MAKING MANUFACTURING LEAN IN THE ITALIAN AUTOMOBILE INDUSTRY: THE TRAJECTORY OF FIAT

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INTRODUCTION

Objective of this paper is analyzing the strategic and organizational evolution of FIAT Auto. The analysis of this trajectory is particularly pregnant and meaningful for the destiny of the Italian automobile industry given the troubles and difficulties it has been facing (as most of the car makers all over the world) in the early 1990s.

During the 1980s, FIAT's comeback was widely celebrated (Levy, 1988; Pansa, 1988). But while some car manufacturers (especially the Japanese) were outperforming the others through lean manufacturing (Womack and others, 1990), FIAT's strategy consisted in a refinement of the traditional manufacturing model based on a few extraordinarily successful product (e.g. the "Uno" model (Scott, 1991)), the production efficiency provided by process automation technology (Mana and Valvo, 1985), the work flexibility granted by an industrial relations strategy based on managerial unilateralism an concession bargaining (Becchi Collidà and Negrelli, 1986; Dealessandri and Magnabosco, 1987; Locke and Negrelli, 1989; Kochan, Locke and Heye, 1990; Camuffo and Costa, 1990), and the prevalent concentration in the domestic market (Volpato, 1994).

However, the tremendous success obtained by Fiat between 1983 and 1989 in some respects disguised or at least delayed the perception of the competitive challenge which would erupt in the subsequent years, demanding for new organizational strategy and manufacturing model in which human resources and skills were to play a central role.
But at the turn of the decade, market difficulties and international competition revealed FIAT strategic unbalance, organizational weaknesses, and industrial relations policy short-sightedness.

FIAT reacted designing a comprehensive strategic and organizational change consisting of new relationships with suppliers and dealers, massive investment in new product development, a new organizational model for manufacturing plants, and innovative industrial relations and human resource management policies.

The results of this massive effort can not yet be completely evaluated. Even if they seem very promising, the most relevant competitive advantages generated by the reorganization will emerge with the launching of the new models as the Fiat "Punto" proposed to the customers in November 1993, and the completion of the new plants in the south of Italy (Melfi and Pratola Serra) whose production will start in the Spring of 1994.

From a theoretical standpoint, studying and interpreting such a massive change is interesting in order to assess the characteristics of the emergent organizational paradigm.

The main thrust of this paper is therefore to highlight that:
1. external pressures, both institutional and competitive, explain by themselves only part of the changes taking place; in fact,

2. they are filtered and interpreted by the firm on the basis of given (and historically determined) codes (organizational knowledge and routines, managerial cognitive "schemes", etc.); as a consequence,
3. internal factors (especially in terms of specialization and scope of competence endowment cumulated by the firm throughout its history by means of costly and risky investment in technologies, organizational routines, labor skills etc.) greatly influence the firm's evolutionary process, shaping the emerging organizational paradigm, determining the speed of the transformation process, and characterizing the difficulties and obstacles hindering change;

Given these three points, the paper tries to discuss some intertwined sets of questions.
Before the ongoing transformation, which was Fiat's organizational model? Was it a modified version of a mass-production or Fordist approach? If so, when did Fordism emerge at FIAT?
Since 1990 FIAT seems to be moving toward a different organizational paradigm. What changes are taking place in terms of manufacturing model (quality, etc.) and relationships with suppliers and dealers? Does the new model converge toward "lean manufacturing"? Is Fiat "japanizing" or are there significant differences.

This paper represents an attempt to analyze these questions and give some preliminary, tentative answers. In order to do so, section two sheds some light on the emergence of mass-production and Fordism at FIAT. Section three illustrates FIAT difficulties in the 1970s and consider them as conditions for the company turnaround and comeback in the 1980s. This is described in section four. Section five examines the quality challenge and FIAT strategy in the early 1990s, describing the vast reorganization process launched in 1989. Section six focuses on the new FIAT organizational model at the plant level, the "Integrated Factory" (*Fabbrica Integrata*), and section seven aims at pointing out if and how much it resembles to a shift toward lean manufacturing, discussing the implications of this strategy in terms of work organization, human resource management practices and industrial relations policies.
Section eight reconsiders all the work done by drawing some implications and interpretative frameworks.

1. FORDISM AT FIAT

The first issue that must be analyzed in order to understand recent changes in FIAT manufacturing strategies and its possible shift toward a new organizational paradigm is if and when FIAT began mass production and adopted a manufacturing model based on the principles of Scientific Management.

At Fiat, the introduction of the fordist paradigm was gradual and did not reach a meaningful threshold till the 1950s.

Although the U.S. automobile industry experience inevitably represented a kind of benchmark to which all European car makers had to refer to when developing their competitive positions at the beginning of the XX century, the prospect of "doing like Ford" was largely obstacled by the specific characteristics of the European setting, especially in terms of size of the market, general socioeconomic conditions (quantity and quality of work force available) and union hostility towards the implementation of fordist schemes.

For at least three decades, instead of focusing on expanding the market through massive investments aimed at achieving economies of scale: Ford viewed the U.S. demand as highly elastic with respect to price (Volpato, 1983), European producers firmly maintained high

product differentiation, believing that a broad product line would be the most effective strategy in the Old World highly fragmented market.

In Italy, where demand was comparatively smaller than in Germany, France and the UK, Fiat was the only domestic car maker aware of the market potential and firmly convinced that large scale manufacturing was possible and necessary in order to be successful. FIAT therefore soon targeted the international market, as an essential step to reach the necessary volumes.

Funded in 1899, with substantial financial resources, marked vertical integration and an international viewpoint, Fiat's distinctive competence was the founders' market oriented approach. This apparently obvious attitude (but not much for that time), especially strong in Giovanni Agnelli (Castronovo, 1971), enabled Fiat to emphasize the manufacturing and commercial perspective along with the technical and engineering aspects[3].

In the 1920s Fiat held a 80% share in the national market, and exported over 50% of its production. Major steps toward high volumes were made with the set out of the "Lingotto" (1921), and Mirafiori (1936) plants, in which elements of mass production (assembly line, etc.) were introduced in large factories employing thousands of workers (Volpato, 1994).
In Italy, Fiat pioneered the adoption of fordist principles. However, the actual degree of their implementation was still limited and gradual partly because the limited size of the market, partly because of workforce and union opposition, and partly because of the lacking of skills in applying the scientific management prescriptions.

For example, in the 1930s, looking at production volumes, the production of the single most popular Fiat model was about 5,750 units per year, while Ford had broken the 2 million limit per year with its "T" model many years before. At FIAT, as well as in most of the other Italian firms, Scientific Management was not introduced systematically and its application was partial and distorted.

A comprehensive reorganization around fordist practices was not carried on not only for the demand size limiting specialization and economies of scale exploitation, but also for cultural backwardness and in order to avoid labor-management conflicts. The bottom line was that, from the organizational standpoint the adoption of fordist practices was limited to a partial introduction of some mechanisms such as time and motion analysis and piece work in the Bedaux and Rowan versions[4].

Fordism was instead fully applied at FIAT after World War II, with the "600" model, whose production began in 1955 and the "New 500" model (1957). Production growth was striking: it soared to 100,000 units in 1950, 500,000 in 1960, and 1 million in 1966. These volumes allowed the introduction of technical innovations and organizational solutions consistent with mass production. Considering a rough measure of labor productivity as the cars-per-employee ratio, no relevant variations (in the 0.5 - 2 range) can be seen from 1901 to 1950, meaning that efficiency gains had been compensated by the increased technical complexity of cars. But since 1950, with the comprehensive restructuring of Mirafiori, the mass production scheme entailed a constant productivity growth, up to 7.5 cars-per-employee in 1960.

[3]In that period, European car manufacturers are very concerned with technical-engineering perspectives, given that car are sold according to their achievements in races, with mass-media advertising their successes.
[4]The introduction of Taylorism in Italy has been analyzed elsewhere (Volpato, 1978). For the application of the scientific management principles in UK, see instead Lewchuk (1987).

Throughout the 1960s FIAT basically worked out this "organizational trajectory", becoming an efficient mass-producer of small cars, mainly targeted to the domestic market. But this "forced specialization" (the high fiscal pressure on cars and gasoline drove Fiat to specialize on lower car segments), although enhancing FIAT's short term performances, hindered the development of technological innovations, since these are generally experimented and introduced first on more expensive cars. In other words, FIAT's "forced" focus on the domestic market and lower car segments entailed a specialized heritage of competencies, narrowing the scope of future strategic options.

In the post-war period, with Vittorio Valletta replacing Gianni Agnelli at the top of the company, FIAT fully developed the mass production schemes fully drawing its implications in terms of management style, human resource management and industrial relations. FIAT's strategy based on high volumes, cost efficiency and fordist work organization required a strict control of workers' behavior. Valletta therefore implemented a set of human resource management and communication policies explicitly or implicitly aimed at reducing uncertainty and lowering the unions' power.

The labor movement emerged in Italy as highly politicized and centralized. Throughout the 1950s and 1960s the politics and strategies of the three confederal unions (CGIL, CISL and UIL) were shaped by their political affiliations and rivalries (Neufeld, 1960; Locke, 1992).
Until the mid-1960s, unions were weak and divided because of ideological, political and economic factors (cold war, etc.). For example, CGIL parallelism with the Communist Party (PCI) was so strong that its role at FIAT could be easily identified in that of "driving belt". Valletta maneuvered these weaknesses and divisions with an opportune mixing of *realpolitik* and rigidity of rules. His strategy, supported by a paternalistic management style and *ad hoc* policies for middle managers and shop stewards, alternated timely openings to union groups willing to cooperate, and systematic confinement and ostracism of militant union members and representatives (Bairati, 1983).

Though effective in reducing union intervention, these "ghetto-like" practices of filings and confinements inevitably amplified the tensions which would erupt in the late 1960s.
Along with the implementation of the mass production scheme, Fiat had a huge growth, expanding the marked vertical integration processes which had begun in the 1920s. Fiat tended towards a structure similar to that of General Motors, on a smaller size. This vertical development was allowed by large financial resources, but mostly consisted in a necessary step, because until the 1960s the Italian industrial setting was undeveloped and few component suppliers had the managerial, technological and financial resources required to produce according to the standards demanded by Fiat. The organizational structure will remain centralized, rigidly department based, and highly vertically integrated until the end of the 1970s.

2. THE CRISIS OF MASS PRODUCTION

The 1970s represented a decade of profound crisis for Fiat, as social, market and internal factors contributed to the worsening of competitive and financial performances. The union-restraint strategy fell into crisis during a period of full employment and social pressures.

Industrial relations played a major role in FIAT crisis. At the end of the 1960s, along with a national situation of full employment, the union movement regained strength and unity. The unsettled nodes of the Valletta era, together with the new political and social context, burst out in the "hot autumn" (*autunno caldo*) (1969) conflicts. The growing discontent among workers (living costs were rising fast, massive immigration from South Italy of unskilled workers generated social tensions, etc.), enhanced by a wave of political resentment, pulled together the

unions. During the "hot autumn" of 1969 strikes amounted to an equivalent of 277,000 cars lost (figure 1), and from 1972 terrorism episodes occurred against union representatives and managers (the 1970s see a strong wave of terrorism throughout Italy - i.e. Red Brigades). Fiat management blamed the union for not collaborating to discipline all abuses, and the renewed bargaining power of the union, together with a unilateral approach to labor relations by Fiat management, was unable to mature into advanced forms of industrial relations.

An easier situation might have probably allowed union-management relationships to be a "positive-sum game" for both, but all difficulties converged in generating a "zero-sum game", where any advantage acquired by one part resulted in a detriment of the other.
Union pressures on union rights (legitimated by 1970 *Statuto dei Lavoratori*, a labor law inspired by US Wagner Act), job classifications (with the *Inquadramento Unico*, the number of job classes was reduced -from 13 to 7- with a unique grading for white and blue collars, and each class was made wider by the metal workers national agreement of 1973), information and work organizations (*Diritti di Informazione* and *Esame Congiunto degli Investimenti* implemented with 1976 contracts) systematically increased in the early 1970s. For example, in August 1971, after strikes and long negotiations, FIAT management and unions signed an agreement introducing major constraints on work organization, eliminating discretionary job assignments, posing limits to worker saturation levels and phase times, etc.). There is no doubt that the contents of the agreement seriously infringed the efficiency requirements, at least in manufacturing.

Along with that, the rise in labor costs, generated by the introduction of wage indexation (*scala mobile*) and national agreements with Unions (1969, 1973 and 1976), affected Fiat's productivity to a greater extent than other European car manufacturers. A mayor role in this decreased efficiency was played by complementary compensation (social security) which accounted for about 45% of labor costs (1977) in comparison to 32% for France, 32% for West Germany and 16% for UK.

A massive negative influence in the economic situation of Fiat was also played by the 1973 oil shock. The oil shortage triggered inflation. The impact of price increases was more severe and prolonged than in the other European countries. As a consequence, there was a dramatic slump in the car market. Overcoming the slowdown in car demand took only one year for West Germany and two years for France; but in Italy registrations of new cars went back to the 1973 level only in 1980. Because the national market was fundamental for both profit margins and volumes the situation generated by the labor conflicts and oil shock determined a financial unbalance which slew down investments and renovation of the outdated product line. A feeling of discourage and general uncertainty pervaded Fiat management that underwent an accelerated turnover also at the top. In order to avoid such compelling pressure the new top management on duty in the second half of the seventies[5] implemented a new strategy based on financial restructuring of the Group and technological improvement of products and processes through a strong application of automation whose first application were put into effect in the first half of the decade.

[5]In the late 1970s, Cesare Romiti became CEO of Fiat Group, while Vittorio Ghidella was CEO of Fiat Auto.

fig.1

The automation strategy is most meaningful for the understanding of the new Fiat trajectory. It was oriented to:

- implementing a higher level in quality and productivity;
- reducing conflicts through the abolition of the most dangerous and tiring manual operations (ergonomy was a major cause for workers' conflicts);
- bypassing union control on work organization (the disruption of traditional lines implied workers deskilling);
- reducing union influence on the workers (extremely high in the traditional fordist assembly line where social rules determined working standards and rhythms - i.e. on time definitions).

FIAT began investing heavily in more advanced and labor saving manufacturing technologies. Through automation, FIAT aimed at making production to a certain extent independent on workers consensus and participation. This technology strategy was based on the progressive automation of the manufacturing process and can be interpreted as a two-phase process: a first phase (1972-1978) of rigid automation, and a second phase (1978-1988) of more flexible, partial or full automation.

The first robots were introduced at Mirafiori in 1972 (for the 132 model line), but a conspicuous leap in manufacturing automation was made with the Digitron system two years later (for the 131 model line). Digitron (implemented at the Mirafiori plant in 1974) was a computer-controlled system of docking. The chassis was loaded on a robocarrier, and conveyed to automated screwing stations where he body was assembled. Tiring and wearing work operations (like working hands-up) were eliminated. As already mentioned, the major purpose of these innovations was clearly to solve ergonomic problems by eliminating the kind of jobs more associated with episodes of industrial conflict. As a consequence, uncertainty related to manufacturing decreased, efficiency increased (at least to some extent), and organizational control was regained despite union constraints. Anyway, Digitron represented the first example of a computer-controlled manufacturing system at Fiat, aimed at exploring technologies with high potential, but whose boundaries were not yet well known. Although it was a relatively efficient example of rigid automation, over time, in order to meet the market demands, it became necessary to improve flexibility (against static efficiency) adopting manufacturing technologies capable of producing a wider and variable set of models and versions.

The Robogate system (implemented at the Rivalta plant in 1978) came to this purpose. Theoretically, it allowed "360° flexibility" in terms of market response (Robogate could manufacture a relatively wide scope of models), in terms of product lines renewal and update (Robogate could be relatively easily converted and adapted to the introduction of new models), and in terms of process (Robogate non-in-line process could reduce technological breakdowns related costs). Put in practice, the system was designed for five different bodies (but Fiat applied it only for two), 80% of the investment was re-usable and adaptable for new product lines, and the non rigid sequence of working-manufacturing operations (computer regulated asynchronic movements) allowed systematic prevention of complete breakdowns. Thanks to Robogate, body parts were hooked on pallets, which were loaded on computer-controlled robocarriers: welding was fully automated (more than 90% of operations), so that it required only inspection and service by maintenance workers (indirect workers quadrupled, as direct workers drop to a quarter) as shown in Figure 2 which illustrates the new job distribution at the Rivalta plant compared with that of the previous system).

fig 2

Even though these sophisticated technological features were never completely exploited, as the system entailed an excess of costly manufacturing flexibility (especially the 25 robocarriers Robogate used were money and space-consuming), Robogate represented worldwide an advanced solution (it will then be installed by Comau, a subsidiary of FIAT, in other European and U.S. plants). In order to improve Robogate cost-efficiency, its computer-regulated asynchronic movements, originally intended to prevent breakdowns of the whole system, were then transformed into a step-by-step line sequence (it came up that line breakdowns were reasonably manageable). The Robogate version implemented later in 1982 in Mirafiori marked the shift to the sequential model (this happened also because the improved industrial relations climate in the 1980s diminished the need for high flexibility solutions).

This technology strategy based on progressive automation of all the manufacturing process went on with the implementation of LAM at the Mirafiori plant in 1979. The LAM *Lavorazione Asincrona Motori* (Asynchronic Engine Manufacturing) system consisted in the partial automation (manual operations still existed) of the automobile engine assembly process: computer-guided minitrailers loaded the engine-pallet and transported it along the different engine assembly areas.

The restructuring of the engine manufacturing process (in terms of both machining and assembly) implied:

- a re-organization of work together with job re-design; safer and better working conditions, job enlargement (extended working sequences and larger phase time -4 to 8 minutes-), a certain degree of job enrichment, the separation of manual operations and working sequences from a rigidly determined line pace);
- increased flexibility; a few engines of the same "family" were manufactured for four models, with 110 versions.

LAM impact on productivity was nevertheless lower than expected partly because of intrinsic features and partly because it was applied to the manufacturing of pre-existing engines (designed at the end of the 1960s and not designed to be assembled with LAM).

3. TURNAROUND AND COMEBACK IN THE 1980S: MANAGERIAL UNILATERALISM IN INDUSTRIAL RELATIONS AND HIGHLY AUTOMATED FACTORY

3.1. Managerial unilateralism and concession bargaining

In the 1980s Fiat managed to stand out of the vast crisis which affected its performances and its industrial relations setting. This section describes the emerging industrial relations strategy based on managerial unilateralism (Locke, 1992). Such a strategy seems consistent with the strong automation-based technology strategy pursued in the 1980s (see section 3.2).

On September 11, 1980 the management announced an imminent layoff of 14,469 workers. After a decade of exacerbating union-management frictions this event inevitably led to an extensive blockade of the firm. But on October 14, 1980 the "silent majority" of workers (the "march of the 40,000") stood against union militants and the protest strike that had shut down the firm for 5 weeks, proving willing to end a period of violence and anarchy. This was the moment for Fiat to adopt a tough line with the union and the state in negotiating the labor implications of the restructuring. In 1980 20,500 workers (about 15% of the work force) were

on the state-supported redundancy fund (the *Cassa Integrazione Guadagni,* CIG), and tough concession bargaining policies were negotiated with the weakening unions. After decades of personnel policies focused on employees as a whole and on collective (firm-union) transactions, new attention were paid to specific segments of the work force and to differentiating and customizing personnel policies. Ad hoc human resource management (HRM) policies were designed for shop stewards, professionals and middle managers; merit-based promotions and career progressions, pay-for-performance, increased autonomy and responsibility are applied to cadres in order to speed the generation of organizational information and to create a new and homogeneous strategic vision through middle-management commitment (Camuffo and Costa, 1993b). Moreover, new emphasis was generally put on individual (firm-worker) transactions (or "internal relations", as Fiat HRM Department defined them (Auteri and Busana, 1985)), i.e. on the relationship between the firm and each employee at every level of the organizational structure. Fiat management tried to take a step forward, conceiving internal relations as customer-supplier relationships (Camuffo and Costa, 1990), and managing them using also internal marketing tools (communication, etc.).

The most relevant concern was to develop a set of personnel policies aimed not only at satisfying key employees needs and expectations, but also (and overall) at legitimating management and restoring hierarchical authority on decisions about the organization of work, compensation and mobility criteria within the newly propelled internal labor market (Camuffo and Costa, 1993a). Union density decreased from 32.5% in 1980 down to 20.5% in 1986 (Kochan, Locke and Heye, 1990). After 1980, "bilateral industrial relations" were reduced to a few issues (employees going back to work from the state redundancy fund, some calendar problems), and the "unilateral model" of industrial relations considerably expanded the scope of managerial decisions (Locke and Negrelli, 1989). For some years major technological and organizational innovations were introduced in a non-cooperative setting, and with a substantial aversion towards procedures aimed at a deeper union involvement.

In the mid-eighties the reprise due to the growing demand for cars (especially the "Uno model") and the parallel return of workers previously in the redundancy fund, had a strengthening effect on the bargaining power of unions. Along with that the rigidities embodied in automation and information based technology (despite the higher "theoretical flexibility") required a different attitude in the work force, different HRM policies, as well as a different approach to manufacturing quality (the 1988 Cassino plant is an example of that). After 1985 originated a new industrial relations model based on union concessions to the urging managerial pressures towards internal firm flexibility, in order to face a growing demand (Locke and Negrelli, 1989). By a general perspective the concession bargaining model (Osterman, 1988) still appeared grounded on collective relationships, and the union was involved in the flexibility strategy with an instrumental role, that is when its consensus was necessary (i.e. third shift introduction, collective overtime, mobility).

Some union-management agreements, as that of march 1986, consolidated the development towards an "exchange" model of industrial relations where information and decisions on such issues as technological investments, new skill profiles (e.g. the formal recognition of the conductor figure at the highly automated Termoli plant) and CIG workers re-employment, were traded with union concessions on labor-flexibility.

By the last years of the decade the redundancy fund was cleared, absenteeism and strike levels reached their minimum, along with a flourishing competitive and financial situation of the company (Figure 3 and 4).

fig 3

fig 4

3.2. The Highly Automated Factory

The above mentioned motivations of FIAT's technology strategy based on progressive automation of production resulted in a series of manufacturing system or non integrated computer automated manufacturing "islands". Only with the Termoli 3 facility (1985) the idea of a fully automated factory was conceived and implemented. With Termoli 3 and the FIRE engine, for the first time FIAT designed and developed jointly the product, the plant and the manufacturing system. The Fire manufacturing system at the Termoli plant produced engines from 1000 to 1300 cc., and represented the first, worldwide recognized, example of HAF "Highly Automated Factory".[6] Fiat management itself considered it as the "natural" evolution of the Mirafiori LAM system. The Fire system was less flexible in terms of product mix and plant convertibility. But its relatively dedicated lines allowed higher productivity and efficiency. This is the reason why it represented an important shift from an overabundant concept of flexibility to a more moderate one, determined by market requirements in terms of product variety and variability (Locke and Negrelli, 1989). As a consequence, if compared to Robogate and LAM, FIRE marked a return to a linear operational sequence.

The key elements of the new plant were:

- the internalization of all the strategic manufacturing phases and operations, where strategic meant either crucial in achieving economies of scale and quality or plant-specific in terms of know how;
- the optimization of material handling and layout;
- the high speed processing, with cycle times lower than a minute, and utilization rate, load factors and equipment saturation were always very high;
- the extensive use of robots to reduce direct workforce.

The only manual operations maintained in the cycle consisted mainly in some assembly (filters), and fluid insertion, with an automation ratio as high as 85%. The "high-tech" character at Termoli was due, beside the already mentioned technology strategy aimed at reducing conflicts and union influence, to strong internal pressure by Comau.

On the whole, the Termoli plant undoubtedly conferred to the Fiat Group an outstanding technological and manufacturing status, still recognized by most of its competitors.
The new FIRE engine enabled Fiat to reduce by 10% the list price of its best selling "Uno" model, previously equipped with the traditional 903 cc. engine. FIRE was much better also in terms of both quality and performance. This better standing came from such features of the FIRE manufacturing system as: reduction of the number of components by 30%, employment cutback by nearly 40%, a halved manufacturing lead time (107.5 min. versus 231.5 of a 903 cc. engine - see figure 5), and a production schedule of 1000 engines per shift on three daily shifts.

As argued by Cattero (1992), the organization of work, the job contents and the skill profiles of blue collars changed as manufacturing began, production ramped up and organizational processes consolidated. In fact, the original plan, consistently with FIAT management idea that the HAF concept was going to increase indirect jobs importance, yielded a reduction in direct jobs. The organization of work at the Termoli 3 plant evolved according to a learning process. The original aim were those of massive reduction of direct workers and strong presence of indirect (mainly service and maintenance jobs) workers, referred to, in the firm jargon, as

[6] F.A.A. in the Fiat jargon stands for "Fabbrica Altamente Automatizzata". FIRE stands for Fully Integrated Robotized Engine.

fig 5

meccatronico (Cattero,1992). But as this design was being implemented and as the factory reached a "regime" situation, learning took place and a new job and skill profile emerged: the conductor (Kern and Schumann, 1984). At full capacity Termoli employed nearly 340 conductors out of 1167 total jobs (almost 30%).

This new job allowed to govern task interdependence and inter-functional integration, as the goal of minimizing stops and idle time of capital-intensive machinery require "simultaneous" rather than "sequential" responses (Cattero, 1992; Cerato and others, 1987). The conductor was linked to a part of the manufacturing cycle by the interface of an information device; he performed some residual manual direct operations and some "service" or "indirect" activities, such as maintenance and setup, and manufacturing process testing. While procedures and parameters were defined by specialists, the conductor had a major role in interpreting and diagnosing the "weak signals" which could jeopardize the smoothness of the manufacturing process (Cerruti, 1993). The conductor figure, emerged from an organizational learning process at the Termoli plant, was institutionalized with the April 18, 1986 plant-level agreement and included at the fourth level of the metal workers national contract job classification schemes. This job and skill profile was later extended to national scale with the metal workers CCNL (National Collective Labor Contract) signed on April 18, 1987.

As easily understandable, the FIRE engine and the Termoli plant were a great success for FIAT. The competencies in terms of automation technology, organizational solution and human resource management policies developed at Termoli, and that were later fully developed in the HAF concept, led FIAT management to ask the question if the technological and organizational know how so successfully developed and implemented at the Termoli plant in engine manufacturing be applied (by analogy) to an assembly plant. The positive answer induced FIAT management to re-design and restructure the Cassino assembly plant. In other words, the set of core competencies associated to the HAF philosophy were adapted to the Cassino plant, where the "Tipo" model bodies were originally manufactured and assembled. The "Tipo" was being produced there also before, since its appearance in September 1987, but the managerial decision to implement the HAF in Cassino dates Jan. 1988. The 2,000 billion lire investment was intended to go far beyond a single model life- cycle, as Fiat Auto CEO Vittorio Ghidella said.

But Ghidella's idea that automation was the crucial weapon to keep up with the Japanese, together with the not completely successful results of such models as FIAT "Tipo" and "Tempra", and Lancia "Dedra", did not prove to be correct. The adaptation of the HAF concept to the Cassino assembly plant entailed huge implementation problems. It was soon clear that logistics was going to play a crucial role in the whole system, and that the degree of complexity to be governed was too high.

This complexity stemmed from:

- the stronger presence of manual operations: automation ratios in assembly plants are significantly lower than in engine manufacturing plants; this implies more organizational uncertainty and a higher degree of coordination and task integration;
- the impossibility (or lack of capabilities) to fully exploit and optimize the use of information technology to control and govern fully the manufacturing system: some problems such as doors and body coupling after internal trimming had to be solved manually for a long time; the assembly of "Tipo" rear door also had to be realized manually for some time;
- the difficult and very high level of required flexibility; instead of the relatively low variety of engines manufactured at Termoli (FIRE), in 1989 Cassino featured 23 versions of the "Tipo" and later of the "Tempra" model, manufactured on customer specifications.

Considering that manual operations were many more than in Termoli (according to FIAT figures, Cassino automation ratio in assembly activities was around 22% -1000 automated operations out of 4500), and notwithstanding the 450 robots installed (out of 1933 robots in the Fiat Auto Group in 1988) it is understandable why Cassino productivity has been systematically lower than expectations, even when market conditions were favorable.
At the Cassino plant stamping and welding were performed on automatic lines (Robogate), and some groups of components (mechanical groups, doors, etc.) were automatically assembled and tested off-line. Bodies were carried by truck conveyors whose movement was directed by automatic devices. The balancing of the assembly line, which originally had a constant cycle time (but then was modified in a step-by-step line, required continuous adjustments as cars with different characteristics (called "specialties") had to be manufactured implying more operations and longer cycle/phase times.

Because of this, along the assembly line some operations overlapped with those of the subsequent workers downstream, and this called for considerable flexibility in job assignments, administered by shop stewards (the so called *caposquadra*). Examples of "specialty" characteristics were: air conditioning, automatic transmission, sunroof, etc. In order to keep the line smooth, job redistribution required the intervention of off-line "jolly workers" together with "specialty operators". This caused troubles and inefficiencies with stops of the lines. Moreover, the complexity of the manufacturing system entailed problems and variances which had to be systematically absorbed by the workforce (the information system designed to handle them often broke down or proved to be inadequate). For example, problems in doors or door-body coupling caused about 10% of cars to advance through the final part of the line without doors, requiring additional end-of-line operations.

Other problems can be inferred by the emergence of informal work rules and "local" redefinition of procedures. For example while the shop steward organized work and assigned jobs aiming at saturating each team member, the workers often revised these assignments considering task or operation interdependence: for instance workers preferred to change "informally" job assignments and do more convenient operations - from a sequential standpoint - even if this implies a higher degree of saturation for themselves.

This task-specific knowledge was sometimes retrieved by the shop steward according to his sensibility. Plant managers or shop stewards in some cases might redefine, more stringently, intervals for some operations. Another example of informal work rule redefinition can be found in the use of electric screw drivers. They were forbidden for safety reasons (on behalf of air-powered units), but workers kept using them because lighter and handier, therefore requiring less strain.

3.3.Toward a new organizational scheme

The organizational problems encountered, combined with the sales of the "Tipo", which did not meet Fiat high expectations, prevented Cassino and the Tipo from reaching the status which Fiat expected. Overall, it seemed that the systemic and holistic approach adopted in designing and implementing the H.A.F. at the Cassino plant on the one hand underestimated the complexity of the processes to be governed, and on the other hand hindered the possibility to fine tune the manufacturing process and trigger organizational learning. Labor flexibility is critical (in assembly plants even more than in engine or other part manufacturing) in order to diagnose and solve quality related problems. In fact, only line workers on the one hand truly embody the tacit knowledge necessary to react immediately and simultaneously to emerging troubles and problems, and on the other hand can codify these competencies transforming them in working practices and shared knowledge (Adler, 1993).

But this attention to human resources and labor relations lacked until 1989. This awareness that human resources are, especially in assembly plants, not merely instrumental to plant performance, that they can be, within a new organizational framework, trouble shooters rather than trouble makers (Camuffo and Costa, 1993b) came only with the 1990s (Magnabosco, 1993). At the end of the decade it came clear enough that a new organizational model was needed.

Summarizing, during the 1980s, while all over the world Japanese car manufacturers were outperforming their competitors (Hayes, Wheelwright and Clark, 1988; Dertouzos, Lester and Solow, 1989; Womack, Jones and Roos, 1990) thanks to lean manufacturing and to new organizational models: decentralization, flat organizational structures, team work, suggestions and quality circles, job rotation etc., FIAT pursued a technology strategy based on state-of-the-art (frontier) manufacturing automation and labor saving investment. This strategy, successfully implemented at Termoli, had some results in terms of improved working conditions and ergonomy and in terms of emergence of new jobs (the conductor), but did not imply the end of fordist division of labor. Rather, it basically supported a labor relations model based on concession bargaining (Osterman, 1988; Camuffo, 1992) and managerial unilateralism (Locke, 1992), and a human resource strategy aimed at setting up individual relations between the firm and the worker, bypassing or weakening, where possible, the unions' role.

4. THE CHALLENGE OF THE 1990S : A TOTAL REORGANIZATION TOWARDS TOTAL QUALITY AND THE INTEGRATED FACTORY

4.1. A new competitive climate

The first section already pointed out Fiat's weaknesses at the turn of the decade: a somewhat too high degree of vertical integration, an outdated product line (and a certain slowness in model renovation), a too heavy reliance on its domestic car market, a marked dependence on market segments difficult to defend or penetrate in foreign markets. Apart from this dangerous concentration of sales, an even more serious issue regarded FIAT profit margins, strongly depending on the domestic market. As sales abroad required higher logistic costs and aggressive marketing policies (lower prices, more advertising, etc.) domestic sales had to finance abroad expansion.

Since many times aggressive export policies relied on internal market profits and FIAT market share in Italy (higher than 60%) seemed untouchable, few expected that it would be eroded so rapidly and so far in advance of the opening up of the Italian car market to greater Japanese competition (Economist Intelligence Unit, 1992). Industry analysts agree that it was Ford's decision in 1989 to pursue greater volume sales in Italy at the expense of margins that really started the rot.[7] Prior to that, most competitors in the Italian car market had appeared willing to shelter under the high "margin umbrella" provided by Fiat (Economist Intelligence Unit, 1992), traditionally "price-maker", at least for the first four market segments (Volpato, 1994)[8].

[7]Ford launched the new FIESTA model competing against the by that time outdated UNO. Also Renault imitated Ford's strategy with the CLIO model.

[8]Car manufacturers who concentrate higher shares in European countries where there are more restraints to Japanese imports, will be the ones more negatively affected by further evolution. In 1991 Fiat sales rely for 81.90% on Japanese-restrained markets, while for Volkswagen-Audi-Seat this value is just 37.69%. This represents a dangerous "time bomb" (Volpato, 1993) for FIAT. In July 1991 an agreement is signed by the EEC and the Japanese MITI (Ministry of Trade and Industry), introducing vehicle import restraints during the 1993-1999 transition period. The problem is that this pact (defined "Elements of Consensus") is

Besides market shares (both in Italy and abroad), productivity is a crucial issue: according to industry analysts estimates, FIAT actually has an estimated cost-gap of about 2,000 US$ per car relatively to the Japanese.

4.2. The great spurt

All these circumstances moved Fiat to launch an immense reorganization process which involved all the group's activities, the relationships with suppliers and the dealers' network.
This wide effort began in autumn 1989, but some steps had been taken time before. Quality circles, for example, originated first in 1982, and in 1987-89 as much as 1,000 billion lire were invested on quality improvement projects. But it was with the Convention at Marentino (where FIAT training center ISVOR is located) that the whole restructuring project was launched officially in October 1989. It was a five-year program (total quality program), articulated in a number of operational projects, grouped at three levels.

At the first level FIAT put 4 projects regarding the whole company: time to market reduction, new product development decision-making, product-process carryover, product quality information system aimed at cross-plant quality measurement. At the second level, FIAT developed 80 projects regarding organizational processes in different areas. The most important among them is the Integrated Factory project. At the third level, over 200 projects were developed on microprocesses and specific activities.

In 1991, in connection with the appointment of Paolo Cantarella[9] as CEO of Fiat Auto, the Total Quality Program was reorganized into a series of 20 plans called "Competitive Improvement Projects" with specific assignment of responsibility for times and results. Before carrying on a detailed analysis of the Total Quality and Integrated Factory programs (section 5), it is necessary to describe briefly the other components of this comprehensive restructuring project, as instances of its size and scope.

4.3. Product development

As regards new product development, Fiat decided to invest 25,000 billion lire in the 1992-96 period and 40,000 billion lire until the year 2000. This investment should lead to 20 new models before the end of the 1990s. Over the next nine years Fiat has announced it intends to launch two new models per year. But this implies a conspicuous reduction in time-to-market (currently 5 years) down to three. Carry-over strategies will be pursued, as the "5x2" (every chassis will remain in production for 10 years, but changing its exterior look every other five). Within this program, the replacement of its best-selling model "Uno" by the end of 1993, along with its production in the new-design plant in Melfi (see next chapters), represents the all-important bet for Fiat in the 1990s.

4.4. Lean production with Suppliers

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ambiguous on a fundamental issue, that is on Japanese transplants (no restraints on capacity expansion). Fiat's new managing director, Giorgio Garuzzo, asserts its bias towards Japanese transplants, since they "will never be plants like ours, since research, design and components will always be done in Japan, and these are the key factors for the survival and development of the car industry" (Il Sole 24 Ore: May 29, 1990). Moreover, they have a "considerable advantage in labor costs, state aid, new components, absence of restructuring and unions" (Il Sole 24 Ore, July 16, 1991).

[9]Previously, Paolo Cantarella had been CEO of Comau. In 1989 he joined Fiat Auto as director for procurements, in 1990 was appointed general director of Fiat Auto and then, in 1991, CEO.

Fiat has begun revolutionizing its relationships with parts manufacturers. Its objective is to set up partnerships with suppliers. This implies recognizing the strategic role of component manufacturers in determining the quality and cost of cars, the necessity of cooperation and collaboration, and the development of co-design initiatives. Within this new policy, not too far from being completely implemented, the number of suppliers is being reduced. New, longer term relationships are being set up putting plenty of emphasis on assistance, trust building, just in time coordination, and comakership.

Outsourcing policies have been targeted and differentiated. For example, suppliers have been divided into five tiers :

A) leader with high standards, operating in partnership with Fiat;
L) supplier with high standards, but not in partnership (i.e. captive firm of another car-maker);
B) "administered growth" supplier; Fiat partnership with these suppliers should focus on quality improvements and cost efficiency;
C1) "stand-by" supplier; under evaluation towards B) rating;
C2) "exit" supplier; contract will not be renovated.

The degree of vertical integration, traditionally considered comparatively higher at Fiat than other European and Japanese car makers, is being reduced. Internal sourcing has been increasingly regarded as a rigidity factor hindering quality and efficiency improvements, Particular attention has been paid to outsourcing complex or hi-tech parts, and subsystems of components: purchases from A) and B) suppliers increased from 34% in 1990 up to 80% in 1992 (% of total purchases). And Fiat management foresees intensified outsourcing. As a consequence, the distribution of the dollar value of auto components used by FIAT show a significant evolutionary trend toward externalization, complex bilateral relationships and vertical disintegration.

		1991	1992	1993	1994	1995	1996
Internal design	76%	70%	60%	50%	40%	30%	
External design		24%	30%	40%	50%	60%	70%

(Source : Fiat internal reports)

JIT supplying is one of Fiat objectives. In the development of the new assembly plant at Melfi (South Italy) approximately 700,000 sq. mt. are dedicated to suppliers. These will produce those "Punto" new model components which are either critical or burdensome to transport. Their location, adjacent to the assembly plant, is aimed at minimizing sourcing lead times. Along with these main suppliers, research centers will also be located nearby the new Melfi and Pratola Serra plants ("Elasis project"). Hopefully, the suppliers and these two centers dedicated to the logistics of "external" components, will operate on quality self-certification. Fiat management also expect that these location choices will trigger synergies and interactive learning as in industrial districts.

At the moment, given Fiat long tradition of high vertical integration, the shift to JIT practices encounters many technical, social, and cultural resistances. In many cases, parts manufacturers have only decreased the average size of batches, increased delivery frequencies and shortened delivery times. Only in a few cases (e.g. car seats for the models assembled at the Rivalta plant), parts manufacturing takes place just in time according to Fiat needs. Having smaller

batches of components delivered more frequently is completely different from having a lean supplier, manufacturing those batches in smaller sizes (Womack, Jones and Roos, 1990). Moreover, the new cooperative attitude of Fiat (direct assistance to suppliers, suppliers' workers and management training, management and manufacturing consulting, co-design, etc.) is somewhat ambivalent.

First of all, suppliers find it difficult to trust a customer that has traditionally developed very aggressive market relationships, based on competitive bids and on a short-term basis. This issue of credibility is moreover related to a more general issue regarding the manufacturer-supplier relationship: how much of these "new" practices is aimed at helping the supplier and improving coordination as opposed at overcoming information asymmetry (in terms of know-how and cost structure) in order to keep the supplier under control? Related to this, there is the issue of risk allocation. How much of these "lean" practices implies that manufacturers are willing to reciprocally absorb risk (in terms of volumes, variances between target costs and real costs, etc.) as opposed to risk shifting (Asanuma, 1989; Asanuma and Kikutani, 1991).
These issues are particularly critical during recessions, when market difficulties may incentive opportunistic or at least elusive behaviors by both car makers and suppliers.
For example, the first tier suppliers (partners) sometimes dispute with Fiat about whom should take care of JIT malfunctions related costs.

But all this kind of difficulties, easily understandable in a so huge transformation process, seem to be on the way toward solution. In the new Melfi plant the suppliers are managing to service the assembly line of new model "Punto" with a *synchronous kanban* system. Synchronous kanban means that the delivery of parts must arrive in the same sequence of the bodies processed by the assembly line. The supplier has only two-three hours to respect the order of delivery: the time a specific body spends to go from the painting shop to the point in which the component must be utilized in the assembly. This synchronous kanban will be applied for the 42% (in value) of the supplied components.

4.5. Lean Production with Dealers

Many partnership programs are targeting the dealers' network (Campus, Europa '93, Sirio, etc.). The starting point is the realization of a Customer Satisfaction Index, regarding both Fiat cars and dealers' service. While in the past the incentives for dealers were based exclusively on volumes, today Fiat aims at relating incentives to the Customer Satisfaction Index. The main objectives are reduction in stocks, order processing time, dealers' turnover and an improved concern for quality among dealers by defining ad hoc improvement programs.
Many of the considerations proposed in the previous section for the relationship between Fiat and its suppliers can be applied to the relationship between Fiat and its dealers.

Another important intervention aimed at improved quality and customer satisfaction concerned after-sale services. Distribution and services absorb a relevant quota of the overall cost of the car. It accounts for a 25% of the cost of the small models, and for a 35% of the luxury type. In this area, productivity gains comparable with those already achieved in other activities (procurement, design, manufacturing) are hard to reach. Distribution and assistance are "soft" activities in which there is little room for applying automation technologies. Furthermore, this kind of activity is managed for the most part by independent actors: the dealers. In Europe, dealers are usually small firms, very different from one to another in terms of size, profitability of their local markets, managerial capabilities, financial strength and experience. For car manufacturers, it is therefore difficult to elaborate standard rules for organizing the distribution network.

During the 1980s, Fiat implemented a commercial strategy based on a systematic expansion of the number of dealers in the domestic market, and in the other European Countries. Underlying this policy, there was Fiat's assumption that its products were competitive. As a consequence, the efficiency of the dealer network was to result from strong competitive confrontation. But competitive relationships existed not only with the networks of competitors, but also within Fiat network.

As an implication, dealers had to focus their efforts on an exclusive target: market share gains. In fact, Fiat's incentive structure was centered on bonuses based on volumes. This strategy allowed a spectacular growth of the market share for Fiat in the second half of the 1980s, when models were still quite new and appealing.

In 1988 and 1989 Fiat became the market leader in Western Europe. But this leadership, together with the difficulties of governing a much wider dealers' network, caused also some pitfalls, especially in terms of quality and customers' satisfaction.

Since 1990, Fiat distribution strategy has been oriented toward (Volpato 1994):

- creating, developing and maintaining customers' satisfaction over time in order to get their fidelity;
- studying, testing and diffusing new procedures for effective partnerships with dealers. These objectives have been pursued by means of:
- a reduction in the number of dealers in the various national markets: for example in Italy the number of Fiat franchised dealers decreased from 852 (1989) to 677 (1993);
- the opportunity for small Fiat Auto dealers, operating abroad, to became multi-franchise dealer adding to the franchise of Fiat that of Lancia or Alfa Romeo;
- the constitution of the Fiat Marketing Institute, with the mission of a systematic search of excellence in commercial activities and in their transfer to the network through integrated educational efforts.

But the most relevant lever of the partnership program is represented by the redefinition of the incentive mechanisms. Instead of centering them on market shares, Fiat targeted customer satisfaction as key variable. As a consequence, dealers' incentive scheme is linked to service levels really provided to the customers. Fiat Auto adopted a Customer Satisfaction Index (CSI) derived from systematic interviews of customers at different stages of the car life-cycle and in different situations: e.g.: before and after sale, financial repair services, etc.

This index is used not only for defining periodical incentives but, more interestingly, for systematic discussion with each dealer in order to study, test, and apply new initiatives in customer care.

5. THE INTEGRATED FACTORY (IF)

5.1. Hypotheses and goals

In order to understand how Fiat comprehensive strategic change is affecting industrial relations strategies, human resources practices and work organization concepts it is necessary to focus the attention on the most important organizational project: the "Integrated Factory" (IF).[10] The IF originates as a necessary aftermath of (and as an attempt to overcome) some of the mismatches emerged at the Cassino assembly plant in the Highly Automated Factory (HAF), especially in terms of body assembly operations.

The basic concept of this new plant organizational model is "integration", i.e. the emphasis is put on organizational interdependencies and integrating and coordinating mechanisms, as automation ceases to be the only driver of productivity. Organizational, industrial relations and human resource management choices are rediscovered as key constituents of the firm's competitive performance. The IF model was initially designed in 1990. Fiat chose to implement it almost at the same time in its plants rather than test it in a pilot plant. During 1991 the only partial applications took place at the Termoli and Cassino plants, but Fiat extended the model to all its plants during 1992 (beginning with the Rivalta assembly plant).

However, a comprehensive implementation of the IF scheme will be achieved only with the setting out of the two new plants in Southern Italy. In fact, Melfi and Pratola Serra will represent the "true" application of the "IF" concept both from a structural standpoint (e.g. the layout of old plants is partially inconsistent with the integrated factory; the simultaneous and consistent design of new plants and new models facilitate the adoption of new organizational concepts) and from an industrial relations perspective (as previously pointed out, the history of Fiat and unions is dense of unilateralism and conflict)[11].

The integrated factory seeks to achieve an improvement in productivity and quality by maximizing product manufacturing efficiency, quality improving and systematic monitoring, and control of logistics. According to FIAT management assessments (see figure 6), these results will be reached, paying off the related investment (implementation, training etc.) in only a few years.

The key organizational principles of the new organizational model are:
- process based rather than function based organizational structure;
- activity integration (both function/function and firm/worker);
- "lean" organizational structure;
- decentralization;
- labor involvement.

The integrated factory model and its meaning can be grasped examining the following dimensions: plant organizational structure, work organization, recruitment, training, compensation and industrial relations.

[10]Fiat calls it FI, which stands for *Fabbrica Integrata.*

[11]The new-design plants at Melfi (integrated assembly plant for the new "Punto" model) and Pratola Serra (a state of the art engine manufacturing plant) will represent the "definitive" and more comprehensive implementation of the IF scheme on a "green-field" setting.

fig 6

5.2. Plant level organizational structure and work organization

With the integrated factory, substantial delayering and decentralization is supposed to take place in the plant organizational structure: former sectors are divided into "Operational Units" (*Unità operative*), by aggregating previous machine-shops (*officine*).
At the plant level, part of former central staff units, maintenance, material planning etc., are decentralized at the "Operational units" level. In fact, each Operational Unit is articulated and specialized in two areas: Operations and Production Engineering. Production engineering is a decentralized pool of technical competencies, working as a staff of operations.

Through delayering, 2 out of 7 hierarchical layers were eliminated, including the so-called *capireparto*, i.e. the most traditional shopsteward figure. Plants should achieve a flatter organizational structure. This should enable both cost reduction and, when associated to integrators, more horizontal (less hierarchical) coordination.

The key element of the integrated factory is the Elementary Technological Unit (ETU)[12], defined as a unit which governs a segment of the process (a technological subsystem), in which such activities as prevention, variance absorption, self-control and continuous improvement are carried on, in order to achieve the firm's goals in terms of quality, productivity/costs and service. Normal workers (blue collars) are assisted (ratio 1/10 or 1/30) by highly skilled workers (integrated process operators, integrated process conductor) whose tasks are quality improvement and people training. ETUs' size vary according to the technological area; while in components and engine manufacturing the average size is 20/30 workers, in body assembly they reach 40/70 units. The main thrusts of the ETU are appointing the solution of problems at the lowest possible level (resources and skills are placed so that problems may be solved as and where they occur) and facilitating product and process quality improvement by systematically incorporating organizational learning developed in the workplace.

At the same time, the ETU should allow leaner and smoother manufacturing processes, cycle times reductions, flexibility enhancement, and lower costs. ETUs are upstream/downstream related to one another with a supplier/customer-like relationship. Every ETU should work and be managed by an information system made of diagrams consisting of indicators on product and process quality, costs, productivity, workers' skills and maintenance. Most of them are common (so called institutional indicators), others are customized and defined according to specific ETU needs. This complex information system (so called *gestione a vista* or management by sight) is composed of subsystems concerning quality control, manufacturing performance measurement and so on. Each subsystem includes such instruments and indicators as defect ratios, Pareto diagrams, CEDACs, Flag systems, labor productivity ratios, Radar Charts etc. These elements contribute to overcome information asymmetries between directing and operating people and to confer transparency to the organization. Besides "*gestione a vista*", other management techniques such as statistical process control and TPM are being implemented in order to control microprocesses.

Jobs and skill profiles within the integrated factory are very much different from those of the highly automated factory. New organizational roles are the IPC (integrated process conductor, every 12-15 workers) in final assembly and the IPO (integrated process operator, every 25-30 workers) in other areas.[13]
Their main tasks are workers training, prevention and information on quality. They intervene in the manufacturing process and deal with informal work organization aimed at process

[12] In Fiat : *Unità Tecnologica Elementare* (UTE)
[13] In Fiat CPI (*Conduttore di Processi Integrati*) and OPI (*Operatore di Processi Integrati*).

improvements. This basically happens by means of suggestions or other kind of interventions, such as on job assignments, based on their experience. IPCs (in body assembly operations) and IPOs (elsewhere) can be considered the functional equivalent of conductors (regulators of highly automated processes) as defined by Kern and Schumann (1984). As said before, such staff as technicians and other specialists (maintenance) are decentralized at the operational unit level and integrated to ETU's workers (direct people) by means of technological *teams*.

Within the IF model, teams are conceived as *integrators* (Lawrence and Loersch, 1967; Galbraith, 1977), i.e. as organizational devices enhancing horizontal coordination, information sharing, and organizational learning. In order to understand what role teams play in this organizational model, it must be pointed out that, within the production engineering unit (staff of the operational unit) other new jobs and skill profiles emerge with the integrated factory:

- the line technologist, whose task is that of supporting the ETU chief in training and respecting time and cost targets;
- the technology specialist, whose task is that of technical anomaly diagnosis and solution (referred to a given technology area, e.g. electronics, etc.);
- the product/process technologist, whose task is that of continuous improvement, process reliability and product quality, as well as participation to new or modified product engineering.

At the shopfloor level, a team is therefore made up of the three technologists considered, the E.T.U. chief, a procurement manager, and a maintenance and quality manager. The team's task is problem identification and solving. Once the problem has been discussed the line technologist will then cooperate with technology specialists. These teams are not autonomous work groups (as those of the socio-technical tradition or similar to those adopted at Alfa Romeo during the 1970s, or at Volvo during the 1980s (Berggren, 1990)), but organizational mechanisms of interfunctional integration, aimed at governing complex interdependencies (Cattero, 1992), at activating lateral relations on purpose (Galbraith, 1977), that is when specific problems arise on the process segment considered. Confronted with other teams like those at Mercedes (Skeleton shop agreement pilot project) and at Volvo, Fiat's IF teams do not entail a shared and common task, are more centered on professionals, and located to a somewhat higher level than that of the line worker. Teamwork has also the major objective of enhancing flexibility and reducing costs by means of:

-increasing workers' polyvalence (e.g. at the Termoli plant, female workers perform manual assembly operations -gears components-, but, when non saturated, are shifted to repairing);
-reduction in idle times and workers' non saturation (at the Mirafiori assembly plant, the first step of the IF implementation has been a re-design of teams). Figures 7 and 8 picture the traditional organization versus the new IF model.

5.3. A new focus for recruitment and training policies

In this time of labor redundancy, and layoffs staffing does not represent a problem, except for the new plants. At Melfi and Pratola Serra Fiat workers' recruiting policies are innovative. The selection criteria, used as "port of entry" of the internal labor market, are extremely rigorous. Both for line workers and plant level professionals, their emphasis is not only on skills and learning potential, but also on the psychological and social traits of the candidates. Loyalty, a cooperative attitude, the capability to interact and absorb stress are only a few of these new abilities Fiat is seeking out. These recruiting policies are aimed at avoiding mismatches between

fig 7

fig 8

the new organizational philosophy (which emphasizes workers' flexibility, team work, cooperation etc.).

In other words, such a strict screening is instrumental at preventing possible self or adverse selection (from the firm standpoint) of recruits, and reducing opportunistic or elusive behaviors, i.e. those behaviors that are not fully committed to or consistent with the firm's objectives. In other words, the new organizational model needs not only highly qualified and skilled workers (particularly ETU chiefs and IPCs), but also people with relational skills and personal flexibility, given that an overload of tasks and responsibilities comes along with the new delayered structure. Besides, plenty of emphasis is put on recruiting young and well-educated workers (in the new-design plants 10% of employees will be graduates). This will probably impact also on cultural values and social behaviors (e.g. union related) within the factory.

This focus on recruiting is associated to a new effort in training. In fact, as focused selection of candidates allows turnover reduction and higher workers' motivation, investment in training tends to be, according to Fiat, more effective and less risky.
Training expenses have been boosted by the introduction of new work organization practices. For example, training expenses as a percentage of salaries grew from 1.3% to 3.1% in 1990-91 (Follis, Pessa and Silveri, 1991). The organization of work emphasizes on-the-job training and "teaching by doing", especially regarding IPCs and IPOs.

This is another way by which Fiat tries to exert pressure on workers, in a true Japanese style.
For the new plants in Southern Italy Fiat developed, thanks to its training center Isvor, a complete "ad hoc" training system (articulated in subsystems) rooted in the training programs (so called *Anatra*) pioneered at Termoli. This training system has been carefully engineered and designed in advance. Moreover, agreements and partnerships with local institutions (e.g. co-design of educational programs in technical secondary schools) have been set up.

5.4. Compensation: a new fuel for participation

Throughout the 1980s, Fiat labor costs have consistently grown, in part as a result of wage indexation (whose effects were nevertheless progressively dampened with the interconfederal-national accords in 1983, 1984 and 1986), in part because of collective bargaining at the national (metal workers) and firm level, and in part because of Fiat compensation policies (Fiat was achieving conspicuous financial results in these years). These labor cost increases were covered by the productivity gains realized with the implementation of the Highly Automated Factory (at least in engine manufacturing). But in the late 1980s, as the first signs of worsening emerged, Fiat management began thinking about how to make compensation and wages more flexible.

The first step was the July 18, 1988 firm-level union agreement, linking wage increases to firm performance. This accord was very controversial. Only two of the three confederal unions (FIM-CISL, UILM-UIL) initially signed it. FIOM-CGIL agreed only later, with strong internal dissent.[14] This accord was not a "classic" gainsharing plan. Rather, it represented a contingent pay scheme in which wage increases were allowed to take place only if firm performance was good. In other words, contrary to the traditional rigid wage increase claims demanded by the unions throughout the 1970s and the 1980s, this agreement represented: an attempt to re-define

[14] The bonus is defined "PPG" (Group Performance Premium). The four indicators are net sales per employee, net sales on net investment, net investment on equity and net sales on warranty- expenses for products, all weighted as following : 50%, 20%, 20%, 10%. Some debate has arisen over the possibility to establish plant-level rather than global agreements.

the how to allocate productivity gains between the firm and the workers (and, hence, who would bear the risk of not achieving such increases); an attempt to overcome information asymmetry (disadvantageous for the unions) (Wachter and Wright, 1991). In fact, the unions wanted to link bonuses to parameters measuring Fiat flourishing financial results.

Also at a more micro level, the need for more flexible compensation schemes emerged at FIAT. Wage differentials within the new IF organizational model must be redesigned, and this poses important problems in terms of internal equity. Given the firm's objectives in terms of quality, cost and delivery, higher workers' participation and involvement become more crucial in the I.F. model. Thus, new incentives were required in order to gain people's commitment and trust, overcome information asymmetry, and align firm's and workers' goals.
Workers' participation had been partially fostered by the spreading out of quality circles. These had been initially developed in assembly plants, with the union acquiescence. They were made up of 8-10 workers on a voluntary basis, off working hours and without compensation. Participation, QC, personal involvement and incentives were then linked together with the January 25, 1991 firm-union agreement: adopted suggestions (both for quality circles and individuals), were awarded with "quality prize" bonuses. This incentive scheme idea was applied to the 600 Fiat quality circles then existing, and, on an experimental basis, to 15,000 blue and white collars at the Rivalta, Termoli and Cassino plants. Suggestions were to be presented to ETU chiefs, then reviewed and awarded, if applicable, by a joint plant union-management committee. Ideas are grouped into four main categories: product quality, working methods, input/energy cost saving, equipment efficiency.

5.5. Industrial Relations : bypass or opportunity?

The most recent research (Bonazzi, 1993; Pessa and Sartirano, 1993; Santagostino, 1993; Rieser, 1993), highlights that the organizational innovations underlying the IF model cannot be successful if the unions do not buy in. At the moment, there seems to be hints and cues of new bilateral relationships between management and the unions. The June 15, 1993 accord about the Melfi plant organization[15] (although it needs to be tested) is clearly a symptom of a more collaborative attitude of both management and the unions. It is not yet a full participative model such as that developed in other major Italian companies like Zanussi (European leader in consumer durable manufacturing). Nevertheless, within the emerging organizational paradigm, unions have been playing a more and more important role, and are "institutionally" involved at two levels :

- the "consulting committee" level (instituted in October 1990), where the firm reports to the union the results about quality and productivity improvements;
- the "participation committee" level, which team up plant managers, quality managers and union representatives, in order to facilitate workers' participation.

On the whole, these committees contribute to shape a positive internal climate, allow the development of trust among the actors, improve communication by reducing information asymmetry between the parties, and allow a more clear interpretation of the new organizational concepts by language sharing.

[15]Despite the accord, the interpretation of the IR strategy underlying the Melfi and Pratola Serra developing plants. They can be viewed either as means to bypass mediation and intervention (note, however, that only some of the unions seem willing to substantially change their attitude towards the emerging IR model), or as green-fields where to develop a brand new IR model (from this standpoint, the new plants represent a unique opportunity for the unions themselves).

For example, while a very militant minority of FIOM-CGIL ("Essere Sindacato") was very resistant to change in the old plants (Mirafiori, Desio, etc.), during 1991 other unions understood the opportunity provided by the Melfi plant. FIM-CISL, for instance, proposed and discussed with the other unions the possibility to implement, at Melfi, an IR model similar to the Saturn-GM one. Obviously, FIM-CISL envisioned the Melfi plant as a pilot-experiment to be later on extended to other sites. Considering also the representativeness problems facing the unions especially in terms of "democracy" (e.g. the election of factory councils - which have not been renewed for a decade in many Fiat plants - with stronger "voice" of the base and lower presence of union bureaucrats) Melfi can be seen as an accelerating factor in union evolution and modernization.

6. WORK ORGANIZATION, HUMAN RESOURCE MANAGEMENT AND LABOR RELATIONS IN THE INTEGRATED FACTORY: WHAT IS LEAN AND WHAT IS NOT

6.1. Organizational structure and work organization : delayering a mammoth

As previously pointed out, the IF, can be seen as a crucial component of the manufacturing paradigm-shift taking place at Fiat. From a theoretical standpoint, an interesting question is how much of this change resembles to a move toward the lean production model.

Another interesting problem is whether this change is the mere result of an attempt to adapt to institutional or economic/competitive pressures, or it depends and is shaped by internal factors, rooted in the firm organizational heritage and endowment of competencies.

From this standpoint, it is important to look at those areas in which the adoption of the new organizational model generates tensions and contradictions, and what factors are causing these difficulties. It is useless repeating that the preliminary stage at which Fiat is suggests suspending evaluations waiting for developments. This will allow a deeper understanding of the dynamics taking place.

Considering the organizational structure implied by the IF model, delayering requires a great deal of cultural shift. The traditional shop-floor authority-based setting (vertical communication, hierarchical coordination, etc.), which generally inhibited cooperation and horizontal information flows, is replaced by integrating mechanisms such as the ETUs and Technological Teams. The success of such shift depends not only in the coherence of the organizational design, but on the attitude and behaviors which managers and workers have to develop. For example, at the Rivalta assembly plant, only white-collars participate systematically to teams; IPCs and IPOs, who should be integrative part of the team effort, often have no time, inclination and motivation to do it.

Another key aspect of the IF is decentralization. Decision making is supposed to take place at the lowest possible organizational levels. Direct workers should take on responsibilities and be autonomous as regards some aspects of production. Despite this approach and intentions, a number of contradictions arise. For instance, the IF model entails the "*jidoka*" Japanese practice (workers could and should stop the assembly line intervening in order to anticipate or solve problems as they occur). But this does not happen systematically, given the resistance of both workers and plant managers, tending to stick to the traditional hierarchical practice of activating upper levels. In practice, lines are seldom stopped by workers. Rather, plant managers continue to decide about line-stops, and their traditional concern about quantity goals tends to dwarf attention toward quality. For example at the Rivalta assembly plant little *jidoka* is taking place (Pessa and Sartirano, 1993). However, in the new assembly line set up for the production

of Lancia Dedra (which has been moved from the now closed Chivasso plant), workers frequently stop the line because of quality problems. These stops, although implying sub-saturation of the production line, eliminate some typical low-quality related activities and costs (e.g. those jobs taking care of defects and poor quality related problems at the end of each workstation).

Moreover, another factor hindering decentralization is that the average worker does not want to take the responsibility to stop the line. The ETU Chief himself often tends to avoid the responsibility and call the Operational Unit manager or the plant manager (who are still oriented on volumes and therefore not willing to stop the lines). This is also due to the inadequate and ambiguous definition of quality standards, so that it is not clear if and when the line should be stopped by the workers.

The implementation of the IF model is also not facilitated by the layout of older plants. As an engineer said: "defining an ETU in Termoli sounds fine, but in Mirafiori there are problems with the layout" (Bonazzi, 1993). Contrary to those who see the IF as an organizational model able to maximize organizational transparency and to eliminate information asymmetries (Bonazzi, 1993), the complex system of information ("*gestione a vista*", consisting of diagrams, indicators, CEDAC, etc.), displayed in every ETU is often ignored, probably because of time pressure and difficulties in readability and updating. The work load is perceived too heavy in order to allow systematic use of all these instruments which, in some cases are seen as "useless paperwork". Moreover, especially when the workforce is old and unskilled, the interpretation of all these fancy management techniques causes frustration and misunderstandings. Moreover, team redesign, changes in job assignments, and modifications in phase times aimed at increasing workers' saturation put much pressure on workers.

Cerruti and Rieser (1992) pointed out that quality data are sometimes disguised or non detected, and that workers' quality self-certification is only theoretical. These frustrations sometimes emerge also in IPCs and IPOs. First of all because they trigger and activate teams in order to solve the problems they detect on the line, but are not actively involved in problem diagnosis and solving, who is carried on by technologists and ETU chefs. Secondly, sometimes they tend to misinterpret their role, playing like quasi-hierarchical figures (according to the traditional assistant -AIS- role).

Overall, structural changes are conspicuous from a quantitative standpoint. From a qualitative standpoint, hierarchical coordination has been only dampened by integrators and other horizontal coordinating mechanisms (teams, management by sight, etc.). The new model impacts in terms of job design and work organization mainly on higher technical-hierarchical levels (middle managers and ETU chiefs), while only a small percentage of workers (IPCs and IPO) see a significant transformation of their roles. Nonetheless, in the last 15 years, significant changes in skill profiles and jobs took place as cumulative effects of the HAF and of the IF implementation. Figure 9 provides some evidence in terms of data on blue collars distribution according to national contract job classification in 1975, 1983 and 1990. Blue collars are increasingly concentrated in the higher classes of the classification scheme.

fig 9

6.2. Recruitment and training policies

Both Fiat management and the unions are aware that the comprehensive organizational change entailed by the IF model requires time and a generational turnover in the work force as well as in middle management. Tenure is strongly positively related to resistance to the reorganizing effort (Pessa and Sartirano, 1993).

Team-work and employee involvement policies are adversed especially by older workers. While on average younger workers are convinced by the IF model and act to implement it, older workers generally consider it not applicable, and adapt or conform to the new guidelines with an opportunistic and passive behavior. For example, they are often reluctant to stand out even for a simple suggestion, notwithstanding the provided reward.

A manager at Mirafiori plant pointed out that about 50% of first-line supervisors do not hold secondary school degree, are between 45 and 50 years old, and have always been working in the same factory spot (Bonazzi, 1993). Fiat top management estimated that approximately 30% of the shopstewards cannot be re-qualified and used either as ETU chiefs, or professionals (technologists etc.). Voluntary or incentivated exits are not rare (Cerruti and Rieser, 1992).
In other words, it seems as if generational turnover, both among workers and managers, will be the ultimate driver of the organizational change.

Another task of the IF model is to overcome the limits and flaws of traditional middle managers' culture. Also the new recruiting policies are instrumental to this cultural shift, given their prevalent focus on a relatively young and well-educated work force. Nevertheless, this creates generational gap which can jeopardize the climate and social equilibrium within the firm. At the Rivalta assembly plant, for example, there has been a certain degree of turnover among IPCs , IPOs and middle managers. Some young and educated people, recently recruited, have been appointed ETU chiefs.

Moreover, the most important selection criterion for IPCs and IPOs (on average younger and more educated recruits), is the relational ability (dialogue, communication, collaboration, etc.) with other workers. These jobs require a great deal of flexibility and much overtime. Strong pressure is also put on ETU chiefs, often subject to a sort of selection by survival. There are some cases of unmet expectations among the new IPCs and IPOs, due to some discrepancies between what they have been trained to do, and what they are really asked for in the workplace. Many of them, as well as some ETU chiefs, feel underestimated and have higher salary and career expectations; this provokes a certain degree of turnover. Also plant and operational unit managers often perceive and deal with IPCs and IPOs as if they worked in the old structure (the assistant figure "AIS").

As already mentioned, training efforts are impressive. However, they are relatively centered on the new jobs and skill profiles.[16] Most of the workers are only superficially involved, by means of the two-hour weekly meeting where they are told about IF changes. Generally, direct workers are subject to more intensive training (rotations) and higher responsibility (quality self-certification of operations). In many instances, the unions argue that this selectivity in training does not represent a substantial change in Fiat attitude. Moreover, it does not seem to signal a changed interest of the Turin-based company in fully developing its workers' potentials (Follis, Pessa and Silveri, 1991). The flatter organizational structure, despite its positive effects in terms of cost efficiency, raises the issue of career paths and professional development. Without

[16] Note that the investment in training vanishes as turnover occurs.

real opportunities for career progressions and horizontal mobility the impact of training on quality and productivity cannot be fully exploited, indeed, demotivation and turnover can be triggered.

6.3. Compensation and quality

The new organizational model poses serious challenges in terms of reward systems. Due to the rigidities inherited from the 1970s, Fiat had put, throughout the 1980s, a major effort in widening wage differentials *among* the classes of the national level job classification scheme. *Ad hoc* compensation policies were designed for shop stewards, professionals and middle managers with the explicit intention of "reconstructing" a hierarchy also among jobs. The ratio between the average salary of the workers included in the highest level of the job classification scheme (7th super) and the average wage of the workers included in the lowest (3rd) level of the job classification scheme, which was approximately 1.3 in 1977, is 1.72 in 1993. But now, the IF organizational model seems to require very different policies. Delayering implies less hierarchy and thus less "vertical" wage differentiation. The new professional figures, and the continuous changes in the organization of work, together with the application of the team concept, makes it impossible to rigidly attach compensation to jobs. Knowledge, competencies and performance are becoming the new drivers of the reward system. Moreover, the need for highly-skilled workers implies a concentration of the workforce in the central and higher classes of the job classification scheme.

As a consequence, wage differentials *between* classes seems to be narrowing, while wage differentials *within* each class seems to be widening as result of pay for knowledge, pay for capabilities and pay for performance initiatives. Flexible compensation packages have been only partially implemented at Fiat. First of all, the contingent pay scheme included in the July 18, 1988 accord (the one linking pay increases to firm performance) failed because of disputes over the details of the mechanism. The indicators for firm performance determining the PPG (the collective bonus distributed) worsened because of market downturn, becoming unsatisfactory for the unions, which had much higher expectations. At the moment, bonuses and the related performance indicators are still disputed by unions. The reason why this contingent pay scheme failed is that neither the firm nor the unions were really willing to bear the risk deriving from exogenous factors. Despite the new industrial relations approach that seems to be emerging, reciprocal attempts to shift risks to the counterpart, are in some cases the premises of non-cooperative union-management relations.

Bonuses, merit pay, and pay for performance are used at Fiat plants. However, they still follow the guidelines emerged during the 1980s (Cerruti and Rieser, 1992). For workers (3rd, 5th and 5th level of the national job classification scheme), this elements of the compensation packages depend on shopstewards' performance appraisals, based on such criteria as seniority, loyalty, flexibility, willingness to do overtime, to change shifts, to intensify work. In some cases wage increases take the form of *una tantum* (spot bonuses), in others that of permanent increases (*superminimi*). For middle managers, pay increases are linked to a MBO system. Objectives include volumes, quality, absenteeism, injuries etc. Annually bonuses are given (after result evaluation) up to 600,000 Italian Lira. This part of the salary becomes permanent after 4 years. Other reward policies are linked to quality circle activities. As regards the relationships between individual incentives and quality improvement, the experimental stage of the suggestion system (from February to September 1991), yielded the results showed in figure 10. Although lower than comparative data for other European and Japanese competitors, the impact of participation seems significant.

Figure 11 and 12 show, instead, the results of the suggestion system at the end of December 1992. First of all, the number of suggestions per employee (ideas/population) increases after

the experimental stage. The number of workers participating to the suggestion system (as a percentage of the total population) is low if compared with other car makers manufacturing plants. However, at least in some plants as Termoli and Rivalta, data are promising (about 20%) if evaluated considering the recent introduction of the system. Furthermore, figure 13 evidences how suggestions are distributed according to issue/concern. The data show a marked concern for efficiency issues in newer plants (Termoli, Cassino), while in older plants (Rivalta, Mirafiori, Arese and Pomigliano D'Arco) a concern for quality prevails. This may be explained by the fact that quality was an important concern already in the engineering of the newer plants (such as Termoli and Cassino), and therefore it has been much embodied in the manufacturing system. As a consequence, efficiency is the key issue in these plants.

On the contrary, the reverse probably happened in older plants, where quality is not "built in" the process. In order to get the flavour of the distance among FIAT and Japanese car makers, figure 14 snapshots the existing gap between Cassino (which ranks best among FIAT plants in terms of suggestions per worker) and the average Toyota data. Figure 11 crosses the data regarding union density (union members as a percentage of employees) and workers' participation to the suggestion system (workers actively providing ideas and suggestions as a percentage of the total workforce) in the different plants. Crossing membership and participation to the suggestion system (considerable as a proxy for the degree of consensus and involvement to the new organizational model) is another (although rough) means for understanding the reason why the situation is so diversified across FIAT plants.

Even if cross-plant comparisons are difficult and data should be interpreted very cautiously (for instance, Termoli is not a final assembly plant and thus is not perfectly homogeneous to the others), the diagrams in figure 11 show a certain degree of inverse relation, in the different plants between the union density and the percentage of workers involved in the suggestion mechanism. In other words, the higher the union density, the lower the participation to the suggestion system. This relationship is not, however, so neat and clear. Furthermore, data often hide very different situation, and the number of workers actively participating to the suggestion system is not always a good proxy for participation and consensus to the new organizational model (in some cases, ETU chiefs require a minimum number of suggestions).

Take for instance Cassino, the most modern assembly plant. There seems to be little participation (figure 11). However, figure 12 shows that suggestions are very concentrated (high level of ideas per participating worker), meaning that relatively few workers participating submit a great number of suggestions. As union sources point out (Pessa and Sartirano, 1993), this could depend on the difficult implementation of the system and, more generally of the IF concept. In fact, at Cassino (as at Rivalta), suggestions, rather than being formulated by workers and evaluated by supervisors and committees, are often formulated by ETU chiefs and then informally passed "down to the workers". Further elements are however required to really ascertain if the concentration of suggestions is determined by this informal practice, with supervisors passing the ideas always to the same workers. Union representatives also point out that suggestion-related incentives are inadequate in effectively stimulating participation. For example, at the Rivalta assembly plant, during the first half of 1992, only 65.5 million lire of bonuses (about twice the yearly salary of a blue-collar worker) have been awarded, for a total of 867 suggestions. However, confederal unions did sponsor the suggestion system. For example, at the plant level unions autonomously instituted prizes (mountain bikes, TV sets etc.) for those suggestions covering particular issues (especially quality of work life and safety

fig10

fig11

fig12

fig13

fig14

issues). As unions representatives said to the press, this "parallel" incentive structure was meant as complementary, and not in contrast with that of Fiat.

Quality, which has been the most critical competitive weakness of FIAT in the last years, has significantly improved since the implementation of the IF model, as shown in figure 15. The data display quality trends for Fiat, Lancia and Alfa Romeo. Quality indexes are based on an elaboration from SIGI assessments and other Fiat information. Across FIAT brands there are differences and variations (e.g. due to defects in batches of components) but clearly all three show a significant improvement. Nevertheless, it is difficult to assess if there is a substantial gap between Fiat and other European car makers in terms of quality.

6.4. Industrial Relations

The IF model does not represent, for Fiat, a means to co-design the work organization with the unions (shifting towards a microneocorporatist firm-level IR model). Rather, it is conceived as a project anchored on managerial prerogatives. As a consequence, union involvement and consensus has been sought and pursued *only* during implementation, not in designing the new organizational model (as for instance happened for GM Saturn) (Cerruti and Rieser, 1992).

However, Fiat comprehensive restructuring could not have even begun with union opposition. In fact, the implementation of the new organizational model requires new rules and mechanisms in work organization and HRM practices (e.g. the recent accord for a third, night shift at Mirafiori for continuous production, or new career ladders for IPCs and IPOs), which can be provided only by innovative union-management relationships. There seems to be symptoms and signs of stronger collaboration. Fiat management seems willing o push for workers' and union's active cooperation (Cerruti and Rieser, 1992). For example, the joint union-management weekly committee at the Rivalta plant solved many problems about product quality and work organization related to the start of the Croma model production. The new Croma was transferred from Mirafiori to Rivalta in early 1992. Immediately, a number of problems arose (for instance, end-of-line defect rate was as high as 80%). FIOM-CGIL launched, involving other unions as FIM, UILM and FISMIC, the idea of a joint management-union committee (*Commissione di avviamento*) meeting every week. The committee faced and solved quality problems (lowering end of line defect rates from 70% to 12% in one month) deciding about line stops, workers' substitution, integration of workers moved from Mirafiori, redefinition of phase times and saturations. Interventions were made also in the layout (e.g. uplift of panels carrying bodies to be assembled in order to reduce fatigue and stress), and tools. The committee also solved disciplinary problems related to 120 workers reaching production target only at 40-60%, and reducing these cases to 20.

Despite these experiences of improvement and cooperation in IR, Fiat maintains a somewhat unilateral approach, emphasizing individual (i.e. direct management-worker) transactions. Moreover, new challenges have recently jeopardized FIAT attempts to restructure. The market crisis of the early 1990s forced Fiat to use massively the redundancy fund (in 1990 CIG was used for the first time since 1980) in order to reduce the stock of unsold cars (figure 16)[17].

[17] Fiat does not intend to cut capacity not to lose the opportunities which will appear in 1994, when demand is expected to rise. Other firms chose to close plants and lay off workers, but Fiat believes that, although suffering competition on prices, this choice in the long run will guarantee the reprise.

fig15

fig16

The repeated use CIG during 1991, 1992 and 1993 has confirmed a situation of crisis and is eventually raising tensions in labor-management relations (as shown by the increase of strikes and absenteeism taking place as C.I.G. is used -figure 17). Very recently, after exploiting all the CIG *ordinaria* ("normal" state redundancy fund available for cyclical market downturns) Fiat asked for further state help (access to CIG *straordinaria*, i.e. to special state redundancy fund related to structural crisis). This situation create tensions and uncertainty among blue collars, but for the first time also blue collars see their job security jeopardized.

On the whole, unions are cautious in evaluating FIAT management efforts. They are satisfied about the quality effort, the training programs, the new incentive schemes, because these represent a major discontinuity with respect to the technology strategy of the 1980s. But they also fear the use of CIG would announce layoffs, the set out of the new plants in the South would imply the shut down of older plants (as the Lancia plant at Chivasso, closed in 1992), the generational turnover led by Fiat recruiting policy would weaken their presence, and the adoption of lean manufacturing would mean more intensive work, etc.

Summarizing, with the IF model, in spite of its already mentioned contradictions, human resources involvement, commitment and consensus regain their status of key success factor. But, considering recent history, the evolution of firm-level industrial relations remains complex and multi-faceted. For example, industrial relations seem to be more cooperative and open, but strikes and absenteeism are soaring for the first time in a decade; union density indicators do not diminish as they did in the 1980s (Kochan, Locke and Heye, 1990), rather they show some sign of increase (figure 18) and almost reach (for blue collars) the 1980 level (figure 19); however, the union entropy coefficient increases[18], suggesting a state of increased disorder (figure 20), which corresponds to the difficulties unions are undergoing at the macro level especially in the industrial sector.[19]Figures 21, 22 and 23 illustrate strike and absenteeism rates for blue and white collars in the last decade.

[18]The entropy coefficient is defined as:

$$\sum_{i=1,2,3,\ldots,n} Q_i \log \frac{1}{Q_i}$$

where: Qi = union membership (share of total) of union i. It measures the dispersion of union membership.

[19] The increasing entropy evidences the fragmented situation among unions (in 1987 the FIM union had a major separation among its ranks; separatists were led by Tiboni who spinned off creating another union; the SIDA union has emerged in the last years, achieving strong representativeness for instance at the Cassino plant; anarchical fractions of the union movements tend to emerge).

fig17

fig18

fig19

fig20

fig21

fig22

fig23

CONCLUSION

Contrary to other studies, which tend to find much "leanness" in Fiat new organizational model and employment system (Bonazzi, 1993), many elements suggest that lean manufacturing both has not yet been fully implemented in Fiat, and it is impossible, at least at this stage, to assess if and how much the parameters pointed out by Womack and others (1990) are being adopted.

Leaving aside the ambiguities related to the definition of lean manufacturing (Babson, 1992; Williams and Haslam, 1992; Unterweger, 1992), on the whole, the organizational model based on the IF concept can be considered as a hybrid model, with strong differences as far as its implementation is concerned, also across Fiat plants.

These diversity from the Japanese manufacturing model derive from differences:

- in the institutional and cultural context (which, nevertheless, can be reduced as proved by successful Japanese transplants in the US and Europe);
- in difficulties in adapting "Japanese" management techniques generally due to misinterpretations and biases based on management and union cognitive schemes and problem framing;
- the non compatibility between Fiat past trajectory (and the related background of competencies) and new evolutionary avenue.

This last point seems particularly intriguing. Firms' trajectory are not only the result of adaptation to exogenous pressure. Rather, they are based on internal factors and are largely history dependent. Enterprises differ from one another in terms of organizational knowledge (Nonaka, 1991), i.e. of resource endowment and repertoires of capabilities. Organizational knowledge is incorporated in tangible and intangible assets (i.e. in sunk costs and routines), and results from learning, i.e. from the development (by means of risky choices and actions) of competencies *vis a vis* institutional and competitive pressures posed by the environment. The learning processes shaping organizational knowledge are firm-specific and, at least in part, cumulative and non reversible. As a consequence, each firm develops a given set of capabilities (different in terms of scope and depth). But this peculiar and unique set of competencies largely determines also the scope of the strategic and organizational alternatives available. In other words, firms' evolutionary patterns are *path dependent.* Organizational change takes place along a given trajectory if there is a certain degree of compatibility between exogenous pressures and the firm's resource endowment. But when a mis-match between a firm's organizational heritage and the request of the institutional and competitive environment arises, then a paradigm-shift, or radical organizational change is likely to occur. Obviously, some key actors (top management, stakeholders etc.) play a crucial role in determining when the change is triggered and how long it takes.

Furthermore, such change is risky, costly, and, as in every innovation process creatively destructive. Again, the firm's endowment of resources and capabilities can in some respects hinder and in some other foster organizational change. The complexity of firm-trajectories unfolding is well illustrated by the Fiat case. The emerging organizational model is a major discontinuity with the past. It is a hybrid model, very different from the toyotism or lean manufacturing because Fiat both did not *mean* to adopt them and *could* not adopt them.

The emerging organizational paradigm, and the difficulties Fiat is facing in implementing it, notwithstanding the huge effort and resources spent, largely depends on the configuration of Fiat's organizational knowledge as derived from its history. For instance, the paper tried to show how and when fordism emerged at FIAT, pointing out the specificity of such mass-production model, driven by exogenous factors. The relatively narrow scope of competencies

developed in that period (focus on the domestic market to respond to institutional factors, specialization on given product segments, etc.) greatly influenced the firm trajectory, and are still negatively impacting on Fiat performance.

Moreover, the Turin-based company shaped its competitive strategy in the 1980s according to the "smart machine" (Zuboff, 1988) approach, or, as recently argued by Bonazzi (1993), by "information technology based" neo-fordism. Many scholars (Cerruti and Rieser, 1992; Kochan, Locke and Heye, 1990) criticized this technology strategy and pointed out its excess emphasis on automation, and this paper itself showed some excesses and inconsistencies underlying Fiat manufacturing automation. Nevertheless, the HAF model (built on the experiments of Digitron, Robogate, LAM etc.), allowed the development of state-of-the-art knowledge in process technology, i.e. the acquisition of top know how and capabilities in engine manufacturing and body assembly. And these capabilities can now be applied to the new plants in South Italy. In fact, recent research work (Rieser, 1993) shows that assembly operations at the Melfi and Pratola Serra new plants will probably be closer to the LAM system, "back to the past".

Fiat's industrial relations strategy based on managerial unilateralism and concession bargaining was a key success factor during the 1980s. However, this policy left a heritage of mistrust and a memory of tensions and conflict in union-management relationships that only now begins, slowly and hardly, to fade (see for instance the recent Melfi union-management agreement). Middle managers (especially at the plant level) were a privileged target of HRM during the 1980s. *Ad hoc* policies in terms of compensation, incentives, careers, etc. were designed and implemented in order to re-gain middle management's loyalty and commitment, and re-build a solid and reactive hierarchy.

But now these policies represent, paradoxically, one of the largest obstacle in implementing organizational change. Middle managers (but also workers, especially those with long tenure within the firm) still behave as they have always done, and resist changes. Problems continue to be framed by old cognitive schemes, those consolidated and reinforced by incentive and success during the 1980s. However, the design of the IF organizational model proves that Fiat has learned the lesson that advanced technology had to be carefully matched with innovations in organizational and human resources practices. As a result, the key issue for the Turin-based company is having "smart people around the machine" (Zuboff, 1988) and, even more important, participating people.

The new plants in South Italy will be critical in determining whether the organizational paradigm-shift begun in the other plants will be successful or will abort. In fact, if the new plants will not be "insulated" green-fields, but, rather, the transformation drivers and organizational benchmark for the whole Fiat industrial setting, then Fiat will survive and start to work out a new organizational trajectory. The learning process underlying the development in the new plants (primary organizational knowledge and first-level-learning), and the ability to replicate and spread it in the other plants (metaknowledge and second-level learning) (Russo e Schoemaker, 1992; Schoemaker, 1992) will enrich and widen the depth and scope of Fiat's competencies, allowing the shift toward a new trajectory.

Nonetheless, this process is risky, and its outcomes uncertain. Furthermore, it takes time and requires massive investment, and asks for absolute commitment of all the actors and stakeholders. The crisis affecting Fiat as many other auto makers, does not facilitate the process and, most of all, does not allow sufficient time to operate serenely on the restructuring.

Overall, the paper allows to draw some general considerations. First, the "lean" concept must be revisited according to the different industrial settings and contexts. The Fiat case illustrates that not only the concept of lean manufacturing or toyotism is ambiguously defined and differs across countries and across firms because of institutional and cultural differences; but also that organizational models are firm-specific since they result from learning processes that are, at least in part, cumulative and non reversible. As a consequence, Fiat has developed historically a given set of capabilities (different in terms of scope and depth) which play a great role in explaining its evolution. But this legacy, this peculiar and unique set of competencies largely determines also the scope of the strategic and organizational alternatives available.

The IF model also shows that Fiat put much emphasis on organizational design and engineering, focusing on maximizing information diffusion throughout the organization. In other words, the Integrated Factory is a comprehensive attempt to make the organization transparent. Its *fil rouge* is the systematic reduction of information asymmetries among workers (teams and management by sight techniques should reduce elusive or opportunistic behaviors and assure horizontal relations in order to share information and solve as quickly as possible manufacturing problems arising in the workplace); between management and workers (the new recruiting policies aim at getting "exante" all the possible information about recruits, thus preventing possible adverse selection; the suggestion system and the related incentive scheme tries to overcome the information asymmetry existing between workers (who have task specific skills and job specific knowledge) and management (thus transforming individual information and knowledge into organizational knowledge and learning); and between management and the unions (joint union-management committees, and contingent pay schemes (based on union-management agreements) are aimed at information sharing[20]. This emphasis on the design of structures, systems and relationships can be deceiving if not integrated by attention to processes, behaviors, values and motivation. Trust building, consensus research, commitment gaining are fundamental, necessary to get new organizational concepts work. The fact that such activities are incorporated in intangible assets does not imply they can be done costless and effortless. Rather, trust, commitment and consensus require dedicated resources and investment which can, in the short term, negatively impact on the firm performance.

Summarizing, Fiat has envisioned the restructuring process as an "organizational revolution" or "radical organizational change" (Tushman, Newman, and Romanelli, 1986). This may entail all the positive outcomes of a major leap, but all the troubles associated to a holistic and comprehensive plan. In order to catch up, FIAT is pursuing a leapfrogging strategy, and is facing a phase of upheaval which partially contradicts the Japanese formula based on incremental processes and gradual changes. But, unfortunately, there is no time to proceed incrementally.

[20]In other words, many of the concepts developed by the principal-agent approach can be used to interpret some of the changes taking place at FIAT in terms of industrial relations and HRM. But these concepts need integrative analysis when context dependence and cultural factors must be considered in order to understand complex individual and collective behaviors.

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During the 1950's, Fiat, one of Italy's most important manufacturing companies, grew at enormous speed. Two factors helped the car maker achieve this impressive performance: For one, a set of import barriers virtually denied foreign producers access to the Italian market until the founding of the European Economic Community (EEC).Â Laux, The European Automobile Industry, 196. On Italian duties on imported cars see Wells, Louis T. Jr, â€œAutomobiles,â€ in Big Business and the State: Changing Refotions in Western Europe, ed.Â 47 In the beginning, very few Italian firms took advantage of the opportunity offered by American funds to renew their plants, considering it a risky business and preferring to concentrate instead on raw material orders. 12 - Making Manufacturing Lean in the Italian Automobile Industry: The Trajectory of Fiat 311. Notes 334. STATISTICAL APPENDIX 12: Fiat 336. Bibliography 336. 13 - Peugeot Meets Ford, Sloan, and Toyota 338.Â 2 - Models, Trajectories, and the Evolution of Production Systems: Lessons from the American Automobile Industry in the Years Between the Wars 49. Bibliography 59. Part I - ONLY ONE MODEL IN JAPAN? Fiat Group Automobiles,1the group that controls automotive manufacturing activities within Gruppo Fiat SpA, has gone through many crises in more than a century of existence. The crisis that arose...Â Camuffo, A. and Volpato, G. (1998) â€˜Making Manufacturing Lean in the Italian Automobile Industry: the Trajectory of Fiatâ€™, in M. Freyssenet, A. Mair, K. Shimizu and G. Volpato (eds), One Best Way? Trajectories and Industrial Models of the Worldâ€™s Automobile Producers. Oxford and New York: Oxford University Press.Google Scholar. Camuffo, A. and Volpato, G. (2002) â€˜Partnering in the Global Auto Industry: the Fiat-GM Strategic Allianceâ€™, International Journal of Automotive Technology and Management, 2 (3â€“4): 335â€“52.CrossRefGoogle Scholar.