

RESUME

**NOUVELLES TECHNOLOGIES, NOUVELLES FORMES DE REGULATION:
QUELQUES IMPLICATIONS SPATIALES.**

Les nouvelles technologies peuvent être mise en oeuvre à travers une polarisation accrue des qualifications ou une implication générale des producteurs, avec une forme de contrat salarial rigide ou flexible, avec une négociation individuelle ou collective. On dégage ainsi trois classes de modèles, "Néo-Tayloriens", "Californiens", ou "Saturniens". Dans le domaine de l'organisation industrielle, les nouvelles technologies privilégient l'"entreprise spécialisée" et la "quasi-intégration verticale", "territorialement intégrée" ou "désintégrée" selon le type de modèle de développement. De ces bifurcations résultera une évolution des déploiements régionaux vers plusieurs types de territoires: "Aires Productives Spécialisées", "Systèmes Productifs Locaux", "Aires-Systèmes".

MOTS-CLEFS : Nouvelles Technologies-Rapport Salarial-
Organisation Industrielle-Territoires.

SUMMARY

**NEW TECHNOLOGIES, NEW MODES OF REGULATION:
SOME SPATIAL IMPLICATIONS**

At the wage-relation level, the New Technologies may be implemented through more polarization in skills or through a general involvement of workers, with flexible or rigid wage-contracting, with individual or collective negotiation of the workers' involvement. These bifurcations lead to various classes of models of development, which are labelled here "Neo-Taylorist", "Californian" and "Saturnian". As far as industrial relations are concerned, new technologies induce Specialized Firms and Vertical Quasi-Integration. But this may be realized through Territorial Integration or Disintegration. As a result of these divides, territorial organization is likely to foster different types of regional patterns: "Specialized Productive Areas", "Local Productive Systems", or "System Areas".

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**NEW TECHNOLOGIES, NEW MODES OF REGULATION :
SOME SPATIAL IMPLICATIONS**

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**NEW TECHNOLOGIES, NEW MODES OF REGULATION:
SOME SPATIAL IMPLICATIONS**

To be a serious candidate for "the way out of crisis", any new model of development must be practical. As any model of development, including the one which is presently in crisis, "Fordism", it must involve a conjunction of three aspects: a form of organisation of labour (a industrial paradigm), a macroeconomic pattern (a regime of accumulation), a set of accepted and institutional rules (a mode of regulation) about the wage relation, the connection between capitals, a.s.o. To these must be added a new international configuration. The new technologies have their part to play, but do not determine which model will succeed. New technologies, in other words, would be compatible with a range of new models of development.

This paper will not attempt to outline alternative models in all their complexity. Thus, we shall not deal with State policy, money, credit, and international relations (on this, see LIPIETZ [1985a, 1987]). Rather we shall focus on the following areas of choice:

- about the organization of labour: responsible involment versus polarization of skills,
- about the wage relation: stable contracting versus flexibility.
- about the connection between industrial capitals: territorialy integrated vertical quasi-integration versus territorial disintegration.

In a first section, we sum up the analyses of the so-called "French Regulation School" about Fordism and its crisis (AGLIETTA [1976], BOYER-MISTRAL [1978], CORIAT [1978], LIPIETZ [1979, 1983, 1985b]). The second section will deal with new technologies, labour organization and wage relations, while the third section focuses on inter-firms relations. The final section will examine the spatial implications of the alternative models of development outlined in the previous sections. But it must be inderstood that future spatial configurations cannot be deduced from the features of any one model. Contemporary national and regional locations constitute the sites

in which the conflicts over new models are played out. Thus, we should speak of "feasable processes of spatial restructuration".

I - FORDISM AND ITS CRISIS

Along history, the main difficulties arising from the commodity-producing nature of capitalism, from the wage relation, from international relations, remained unchanged. Yet historically different solutions have become established as models (or pattern) of development. The era of hegemony of one or several countries adopting variants of the same model may be considered as a period of hegemony of this model. A pattern of development can and must be analysed from three different angles. First, as a model (or paradigm) of industrialisation: the general principles which govern the evolution of the organisation of labour (principles which are obviously not confined to industry). Second, as a regime of accumulation: the macroeconomic principle which describes the compatibility over a prolonged period between the transformations in production conditions and in the uses for social output. Third, a mode of regulation: the combination of forms of adjustment of the expectations and contradictory behaviour of individual agents to the collective principles of the regime of accumulation. These forms of adjustment may include cultural habits as well as institutional limitations such as laws, agreements etc.

The regime of accumulation therefore appears as the macroeconomic result of the workings of the mode of regulation, based on a model of industrialisation. This compatibility is yet a "chance discovery", the involuntary product of social and ideological conflicts. The post-war pattern of development of the advanced capitalist countries (which we shall label "Fordist") gives a perfect illustration of these different characteristics.

The co-existence of a number of countries expanding rapidly within the same pattern has brought about a certain world configuration. Without this configuration, it is probable that country-by-country implementation of the pattern would have been much more difficult. We shall deal mainly with the "inner" aspects.

1') The pattern of industrialization

As a model of industrialization, the Fordist pattern marks the high point of the Taylorist revolution at the beginning of the century. Its principles are well-known: a rigorous standardisation of operating practices and a corresponding rigorous separation between the Organization and Methods Office and the shopfloor, between conception (design, engineering) on the one hand and manual manufacturing on the other hand.

This rationalization through separation has two objectives. The first aims to implement as quickly as possible the apparently most efficient method (the "one best way") and to eliminate both experimentation at the workbench and malfunctioning along the workbenches. It aims to obtain gains in productivity in its strict meaning (physical efficiency of each operation) by the organised socialisation of collective "learning by doing". The second objective, less loudly heralded, is to obtain, via knowledge of the time needed to carry out each operation, rigorous control of the intensity of the operatives' work (number of operations per work-hour), in order to cut down the worker's "idleness". This control is exercised through standard procedures given to the operative by the O&M office.

True Fordism can be distinguished from Taylorism in the fact that these norms themselves are incorporated in the automatic apparatus of machines. Thus it is the movement of machines (notably in the case of the assembly-line) which dictates the operation required of the operative and the time allowed to carry it out.

Fordism as a pattern of industrialisation has caught on to such an extent that the gains in "apparent productivity" (combination of gains in actual productivity and gains in intensity) are unprecedented in world history. These gains were the basis (not the sufficient conditions) for the growth in the "Golden Age" of Fordism. Yet, by the end of the sixties, this basis began to be eroded (LIPIETZ [1986], GLYN et al. [1986]). Productivity began to slow down, and the capital/output ratio to rise. That led to a fall

in the rate of profit, hence (after a lag) in the rate of accumulation. Since we are examining here the possibilities for a "technological way out of crisis", we must interpret carefully the reasons for this erosion.

* Taylorisation, while spreading the "one best way", automatically increased average productivity in the strict sense along a "learning curve", and prevented any "trade-off" between growth in productivity and slackening of intensity. And in addition, work experience daily brings about the discovery of new "one best ways". But movement along the learning curve obviously drops off after a certain time. As for displacement towards the top of the logistic curve, it depends on the collective capacity of the workers (blue and white-collared) to invent new techniques. The Taylorist principle, while polarising this collective capacity between a mass of unqualified and unmotivated operatives on the one hand and the designers and technicians of the O&M office on the other, gradually confined the struggle for innovation to the latter sector. Yet this can only contribute to a general rise in productivity by the ever more complex machines that it designs. The majority of the production team finds itself excluded in principle from the battle for productivity and quality. It is thus the result of Taylorist principles that applied scientific experimentation (R&D) appears as a purely specialized practice and that its implementation in industry can only be introduced "from the top". Hence the illusion that technical change is a pure input, whose price is reduced to the cost of R&D on the one hand, and to the cost of incorporation into fixed capital on the other. But this is the counterpart of the fact that operatives' involvement and imagination is excluded from the process of technical change.

* This first comment must itself be qualified. In fact, the most Taylorised operative is not only obeying the instructions of the O&M office or following the movement of his or her machine. He/she is permanently using his/her brain and imagination to guarantee the smooth-running of the process, despite the innumerable interruptions caused by semi-finished products, break-downs and malfunctioning in equipment etc... He/she does so to assert his/her autonomy as a human being. In other words, he/she is always secretly, unconsciously in opposition to the formal mode of operation laid down by the O&M office. This

contradictory, "paradoxical involvement" (D and R LINHART (1985)) of the manual worker is in fact assumed by the O&M office and by the line managers. Without it, an automatic plant, however well designed, could not function. But it is not recognised by the formal organisation of the Taylorist enterprise. It represents an accumulation of know-how which cannot be socialised or generalised. Furthermore, it is dependent on the "social climate" on the shopfloor and the threat of its denial can become a weapon in the workers' hands. The "microconflictuality" at the end of the '60s may be understood as an outcome of the full-employment situation at the time. That is the grain of truth in the interpretation of the crisis as a "full-employment productivity-pulled profit-squeeze" (LIPIETZ [1986]). But that argument cannot explain the permanence of productivity crisis at the end of the '70s. The rising cost of job loss recreated the conditions of "paradoxical involvement": but the problem was that involvement remained paradoxical.

2*) The regime of accumulation

The immediate consequences of the pattern of industrialisation described above are as follows: a rapid and prolonged rise in apparent productivity (i.e. in the volume of goods produced per person); a steady and general rise in volume of per capita fixed capital. "Intensive" accumulation is used with this double meaning.

To a varying extent, depending on national circumstances, it has been found that a rise in productivity in the capital goods production department has soaked up almost exactly the amount of rise in per capita fixed capital. The "organic composition of capital" therefore hardly varied in the Golden Age of Fordism.

The major post-war innovation consisted of counterbalancing this growth in production against an equally massive growth in consumption - a steady, universally forecast and anticipated growth, extending to all sectors of the population but first and foremost to the wage earners. This growth in the purchasing power of the waged workers parallel to the growth in work

productivity was itself the result of a combination of growth in the purchasing power of each wage-earner and the growth of the non-productive or not directly productive wage-earning sector: training and welfare duties in the public sector (admin, health, teaching, insurance etc...) and design, training, marketing and financial duties in the private capitalist sector (AGLIETTA and BRENDER (1984)).

3*) The mode of regulation

The forms of regulation established or developed since 1945 may be said to conflict with those of the classic capitalism of the late nineteenth century in so far as they reduce the importance of "competitive" adjustment mechanisms. In short, it was a question of allowing the economic agents to interiorise the logic of the regime of accumulation, not by sanctioning their failures, but by anticipating the success of their initiatives, and in particular of the choice of production expansion.

a) The wage relation

History has shown that the parallel growth of productivity and purchasing power is ex post verified for the more or less long-term in Advanced Capitalist Countries. What characterises Fordism is that this link is ex ante institutionalised by laws or agreements, and spread more or less formally to all strata of wage workers (and even of population), without being confined to the most productive companies and sectors, as was the case in the days of competitive regulation of the labour market. The general law of direct salary structure is therefore: rate of wage rise = rise in prices + rise in general productivity, hence: rise in real wage = rise in productivity.

The OECD member countries have arrived at this result by a variety of different means. They generally have combine the role of leading sectors and a minimum wage set and adjusted by the state. But the principle of Fordism implies that the general rise in productivity will be effectively reflected in a general rise in purchasing power, anticipated by all entrepreneurs. This

general rise is therefore both an encouragement to capacity expanding investment for the more productive companies, and a constraint forcing productivity increasing investments on the rest. These compulsory agreements rendered the wage contract relatively rigid, including limits on the freedom to fire workers.

Collective agreements and minimum wage regulate the income of active wage earners, agricultural policies regulate agricultural incomes, there remains the problem of those non active. Here the "Welfare State" played its part via collective provisionnal allowances for the "normally inactive" wage-earners (old age pensions, sickness and maternity benefits, the dole).

b) The hegemony of the large companies

The concentration of capitalist power and property is a much older phenomenon than Fordism. But this sort of "monopolization" holds a different micro- and macroeconomic meaning within the more general context of Fordism.

The concentration of financial and technological facilities, and of parts of markets on a fairly wide range of like and semi-like products, means that oligopolies can benefit from the general atmosphere of market expansion without having to fear gains in productivity, contrary to what BARAN and SWEEZY [1966] thought. The fear of depreciation of existing plants, and the fear of price wars which might have stemmed the continuous flow of innovation of "products and processes" is in effect allayed. By commanding both the channels and the outlets, the oligopoly can guarantee the financial write-off of old-model production plants by incorporating it in the administered price for new products and processes. In fact, the mark-up becomes increasingly an administrative variable, manipulated according to the dictates of competitive strategy (LIPIETZ [1983]).

c) The "interfering" State (DELORME and ANDRE (1983))

The State's monetary responsibility in regulating the creation of credit money, and its capacity to bring pressure to bear on earned income

through the minimum wage and the rate of taxes or the Welfare State, are the State's two main characteristically Fordist anchor points for the economy. The "manoeuvrability" of effective social demand and of liquidity are the basis of what has come to be known as "keynesian policies", even if academic keynesianism has laid more stress on the State's direct expenses ("absorption"). This implies considerable expansion of social welfare (schools, health, subsistence allowances, ecology, etc...) while not precluding extension of the duties normally expected of the state: agricultural and industrial policies, organisation and funding of research and development, direct control (nationalisation) of certain industries, forward planning ("general market survey"), town planning, etc...

State regulation and national agreements were thus the second pillar of the success of the Fordist regime of accumulation (besides the success of its the industrial paradigm). This second pillar was in turn eroded by the growing internationalisation of production process and markets (LIPIETZ [1985b], GLYN et al. [1986]). To its character of cost and of determinant of inner outlets, the wage level added a new one: a determinant of national competitiveness. In the '70s, the trade-off between growth of inner market and clearing of trade balance became more and more uneasy. With the monetarist shock, some of the greatest advanced capitalist countries made their choice. Giving priority to competitiveness and reconstruction of profits, they undertook the destruction of the whole set of wage regulations and agreements, thus putting a definitive end to the fordist era.

4*) The Crisis of Fordism : a summing-up.

A common-sense interpretation of the crisis of "mass production" (a broad qualification for the Fordist model) emphasizes the demand-side aspect: the stagnation of markets due to the pressure of international competition, and the growing volatility of the pattern of demand (due to the same competition in a context of saturation of core markets for durable goods). Hence the characterization of crisis as an "underconsumption crisis" (PIORE and SABEL [1984, p.254]). The reality is more complex.

An alternative explanation could be sketched out as follows (LIPIETZ [1985]). First, a latent crisis of the industrial paradigm, with a decrease in the rate of growth in productivity and a growing capital/output ratio, led to a fall in profitability in the late sixties. The reaction of management (through internationalization) and of State (through austerity policies) led to a crisis in employment, hence in Welfare State. Internationalization and stagnation in demand both triggered the "demand side" of the crisis in the late seventies. "Flexibility" then appeared as an adaptation to this later aspect of the crisis, but the "profitability" aspect remains.

The possible ways out of this "double-sided" crisis opened by new technologies will be scrutinized now.

II - REORGANIZING LABOUR PROCESS AND WAGE RELATIONS

The aim of the monetarist shock was not only to put an end to the fordist forms of regulation (via delinking wage-price indexation, cuts in the welfare, and credit glut), and thus to the corresponding regime of accumulation (less mass consumption, more profit, high revenues, savings and investments). The model of industrialization itself was at bay, and new ways were being explored. That research was presented as a "technological necessity", and the correlative destruction of old industries based on the fordist principle was presented as a "creative destruction" in the Schumpeterian mood.

1') Nature and potentialities of technological revolution.

The main feature of present technological revolution is the invasion of microprocessors and electronic interfaces, not only within new products, but within the labour process itself. No doubt that product-innovation (electronic devices in cars, HiFi, home-computers) is likely to entail important cultural changes. Yet, from a macroeconomic point of view, they do not provide a wide scope of significant new outlet (such as housing and the automobile constituted in Fordism). Rather, it is the process-innovation

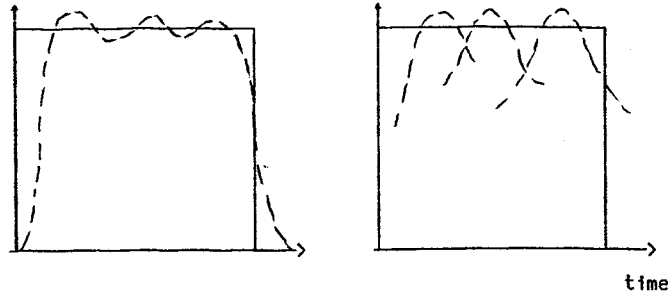
which appears to be the more important. And here, micro-electronics is redefining the very meaning of "automation".

a) On each work station.

First, electronics provides devices in order to make the move of the machines more complex. They are now becoming able to operate what used to be necessarily manual operations (assembly operations, a.s.o.). In this respect, electronics follows the previous trends, extending volume capital per capita, and the very fast fall in cost of electronic hardware is not likely to offset the rising cost of hydro-pneumatic or electro-mecanical parts of the machines, peripheral equipment, and software.

But, above all, electronics gives more flexibility to the shop. That is, it opens up the possibility (through an allegedly low cost and fast reprogramming) of changing the operation of standardized machines (even automatically). That innovation is supposed to introduce a major break into the articulation between micro and macro-economics (CORIAT [1983]). In the classical fordist model, mass production is in fact both a micro and macro-economic necessity. The profitability of a large rigid automatic machinery requires continuous and long series production of the same product, thus for a mass-market. On the other hand, flexible plants, which are as costly as classic fordist techniques (if not more so), require also a continuous and long series utilization, but not necessarily of exactly the same production. The "life-cycle" of a plant is thus partially delinked from the life-cycle of a single product. The profitable operation of a flexible plant is now possible with several short series within a range of differentiated products, aiming at smaller segmented markets. Nonetheless, the total market should grow because of growing costs of fixed assets and faster amortization.

physical
amortization
and degree of
utilization



Rentabilization of
fixed capital

rigid equipment

flexible equipment

————— Plant life cycle
----- Product life cycle

b) Among work stations

Still more important, shop-floor management itself can be modified by the introduction of electronics. The Computer Aided Manufacturing considerably widens the possibility of managing in real time the in-process inventories which are required on each operation, according to the needs in production of the shop (which can also be optimized according to intermediate and final demand). In the same way, it widens the ability of optimizing the process between the separate work stations (and thus the planning on each station). Design and Manufacturing can be more strictly linked. The "Just In Time" principle take the advantage on the "Just In Case" principle, and the "J.I.T." principle can be extended to the inter-shop connections within the plant, within the firm, between firms and sub-contractors (SAYER [1985]). The "idleness of machines" between operations, and the accumulation of inventories in buffers, can be strictly limited. Hence important economies in both fixed and circulating capital are achieved.

c) Limits

This brief survey of electronics promises should not lead to idyllic visions (BERRY [1985]).

First, the virtues granted to machines (they are not supposed to become tired nor to go in strike) are counterbalanced by the fact that they do break down. Though a standard robot may have a failure rate of 1 %, it should not be forgotten that a chain of robot may include 30 to 50 machines, with the failure of one of them entailing the interruption of the process. Then the rate of availability of a set may be reduced to 30 % or 50 %, unless on-the-spot manual operators are able to compensate for the missing operations, or if the maintenance staff can interfere in real time, or if "emergency softwares" can modify the planning of the set (skipping the defaulting machine). That remark raises more or less the issue of workers' involvement and qualification.

Still more severe are the limits to flexibility. Contrary to a common overestimation of the "new industrial divide" (PIORE and SOBEL [1984]), the flexibility entailed by electronics does not necessarily imply the end of the trend to technical and financial concentration of capital. In fact, the flexibility of plants is constrained within a narrow scope of adjacent products. Moreover, implementing flexibility (that is, fast shifts within the arrangement of the process) is a very complex operation, which requires a fairly great activity in real time, involving at the same time the design staff, the maintenance staff, and the manufacturing staff. More generally, implementing new technologies requires a "training-by-doing" delay involving both the hardware and the software and mobilizing a qualified working force (1).

The "technical revolution" of electronics thus lies "upstream" from the real industrial divide: is the classical fordist division of labour going to be reshaped or not, is the workers involvement definitely going to be dismissed or on the contrary its "paradoxical" character offset, thus mitigating the very division between design, maintenance and manufacturing ?

2°) Three types of industrial relations

The first alternative could involve the total expropriation of the direct operator from any initiative, the triumph of the central bureau of methods. As a tendential result, the shop could become a kind of automatic

galactic module, with some unskilled blue-collar workers serving some feeding or cleaning jobs, and some white-collar professionals tuning the process.

This may be the dream of a majority of bosses, faithful to the logic of Taylorism, and more precisely in the plants where in early seventies social discontent had completely worn out any involvement, even paradoxical, of the workers. That is the way chosen in Torino by FIAT. With the Robotgate, the Digitron, the L.A.M., the management got rid of the very presence of workers in the most disturbed shops. The choice of the elimination of living labour was mainly a political one. The counterpart was obviously a great leap forward of the capital output ratio, overshooting from the "rational" point of view. Except for the Robotgate (which is even exported to the USA), the management is no longer willing to build up plants at such a rate of automation, now that the victory against the workers' unrest has been achieved. According to one of the FIAT major managers, «Having been created at a time when the social situation had become unmanageable, the L.A.M. is an interesting experiment which is not subject to generalization. It is an expensive system, it costs a lot, requires a lot of space, and is more subject to default than less sophisticated ones» (SANTILLI [1985]). This reversibility of mechanisation is characteristic of a "labour-capital trade-off" within the fordist industrial model, not outside of it.

The alternative is obviously the choice of "less sophisticated" technical realisations, mobilizing in real time the involvement of direct operators. This involvement could not remain "paradoxical" anymore. The stake is inducing the working teams not only to become involved voluntarily in the permanent tuning and maintenance of the plants, but to do so in such a manner that the improvement could be systematically embedded into the hardware and the software. The "know-how" acquired through learning-by-doing within the day-by-day maintenance of the labour process should be amenable to formalisation and assimilation by the methods, design and engineering, staff. In fact, the problem is to reconnect what Taylorism had disconnected: the manual and intellectual aspects of labour.

Such a kind of industrial relations looks more "rational" than the former (AOKI [1985]). But how could such a compromise between the new "involved and multi-skilled" collective producer and the management be regulated, since obviously involvement and skill enhances workers' independence (and that was the main reason for Taylorism)? A new divide appears.

The first alternative, which the Japanese example made famous, consists in an individual bargain between the involvement of the worker and its sharing out of the improvements through bonus, career advantages, etc... The other alternative, exemplified by Swedish attempts (or the Pirelli agreement in Italy, the BSN agreement in France, the GM Saturn project being an intermediate case) is collective bargaining. The union offers the involvement of its members in order to achieve the expected rate of growth in productivity and the quality standards, in exchange of a right to control working conditions, redundancy, and a sharing-out of productivity gains.

At this time, none of the three ways (increased polarization, individual bargaining of involvement, collective bargaining of involvement) has imposed itself as a new hegemonic model of industrialization. They coexist within most countries, within firms, even within plants. None of them has laid the foundations for a new regime of accumulation, a new model of development. Yet one might guess that the first one would lead to an increasing social polarization (in terms of skills and revenues), the second one could induce the same result through the mood of individual competition that it induces in the whole social body (including school), the third one being the only one that could lead to a collective social and cultural promotion of the wage earners.

3*) Labour process and wage contract flexibility

Though the transformations within the industrial pattern (or technological paradigm) are certainly of major importance regarding the fate of crisis, they do not tell us anything about what could be the next "regime of accumulation" and "mode of regulation". To discuss that issue, we should

at least take into consideration another current debate : that of flexibility within the wage contract. Such a flexibility, allowing management to hire and fire at will, is proclaimed necessary by many business representatives, and is one of the main claims of the monetarist policy. A definitive attack against on the "excessive rigidity" of the fordist-type wage contract would open the road to a new regime of accumulation (as for the wage-formation itself, we are not going to discuss it here).

In developing alternative models, therefore, one is to consider not only three typical forms of reorganizing labour-process (A : deskilling, B : individual involvement, C : collective involvement), but also two typical forms of wage contracting: I "rigid" and II "flexible". Of course, the situation is more likely to shift towards a "segmented labour market", a tendency already observed in Japan, the USA (GORDON, EDWARDS, REICH [1982]) and Europe (BOYER ed. [1986]). Here, the "primary" segment, benefits from pretty stable wage contracts, while the "secondary" one is submitted to flexibility (through subcontracting, temporary contracts, a.s.o.). The "primary" segment includes both independent and subordinate jobs.

Are "flexibility" and "rigidity" compatible with any form of reorganization of labour process ? At this stage of historical experience, we can only have a glance to the logical implications of the different combinations.

The A-I case (polarization in skills through automation + rigidity in wage contract) is the strict continuation of fordism, and it was the main tendency in the seventies in Europe and U.S. As we have already seen, it did not reverse the underlying weaknesses of the late sixties : increasing capital/output ratio, insufficient gains in productivity.

The A-II case (same industrial paradigm, with more flexible wage contract) was the main answer to these limits. The idea is to optimize the microeconomical capacity of the firm to adapt to volatility in demand, and to ensure a better share to profit in value added. But this microeconomic falls into a fallacy of composition, even at the national level: with lower wages

and less rigidity in aggregate demand, problems are likely to appear in the "demand-side" (let alone the social unrest !), thus leading to a "come-back" of business cycles, and to a further ex-post fall in profitability for highly automated plants. That situation, not very different from pre-war problems of competitive regulation, could be a characteristic of the US economy after 1979, and more precisely after 1981. Moreover, there is some doubts that such a solution could lead to an improvement in quality of products.

Now, the B-I case (attempts to individual involvement within rigid wage contract) was a minority experience of early seventies. These experiences of "job enrichment" were not, at the time, considered as great success, since incentives to better involvement were difficult to find within a rather homogenous collective bargaining. "Corporate patriotism" is the only possible incentive and is widely used in Japan.

On the contrary, the B-II case (individual bargaining on involvement plus flexible wage contract) seems to be a pure implementation of liberal principles, and an idealization of the current italian experience (though is certainly not a faithful interpretation of italian industrial success). In fact, lighter industries and individual bargaining could be compatible (from the microeconomic point of view) with flexible contracts, and workers would be likely to become "involved" in order to avoid dismissal. "Corporate culture" could be the ideological cement. Yet the problem of aggregate national and international demand remains insolved, and huge international business cycles are likely to reappear.

By contrast, the C-II case (collective bargaining on labour process plus flexible contract) appears to be simply inconsistent at the microsociological level. An "involved working class" is a working class whose "know-how" is accumulated both to the benefit of the firms and of the workers. It is impossible if there appears to be no community of destiny between the firm and its employees.

That is precisely what the C-I case (collective bargaining on involvement within rigid wage contract) would secure. That combination

appears as the best compromise between the need of firms for flexibility of production and the need of workers for security. Besides, it opens the possibility of a macroeconomic agreement securing full-employment (by reducing labour-time for instance). But that national compromise (the Swedish one ?) could be threatened by international competition (2).

Certainly, the main industrial success-stories of the first half of the eighties (Japan and West-Germany) belong to a "mixed-case family", that is a sharp division of the labour between a "rigid" and a "flexible" segment (with tendencies in labor process ranging from A to C orientations). The problem is that these experiences are connected with a very strong positive balance-sheet in international manufacture trade (3). Since that could not be the case for all the countries together (even not to all advanced industrial countries), the "demande-side" problem remains open, not to mention the dramatic human and social consequences of that situation for the "wrong" segment of divided labour (see WALRAFF [1985]).

4*) First summing up.

As we have pointed out (especially in footnotes 1-2-3), the previous considerations are far from being sufficient to frame the possible models of development. Different scopes in national compromises (including or not solidarity between the various fractions of labour force), different form of sharing-out gains in productivity (through increase of purchasing power or decrease in labour time), different world configurations could lead to very different regimes of accumulation. Yet, we may already sketch out several "classes of models".

From the previous discussion, a simplification appears. First, we should take into account that A-I case being the fordist starting-point, it is likely to continue to exist for quite a while, with a "natural" evolution towards the A-II case (in search of lower wages). This scenario (deepening taylorist principles, more automation, and less "fordist" counterparts for the workers) could be labelled the "neo-taylorist" way for technology and for society (4). It leads to a very unsatisfying social pattern, with

polarization of skills, dualization of labour market and of society. Since the corresponding regime of accumulation does not exhibit a build-in tendency for the growth of inner markets (the tendency for the composition of capital to rise leading to a tendency to limit wages), that macroeconomic pattern will be characterized by business cycles and world trade wars. Not a nice future, but a possible future.

On the contrary, the C-II case appears simply inconsistent, a pure wishful-thinking from some bosses. The C-I case, on the other hand, may appear as a wishful-thinking from the standpoint of labour. Yet, that dream of a "new-deal for the XXist century" (LIPIETZ [1987]) seems to be shared by some bosses, not only in Sweden, but also in Japan (AOKI [1986]), in Italy (5) and even in the U.S. "Waterbelt" of the middle-east (MESSINE [1987]). Such a model is likely to exhibit the properties of stability of fordism, the bosses being granted the advantages of a less capital-using technological evolution and higher productivity, the workers being granted with a higher security, higher pay and/or less labour-time. Let us call this model "saturnian" (as an eponymical revanche of G.M. on Ford, and even if G.M.'s "Saturn project" is no more Saturnian than the Ford T was Fordist !).

Now the B-cases remain. The difficulties of the B-I case (the "voluntarist" way of involving workers) may be removed when taking into account the possibility of wage differentiation as a function of individual worker's involvement (WALTON [1985]). Combined with the "stick of job-loss" of the B-II case, that "carrot" may lead to a kind of "re-commodification" of the wage-relation, according to the quality of commitment at work, which seems to be in line with the general preference for market regulation. Let us call this model "californian".

The macroeconomic properties of a californian model are unclear. Due to its greater flexibility and less capital-using character, it is likely to be a little more stable than the neo-taylorist model. But, as MESSINE [1987] points out, new technologies require more than "individual involvement" for their implementation. The "know-how" is likely to be collective, except for the high professionals. Thus the more sensible is to think the model as

leading to a "3-tier" society à la GORDON: primary independent jobs with a B-II wage relation, primary subordinate jobs with a B-I wage relation (including bonus), secondary jobs with A-II wage relation for the lower skilled tasks. We recognize here the Silicon Valley.

Since there is not yet any hegemonic model, the reality appears at present as a mix of the various models. Thus, it is hard to identify the "spatialities" (LIPIETZ [1977]) of these, models. Moreover we need some missing links. The preexisting territories will give different opportunities for the spatialities of the models to unfold. And the unfolding itself will be the result of the reorganizing strategies of capitals, their interfirm and interplants policies. We are thus to deal now with "industrial organization".

III - NEW TECHNOLOGIES AND INDUSTRIAL ORGANIZATION

The classical form of industrial organization within fordist model was the intra-firm division of labour between shops according to taylorist principles (I: design and O&M offices, II: skilled machine manufacturing, III: unskilled execution, e.g. assembly lines). So sharp was the division that intershop division could be realized as inter-plant division, with "spatial disintegration", and even "vertical disintegration" at level III. That led to the "branch-circuit theory" (LIPIETZ [1974, 1977]). More recently, the tendency to "vertical disintegration" became so widespread (and the middle-small firm so over-emphasized !) that industrial geographers (e.g. STORPER [1985], WALKER [1985], SCOTT [1987a]) had to come to a closer study of industrial organization, and to the classical debate "market vs hierarchy". Re-reading COASE [1932] and his followers, SCOTT argues that a firm will tend to vertical integration not only for "economies of scale" reasons, but more deeply in case of "economies of scope". Obviously, routinization of the labor process according to taylorist principles is likely to weaken these economies of scope. This may entail spatial disintegration in search of "location-specific" conditions of the labour-market, and further routinization entails vertical disintegration ("volume

subcontracting"). On the contrary, the key "level I" tasks (R&D, O&M, marketing) must remain vertically integrated.

Now, as far as industrial organization is concerned, what are new technologies able to supply to capitals in search of lesser costs, especially economies in fixed capital, better position in a more competitive world market, with higher differentiation of products through innovation and quality (6)?

1*) Towards the "specialized firm".

New technologies (mainly through Computer Aided management of flows, flexibility of equipment goods, and high precision manufacturing) offer new possibilities.

* The segmentation into "modules" of labor processes, with integrated functioning, allows for transformation of batch processes into continuous flows, and for continuous production of differentiated goods (hence the transformation in the content of "economies of scale" outlined in our part II-1*).

* Transformation in the notion of "time-saving" that extends from the direct labour process to the entire process (from design to sale). This leads to the "Just-In-Time" management of the process.

The optimal management of integrated modular processes is likely to entail more vertical integration, but flexible automation and computerized management of flows leads to new possibilities in vertical disintegration. The new "fix" appears to be the "specialized firm", producing a restricted scope of differentiated goods (final or intermediate), with an optimal management of quality, innovation, and time-saving.

In fact, automation leads to an ever wider multiplication of sharp "specialized know-how", including software production, R&D, which were considered ten years ago as part of the core of the great firms, and which

become now genuine branches. On the other hand, flexible production emphasizes the importance of mastering a succession of short series. That may be done inside integrated firms, but more and more outside, on the basis of a network of specialized firms subcontracting for one or various firms. This is due to a law of complexification of integration more than proportional to the number of links to be integrated: here technical desintegration allows for a tighter control of costs and quality. And computer-aided management of external flows (along with the greater precision of manufacturing) supplies principal firms with the possibility of coordinating subcontractors "just-in-time".

To these "technical" reasons for disintegration must be added economic ones. Whatever may be the next "model of development", the present crisis (and the tendencies towards more unpredictable business cycles and shorter life-time of products) strengthens the importance of "mutualizing" the risks of R&D, high-tech assets, and more generally fixed assets, between various capital owners. The deverticalization of great firms into networks of specialized firms may be an answer to this challenge. But this deepening of the social division of Labour does not entail a parallel de-concentration of capitalist control and hierarchy!

2*) Vertical Near-Integration

The gray area between hierarchy and market is highly enlightened by the concept of "Vertical-Quasi-Integration" (HOUSSIAUX [1957], ENRIETTI [1983]).

a) Definition

V.Q.I. may be characterized by: stable connection between suppliers and customers, high share of the customer in the turnover of the supplier, scope of subcontracting extended from manufacturing to design, non-market forms of inter-firms relations ranging from hierarchy to partnership.

Thus, the principal firm benefits from the advantages of Vertical Integration (low costs of contracting, just-in-time management, quality

control, flexibility on the whole policy) and of Vertical Disintegration (innovative thrust of the subcontractors, mutualization of risks on R&D and fixed assets). This implies generalized non-market relations between firms: technology transfers, common research programs, joint ventures, a.s.o.

V.Q.I. certainly includes classical fordist forms of subcontracting, but the great innovation within it is the specialized firm endowed with conception ability, and the correlative development of partnership within domination. V.Q.I. is thus a form of control of competitive market. In fact, <<the very capacity of managing n product with m processes on p markets becomes the main entry-barrier into the sector, and it consolidates the operative bounds between existing firms>> (BIANCHI [1985]).

But what "existing firms"? Here a major distinction is drawn about the advantages of V.Q.I. according to its territorial unfolding. What may be seen as a "disadvantage" in USA or in France (that is: threat of competition from subcontractors, loss of know-how and control over production in principal firms: see WILSON and DOBRZYNSKI [1986]), this may appear as an advantage for Italy, Japan, Germany.

b) Two polar forms of V.Q.I.

The "disadvantages" of V.Q.I. may be seen more clearly in the US case where it is realized through delocation towards other countries: Japan (for high-tech level I skilled operations) and Third World for level III (and even II) operations (e.g. SCOTT [1987b]). Let us label this case "Territorially Disintegrated V.Q.I.". This leads to marked disindustrialization, weak diffusion of high-tech innovations to the rest of industry, a.s.o.

On the contrary, "Territorially Integrated V.Q.I." realizes the network on the same national or even regional territory. The macroeconomic accelerator-multiplier effects remain internal to the country, which masters the diffusion of high-tech innovations through direct intra-regional

connections. This is typical of North-Center Italy, of many länders in Germany, and in some places in France (Isère, Savoie: see COURLET et al. [1987]).

The contrast between the results of the two forms of V.Q.I integration is perfectly clear in the equipment goods sector (machine-tools, robots). But this sector may be considered as a core microcosm of the whole economy (LEBORGNE [1987]).

IV - ATTEMPTS IN SPATIAL PROSPECTIVE

We could now go on as in part II with a discussion on "V.I./V.Q.I/V.D.", "T.D./T.I." typology, then cross with the results on labour organization ! That would be too complexe for such a prospective exploration. So let us start directly from our typical "models of development", add our reflection on industrial organization, and deduce some spatial tendencies.

1*) Neo-Taylorist way

This class of models would be in line with the classical tendencies of the fordist model (from LIPIETZ [1974] to NOYELLE [1982]). Territorial Disintegration along to 3 levels of skill onto 3 types of regions, with subcontracting more and more frequent at level III of skill (except for the last downstream assembly operations). This may be considered as the "poorest" form of V.Q.I : the poor qualities of bounds within inter-firms hierarchy reflects the poor quality of intra-firm social relations. Territorial Disintegrated V.Q.I is likely to prevail. In the case of Vertical-Integration, branch-plants will be scattered in the country-side. In the case of V.Q.I, agglomerations of subcontractors will appear, around main firms or in low-wage areas, according to possibilities of external economies in transportation and contracting costs. These area may been seen in South-East Asia (SCOTT [1987b]). They correspond to the "Specialized Productive Area" in GAROFOLI's typology of productive areas [1986].

Specialised Productive Area are of recent formation, with weak relations with previous regional social formation. They are mono-sectorial, outwards oriented, with weak territorial inter-firm relations, except that of competition. The wage relations are of the A-II type.

In some industries, neo-taylorism could lead to such a labour-saving automation that unskilled direct jobs may nearly disappear, and integration prevail. This would not stop the process of territorial disintegration (e.g., automatic plants leaving Santa Clara County in search of cheaper space).

On the whole, a neo-taylorist model would lead to a more polarized world, to more polarized national societies, to a marked inter-regional and intra regional specialization. Level I tasks (R&D, design, finance, high tertiary jobs) will concentrate in some "Nodal Centers", or more precisely in some down-towns, with a hierarchy of suburbs, secondary urban centers, specialized productive area of "back office jobs" (K. NELSON [1986]). Since wealth will be more concentrated, and since "Warfare State" is likely to overcome "Welfare State", the proliferation of poorer people waiting for a "trickle-down" would enlarge secondary jobs in non-producer-service activities, with a dualization inside cities according to gender, ethnicity, a.s.o. (HARRISON and BLUESTONE [1987]).

Such a picture may fit to the U.S. main-stream, as brilliantly forecasted by CASTELLS [1985] (7). But it is not a necessary outcome of High Technologies. It is the one corresponding to a "neo-taylorist" model of using it ! And it may not be the better one, even from a capitalist point of view.

2*) The Californian way

The main character (B) of the "californian" models is the involvement of workers on individual basis (pay-incentives, career, threat of firing). The macroeconomics of this class of models is unclear. "Individual involvement" could be used as simply more efficient professional relations within a mainly "neo-taylorist" system (for instance, B-II type wage-relations in Disneyland), but it could also deeply modify the implementation

of new technologies, through other industrial relations and spatial implications.

Breafly put, involvement means more profesionalisation, and more face-to-face non-hierarchical and non market transactions. But market regulation still prevails in the californian models, both in labour relations and product circulation. Thus, Vertical Disintegration tends to become the dominant form of industrial organization. But the need for face-to-face and professionalism entails a territorial concentration into Local Productive Systems (in GAROFOLI's typology). A L.P.S. is still mono-sectorial, externally demand-led, but there is an intra-sectorial specialization of firms, thus a tendency to local V.Q.I. between firms. It is based on a local (likely ancient) supply of professionalism. The origin of firms may be external or internal (through spin-off).

The typical case is of course Silicon Valley, Santa Clara (see SAXONIAN [1985]). It is the market meeting point of a very centralized supply of personally-owned know-how (Stanford University creating its Industrial Park in 1952) and of a huge and permanent State-warfare demand. Moreover, after Hewlett-Packard (1938), the Bell-Fairchild trunk provided a genealogy for the proliferation of chips-makers. As may be seen, the regulation within a Silicon Valley is the market, but its genesis is far from being an outcome of free competition ! But besides this early "Technopolis", there exist a lot of spontaneous L.P.S. based on ancient traditions and know-how, in Italy, Germany, a.s.o. But State intervention and organized diffusion of technological know-how proves that, even in South-East Asia, and not only in Korea, there are possibilities for a transition from "Specialized Productive Area" of the neo-taylorist type to Local Productive Systems (cf SCOTT [1987b]). A major threat for external principal firms !

3°) The Saturnian Way.

This third class of models implies not only involvement of workers but also a collective non-market negotiation of the involvement (C). Labour and professional Unions, and political agencies (at any level), are thus implied

in the mode of regulation. No doubt that this class of models (exemplified by Sweden and to some extent by Japan, Germany, in Italy Emilia-Romagna and some States of U.S. "Waterbelt" (8)) will exhibit higher performances.

Since intra-firm labour-relations are based on professionalism and cooperation, inter-firms industrial relations are likely to be based on Firms-Unions-University-Territorial Authorities partnership. The spatial form of it is the System-Area in Garafoli's typology. The V.Q.I. takes the form of a Territorially Integrated, diversified, multi-sectorial, network of specialized firms and principal firms. There is an organized and even planified diffusion of social knowledge, with strong relations between territorial banking-system and industrial system, strong relations with the whole civil society (including farming, family, school), with large possibilities of upstream social promotion through learning and involvement, and so on (9).

In a word, a Saturnian Model unfolding into System-Areas requires (and consolidates) a social consent. It rejects the dualization in society. Thus, it is likely to appear where the crisis of the old Fordist compromises does not lead to a defensive flexibility (a destruction of ancient Labour-Capital agreements), implying social atomization. On the contrary, it requires a higher degree of explicit compromise between labour and capital, building an offensive flexibility, that is a higher collective ability to take a productive and social advantage of new technologies, leading to an upstream general diffusion of social knowledge.

CONCLUSION

Like the God Janus, New Technologies are double-faced. They supply opportunities for both social regression and progress.

At the wage-relation level, they may be implemented through more polarization in skills or through a general involvement of workers, with flexible or rigid wage-contracting, with individual or collective negotiation of the workers' involvement. These bifurcations lead to various classes of models of development, which are labelled here "Neo-Taylorist", "Californian" and "Saturnian".

As far as industrial relations are concerned, new technologies induce Specialized Firms and Vertical Quasi-Integration. But this may be realized through Territorial Integration or Disintegration.

The spatial implications seems to be the following. "Neo-Taylorist" way is associated with Territorial Disintegration and leads to a polarization between financial and high level service-to-producers concentration in the downtowns of big cities on one hand, and a scattering of branch-plants and low-wage Specialized Productive Areas on the other hand. "Californian" way is associated with higher Territorial Integration and favours "Local Productive Systems". "Saturnian way" is associated with partnership within Vertical Quasi-Integration, and induces the formation of Territorially Integrated "System-Areas".

Of the two polar ways (Neo-Taylorian and Saturnian), the first is obviously the easiest way for capital, taking advantage of weaker bargaining power of labour. It was certainly the "mainstream" in the early eighties. But nowadays, the advantages of more "saturnian-like" ways is enlightened by the industrial successes of Japan, Germany, Italy, and the difficulties of U.S.A. (10). This is the result of better accommodation of capital and labour middle-term interests in the mastering of new technologies.

Certainly, strong forces push capital-owners towards other direction. Certainly, labour may be reluctant to give up the old compromises, or unable to impose "Saturnian" compromises, or may struggle for still higher interests. As the present, the future is likely to be an unpredicted mix between the three models. But anyway it will certainly not be "determined" by the pure "logic of capital", or of new technologies. As in former major crises, the strength and the orientation of Labour movement will be of paramount importance in the orientation of post-crisis capitalism (LIPIETZ (1987), MAHON (1987)).

In this paper, we have not explored the feasibility of the "Saturnian way", nor the institutional framework regulating its emergence, nor gender or ethnicity related issues. Above all, we have not dealt with its macroeconomic consistency, nor its stability in front of unregulated world competition. In a statement quoted by Messine (1987), Jack Russell, a Michigan civil servant, herald of the Saturnian-System Area logic, concluded:

<<Maybe, in the '90s, we shall be looked at as pioneers. Maybe our work will have been swept away by macroeconomic forces we have no control over. But doing what we do seems to be the only honourable attitude in the present situation>>.

D. LEBORGNE, A. LIPIETZ

NOTES

- 1) In other words, investments in new technologies remain a dramatic gamble, subject to radical uncertainty about the macroeconomic and sectorial demand for their output. The classical macroeconomic problems of growth and fluctuations in advanced capitalism remain unchanged, contrary to the "benign neglect" about macroeconomic issues in PIORE and SABEL's model of "flexible specialization", that "would restore the neoclassical equilibrating mechanisms of the early-nineteenth century American economy" (p.276).
- 2) Certainly, good social-professional relations and collective involvement lead to higher productivity, thus higher competitiveness, even in spite of relatively high wages. The C-I case is thus in a good position to escape from the "foreign constraint". Yet it cannot avoid problems arising from world macroeconomics (e.g. low-wage commercial war through a world depression). This remark intends only to emphasize that our paper do not deal with all the problems to be solved for a way out of crisis. As we have noticed in footnote (1), improvements in the "supply-side" of the crisis are not sufficient. Improvement in the management of demand, at the national and international levels are also required (see LIPIETZ [1987]).
- 3) AOKI [1986] cast a light on this. According to its analysis, the compromise between management and workers in Japanese principal firms and major subcontractors is a sharing-out of rents (in Marxist terms: extra surplus-value) accruing to these firms because of their higher productivity in world market. Other counterparts for workers involvement are: an implicit contract of life-time employment (C-I aspect) and individual explicit bonus (B-I aspect). But this "loyalty" between firms and their workers must be restricted to a limited fraction of the working class, a "closed-shop" compromise opposed to the "secondary" workers of the secondary layers of subcontracting. In other words, the "Saturnian compromise" (see below), when negotiated (even implicitly) firm by firm, entails a dualism in labour market. This is the "dilemma of workers democracy" (AOKI). R. MAHON [1987] emphasizes the risk of this "Naples model", with a restriction of the "yeomen democracy" à la PIORE and SABEL to a privileged fraction of the working class. The services-to-consumers are likely to be ruled by poor and flexible type wage relations, and, as JENSON [1987] points out, women are likely to be the first excluded from the "yeomen democracy".
- 4) This term, and the following "Saturnian" and "Californian", are proposed in the nice book by MESSINE [1987].
- 5) Just two examples by M. CHIESI and T. RINALDINI (in BACHET et al. (eds) [1986]). In textiles: agreements on restructuration and flexibility against employment guarantees (through labour-time reduction). The IRI agreement (December 1984): acknowledges the right for trade-unions to negotiate ex-ante restructuration projects (a common agreement in Emilia-Romagna).
- 6) For more precision see LEBORGNE D. [1987] dedicated to the study of new production goods. It refers to several Italian works, such as these from ENRIETTI A. [1983], BIANCHI [1985], LUGLI and TUGNOLI S. [1985].

- 7) Note that CASTELLS's forecasts are in line with NOYELLE's and STANBACK [1985] retrospects! In fact, it has been spoken of "Latinamericanization of the United States" at least since BARNET & MULLER [1974]!
- 8) With this term MESSINE [1987] refers to some States around the Great Lakes (e.g. Michigan) but would not exclude Massachusetts!
- 9) In Italy: FRANCHI-RIESER [1986], LUGLI, TUGNOLI [1985], DINA [1986], RINALDINI [1986]... In Japan: AFRIAT, LECLERC [1986]... In USA, MESSINE [1986]... In Germany: FORAY [1985]...
- 10) In LAFONT, LEBORGNE, LIPIETZ [1980] already, we interpreted the fall of France in the industrial hierarchy as a result of the poor quality of its intrafirm wage-relations and of its inter-firm subcontracting relations. In the terms of the present paper, France was then the archetype of "A-II, T.D.". The USA of the heighties may be a still better example.

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