseas operation for Toyota, and as such has seldom attracted the attention of researchers and journalists worldwide, however it seems to deserve close investigation as one of Toyota's oldest overseas operations, as well as one of the most self-sufficient with production, development, sales, finance, and personal functions all delegated as a package to the local subsidiary, and where the local managers enjoy significant autonomy. TMCA, despite its relatively small size, seems to provide us with a valuable precedent case in the era of global complementary networks, where relatively autonomous overseas subsidiaries of various sizes play important roles as critical modes in a firm's network.

Interestingly enough, TMCA's capability-building toward a production center of the Camry model has so far been driven partly by the local government's policy changes away from traditional import substitution and protectionism. For local operations of multi-national auto makers which had existed under import substitution policy, trade liberalization and the surge of import vehicles means intensifying domestic competition - a tough situation in the mature Australian auto market. Considering the worldwide trend toward trade liberalization under the WTO, the experiment of the Australian government deserves careful analysis as one of the pioneering cases of a move in such a direction.

Moreover, it should be noted that drastic policy change often reveals inter-firm differences in international strategies, a situation which applies to the case in Australia since 1988. That is, one company (Nissan) quit assembly operations in Australia; others (US firms) tried to survive by consolidation of local models (i.e., pursuit of scale economy) and strategic alliances; still others try to maintain their facility as a production center of a particular model in Australia by either rationalizing production and minimizing investment (Mitsubishi) or by investing on new facilities, intra-firm international logistic networks, and building organizational capabilities for high flexibility, productivity and quality (Toyota).

These strategic choices are, to be sure, deliberate to some extent, but they are also emergent, influenced by each firm's history, environmental imperatives, as well as a firm's existing organizational culture and capabilities.

In this context, Toyota's strategic decisions in Australia may be interpreted as an emergent pattern which resulted from a series of cumulative responses to the competitive crisis rather than a deliberately planned one as a part of well articulated grand design of Toyota's global strategy.

That is, although Toyota's global network of complementary production and logistics look as if it were deliberately planned and implemented based on an articulated grand strategy at the headquarters, it is more likely to be a result of

emergent interactions between local offices desperately seeking their own survival on the one hand, and the head office trying to continuously adjust its strategy to unexpected environmental changes. Thus, the case of TMCA provides rich insight for researchers studying strategy formation and the role of dynamic organizational capabilities.

For future research, we need a more detailed investigation of TMCA's operations, as well as some international comparative studies of Toyota's production facilities, including Tsutsumi in Japan, Kentucky in the US, and TMCA, all of which produce the Camry. It should be noted here that in the context of the global complementary production network, each of the overseas operations not only compete with other producers but also compete with other overseas plants within the same company for distinctive capability building. The combination of such competition in the building of capabilities between the overseas operations within the same company on the one hand, and the creation of a global complementary network on the other hand, enhances the world-wide competitiveness of a company.

We also need further empirical research on emergent global strategies, the central concept proposed in this paper. The present case study is a preliminary attempt toward a more systematic and dynamic approach to global strategy formation in manufacturing.

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