

PART V : INTER-FIRM PRACTICES WITHIN THE HONDA JIT REGION

Inter-firm practices within Honda's North American JIT region fall into several categories. We will examine different practices in turn :

1. Inter-firm just-in-time.
2. Quality control.
3. rapid response to changing orders.
4. reducing prices of parts.
5. Moving personnel within the JIT region.
6. Integration of R&D into the production structure.
7. Honda Engineering and supplier firms.
8. interventions into other firms.
9. Reorganizing the inter-firm division of labour.
10. Dealing with domestic suppliers.

Together with, of course, activities strictly internal to each firm (and the point is that in this system what is **strictly internal** is minimized by a deep division of labour and by very close inter-firm relationships) all these practices taken together constitute the Honda production structure as the **integrated manufacturing unit** that we are labelling a JIT region. In each practice there is a remarkable degree of collaboration between Honda and its suppliers and among the suppliers themselves, which is why it is so appropriate to speak of the Honda production structure as an integrated manufacturing unit. In each practice too the organizational and spatial frameworks discussed above find their role in **governing** inter-firm relations.

1. Inter-firm just-in-time

a) First-tier relations

Twenty-two of 24 (92%) transplant suppliers whose major customer is Honda state that they deliver parts to Honda according to just-in-time (JIT) scheduling. Frequency of deliveries nevertheless varies greatly, from every half-hour or every two hours for components like seats, wheels, fuel tanks, or windows, to every day or every two and a half days for small metal stampings, small trim items and paint concentrates

(see table 9). Even the two of twenty four firms that claim not to be delivering parts JIT still despatch sets of parts once and twice daily respectively.

Table 9 : Deliveries per (16 hour) day by transplant suppliers in the Honda JIT region vary by part supplied

<u>Part supplied</u>	<u>Deliveries per day</u>
gas tanks	28
rubber engine mounts	8
windows	8
fabric and seat covers	6
steel wheels	6
large plastic moulded parts	5
instrument clusters	4
steering wheels	4
windshield wipers	4
brake line tubing	3
brake components	2
seat belts	2
shock absorbers	2
wiring harnesses	2
automotive belts	1
rubber weathers stripping	1
seat covers	1
shelving	1
small metal stampings	1
plastic interior panels	0.6
seat parts	0.6
colour concentrates	0.4

In some cases a full system of sequential JIT **manufacturing** is in operation. Here, parts are manufactured at the supplier in the same sequence they will be installed in cars; on the assembly line this is only possible for parts that will be installed towards the end of assembly and where there is therefore sufficient lead time after final sequencing of vehicles to manufacture and deliver the parts for installation. And it is only necessary for parts that vary according to colour, for instance. Hence seating is the example often quoted. Indeed Bellemar Parts, the primary seat manufacturer, manufactures and delivers seats within three hours of receiving its order from Honda, although procedures have been complicated by the addition of a second seat supplier and the need to integrate its seats at Bellemar.

Levels of inventories of completed parts vary greatly. Thus one seat supplier has space for only 30 seats at its shipping area, while a supplier of plastic parts maintains a

one and a half day inventory, partly because many subcomponents come from Japan and the firm wants to avoid risks.

Two supplier transplants located in southern states have adopted what they call a "modified JIT system" due to the distance to Honda; one, which was located in the south primarily to serve other transplants, utilizes a warehouse close to Honda as an intermediary location. The other firm delivers less frequently than it might otherwise do because of the distance involved.

Indeed the spatial framework appears to be strongly related to JIT deliveries in the Honda production structure. There is a clear relationship between frequency of delivery and distance from Marysville. We should not expect a perfect correlation, since other factors influence both delivery frequency (nature of product, nature of manufacturing process at purchaser) and location of linked firms (labour markets, location of other purchasers, other reasons for proximity to customer). Nevertheless a striking relationship can be observed in the rough data of figure 9, which displays delivery frequency against a broad measure of transit time. Thus for firms located between 30 minutes to 2 hours away from their customer, the mean number of deliveries per day is 4, whereas for firms between 2 and 8 hours away the mean number of deliveries is 2 (modal values 4 and 1 respectively).

The data of figure 10, which displays delivery frequency against straight-line distances between plants, leads to a more subtle understanding of the relationship between spatial framework and delivery frequency. A perfect correlation would have led to an inverse linear relationship - the closer, the more frequent - but the pattern observable is less clear. Since these are all new investments we would have interpreted this as showing that firms that needed to make frequent deliveries therefore selected closer locations. First, 11 of the 13 suppliers with the most frequent delivery schedule - over 2 deliveries per day - are indeed located within 80 miles / 130 km (straight line distance : still under two hours) of their customer. Of the two frequent deliverers outside this radius, both are located midway between Marysville and another transplant that accounts for 20 percent and 35 percent respectively of their output, and they may have played off ease of transport against opportunity to supply a second customer.

Second, it is noteworthy that otherwise the top right corner of figure 10 is conspicuously empty; ie frequent deliverers do not locate further than 2 hours from Honda. Within the 80 mile / 130 km radius, however, the frequency of deliveries is highly variable, suggesting that other factors come into play in determining delivery frequency, such as nature of part supplied (eg size, number of variants, whether part is

coloured) which determine what form of just-in-time is most suitable, and also implying that more may lie behind selecting locations producing spatial concentration than simply frequency of parts deliveries (see below).

Third, firms which deliver 2 or fewer times per day are more scattered spatially, some within 50 miles / 80 km, others located over 200 miles / 320 km away. It is not possible to judge whether the need for fewer deliveries allows for greater distance, or, inversely, greater distance resulting from other factors leads to fewer deliveries. As mentioned, some firms report that they have modified their JIT scheduling due to distance.

It is noteworthy, however, that none of these suppliers has located outside the narrow north-south corridor dubbed by some "auto alley" that links the Japanese transplant production structures together from southern Ontario to Tennessee. This means that to the extent firms are distant from Honda, they are closer to another Japanese transplant production structures together from southern Ontario to Tennessee. This means that to the extent firms are distant from Honda, they are closer to another Japanese transplant, which they may supply or hope to supply.

b) Second-tier relations

While as we saw above 92 per cent of transplant suppliers whose major customer is Honda or a Honda supplier report that they deliver parts to this major customer "just-in-time", only 47 percent of them (15 of 32) report that their own major supplier (ie second / third-tier firm) delivers parts and materials just-in-time. One might hypothesize that this difference is due to the larger number of domestic firms involved at second-tier suppliers are indeed domestic firms, the proportion of these that are reported to deliver just-in-time, 44 per cent, is not significantly different from the average.

In fact the frequency of deliveries at second-tier level and below is consistently lower than at first-tier level. Thus one firm that supplies Honda 8 times per day receives its own main deliveries 2 times per day. Another firm that supplies Honda every few minutes receives parts 1-2 times per day and 8 times per day.

It is nevertheless true that difficulties due to domestic suppliers have forced substantial modifications to JIT by supplier transplants (table 10).

Table 10 : How Honda's transplant suppliers have been obliged to modify JIT with their own suppliers.

Kanban used in Japan, computerized JIT in USA.

We cannot always count on this system working because America is much larger and many companies don't practice it.

Minimums increased - to allow for full exposure (ie larger inventories to ensure all needed parts available).

American raw material suppliers are undependable on promised delivery dates.

Same as Japan except lead times for U.S. made parts are longer.

Until we can source more components in U.S., we have to maintain a larger than necessary inventory.

Can't practice JIT because US suppliers are too unreliable on delivery.

We use JIT for some vendors and some parts. We currently utilize a large portion of imported parts and JIT is not possible in that area.

Adjusted to compensate for longer lead times required by American suppliers.

Modified due to distance. Longer lead times.

Some inventories must be maintained due to distance of delivery of products and delivery of suppliers.

Problems due to domestic suppliers are prominent in table 10. And there is additional evidence that dealing with domestic firms has caused difficulties in implementing JIT. Thus one transplant supplier finds that very large domestic firms like Dupont simply refuse to deliver small amounts of raw materials at regular intervals according to schedules dictated by the transplant, much to the frustration of Japanese staff. On the other hand, a small domestic firm from Toledo, Ohio that manufactures similar materials was apparently eager to accept JIT schedules to win new orders from this transplant. And Japanese staff clearly prefer to contract with such firms because of what one American manager at a supplier transplant described as the Japanese "fixation" with maintaining zero inventory levels.

In another case, a domestic supplier of plastic parts finds demands on it for JIT deliveries are greatly complicated because it also supplies General Motors, with the risk that both customers will simultaneously change their orders at the last minute. And

another supplier transplant keeps 6-8 days stock of its domestically supplied raw materials on hand, because lead time for new orders from domestic firms is 3 days and there are frequent quality problems with the materials sent.

Besides such difficulties due to domestic suppliers, the comments in table 10 emphasize the importance of the spatial framework in causing modifications of JIT. (Here causality runs from space to JIT, rather than from JIT to space as at first tier level where location choices were new). When distances are longer, JIT is correspondingly more difficult to operate. It is largely at second-tier level that problems due to distance arise. Indeed difficulties due to domestic firms and to longer distances compound each other. Whereas much of the first tier of the production structure has been purpose-built over the last decade in order to implement a JIT manufacturing system in North America, as we have seen above, the second tier relies much more upon existing domestic suppliers. Thus difficulties with domestic materials suppliers, the longer distances involved in inter-firm relations with domestic manufacturing infrastructure, and importation of parts from Japan, all conspire to make JIT implementation more difficult at second-tier level.

Modifications made to second-tier JIT relations typically involve longer lead times, due both to longer distances and to the slowness of domestic suppliers in responding to changed orders, and holding larger inventories, either to guard against risk of late deliveries or because parts delivered from Japan or from distant domestic suppliers arrive in less frequent but larger lots. There is a natural tendency to overorder parts that must be delivered from Japan, both to meet unexpected changes in Honda requirements and to ensure against potential problems of quality. Despite the legendary high quality of Japanese parts problems do arise. In one case a batch of parts manufactured months previously and sent from Japan to a Honda supplier in Ohio were too small to fit where required, causing great difficulties for the workers installing them.

2. Quality control

Honda operates a system of manufacturing and parts delivery where the lot of 60 units guides production planning. Parts are packaged and delivered in lots of sixty, or, if large parts, in sets of fractions of 60 eg 2 of 30, 3 of 20, 5 of 12, and so forth. Two benefits of this system are ease of logistical planning and rapidity of accounting for quantities delivered. But a principal advantage is that it provides a highly effective **automatic control** over both the provider of parts and the manufacturing process at the purchaser at the point where the parts are used. Thus a worker using parts in an

assembly process who runs out of one part before expected or finds one part left over in a parts cart unexpectedly, is provided with a simple but immediate and effective signal either that the supplier has made an error or that the worker has recently neglected to install a part. Downstream workers can quickly check the latter possibility before too much further production has taken place. (Note also how this system reduces the need for all sorts of indirect workers, in logistics, quality control, accounting).

This kind of system in turn acts as a means of pressure upon the supplier, in a manner parallel to how reduction of inventories is said to provide pressure for other improvements in traditional explanations of JIT. In both cases what is demanded above all is perfect quality of parts supplied; not only an absence of defective parts, but also shipments of the correct quantity. The result of operating the system effectively is extremely high quality of finished products, virtually no wastage of parts, and far less supervision by managers and engineers in logistics and quality control.

The importance Honda attaches to quality of parts is reflected in the response to the discovery that someone has delivered defective parts. Ninety-seven percent of transplants in the Honda production structure receive immediate feedback by telephone or cable if a defective part is discovered by people using the parts ($n = 32$). The exception here is an irregular supplier of capital equipment. And 100 percent of the transplants immediately contact their own suppliers by telephone or cable if they find any defective parts.

By the late 1980s the overall parts rejection rate at Honda's Marysville plant was reported as 0.07 per cent (7 in 10,000). One supplier transplant had only 0.01 percent of its parts rejected by Honda, which translated into about one per month, although on one new production line the "high" number of 4 parts per month was being returned by Honda (Honda workers would be taking special care to vet these particular parts as they used them, since they would know they were coming from a new source). Honda rejected 0.03 percent of parts from another firm, while at a third, which was experiencing considerable quality problems with a domestic supplier, the reject rate sometimes reached 0.1 per cent.

While Honda itself audits the quality of incoming parts from its first-tier domestic suppliers, there is no parallel mechanism for what Honda calls "long-established, closely related" firms (ie Japanese transplants). Instead, it is Honda production associates who find defects as they are installing parts. In either case, when problems are reported (ranging from mix-ups of different parts to quantitative mis-shipments and to actually defective parts), Honda engineers telephone the responsible firm immediately : "one little

thing and we hear about it", according to one transplant supplier manager. According to another, "Honda may understand a scratch, but mis-assembly or paint problems is a big deal". Another supplier company engineer reports that after each incident, there is "no finger pointing, no excuses either", but Honda requires that a full explanation and a plan to prevent recurrence are prepared and signed by managers and filed within a week. Honda not infrequently send its own personnel to suppliers to help resolve apparently systemic problems.

3. Rapid response to changing orders

Honda's policy is to plan production schedules well in advance and to adhere to them as a matter of internal discipline. This includes lots of sixty on final assembly lines rather than the Toyota-style line-balancing mixes increasingly adopted by western firms. Nevertheless, managers quite frequently change planned schedules in a manner that requires suppliers to respond very rapidly, perhaps by altering delivery timing or delivery sequences for parts or by altering the balance of different parts required.

This need for rapid alterations to manufacturing by suppliers is premised upon two aspects of the production system Honda uses. First, suppliers stress that when the production schedule is disrupted for any reason, Honda often, as a matter of manufacturing strategy, rejigs its manufacturing schedules at the last moment in order to keep production running, rather than simply halting production for short periods. **Short lead times, then, are less of a permanent feature of manufacturing and more of a frequent surprise.** Thus Honda may experience a problem of painting, so that working with a particular colour is proving problematic. Or it may be that a supplier of certain parts is experiencing delivery or quality difficulties. Honda then responds by rearranging production schedules in an attempt to keep production running while the difficulty is resolved. The changes requested run from delaying or accelerating delivery schedules through to manufacturing parts of a different colour than had been expected.

A second aspect of the production system that Honda uses which leads to a need for rapid reaction times is precisely the just-in-time parts delivery system. Low just-in-time inventory levels imply that withdrawing parts from inventories is not possible as a means for either Honda or suppliers to provide the necessary elasticity.

Transplant suppliers display a varying ability to respond to Honda demands for changes involving altering their manufacturing processes (Table 11). Some firms can respond very quickly, many on the same day and over half within 24 hours. That others respond more slowly may well be because they do not need to frequently alter their

manufacturing process since they do not produce parts for which Honda demands short-notice changes. Indeed it is worth stressing the importance of this kind of difference, where the demands placed upon inter-firm practices vary greatly depending upon the part supplied, how it is used, and so on. Not every component is a seat.

Table 11 : Some Honda supplier transplants can very rapidly to changing orders involving revising their manufacturing process, others less so : table shows time from receiving a changed order to arrival of part at customer

<u>Reaction time</u>	<u>Number of suppliers</u>
Less than 2 hours	0
2 to 8 hours	7
8 to 24 hours	4
24 to 48 hours	2
48 hours to 1 week	4
Over 1 week	4

(n = 21)

Fast reactions are called for throughout the Honda production structure. One supplier transplant engineer with previous experience implementing JIT systems at Chevrolet finds that Honda sometimes only gives his new firm 90 minutes to 2 hours lead time, versus 2 days at Chevrolet. Moreover, it is these short lead times, he argues, that force those suppliers subjected to them to select locations within a maximum of one hour's transit time from Honda, since the travel time becomes a crucial element in response time. By contrast, at Chevrolet location of suppliers was not considered important.

And the better domestic suppliers are set the same stringent targets for last minute changes. Thus one supplier of plastic parts was told by Honda on a Thursday to completely alter the sequencing of components it was preparing for Honda to use in assembly the following Monday. Thousands of parts were repackaged, with work continuing all weekend to meet the Monday morning deadline.

Finally, supplier transplants sometimes resort to flying parts in from Japan to the regional airports at Dayton or Columbus in order to meet Honda's changing needs, though the lead time here can be as long as 5 days because 2-3 days are lost at customs facilities in San Francisco.

4. Reducing prices of parts

Many contracts between Honda and its suppliers in North America follow the Japanese pattern whereby price reductions are expected during the life of contracts. Thus 75 per cent of supplier transplants whose major customer is Honda are expected to reduce prices during their contacts (n = 20). In turn, 75 percent of Honda's supplier transplants expect their own suppliers to reduce prices in similar fashion (n = 32). Supplier firm managers report constant pressure to reduce prices, which is justified by Honda with the concept of "learning curves" (ie as manufacture of a part continues over time, the firm should become more adept, make less mistakes, and therefore be able to reduce costs). Neither are domestic suppliers immune from pressure on prices, sometimes complaining that profit margins are lower than they should be.

5. Moving personnel within the JIT region

The concentrated network spatial framework of the Honda JIT region enables Honda and suppliers to move personnel from one plant to another with relative ease. These personnel movements take several forms. First, there are permanent reassignments that, because of proximity between plants, do not require employees to move house. Thus when Honda first opened the western Ohio Anna mechanical components plant in 1985, it could draw upon an experienced cadre of managers and production associates already employed at Marysville for permanent reassignment to Anna without them necessarily moving house, especially those whose homes were located between the two plants. Likewise, with the opening of the East Liberty plant only a few miles west of Marysville, the backbone of the new workforce, including many managers and engineers and the core team leaders, could simply be transferred

from the Marysville plant. In both cases these reassignments accelerated the pace at which the new plants could be brought up to their full capacities.

A second form of personnel movement is the temporary reassignment. This often involves Honda engineers being assigned over a period of several months to other Honda plants or to supplier firms in order to help with introduction of a new product or new process. Alternatively, if a supplier is experiencing particular quality problems it may find Honda engineers from Marysville commuting every day to its plant until the problem is resolved.

A third form of personnel movement is the regular meeting. Here the network spatial framework plays a crucial role, because it allows all sorts of meetings between personnel from different plants to take place regularly with minimal inconvenience. Meetings variously involve Honda, and first - and second-tier suppliers. At one supplier transplant, for instance, the pre-production phase was characterized by meetings at least once per week with Honda engineers to discuss product quality, meetings which sometimes also included second-tier suppliers. Similarly, personnel / human relations managers from the western Ohio supplier transplants hold regular meetings at which they can compare notes on policies and problems. One topic of discussion at these meetings was whether one supplier transplant had been justified in hiring many production associates previously laid off from a local unionized domestic manufacturer which had recently shut down its plant and moved operations to Mexico.

6. Integration of R&D into the production structure

The transfer of research and development activities from Japan to North America on a systemic basis is an especially interesting issue in the case of Honda, which is a particularly product-oriented firm in which the Honda Research and Development subsidiary plays a very prominent role (thus the penultimate rung on the Honda career ladder - just below president of the whole - is invariably presidency of Honda R&D). Part of the difficulty of transferring research and development activities out of Japan and to the long period that will be necessary to recreate an equal structure in North America even with transfer of a core Japanese staff. But a more significant difficulty concerns the potential role of Honda's supplier transplants. Many of their parent firms are medium and small enterprises, which may be able to support an R&D staff in Japan, but for

whom questions of economies of scale make the prospect of a full R&D facility in North America difficult to contemplate.

Accepting that Honda is intent upon building up its own R&D activities in North America, if R&D is to be maintained as a systemic activity - ie involving supplier firms too - Honda faces the prospect of having its own R&D infrastructure in North America which has to deal with supplier R&D offices in Japan for collaborative design of parts that will then be manufactured at North American transplants. Needless to say, the spatial separation of North American Honda R&D from Japan-based supplier R&D, on the one hand, and of Japan-based supplier R&D from North American supplier transplant production would cause immense problems. Japanese-style collaborative R&D activity might well be crippled. Even if not, it would be dramatically slowed, causing Honda to lose one of the competitive advantages it has pioneered in Japan, its ability to keep shortening the concept-to-production lead time for new cars so as to respond rapidly to new customer tastes. In the location of supplier firm R&D, then, we have a key problem for Honda to resolve in meeting its announced goal of designing cars for the North American market in North America.

By the late 1980s Japanese staff at Honda suppliers were talking openly about the possibility of adding R&D functions to their activities, but several American staff noted pointedly that no concrete moves had yet been made in that direction. Nevertheless, since 1988 considerable progress has been made towards actually achieving a substantial R&D effort that is integrated into the overall production structure, including Honda's suppliers.

In the first place, Honda's own North American R&D activities, which had already in the early 1980s included conceptualization of the sporty CRX variant of the Civic model, led in 1990 to the launch of the station wagon / Aerodeck version of the Accord model, into which North American staff (California and Marysville) were reported to have had substantial input. Thus Honda is moving steadily towards its own goal of full North American design capacities (Note, however, that it seems unlikely that the firm will ever seek to design a whole, **completely separate** - including engine, power train and electronics - car in North America : this simply would not make sense because it is not in this domain that global local marketing strategy requires variation). In particular, the Accord model is now a thoroughly Americanized car in concept, and successors to the current version will surely be increasingly designed in North America.

Secondly, in 1991 Honda announced that it planned to involve North American suppliers to a substantial degree in R&D activities destined for the next (1993). Accord

model, responsibility for the design and development of which, it appears, is indeed being gradually shifted from Japan to North America. Honda is certainly moving this way itself, with establishment of a supplier transplant in suburban Columbus Ohio that manufactures full scale design models for Honda. This firm may become part of a coordinating structure for R&D activities by supplier transplants.

7. Honda Engineering and supplier firms

While the subsidiary firm Honda Engineering is itself responsible for design and manufacture of much of Honda's capital equipment, the Honda Engineering branch located at Marysville has developed purchasing arrangements with several supplier transplants and domestic firms that manufacture capital equipment, for instance suppliers of flexible manufacturing systems, moulds for plastic injection moulding machines, chrome plating of steel stamping dies, and manufacturers and repairers of robot welding heads. A group of such firms is located in the southwest quadrant of Ohio in and around Cincinnati and Dayton, traditional midwestern engineering cities and within short drives of Marysville. This area is at the geographical heart of the corridor of Japanese automobile industry transplant investments, and is ideally located for capital equipment manufacturers to establish bases from which to service all the transplant firms. In some cases Japanese capital equipment makers have purchased existing domestic firms, in other cases they have established plants close to the sources of skilled engineering labour that they require for capital equipment manufacture.

8. Interventions into other firms

Under a JIT inventory control system, manufacturing difficulties experienced at Honda or at its suppliers are rapidly transmitted to the rest of the production structure, potentially halting production at many plants simultaneously. Clearly it is therefore incumbent upon each factory in the system to ensure that all machinery functions properly, that no labour relations problems interfere with production, and that high quality parts are delivered on schedule. This mutual interest - highly intensified by the JIT system with its small inventories - explains much of the extraordinary concern that Honda and its suppliers maintain in each others' "internal" operations.

Whereas in the traditional North American model of relations between assembly and supplier firms in the automobile industry, the internal functioning of partner plants

was considered a private affair, within the Honda production structure related firms seek to learn as much as possible about relevant parts of each others' operations. One aspect of this is that supplier firm engineers and production associates alike visit Honda in large groups, especially to learn about the downstream process whereby "their part" is installed in vehicles or is otherwise used.

More importantly, Honda and its supplier transplants not only learn about but actively intervene in the "internal" activities of their upstream suppliers (Table 12).

Table 12 : Honda intervenes to observe and advise in the some but not all "internal" activities of its supplier transplants

	<u>Does Honda intervene?</u>		
	Yes	No	No answer
<u>When the transplant was setting up operations :</u>			
Quality control methods	16	1	4
Production methods	11	6	4
Labour recruiting / training	4	13	4
<u>With full production under way :</u>			
Quality control methods	15	0	6
Production methods	11	4	6
Labour recruiting / training	2	13	6
			n = 21

The more directly connected to Honda's own manufacturing is the activity in question, the higher is the level of intervention. As far as quality control methods are concerned, such interventions are the norm, and they also occur frequently regarding manufacturing techniques used. By contrast labour recruiting and training are not considered to be a proper area for intervention.

While earlier we mentioned that Honda does not separately inspect parts it receives from transplant suppliers, Honda by no means treats its supplier transplants as privileged group free of all outside intervention. Indeed transplant managers and engineers report that they feel themselves to be under constant pressure from Honda. One new supplier transplant had received two quality ratings from Honda even before trial production had started. When a new product line for Honda was being introduced at one supplier transplant, Honda engineers "practically lived here", according to an American manager. With production successfully under way, however, Honda "backed off". Nevertheless, the high rates of Honda intervention - even with full production

under way (Table 12) - underlines just how crucial is the role of the supplier chain from Honda's perspective.

Moreover, Honda's supplier transplants behave in just the same way with their own suppliers. The pattern is repeated : higher intervention rates in quality control, somewhat less in production, and little intervention in labour recruiting and training (Table 13).

Table 13 : Honda supplier transplants intervene to observe and advise in some but not all of the "internal" activities of their suppliers

	<u>Do you intervene</u>		Answer
	Yes	No	
Quality control methods	25	1	6
Production methods	21	5	6
Labour recruiting / training	2	24	6
			n = 32

Noteworthy is the higher intervention rate at second-tier level regarding production methods and the slightly lower intervention rate regarding labour recruiting and training, in comparison with Honda's interventions in its supplier transplants. This difference is hardly surprising because, unlike the first-tier transplants, most of these second-tier firms are domestic manufacturers for whom just-in-time production systems are novel, but which have long established labour forces. Interventions in domestic firm activities will be discussed more fully below.

Japanese staff at supplier transplants are said by their American colleagues to be extremely demanding of potential second-tier suppliers, appraising in detail all aspects of each firm's operations. Honda participates itself in some cases, joining supplier engineers in inspection visits of second-tier suppliers. Indeed Honda Engineering approval is often needed for second-tier parts purchasing, even of the smallest nuts and bolts.

9. Reorganizing the inter-firm division of labour

Several transplant suppliers, as we have seen, manufacture multiple related and sometimes unrelated products within the same factory. This organizational framawork

was encouraged by Honda especially during the early years of production, when Honda output stood at only 150,000 cars per year instead of the 600,000 attained by the early 1990s, and Nissan was the only other transplant producer in the eastern United States. Thus different Japanese firms would join forces in a JV under one roof as a means to reap economies of scale.

In some cases Honda took the direct initiative of organizing its own supplier firms, in particular two multiple product Bellemar Parts plants, in which Honda held an 80 percent stake, with two Japanese suppliers taking 10 percent each. Bellemar Parts Marysville opened in 1982 when Honda assembly began, manufacturing seats and wheel-tyre combinations. Bellemar Parts Russells Point opened in 1985, after the initial problems with domestic suppliers had become evident, to manufacture seat frames, brake lines, catalytic converters, door sashes and exhaust systems. In other cases Honda encouraged JVs, for instance, one among four of its Japanese metal stamping / welding firms which joined together in a four-way joint venture, KTH, opened 1985, to make fuel tanks, wheel housings and interior metal walls eg between cabin and engine compartment. In each case considerable economies of scale could be realized by sharing overhead costs.

One result of the diminution of the economies of scale problem that has accompanied increased outputs is the shifting pattern of joint venture arrangements, away from Japanese-Japanese cooperation, that we noted above. A second, related result, has been a significant evolution in the inter-firm division of labour. This reflect necessary and possible shifts in supplier firm activities that have accompanied a restructuring of the organizational framework of the production structure from one appropriate to an initial production capacity of 150,000 cars per year to one appropriate to four times this capacity.

Hence the inter-firm division of labour has gradually deepened. Indeed Honda's earliest supplier transplants have undergone significant evolutions in products manufactured since the early 1980s (see table 14).

Table 14 : Late 1980s deepening of the inter-firm division of labour at early-established supplier transplants

- 1987 : shift of brake line production out of Bellemar Parts Russells Point factory to new specialist Japanese-US joint venture Hisan (Findlay, Ohio, 40 miles / 65 km away).

- 1989 : shift of sourcing for alliston seats from Bellemar Parts Marysville, which had built 3rd production line for this purpose, to new Bellemar factory in Canada : line at Marysville then switches to supply newly opened East Liberty assembly plant (n.b. coincident opening of East Liberty and Bellemar Canada).
 - 1989 : shift of some stamping and welding production (together with capital equipment) out of KTH (St. Paris Ohio), four-way Japanese joint venture transplant established in 1985, to Jefferson Industries (Jefferson, Ohio, 45 miles / 70 km away), 3-way joint venture established by two of the KTH partners and Honda (30%) in 1989.
 - 1989 : Yutaka Giken, Honda's largest provider of large stampings in Japan, builds new metal stamping facility for torque converters and oil pans adjacent to Bellemar Parts Russels Point factory. Yutaka Giken takes 10 percent share of Bellemar Parts, Honda increases its share from 80 to 87 percent, other Japanese partners reduced from 10 to 1.5 percent each.
 - 1989 : Sankei Giken, one of the Bellemar Parts owners reduced from 10 to 1.5 percent, opens Blanchester FCM in southwest Ohio, to make power steering systems for Honda. Tokyo Seat, the other Bellemar partner reduced from 10 to 1.5 percent, has in the meantime built several of its own factories in North America, making seats and seat parts for Honda and for other assemblers.
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This ability of the production structure's organizational framework to evolve new divisions of labour indicates what a flexible production structure has been created, in which the firms involved are retained even as they change their roles and as the components required from them are changed. This process closely resembles the "spinning off" of separate companies which characterizes accounts of the growth of the Japanese automobile industry in the 1950s and 1960s. Also noteworthy is the shifting pattern of financial holdings as interests in different firms change over time, as well as the rapidity of these organizational restructurings, occurring only 2-7 years after initial production had commenced.

The spatial framework of the Honda JIT region that we have characterized as a concentrated network form plays an important role in permitting these kinds of restructurings of divisions of labour. That many firms are located within a relatively short distance of each other permits flexibility in determining future arrangements.

10. Dealing with domestic suppliers

We have already discussed in passing many aspects of inter-firm practices that involve domestic suppliers to Honda, showing the roles which these firms tend to play in the Honda production structure, and alluding especially to some of the difficulties that

Honda and supplier transplants have experienced in implementing JIT relations with domestic firms.

Relationships with domestic firms embedded in the Honda production structure are worth looking at more closely, for two reasons. First, these relationships have played a significant role in explaining Honda's parts sourcing practices, since relations with domestic firms during the early 1980s formed the context for development of decisions during the crucial late 1980s over whether Honda would source parts from Japan, from domestic firms, or from supplier transplants. Second, these relations are of enormous broader significance since they hold one of the keys not only to the ability of Japanese firms to transplant their production structures abroad, but also to the much wider diffusion of Japanese inter-firm practices, and of Japanese manufacturing processes in general, into the industrial infrastructure of North America.

Prior to start-up of the first production at Marysville in late 1982 Honda searched for domestic suppliers by giving a set of domestic firms carefully selected in advance plans for manufacturing of the Accord. Presumably this selection was meant to indicate to these firms that they stood a very good chance of gaining Honda contracts. However, whereas in Japan supplier firms are expected to maintain secrecy even when they deal with several assemblers at once, some of the domestic firms appear to have circulated Honda's plans within the wider domestic automobile industry, leading to their publication in the United States automotive press. Honda viewed this as a betrayal of confidence, concluding not only that it could not trust domestic firms but that domestic supplier firms did not trust the automobile manufacturers.

Moreover, this inauspicious start was soon aggravated when many suppliers that were contracted simply did not take seriously Honda's strict demands for parts quality and delivery scheduling, tending to treat them with a "flexibility" that Honda did not expect. The problem, according to a Japanese Honda manager who has been in the United States from the start of Honda production there, was that domestic firms claim that they understand total quality control and just-in-time techniques, but in reality are unable to fulfil their promises. American managers at transplant suppliers agreed with this viewpoint, regarding domestic suppliers as superficial in their understanding of JIT. according to one, neither are they able to meet the short-notice changes that are expected:

Japanese firms are more adaptive, US firms can't handle rapid changes in what's demanded of them (Personal interview, 1988).

The result was that of the original set of domestic firms selected for 1982 production, less than 30 percent were retained by the late 1980s, the rest having been discarded because of problems related to quality, delivery or confidentiality.

After these early setbacks Honda developed a fresh approach to dealing with domestic firms, which has guided it since the mid 1980s. Rather than contracting with domestic firms in a more or less typical North American manner (in terms of organizational framework), and expecting the domestic firms to learn and to implement Japanese-style inter-firm practices, Honda seeks to create exclusive, long-term relations with domestic suppliers wherever possible, and is prepared to invest a determined organizational effort if this is necessary to bring suppliers up to expected standards regarding the inter-firm practices that we have been discussing above.

Both these organizational framework aspects - exclusivity and long-term relations- however, have considerably constrained Honda's ability to widen its network of domestic suppliers in North America. Not only is there a limited number of automotive suppliers that are independent - not vertically integrated into Big Three firms- but to gain truly exclusive relations Honda has pursued contacts with firms previously outside the automobile industry, such as a manufacturer of children's toys that now makes tubular plastic parts, a lawn-seed testing firm that now assembles radio-cassette loudspeakers, or an aluminium casting firm which does have other customers, but all outside the automotive industry.

In this fashion Honda has been effectively developing what amounts to a **parallel automobile industry** rather than rooting itself in the traditional North American automotive supplier base. Not surprisingly this strategy has caused consternation in the domestic automotive supplier industry and its representatives (see Mair, 1991).

Honda is also constrained in an organizational sense when it is obliged to offer the services of its engineers to aid domestic firms, taking the risk that any problems encountered will not easily be resolved, thus threatening tightly planned production schedules in the assembly plants as the new supplier is brought on line and up to speed. On several occasions Honda's Japanese suppliers have been drafted in to aid new domestic suppliers, and domestic firms have been obliged by Honda to buy Japanese capital equipment.

The end result is that domestic firms have found gaining contracts with Honda to be particularly difficult because of the changes Honda puts them through compared to their traditional methods of manufacturing, quality control, and delivery scheduling. Essentially, Honda has refrained from simply drawing up contracts with given suppliers to supply parts and then leaving the supplier to fend for itself in typical traditional North

American fashion : this organizational framework does not provide the results Honda requires. Instead, many domestic firms have found their whole internal structures - from production techniques to organizational frameworks - gutted and rebuilt : either they have done it for themselves or Honda has done it for them.

Honda's American Vice-President for Purchasing is one of the few American Honda managers with previous automotive industry experience, having worked for the large domestic manufacturer TRW as world-wide purchasing director. He was "flabbergasted" by Honda's quality requirements :

We expect basically zero defects. Our goal is to have four hours of inventory.

They think we're quoting from textbooks... It is with great difficulty in almost every instance that we localize parts with an American source (Nelson, in *Electronic Business* 1988 : c/f Nelson's five principles).

By the end of the 1980s finding domestic suppliers was becoming progressively more difficult. According to one Honda manager, the firm had virtually finished sourcing "big, easy parts" in North America, and was now contemplating the small, complex components still sourced from Japan, for which finding domestic suppliers might prove very difficult indeed. It was at this stage that Honda began to enter into a significant number of purchasing arrangements with joint-venture suppliers being set up in North America by some of the larger independent domestic suppliers, firms like TRW, DANA, Johnson Controls, in alliance with significant Japanese firms.

Examination of cases of domestic firms with which Honda has contracted purchasing arrangements is very instructive in giving a fuller picture of these relationships. Two lessons emerge consistently from these relationships. Two lessons emerge consistently from these analyses, whether they are success stories or are failures. The first is the enormous gap between visions among American versus Japanese managers on correct practices of business management - internally and in inter-firm relations - and of production organization. The second is the high level of pressure - either active intervention or telling the firms to come back with "something really new to offer" - by Japanese firms in the internal affairs of the domestic companies in order to force their particular visions onto the domestic managers. One of the important conclusions to be drawn here is that even if Honda has been prepared to alter to some extent its organizational and spatial frameworks - perhaps for the better - to meet local North American conditions, it has not been prepared to dilute its Japan-developed manufacturing techniques and inter-firm practices. It is therefore insisting on transplanting its model of inter-firm practices fully or not at all, refusing to transform its practices to meet existing local conditions.