THE ECONOMICS OF OPEN TECHNOLOGY: COLLECTIVE ORGANIZATION AND INDIVIDUAL CLAIMS IN THE “FABRIQUE LYONNAISE” DURING THE OLD REGIME

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INTRODUCTION

What we call "open knowledge" is a system in which the principles of rapid disclosure of new knowledge are predominant, and in which a number of procedures facilitate and reinforce the circulation not only of codified knowledge but also of practical knowledge and research tools. It is not pure chance that in this world new knowledge is codified and carefully systematized in order to facilitate its transmission and discussion. But in this world particular attention is also paid to the reproduction of knowledge, that is, to learning. It is not because knowledge flows freely – in the form of manuals and codified instructions – that it is necessarily reconstituted from one place to the next. It is also necessary to create and maintain relationships between "masters and apprentices", either in the context of work communities or in that of formal processes of teaching practical knowledge.

11 - From open science....
The economic analysis of open knowledge has been particularly developed in the field of scientific research thanks to the seminal works of Dasgupta and David (1994) and David (1998 and 1999). The approach of the so called “new economics of science” provides the great advantage to make two important arguments for theoretical analysis as well as policy implication in the field of the economics of knowledge:

- Firstly, knowledge openness and sharing behaviours do not only express some kinds of ethics or moral attitude (although ethical conviction plays certainly a role). Knowledge openness is viewed, above all, as a mechanism generating economic efficiency that people in certain circumstances are willing to implement and maintain in order to be a player of a positive sum game. In fact, knowledge openness which entails rapid and complete distribution facilitates coordination between agents, reduces risks of duplication between research projects, functions as a sort of “quality assurance” in so far as disclosed results can be reproduced and verified by other members of the community and, above all, by propagating knowledge within a heterogeneous population of researchers and entrepreneurs, increases the probability of later discoveries and inventions and decreases the risk of this knowledge falling into the hands of agents incapable of exploiting its potential (David & Foray, 1995).¹

- Secondly, open knowledge does not mean the absence of any individual incentives. In the case of open science an ingenious mechanism comes into play, consisting of the granting of moral property rights which are not concretized in exclusivity rights (in other words, they are compatible with the complete disclosure norm). It is the priority rule which identifies the author of the discovery as soon as s/he publishes and which thus determines the constitution of "reputation capital", a decisive element when it comes to obtaining grants. This mechanism creates contexts of races (or tournaments), while ensuring that results are disclosed. It is a remarkable device since it allows for the creation of private assets, a form of intellectual property, resulting from the very act of foregoing exclusive ownership of the knowledge concerned. Here the need to be identified and recognized as "the one who discovered" forces people to release new knowledge quickly and completely. In this sense the priority rule is a highly effective device that offers non-market incentives to the production of public goods [Dasgupta & David, 1994; Callon

¹ In economic term, since the marginal cost of use of knowledge is nil, maximum efficiency in its use implies that there is no restriction to access and that the price of use is equal to 0. Knowledge should be a "free" good; that is the condition for optimum use of a non-rival good.
& Foray, 1997]. This form of organization is particularly efficient for it ensures the rapid and complete diffusion of new knowledge, while preserving a certain level of incentive.

Of course, the ideal world of openness described here does not exclude the possibility of bending or departing from the rules. On the contrary, the tournament contexts created by the priority rule, as well as the size of related rewards, tend to encourage bad conduct. The notion of "open science" is therefore based on an ideal never achieved (in other words, there will always be many cases of various degrees of retention). It is nevertheless still part of the "scientific culture" and as such influences researchers' behaviour. It is a type of prescriptive norm which, all things considered, facilitates the formation of cooperative networks.

These "good properties" have recently been modelled by David [1998], who shows how the disclosure norm positively influences the cognitive performance of the system under consideration. David models stochastic interactions in a group of rational researchers individually engaged in a continuous process of experimental observation, information exchange and revision of choices in relation to locally constituted majorities. This modelling is then used to link up micro-behaviours (being open, being closed) and macro-performances. Simulations suggest that the social norm of openness, which influences micro-behaviours, favours free entry into knowledge networks and in so doing prevents them from closing in on themselves too quickly and excluding different opinions. David shows that a system situated beyond the critical openness threshold ensures confrontation of ideas and provides a mechanism which guarantees the production of consensus and preserves the diversity of opinions. The capacity to collectively produce scientific statements while preserving a degree of diversity of opinions and arguments is thus an important feature in an open research network, and standards of disclosure and openness appear to be decisive in the cognitive performances of the network. The advantage of such an approach is that it produces formal results, derived from the mathematical theory of percolation, on the basis of which more political reflection can be envisaged:

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2 - In this sense we cannot follow Latour (1987) who has come to portray the Mertonian norms as apologetic ideology, self-serving myths about cooperative, dis-interested science. In Dasgupta and David (1994) it is argued that the norms are prescriptive, and that beliefs that are instilled in scientists as part of the "culture of science" have effect on their behavior -- making it easier to form cooperative networks where it is in their mutual interest (and that of society at large) to organize research cooperatively.
- the size of the network is important (the smaller the network, the greater the risk of it rapidly becoming trapped in one of those "absorbing states", i.e. in a situation of complete agreement of all agents, from which it is difficult to collectively withdraw);
- the network can tolerate certain shortcomings and divergence compared to the openness norm. In other words, the same cognitive performance is guaranteed as long as the network is above a certain critical threshold. Cooperative behaviour can emerge and be maintained without everyone complying perfectly with the openness standard.

Apart from this first aspect of cognitive performance, David defines creativity as a function of the size of the network and the propensity to share information (which makes it possible to recombine it). Creativity then becomes an emergent property of social networks possessing certain characteristics of size and openness.

This effect on the cognitive performance of a research system enables us to distinguish clearly between the maintenance of an area of open knowledge, whose characteristics are decisive in the system's cognitive performance, and the role of a public agency. The latter, as essential as it may be in the resolution of problems of funding and expertise, will in no way affect the cognitive performance of the system.

12 ...to open technology

We have discussed "open science" because it is probably the organization of science that is closest to this standard of openness. Yet in the past there have been numerous cases of "open technology", albeit limited in time and space. Historically, most situations of openness were linked to a specific territory: Lyons in the case of the circulation of techniques and inventions relating to the silk industry [Hilaire Perez, 1994] and Lancashire in the case of collective invention in the metallurgical industry [Allen, 1983]. More recent cases are those of emerging industries such as virtual reality (Swann, 1999) or financial software (Crede and Steinmueller, 1999).

The historical analysis of open technology - and the particular case of the “fabrique lyonnaise” to which this paper is devoted - allows to draw a parallel with the economics of open science:
- Firstly, the existence of a collective ethics greatly matters (see below: § 323).
- Secondly, the efficiency properties of systems of open technology are rather similar to the efficiency of open science: in both cases this is a similar way to increase the performance of a system of invention in making the existing stock of knowledge more socially useful by improving transfer, transformation and access to the existing innovations.
- Thirdly, similar collective belief to be part of a positive sum game plays a key role as well. Such a common knowledge that open technology is a positive sum game is particularly effective and “has a force” in the case of Lyon since the place of Lyon is engaged in an international competition with London and the inventors know well that the prosperity of the local system to which they belong directly influences their own individual prosperity.
- Fourthly, both the collective ethics and the common knowledge about the efficiency of open technology are not enough to sustain a system based on the free dissemination of knowledge. There is also a need for some kinds of mechanisms aiming at rewarding inventors without granting exclusivity rights. Particular mechanisms were designed to reward inventors who accept to disclose their knowledge and to actively participate to the reproduction of that knowledge (teaching). The setting up of a rewarding fund, the double process of examination of inventions as well as the design of financial bonuses rewarded to those who accept not only to disclose but also to teach their knowledge are institutional mechanism which make the system quite effective. The “collective fabrique” appears, however, very fragile and quite vulnerable to individual claims, frustrations, hopes of individuals.

This is probably the main argument who would like to discuss: beyond the beauty of systems of collective invention and the nice economic performance such systems can produce, the dimension of individual incentives remains decisive and calls for great institutional mechanisms to give credit to the inventors without granting them with some kinds of exclusivity. A kind of mechanism Dasgupta and David have explored in the case of open science and which remains quite uncertain yet in the case of open technology although the case of the “fabrique lyonnaise” provides some ideas about it.

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3 - As defined in a recent research project (Foray & Steinmueller, 1999) the type of open knowledge we are dealing with in this paper is different from the collusive and explicit forms of collective invention (such as high technology consortiums) which require explicit coordination mechanisms as well as the formalization of agreements on both the distribution of tasks and the attribution of results. Moreover collusive forms delimit semi-private areas for the circulation and pooling of knowledge, which may in some cases be less open than informal networks we are studying.
The historical meaning of invention is being more and more distinguished from the myths of the origins for explaining technical change in craft and industry: the glory of pionners leading the way thanks to inventions disseminating in the whole economy has lost its virtue for understanding what invention and innovation meant in history. This mythology has, in fact, become a historical field per se.

Authors rather focus on the sketchy nature of invention, a notion that was already expressed by actors in the past, at least in modern Europe. During the Renaissance and then in the Enlightenment, theaters of machines and Diderot and d’Alembert’s Encyclopédie presented invention like re-discovering, re-combining and re-using existing devices, materials or patterns. Learning, imitating and excelling in one’s craft were the best ways to invent. There existed a method, an "art" of invention, as Luisa Dolza and Hélène Vérin wrote. Moreover, the Encyclopédie emphasised that inventions were reaching efficiency only when they were put in practice by users amending them and contriving further devices. Improving was central.

The reality seemed in tune with these literary and theoretical approaches. In craft world, partnerships, kinship and subcontracting played an important part in innovating. In scientific world, experimental proofs, such in academic societies, were also leading to improvements and to contriving new tools for testing inventions. Invention was then a collective and cumulative process; it dealt with borrowing, inheriting, collaborating and sharing devices and know-how.

During the Old Regime, in France, the institutional framework matched these innovative processes. The individual dimensions of the English patents for instance were not yet established; private benefit deriving from inventions was balanced by the efficiency of a whole set of collective institutions, ranging from societies for encouragement (also very strong in England) to

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here. The main difference between these two types of collective enterprise deals with the mode of production of knowledge. In the cases studied here, trading or sharing concerns knowledge that is already available. The participants do not participate in a coordinated research project; they trade or share existing technical data. This is an incremental process based on the dissemination and reuse of knowledge available within a group of firms. In the case of collusive and explicit forms of collective invention, the actors engage in operations of knowledge production.
governmental and local systems of rewards. The protection of inventors was based on very sophisticated procedures; depositing, collecting, disclosing, transmitting knowledge were the basis of any official grant. Inventors had to deserve the grant and to make the invention a common wealth. They never managed innovation on their own. Invention was a collective concern, even a civic concern, and it was embedded in open technology policies. As "the cultural matrix, the speech communities and the priorities placed upon knowledge and learning are now seen to have provided new dimensions of creativity", the collective dimensions of invention are highlighted by historians.

Nevertheless, such collective meanings were always entangled with individualistic trends. One of the most striking feature of the last historical studies in innovation is the interplay of cooperative processes and individual strategies, ranging from free-riding enterprises to identitary claim for inventive genius. Evaluating successful flexible and decentralized economies, from the Lyonnaise silk to British engineering or Oyonnax plastic, Charles F. Sabel and Jonathan Zeitlin (1997) have explained that the burst and spread out of innovation was much helped by "a system of collective tutelage which monitored the fluid exchanges among private parties without intruding into them". In such economies, actors would not oppose cooperation and opportunism, neither distinguish politics and economy, nor traditional and modern regulations. The whole set of regulations provided a key for coordinating the different units, for diffusing new knowledge and helping actors to innovate and take opportunities in unstable and uncertain markets. The question of the "governance" was then a central issue.

We would like to stress and enhance these issues in two ways. First, with the example of innovation processes in the Lyonnaise silk industry, we argue that corporation, municipality and central government actually promoted collective practices of economic reformation. The ancient ethos of the community was re-used and combined with other institutional models based upon cooperation, such as the provincial academy and the enlightened central administration represented by the intendant de la généralité. Open technology in Lyon was a success because there was a general agreement about the meaning of invention amongst elites in Old Regime France.

Second, whereas this cooperation strengthened uncertain ventures and helped innovation in a balanced way, the interplay had also to deal with disruption. As Simona Cerutti has shown,
solidarity and institutional homogeneity in corporate world produced heterogeneity, that is hierarchies and strategies of self-distinction. Indeed, the cooperative policy in Lyon brought two paradoxal consequences: it sharpened competition and conflicts in corporate world and it fostered a strong individualistic self-conscienciousness. In Old Regime, invention was a clue to understand the meanings, the representations and the practices of work.

3 - COMMUNITY, OPEN TECHNOLOGY AND INVENTION IN THE XVIIIH CENTURY LYON SILK INDUSTRY

What did individuality mean for eighteenth-century inventors living in the corporate town of Lyon and working within the Grande Fabrique? What did mean collective ethos for them when they were innovating? How did these two sets of value combine or oppose? How did local economic elites cope with individualism growing amongst inventive artisans?

31 - Historiography

There already exist some answers to these questions thanks to historical studies ranging from Justin Godart and Charles Ballot to Maurice Garden, Carlo Poni (1998) and Alain Cottereau (1997), the last two authors having collaborated with Sabel and Zeitlin.

Poni, for instance, echoing Garden, brings a first set of explanations: the Grande Fabrique was a highly turbulent world, submitted to harsh tensions between merchants and independant masters, and to free-riding enterprises of drawers and merchants for launching new patterns fitting the consumers’ taste. Though the author mentions the rich negociations and "creative cooperation" which took place between merchants, drawers, liseuses and weavers, he mostly stresses individual appropriation of drawings, thefts and secrecy, he explains how technical inventions originated from these opportunistic strategies based upon novelty and fashion, and how powerfull merchants did infringe guild regulations. The corporation could then be considered as an old set of rules, grounded on quality products and associated ethos, not dynamic enough to suit the new structure of the fashion market.
Quite different are Cottereau’s arguments when he confronts Spitalfields to Lyon at the beginning of the XIXth century. In London, individualism, secrecy and patents put a break to the diffusion of innovation, whereas in Lyon, ”local regulations put major innovations directly into the public domain of the manufacture” thanks to equipment credits and to ”coherent common policy” involving municipality, learned societies, Chamber of Commerce and Prud’hommes. This model was the continuation of a system grounded in the Old Regime, when the Grande Fabrique was so strong. Lyon was a ”collective manufacture” were coordination was based upon ”communicative action” and this pattern reached its highest degree after the French Revolution. Instead of describing the growing power of merchants in Lyon and the victory of liberalism against corporations, like in classic historical essays, Cotterau insist on the development of negociations and bargain between weavers and merchants, especially thanks to an industrial tribunal, the Conseil de Prud’hommes (1806). Mass production and deregulation were not the fate of Western industry ; even, these could obstruct inventivity like in London were Jacquard’s Loom did not disseminate.

As a consequence, the diffusion of new information (either drawings or inventions) is presented very differently in both articles : in the former, it derived from new networks and coordinations, internal to merchant companies, especially between consumers, drawers and merchants, in the latter it rested upon institutional cooperation provided by ”municipalism” originating in traditions.

We propose a third analysis based on archives which were not central in these studies : the letters and reports relating to eighteenth-century Lyonnais inventors’ claims for grants and privilèges which were treated both in Lyon and in Paris by the Bureau du Commerce. We argue that collaboration in XVIIIth century silk industry was even much stronger than Cottereau found it in XIXth century, because very ancient patrimonial policy was re-invested by new enlightened ideals and practices ; this agreement between artisans, merchants and Parisan elites was essential. ”Municipalism” was embedded in a broader context and this coordination between different institutional scales was the key for success.

At the mean time, conflicts, opportunism and individualistic claims were not always balanced by ”communicative action” in Lyon ; on the contrary, though paradoxal, the cooperative framework fostered private dynamics and disruption, as we shall see later on.
32 - The process of collective invention in Lyon

321 - Lyonnaises inventions

Lyon was the second French town, with 143,000 inhabitants (1789) and 25% were working in the silk industry (35,000). This huge sector was fostering an important internal and foreign trade for luxurious silk cloth. The domination of French silk industry was based on changing patterns according to taste and fashion and on researches either to realize new stitches or to set up (to "read") more easily the drawings on the looms and to make the rich cloth, broché, as quickly as possible (setting up the pattern on the loom would take 25 days). Some inventions aimed to program the patterns on the loom and to select warp threads (like Jean-Philippe Falcon’s), others were intended to change quickly parts of the ropes, to reduce their number (Philippe de Lasalle’s movable "sample") or to ease the pulling of the ropes linked to the threads (Jacques Vaucanson’s hooks). First, the cost of draw-girls (auxiliairies), was a growing burden for guild families as Daryl Hafter explained. At the mid-century, these girls, who came from near provinces, were also very scarce. Not least, they were much despised by masters; the strategies of the merchants to use them as a threat to the prestige of weaving did enhance masters’ hostility against these girls. Second, the speed and synchronisation of the work became the core of inventions at the end of the century as the taste moved from brocades (heavy silk cloth with complicated patterns in gold and silver threads and many shuttles) to façonnés (lighter cloth which could be weft with smaller number of shuttles). This product, especially small façonnés, was the basis for successful researches in suppressing the pulling of ropes. Jacquard loom (rewarded in 1804), which combined Falcon’s program and Vaucanson’s hooks, was intended for façonnés.

Nearly all Lyonnaises inventions which were addressed to the commerce department in Paris from 1700 to 1789 were related to the silk industry (181 in 265, for Lyon), and more precisely to weaving (116) (generally new devices of looms either for brochés or façonnés) and they occurred mostly after 1730. Lyonnais artisans also represented a high proportion of inventors.
applying to the government: there were 170 inventors from Lyon, in a total of 875 inventors addressing the administration of commerce (420 provincial ones), and 105 of them were working in craft trade. Inventors members of the Grande Fabrique were 73 and only 12 of them were large merchants. Though we do not exactly know the sociology of Lyonnais drawers, Poni (1997) wrote they were closely linked to merchants (putting out entrepreneurs) ("marchands fabricants"), the head of the Fabrique (only 70; 120 to 180 according to D. Hafter). The inventors’ profile was quite different: they were rather independent masters ("maîtres marchands"), precisely that category which expected much of the cohesion within the community and which was facing the merchants’ growing pressures (there were 700 independent masters but 8 000 hired masters).

322 - Institutions promoting technology openness

This innovative context was sustained by local institutions, traditionally involved in the management of innovation, since the XVIth century, by the means of local monopolies granted in ordonnances consulaires and financial rewards. In the XVIIIth century, monopolies became very sparse, and there was a rewarding fund officially established, the Caisse du droit des étoffes étrangères, created in 1711 (from a tax upon foreign silk) and intended to promote industry since 1725. From 1752, the intendant was at its head but the procedure involved corporative, municipal and academic institutions: there was even a double institutional network providing a complex procedure of enquiry. The invention was examined, in parallel, by the intendant and a member of the Académie de Lyon on one side, and by the provost of merchants (prevôt des marchands, representing the municipality) and the guild inspectors (maîtres-gardes) on the other side.

It was a model and a kind of laboratory for the enlightened government as it was based on a dynamic relationship between patrimonial ideals and emulation, and it actually enhanced social networks and cohesion.

The rewarded inventions were deposited in the Fabrique’s office, close to the guild’s chapel (église des Jacobins). There, some inventions would have a practical utility: inventors would teach their technics to others and the deposited inventions could be integrated to the traditional procedure for master piece (chef d’œuvre). In 1744, as the merchants elaborated a new
Règlement général for the Fabrique, the writers, under direction of the inventive academician, silk inspector and inventor Jacques Vaucanson, decided to promote the new invented loom contrived by Jean-Philippe Falcon (1742): they made compulsory that, amongst the looms used for the making of master pieces, one be a Falcon’s model, and whereas masters could only run four looms each, they would be allowed to work with a fifth one let it be Falcon’s ("un Falcon").

Let’s take the example of Michel Berthet, who, inspired by Falcon, invented a loom for easing the work of the draw-girls (an essential matter in the Lyonnaise silk industry): in 1760, the intendant de la Michodière agreed with the academician de Goiffon to grant him 1 000 pounds: 600 pounds and then, the rest of the sum, if he taught the maîtres-gardes and if four of his loom did exist in other houses than his. In 1765, for an improvement, the prévôt des marchands proposed 1 500 pounds in exchange of the secret and if some looms be set up in town. De Goiffon agreed for 300 pounds if the secret was explained at the first request of the maîtres-gardes and of all desiring masters. The intendant compelled him to deposit a model and a description at the Fabrique’s office. The grants were not only rewarding the presumed economic utility of inventions; they were indexed on the efforts of the inventor for sharing his knowledge within the whole community.

Thus, secrecy was actively opposed. There were few monopolies for invention in Lyon: nine affairs ended with a “privilège exclusif”, concerning 7 inventors. And 7 of these patents were granted before 1750, 3 outside the Fabrique, and 3 were only prorogations. The Lyonnaises elites preferred to invest in innovation, to make inventions a common wealth, and this was not only a fancy ideal, as the rewards were often bonuses indexed on the spreading of the inventions within the town. For instance, in 1760, Ringuet presented a new loom for broacades which imitated paintings and embroidery; he was granted a 300 pounds ("livres tournois") bonus for the 10 first looms set up, 200 pounds for the next 10 looms and 100 pounds for the 100 next ones during 10 years. He was very successfull: as soon as 1760, he had set up the first 10 looms; in 1762, the next 10 and even 17 more; in 1763, 47 others and in 1764, 85. Thus Rinhuet had even overpassed the quota (169 instead of 120 and in less than 10 years). He was payed for all the looms, even the ones which were not planned in the grant (19 900 pounds instead of 15 000).
Such bonuses did combine corporate controls and the recognition of the power of the market. Each inventor was incited to be a dynamic actor collaborating to the public good and the official credit (financial and symbolic) of the invention was involving the choices and decisions of the common users. It was very characteristic of French expertise to combine the judgement of authority with judgements of facts.

Such a compromise between collective aims and private initiatives was fundamental in the ideal of concord and harmony that the Lyonnaises elites (corporated and academic) cherished at the mid-century. For instance, some inventions had to be sold at an official price. When the inventor de Barme was granted a 600 pounds pension in 1750, he was compelled to sell his silk reel (dévidoir) 360 pounds to the weavers. Whereas some inventors were very much rewarded (Falcon and Philippe de Lasalle), most of them were offered very similar sums, like Berthet’s. It was a conscious policy, as the Lyonnais academician de Goiffon explained it in 1760 when he was in charge of the inventor Jacques Roche’s affair: he pleaded for a grant that "would be proportionated to the rewards already offered to inventors who must not be incited to jealousy".

New technics should not bring tensions nor disorders but, on the contrary, they should cement the social cohesion within emulation. It was true in the way the Lyonnais fund was collectively run. The management of the Caisse was based on a contradictory proof procedure, contrived for getting the more information about any invention, so as to reduce uncertainties and secure the public investment. Since a long time, the French government was expert in examining and judging inventions because technical innovation was always considered as dealing with state legitimacy, not only with private business. This became common practice with the growing utilitarian concern and then, as academicians were challenged by other experts. But the procedure in Lyon was unique because it actually institutionalized the plurality of judgments as method of governance.

This double procedure of judgement meant stimulating exchanges between the central and local elites, compelled to negotiate the rewards (they often contradict) and to mobilise their own networks. The system of the bonuses was also fostering contacts between maîtres-gardes and artisans as there were many visits in the workshops of the town for quantifying the spread out of the new looms. When there was a disagreement, the networks could be denounced. The academician de Goiffon, who despised the maîtres-gardes’ technical culture, would not trust them
because, he argued, they were too close to the inventors and could be personally interested in a new project. Rejecting Farcy’s invention in 1766, he wrote: "the inventor fearing imitators, explains himself only through enigmatical panegyrics of his discovery, and the maîtres-gardes find it worthwhile to keep the same words". Beyond the classical academic incrimination of trade secrets, we must stress how the legal procedure enhanced solidarities and exchanges in the town and within the corporate world, as will shall develop.

Such a collective institutional framework was efficient, as we shall develop, because Lyonnaises elites were not isolated. Their approach of inventions was articulated to a broader national disposal and to main streams in governmental policies.

Eighteenth-century inventors had to deal with an important governmental service called the Bureau du Commerce. Since its foundation (1722), it was deeply involved in reforming the whole economy and his concern grew under the aegis of liberal administrators like Vincent de Gournay and, most important, Daniel Charles Trudaine and his son who directed the whole commercial administration from 1749 to 1777. Liberalism in their mind meant that the economy had its own dynamic, based on private interests and the interdependence of factors, like a clock. Freeing initiatives would strengthen social bounds and exchanges, would lead to social harmony and, if tensions might appear, they would be crushed by the regulation of the State, like a finger on a weighing-scale. Much hope of reform was put in inventions as it was thought that even a slight improvement could bring out huge effects because of this chain between the different trades. Collaboration and diffusion were fundamental, even more than private benefit; social cohesion was the only stake and inventions were considered as good means to reach this aim.

It had two consequences at least, which illustrate how much the Lyonnaise policy was echoed at the highest level in State. First, technical projects and reformation of the economy were involving a whole range of different actors. Either learned experts or practical ones would be required for their advices, they would meet, debate, and judge inventions with respect to their culture and to their uses, as producers or consumers. In that perspective, common utility would be the result of every one’s needs, and technics would be a public and political concern. Experiments were truly moments of negotiating technics utility and then, a kind of metaphor of the whole enlightened project of concord through progress.
Second, rethinking patrimoniality was central. The private appropriation of inventions which was permitted by monopolies was strongly rejected as, since the beginning of the century, exclusive privileges were often used to keep secrets within families or to foster financial transactions. A royal decree of 1762 set up that people could no longer inherit of a privilege, but had to deserve it. Moreover, monopolies became very few at the mid-century and monetary rewards grew up. This meant a close relationship between inventors and the State, based on merit and service to the State, especially by diffusing new knowledge. Liberals and encyclopedists were eager to suppress any obstacle to the free circulation of knowledge, in a revived Baconian approach.

Such a policy in the mid-century relied on widely shared ideals and practices, like in Lyon (but also, for instance, in provincial academies and new founded promoting societies). Both logics, corporate and liberal, were paradoxally uniting in the paradigm of open technology. The double procedure for grants in Lyon, involving the intendant and local rulers did illustrate that consensus.

323 - Ethics: Philippe de Lasalle

Some inventors were emblematic of this common concern, mixing different logics. The best example is Philippe de Lasalle’s cursus (1723–1804). De Lasalle was very famous in the XVIIIth century, in France and abroad, and he was largely rewarded by the Grande Fabrique and the city of Lyon (122 000 pounds). The Lyonnaises elite cherished him but he devoted to the progress of the whole community. Enlightened administrators like Trudaine’s son and Turgot, writers like Voltaire, were friends of his. He belonged to the republic of arts and letters as well as to the economic world. What he did and what he thought derived from general ideals and principles he was eager to realize.

He began learning drawing at some painters’ and became a draughtsman and a merchant ("marchand-fabricant"). He was rewarded from 1758 by a pension for excelling in halftones for flower patterns (he also imitated tiger fur in silk cloth and he innovated by printing silk cloth like calicos. Soon after, in 1760, he was asked to teach drawing in the Fabrique and his pension was enlarged. Ten years later, his inventions for accelerating the changing of patterns on the looms
(reversible loom and movable "semple") majored his pension and he gained a bonus for spreading his looms. After creating machine-tools for the better diffusion of his looms, he was granted 6000 pounds in 1778. According to the administrators and to de Lasalle himself, this pension meant that artistic creativity, technical invention and transmitting knowledge were closely bound. Collaborating and imitating were the main principles everywhere and the only ways to progress. Art and invention rested on a cumulative process, on methods, rules, devices, lines and colours to be learnt side by side to the master, to the teacher, to the contriver or to nature itself, and he had created a garden in South of France for sending his best pupil to train in drawing flowers. For de Lasalle, there was no genius without copying:

"Vous n'ignorez point que l'art s'acquiert par l'émulation, et les grands exemples ; le travail et mes observations sur les ouvrages de ceux qui se sont distingués dans la carrière que je suis ont seuls formé mes talents; plus d'ardeur encore à mériter la protection que vous leur accordez peut leur procurer un jour cette célébrité qui offre des modèles à imiter et excite d'autres génies qui la surpassent: ainsi parmi nous dès qu'un morceau frappant est sorti de la main d'un artiste habile il est levé et porté sous les yeux de chaque concurrent qui cherche les moyens de se le procurer et fournit souvent par son caractère ou la mode de la saison ou l'exemple d'un beau sujet. Lorsque j'eus traité en 1756 une peau de tigre travaillée avec un peu d'art sur un fond d'or, on vit éclore dans chaque fabrique des desseins pleins de goût représentant diverses fourrures; il en fut de même en d'autres temps lorsque j'introduisis des paysages, oiseaux et personnages".

Neither would de Lasalle condemn the theft of patterns or inventions; the aim was the circulating of knowledge and the progress of qualifications which could result. He was even pleased when his printed silk cloth was copied and his workers seduced by rivals:

"...plus de 20 de mes confrères occupent des pinceleuses (pinceauteruses) et séduisent journellement les miennes à mesure qu'elles se forment et en obtiennent les couleurs et même mes propres desseins; ce dont je m'afflige faiblement si cet événement sert à prouver que tout préjugé contre les genres nouveaux sont en pure perte pour le commerce général et particulier".
In a very phenomenological way, all means would be good if diffusion was at stake: teaching, imitating, stealing and, not least, deeds and free offers. Several times, de Lasalle gave inventions and taught his new device without asking any counterpart. Charles Ballot was telling that "he let to rent some looms, provided freely sets of ropes to workers and even gave them half of his bonus". In 1760, de Lassalle was granted a 200 pounds bonus for each pupil he would teach provided, but he refused and preferred to offer freely all his knowledge: "il paraît...qu'il abandonne la gratification de 200 livres par chaque élève au nombre de six et même plus qu'il se propose de former en ne laissant rien ignorer de ce qu'une longue expérience lui a appris". From 1777, the Bureau du Commerce organised public experiments in the Tuileries. As it was a success, the government decided to offer 80 looms to Parisian weavers (the word is "donnés", given, which meant a huge sum as each loom was estimated to 1 000 pounds). De Lasalle himself proposed to one of the weavers, called Renouard, to give him two looms if Renouard was ready to show them every time the government would ask him.

After the Revolution, de Lasalle still wanted to diffuse his devices; he was granted two rooms in the Grand-Collège in 1801, and he tried to explain his devices through comparative observation of two looms, one he had invented, the other of common use. He was taking part to a broader tendency, the teaching of innovation which was developing for instance in the Conservatoire des Arts et Métiers (1794) and which was experimenting since the Old Regime new ways of transmitting technical knowledge: experts were teaching workers out of the traditional frame of the guilds (which had been successfully re-used in Lyon) but it was not theoretical nor science based. It was a "pédagogie intermédiaire" fuelled by public demonstration run by technical expert. The maîtres-gardes in Lyon were actually aware of this innovation as they stated, in an encyclopedist wording, that "here the eye can judge, swiftly, what the mind takes a long time to grasp even in the clearest and the most methodical reports".

De Lasalle, artist, merchant, technician, set a bridge from the enlightened hopes in inventions and the new uses of displays, shows and visits to the civic purpose of technology, the foundation of museums and the commercialisation of the "pleasures of the imagination"; the red line was self-improvement for citizens, building up a national patrimony and exercising sense and sensibility.
The analogy with Jacquard is clear, both because the Jacquard loom was contrived from the whole range of invented looms during the XVIIIth century (programs, suppressing the pulling of ropes, lighter cloth but still sophisticated patterns according to fashion) and because the way the Jacquard looms diffused was similar to de Lasalle’s, through a collective and patrimonial town policy which was economically efficient.

4 - THE ECONOMIC PERFORMANCE OF THE “FABRIQUE LYONNAISE”

There are different ways of evaluating the efficiency of the open technology policies in Lyon. For the XIXth century, A. Cottereau faced a massive diffusion of the Jacquard loom in Lyon (20 000 ones existed at the mid-century) and he compared this success to failure in London (Spitalfields) were sweated industry, specialization and private strategies obstructed its dissemination. The spread out of inventions in the XVIIIth century is not so dramatic but archives reveal the channels through which new looms disseminated and even, how the process of technical creativity was helped by the collective dimension of economic and social life in Lyon.

In his article, Alain Cottereau explains that London and Lyon silk trade had the same basis: there were 12 000 looms in London in 1815 and 14 500 in Lyon, the weavers were mostly dependant on merchants who paid them a tariff but the evolution was quite pooles apart. Though London could compete with Lyon between 1790 and 1810, because revolutionary crisis disrupted production for a while, London silk industry began to decline when in France, Jacquard’s loom favored a renewal of sophisticated and varied silk Lyonnaise fabrics. In London, only 5000 looms could be found out in 1853; in Lyon, there were 30 000 ones (and 30 000 more in rural areas outside the town). Before World War I, the French production was was much higher and most of it was exported, when England was importing its silk fabrics for home consumption.

What favored Lyon, and what London missed, was flexibility of production in international markets, especially the capacity to offer many new samples twice a year and to change patterns very quickly. Lyons merchants could order samples and fabrics to many workshops (designers’, weavers’ or dyers’) and, in a reverse way, the workshops heads could deal
with several manufacturers and change if necessary. The "organizational mobility" provided flexibility, polyvalence and autonomy of all agents. This "economy of variety" was echoing a tradition based on the mobilisation of "technical and human resources", on skill, reputation and self-esteem. In London, both merchants and workers were specialised in one type of fabric and the result was to reduce skill and "variety of experience", hence efficiency. Although in Lyon, in a few days, 5 000 looms could be mobilised for making a new fabric, only 500 could be in London. Lyon was still an industry of commission, waiting for orders, and using samples ; London had become an industry of speculation, based on anticipation and stocks. The difference between both manufactures increased after 1810 when deregulation developed in London, for instance as the Spitalfields Acts of 1773 containing legal prices lists were repealed in 1826.

One of the main differences between Lyon and London was the way credit circulated between merchants and workshops heads. In London, one workshop head would deal with only one merchant. Most of all, indebted weavers were bound to his creditors. As the workshop heads possessed their tools and equipment, the merchants were offering advances to weavers (fabrics were paid only after weaving), with low rates interests, but they prohibited the workers to deal with anyone else. They wanted to profit individually from their investment in the weaver’s looms. The only solution for the weavers was to borrow (at high rates) and reimburse immediately the merchant, but very few could afford this. Weavers would not be tempted to acquire new invented looms.

In Lyon, a weaver could work for different merchants, even if he was indebted to one because his creditor would benefit from a deduction from the weaver’s future pay. Then, when one merchant was investing in one workshop, he was also investing in favor of other merchants and, in a reverse way, he would be paid back by the profits the new merchants would realize thanks to that equipment. Though this credit regulations were set up since the 1770’s, they were actually institutionalized under Napoleon, with the Conseil de prud’hommes (1806). For Cottereau, "responsability for financing of workshop equipement (took) on a collective dimension : the manufacturers ... (were) collectively beneficiaries of the equipement and collectively responsible fror reimbursement". This collective frame permitted the weavers to get more freedom and to "bargain" with their employers. "Speech communities" were no fancy in Lyon. Moreover, the pattern of investment in equipment had also favored "a small collective
manufacture" for building looms; numerous workshops of mechanics, locksmiths etc were operating in symbiosis with the polyvalent weavers, themselves being able to contrive looms and even to sell them. "The regulation of equipment credits produced a collective solidarity over loans and created a collective responsibility for the quality of the machinery while preventing anyone from trying to get exclusive rights to use".

41 - The diffusion of Jacquard loom

These different settings between Lyon and London must be reminded when evaluating the fate of the Jacquard’s loom in both countries. In London, Jacquard did not spread and generally speaking, there were not many inventions in London silk industry (Cottereau even speaks of the "backwardness of all British handlooms"). As for the Jacquard loom, its introduction "gave rise to a frantic race" between important manufacturers; one G. Wilson succeeded and took a patent in 1821. "The new every man for himself of the companies allowed Wilson to keep the secret of the machine"and he did not sell the invention nor new built looms. Cottereau does not mention any use of licence, though they existed in the cotton industry which was the model referred to by silk manufacturers. Wilson thought the Jacquard loom would standardize and concentrate work, like Arkwright’s inventions did in cotton spinning.

On the contrary, in Lyon, the Jacquard loom was aiming at maintaining skill and autonomy of the weavers; indeed, one had to train during one or two years before using a Jacquard loom. The invention was fitting the Lyonnaise silk industry. There was immediate spreading of the new loom and the "mental mobilization" it entailed did result in several useful improvements. Local institutions were reinforcing this collective pattern. The municipality, following the Ancien Régime tradition, kept on rewarding inventions to "put them into the public domain"; then, in Lyon, "great technical innovations were treated as true communal goods". According to Cottereau, Jacquard agreed to give up his rights to patents "and left the fruits of his art to the community". This policy was sustained by learned societies, by the Chamber of Commerce and by the Prud’hommes tribunal. This last one played again a very important part: it set up calibers for the looms components, which were adapted to each type of fabric, so that technically, the Lyonnaise polyvalence was maintained. It also permitted to keep fair contracts
between mechanics and weavers. Jacquard’s invention could then be improved by other loom-builders who made hundreds of them although Jacquard only built up 57 looms and he had to pay damages to weavers when his looms did not fit. On the contrary, the Prud’hommes facilitated "credits for the most efficient looms".

42 - Other examples of innovation diffusion

Jacquard’s example was quite impressive because the diffusion was massive ; the credit for equipment might have been essential. In XVIIIth century, workshops were not so numerous and part of the weavers were still independent from merchants and were able to run their business without such credits networks. Nevertheless, it is possible to know how efficient was the patrimonial policy of Lyonnaise elites. Even, archives tell a little bit more than the XIXth century ones about the channels of the diffusion.

Actually, thanks to the reports established by the maîtres gardes for the bonuses, we have very precise information of the diffusion of several new looms : Falcon’s, Berthet’s, Fleury Dardois’ and Barbier’s. Falcon’s looms were quite numerous in town : 40 were working 1765, 100 in 1773 (out of 14 000 looms in town), according to Charles Ballot, and one rich merchant in 1786 had got 15 of them. The spread out was not impressive as it will be for Jacquard’s, but the impact of the policy was much important for creating networks of diffusion and for developing technical creativity.

Dardois’ new loom was rewarded 300 pounds in 1776 and 24 pounds for each of the 25 first ones set up in Lyon. In 1777, the maîtres gardes recorded 7 looms, in 1778 6 more and in 1779, 15 others (then 28, more than expected). The inspectors precisely noted the names and addresses of the masters who set up such looms (see document and map) : 6 were to be found in parishes near Grollée street were Fleury Dardois’ workshop stood (in the old center of the peninsula), 12 in his street (4 of them in the same house, in 2 different dwellings). We also know that Berthet’s looms were first built up at his 5 sons’ and at his son-in-law’s, Barthélémy Charles. Fleury Familial links, neighbourhood and kinship in the house, in the street and the nearest parishes were stimulated by the bonus system. Social bounds, cohesion which was so much cherished by local and central elites as the main stake of invention were actually strengthening.
and this social impact was helping diffusion of the inventions. We must add that the bonuses were also enhancing kinship within the whole town, thanks to relationships between members of the guild: Dardois’ looms were to be found far away from the inventor’s workshop as 10 looms were set up in the northern part of the Peninsula (Saint-Vincent slopes and western side of the Saône). These networks were even more important: Dardois presented the certificates signed by a huge cohort of 91 masters and merchants ready to support him (he even printed them). Such a proportion was quite unusual (the maximum was reached by Philibert Saigne with 100 certificates), but it was revealing how inventions were involving the whole community and tightening bounds in a very practical way.

They could also extend networks outside the guild. Collective emulation led to cross over traditional boundaries that separated the different corporate trades. These limits were fundamental for the identity of each trade but, the growing fabrication of looms led to major changes. Because the common pattern in Lyon was already "multivalent weaver-mechanics, making fabrics and marketing this or that technical process invented" (Cotterea), locksmiths, joiners, combers, lathe-turners, were getting more and more involved with weavers for contriving inventions. In 1785, Dardois presented some more 5 certificates and one came from a joiner who wrote he had built a loom "à la Dardois" in 1781 because of the command made by a master of the Fabrique.

These networks were the basis for the pattern of innovation in Lyon. Inventive artisans, either weavers or not, were quickly informed of new devices; they watched working new looms, listened to weavers, talked with maîtres-gardes, they worked on rewarded looms and contrived improvements to them. Invention within open technology was breading invention. For instance, Falcon had been granted 300 pounds bonus for each loom until 60 set up in town. Archives keep the records of the first looms built up in 1764: 7 buyers (out of 9) were living in rue Pierre Scize, near La Chana, where silk workers were numerous in the XVIIIth century and one of them was Berthet. Already in 1759, Berthet had presented an improvement of Falcon’s 1742 loom. In 1765, he said he had improved the new Falcon’s loom he had just acquired.

There were many other examples. Vaucanson’s cylinder for programation was inspired by the numerous Falcon’s first looms with paper boards passing round a prism (1742). In a similar way, one of the 91 certificates of Dardois was signed by Rivet; the same year (1777), he also presented a loom for façonnés without tireuses (and then moved to Paris). For the building of his
second loom, Falcon had called a weaver, Allard who then improved the loom in 1763. Echoing
to this, Barbier successfully amended Falcon’s 1764 loom in 1765 as the maîtres-gardes
explained and his loom was preferred by the authorities to Falcon’s. Then, it was de Lasalle who
contrived his first loom, in 1767, from improvements made to Barbier’s. Jacquard’s invention
was much improved by a mecanician from Privas, Breton. Moreover, inventors like Falcon and de
Lasalle kept improving their own devices. One invention was never definitive but always
evolving and these improvements were encouraged by the municipality which, for instance,
blamed Jacquard’s desinterest for amending his own loom.

There were also more latent circulations of technical devices. For instance, Vaucanson’s
loom which were contrived between 1747 and 1750 had been forgotten in Lyon (historians don’t
agree on the reason why) but it was re-discovered by Jacquard who even re-built up one model of
it for the Conservatoire des Arts et Métiers (created in 1794). Collecting and sharing had to deal
with buried memories as well as with conscious processes (and Vaucanson’s numerous machines
were the basis of the collections of the Conservatoire des Arts et Métiers).

There was a kind of kinship between all these inventions, echoing the pattern of social and
political life in Lyon. Actually, Cottereau has found out an essay written in 1863 describing the
networks between the new invented looms in Lyon: "The most conving proof that these
successive inventions were borrowed from one another is that a jacquard card in use today may be
applied both to Vaucanson’s planchette with needles and to Falcon’s, and the match is so good
that Falcon’s initial matrix must have fixed dimensions". According to Cottereau, the effects
"were comparable to what could easily have been the case today if computer systems had been
standardized from the start and made cumulatively compatible as they progressed", even if
contrived by several different firms.

Then, collaboration and open technology in Lyon was highly efficient for the spreading of
inventions, for sharing technical innovative culture and for helping autonomy and research in
craftwork. Maybe, like in Swiss watchmaking, this flexible model had fostered a "professional
elite" of "indefatigable researchers, skilled inventors and artisans, "artists", who often devoted
more time to resaerch than to their own business". Fame, excellence, performance were these
inventors’ aims. But what was the boundary with self strategies? Although Cottereau describes
an equilibrium in the Lyon industry, conflicts and private interests were very harsh. In a paradoxal
way, collective innovation did usher in a disruption of community ethos; it did foster a burst of opportunism, an instrumentalization of corporate rules, especially by merchants, and, most of all, claims for priority and posterity amongst inventors.

5 - COMPETITION AND INDIVIDUAL CLAIMS

51 - Conflicts and self-pride in Lyon

There were two kinds of conflicts deriving from these close relationships, either horizontal, between masters, in the same guild or not, as we already mentioned, or vertical, opposing apprentices to masters, or individual inventors to the merchants and to administrative authorities.

511 - Priority disputes for rewards

First, the spreading of inventions in the Lyonnais workshops could easily foster imitations and improvements but, also priority disputes for rewards. Rivalry between Barbier and Falcon was famous in Lyon. Improving, imitating, stealing were very close and Falcon did not bear this copying, on the contrary of de Lasalle. The relationships between masters belonging to different guilds were also often mentioned in the reports because of quarrels. For instance, the two weavers Buisson and Chambeau competed on that ground for adapting Kay’s flying shuttle to the silk industry. They first had met thanks to a lathe-tuner from Switzerland called Hildebrand who assisted Chambeau. They also worked together with Conte (a lathe-turner, in Grollée street) and Catin, a joiner and Chambeau’s neighbour. When they became enemies, Chambeau asked Catin to copy pieces of the loom and to carry them at a cabinet-maker’s, Francfort, to make up his theft. In other affairs, sub-contracted mechanics pretended that they had invented new devices or that they were copied and their workers corrupted (Couturier), and controversies could rise, even if authorities would never be harsh for imitators.
So the lack of monopolies does not mean that the notion of property was ignored in Lyon. Buisson and Hildebrand claimed they had "property rights on the invention". The maîtres-gardes considered than Louis Jean-Baptiste Duon, competing with Hennequin and with Farcy, was the first inventor and the "owner" of the disputed invention.

The authorities had not set their mind very firmly on that question. When Condurier asked for a reward, in 1764, the maîtres-gardes agreed for 800 pounds if the inventor would disclose his secret, but the first alderman wrote that "Natural Equity order should let him keep the making of his new invented cloth for his own profit so that the reward could be granted without submitting to any condition". The intendant Baillon was not so generous and he reminded that "it was not natural that he (the inventor) would be rewarded before he opened knowledge". What meant "natural" for the alderman and for the intendant was poles apart. Both were right as they did refer to different principles, either collective sharing of innovation as a common wealth, or private benefits secured by secrecy. Though paradoxal in Lyon, this latter argument was not isolated, at least outside administration; it was even more frequently echoed by inventors as merchants’ pressure grew at the end of the century.

512 - Tensions between apprentices and masters, masters and merchants

Often mingling with horizontal conflicts, vertical ones seemed more violent. They were manyfold, as some of them would oppose workers to masters, others masters to merchants or individual inventors to the merchant elite.

The former could develop between an apprentice and a master. Inventing could enhance the possibilities of a worker to pretend to a recognition and an autonomy in the workshop. For instance, Barbier whom we mentioned was a worker at the merchant master’s Bondafonds. When Barbier presented his new loom in 1765, he was rewarded, not his master. Then Bonafonds died and his widow took over. She argued that Barbier had been recruited by Bonafonds only to build up the loom. But, for keeping he precious worker, the widow had to promise him he would get half the grant if she got one and at the end, the worker was rewarded, not the widow master.
But these vertical tensions could also develop on a more general level, between masters and merchants and this raised questions about the economic and social meaning of invention when groups were struggling in the corporate world. The situation is well represented by Fleury Dardois who wrote a pamphlet in 1775 for warning the Bureau du Commerce how his invention could be exploited by the merchants and widen the gap between them and the weavers, mostly salaried and dependant in the 1770’s as Maurice Garden explained (kind of "verlag-system"). Fleury Dardois was fearing that merchants would take the opportunity of his new invented loom (easing the pulling of ropes) to lower the tariff allowed to the weavers. He was then asking Turgot to set up an official tariff as:

"...oui, Monseigneur, la mechanique est bonne,... mais ... les marchands voudront s'en prévaloir comme c'est toujours leur sistème; que diront-ils à l'ouvrier ? ils diront vous avés la un métier qui donne beaucoup d'aisance et de facilité, qui donne beaucoup moins de peine, d'embaras, et qui vous évite beaucoup de frais et de dépense que vous éties obligés de faire auparavant pour monter un métier; ... car ces MM. parlent en Roi à l'ouvrier ... et il est bien juste ajouteront-ils encore, de vous diminuer aussi la moitié ou un quart (plus ou moins) sur le prix de la façon ...
Que diront les ouvriers de leur coté. ils refuseront d'employer la Mechanique...ils diront qu'ils préfèrent leurs métiers tels quils sont à toute l'utilité et les avantages de la Mechanique pour ne pas voir diminuer et reduire presque a rien le prix des façons, pour éviter de fournir des pretextes aux Marchands de les vèxer encore d'avantage ...; plusieurs en murmurent d'avance, ... ".

What natural order was producing in the market place, was not harmony, and inventions could actually disrupt concord, more than cement solidarity. Such a conflicting natural order of society was not a hindrance to progress for Turgot. The balance between private interest and the "duty of justice" recommended by Boisguilbert, in the wake of Locke, was much endangered.
Actually, this was not a new situation within the Fabrique. Conflicts between independant masters and merchants were harsh all along the century and inventions did cristallize the problems as early as the mid-century, after the merchants’ victory of 1744.

513 - Frustration: Jean Pierre Falcon
At that time, Falcon had invented his first loom, inspired from Bouchon’s. He belonged to the wealthy members of the Fabrique; he came from a bourgeois family (150,000 pounds annual rent), he was bound to be a merchant and he learnt the trade at a very famous master’s, Jean Revel, a designer of a new stylistic pattern. In 1735, he made a beautiful coat and became a master and a merchant without paying any fee nor being apprentice. He received a grant and entered a partnership with Bouchon, also a wealthy member of the Fabrique. Except Philippe de Lasalle, he was the inventor most rewarded in Lyon; when he lived, he received 108,384 pounds, that is 52,194 pounds from the Fabrique and 56,190 pounds from the town council (the caisse) and he was well-known in Lyon for that reason (his widow and his daughter still received 24,000 pounds). Never a mere master would obtain so much money. The Fabrique was actually rewarding the inventive merchant and was setting him as a model for the whole community (we remind his loom was actively spread out); the Fabrique was forging an elite of innovators (Bouchon, Falcon, de Lasalle).

Falcon became a target for masters competing the merchants’ strengthening power. In 1737, as masters had overcome merchants, they stopped paying Falcon who had to wait 1744 merchants’ victory to get his money. During the next troubles of 1754, the opponents to the elite took argument of disappointments in the use of Falcon’s loom to prompt workers to criticize the head of the Fabrique. Then, Buisson managed to make 12 weavers sign against Falcon. This "cabal" was successful, Falcon was no longer payed for a time and he lost his dwelling. Solidarity here rather meant factions serving private interests’, which mingled with struggle against the elites.

But, there was an unexpected development of the Falcon’s affair which helps to grasp the importance of the conflicts with merchants for ascertaining inventors’ claims to rights, honor and glory.

Though Falcon was celebrated by the Fabrique and the town council, his daughter kept disturbing the authorities long after his death in 1765 because she thought that the Lyonnais administrators had not treated well enough her father. It was not mere whimsy call fancy. On the contrary, her argument and her violence were efficient in the bursting out of inventors’ natural right as the paradoxal outcome of the collective meaning of invention during the century.
Falcon’s daughter claimed her father had been humiliated because he had been compelled to invent. He had received 6 000 pounds in 1737 and a pension to begin researches and after the loom was achieved (1742), Falcon was refused the huge reward he wished (20 000 pounds) because Trudaine thought that such a sum would no more stimulate him. She added that her father had to teach workers and to show his devices to all foreigners passing through Lyon. He would have earned more money if he had worked as a merchant master ("his superior genius could have granted him a huge fortune in trading, but he would have worked for his sole benefit"); his belonging to the elite should have credited him much more ("my father never was brought up as a worker"). For her, "whereas his talent and his genius should have secured him and family fortune, they have occasioned their ruin".

At the end of the century, according to Falcon’s daughter, enlightened collaboration actually meant dependance, shackles and humiliation. This could be related to the growing pressure of merchants. Fleury Dardois also argued that the authorities had asked him to invent his loom within one month for 144 pounds; he was only given 72 pounds and the other 72 pounds were promised. As one maître-garde wanted to know his secret, he contrived a device for concealing the mechanism but he was "seduced" by the maîtres-gardes. He wrote in anger that "they persist ... keeping the worker under their claws, to want him to depend on them as if they had sovereign power and even stronger: a... despotic power... Tyranny!". He added he was "illtreated, insulted when he asked for his money" "reduced as a beggar" "because the guild wanted to deprive (frustrer) the artist from the reward and the merit of his work"; "was it possible to treat so badly men so useful ... to humanity".

The question was rooted in economic and social struggle developing in the Fabrique, but it had also to deal with identity self-consciousness growing in craft trades. In both discourses, the question of pride and honor was central; inventors were re-using traditional craft discourse on honor for asserting new claims, the rights of genious to unquestioned recognition. Inventors, who experienced being rewarded by the town and the State for their talent, thought they were somewhat exceptional. The cooperative framework, backing poor inventors, rewarding meriting ones, even glorifying some of them, instituted as models for the whole community, all this did encourage artisans’ choices, competing desires, mobilities and individualistic self-conscienciousness. Invention had to deal with free-riding responsible subjects. In Lyon, such an
emancipation was not easy to be tolerated by merchants at the end of the century, when the gap widened between them and the weavers. Different conflicts did occur as inventors became conscious that the collective ethos could be used as a stratagem for depriving them of any right upon their creations. This was essential for the bursting of natural right arguments in France.

This could express in very material forms. The father’s honor in the words of Falcon’s daughter rested upon a capacity to earn his living thanks to his genius creations. The question of money was central in her discourse and it was not hazard. Living of one’s inventions, like living of one’s books of paintings, was the basis of the emergence of the social, cultural and juridical identity of inventors, authors or artists. The market pressures weighing upon the creators’ shoulders were as instrumental as the academic rigid judgments in fostering the claims for rights and freedom. The Lyonnais silk merchants were denounced (and Trudaine too) because, through the rewards, especially the complex system of bonuses, they were linking inventors to their market strategies and preventing them of developing their own initiatives.

There was a very similar problem repeating in the XIXth century for Jacquard and his new invented loom. Whereas A. Cottereau explains how the invention became property of the town and did quickly spread out, Pierre Cayez has stressed the conflicts between Jacquard and the municipality which compelled him to stay in Lyon and which feared so much that he would sell the invention to competitors. In 1814, as Jacquard had left Lyon, the police was urged to take him back and to check if he had transmitted his invention to rivals. But Jacquard has become a main figure of the mythic history of inventors ; at least he won the judgement of posterity. Falcon’s daughter had still to fight for that.

Pride, as expressed by Falcon’s daughter, was grounded on a familial and patriarchal sense of patrimoniality. Actually, the daughter and her husband had worked a lot on Falcon’s looms. That was not unusual, as familial networks were essential in the transmitting of knowledge within the corporate world. The Fabrique was encouraging this spreading, often associated to apprenticeship, so that it was common for authorities to deal with inventors for two generations, for instance with revertible pensions (as Falcon’s and de Lasalle’s). Familial appropriation was enhanced in the name of utility and public good, though the new meaning of patrimoniality was not a familial one. The ambiguity was patent in Falcon’s case as he had sent his own daughter to Paris for requiring the 20 000 pounds and, most of all, he planned that this money would provide
dowry for a daughter and permit her to set up. Moreover, the pride of fathers and of their wives or daughters was emphasised in the guild during the whole century, as auxiliaries were thought to threaten masters’ work, as D. Hafter has shown. This complex situation did enhance the memory of the inventor, of his name as a father. It was one more paradox of open technology. It fostered a desire of posterity, in the name of the father; self-consciousness was deriving from a sort of cult of ancestor’s genius, of the spirit of the family.

This pattern was not so far from the worship of scientists and inventors, which developed for instance in the Encyclopédie (though praising collective improvement), with names quoted as gallery of portraits, as a new lineage for humanity. Some inventors had to be reminded like fathers; they belonged to a new built collective and selective memory, to myths.

52 - Incentive structures in systems of open knowledge: discussion

521 - The basic ingredients of systems of open knowledge

As clearly shown in both cases of open science and open technology a critical factor deals with the emergence and re-enforcement of a common knowledge that openness increases the general performance of the system and that diffusing its own knowledge contributes to a positive sum game. Such a collective belief is particularly strong in cases of localized systems of open knowledge which are competing with other systems (Lyon against London). Collective ethics plays also a great role. However this is not enough as clearly demonstrated by Dasgupta and David in their analysis of open science. There is also a need for a mechanism to give credit to the inventors without creating exclusivity rights. The ingenious mechanism of priority rule which determines the constitution of reputation capital plays this role. In the case of the “fabrique lyonnaise”, a financial reward is attributed to inventors who accept to diffuse their knowledge and bonuses are given if the inventor actively take part to the adoption of his technology by others. The great system of bonus shows how well the conditions for an efficient reproduction of the knowledge once created were understood: Michel Berthet received 600 pounds for his invention plus 400 pounds if he taught his knowledge and if four of his loom did exist in various other places.
In both cases - open science and open technology - the reward system introduces competition and increases the risk of disputes. Then the force of ethics as well as the effectiveness of the common knowledge about the efficiency of the system come into the front to mitigate individual misconducts and frustrations.

522 - The mistery of Linux

Linux is the new example of a technological community based on openness, without being territorially limited. It is a computer operating system inspired by Unix, delivered free-of-charge with the source code (the series of instructions that forms the programme before its compilation). The fact of giving the user access to the source code makes it possible to generate gigantic effects of learning-by-using, in other words, to fully exploit a fantastic amount of distributed intelligence. Thousands of users reveal problems and thousands of programmers find out how to eliminate them. According to the terms of the Free Software Foundation, everyone can use the code and amend it, provided they inform the organization of the change so that it can be checked and assessed. We have here the "good properties" of knowledge distribution and systems of open knowledge: only with the fast and large-scale circulation of knowledge can we benefit from the unique potential of a very large number of skilled individuals. In a way, the billions of dollars spent by Microsoft to maintain huge teams of researchers seems very expensive compared to Linux's capacity for "brining together and exploiting the IQs of thousands of users in the four corners of the Internet" [Alper, 1999].

The case of Linux provides a new insight into our exploration of open technology. Open knowledge does not mean the absence of legal rules. There is a necessary “legal equipment” to protect the free nature of knowledge from private appropriation. In the case of Linux the general public licensing (GPL) makes it impossible to privately appropriate some improvements which could be introduced into the operating system.

Such an analysis, however, leaves one question open. While it is clear that there is a strong collective belief among the Linux community about the efficiency of the “bazaar model”, and that ethics plays a great role in the Linux enterprise as well, we do not see any mechanism designed to give credit to great software developers without creating exclusivity. This is probably
due to the particular features of the division of labor in this kind of creative process (Arora and Gambardella, 1994): division of labour is so deep that it makes it difficult to individualise inventors and creators. However, this impossibility to reward individual efforts raises great concerns about the stability and durability of openness in this particular case.

CONCLUSION

The Lyonnaise silk industry was provided with institutions which played a major part in the building up of a policy for innovation and of a legal frame for inventing. There were two reasons for that. Lyonnaises institutions managed to combine emulation and cooperation and this was fundamental in the enlightened administrators’s mind. Lyon was thus a central piece in the reforming and encyclopedic attempt of the mid-century. Corporate and municipal traditions were not combining with liberal reforms. The result was effective diffusion, though it was much more impressive in Jacquard’s time, as foreign markets were more active too. The impact was rather one of cumulative and collective invention which benefited to Jacquard (Cayez called his loom "Vaucanson-Falcon-Breton").

But, the lack of monopolies, coupled with the collective principle and practices were also perceived as means for dispossessing inventors and clushing down their desires of autonomy. The situation was more conflictual than ever as the rewarding of meriting inventors and the praising of their initiatives had fostered desires of social, economic and cultural upwarding (which did occur for some workers) and the feeling that inventors deserved public recognition and everlasting memory. They were heroes, overpassing human laws, and this was the basis for claiming a natural right. The experience of feeling singular was originating in a collective process. The corporate and industrious town was thus a privileged place for the elaboration of the inventors’ identity, still an improver and already a hero (amnesia and memory).

Thus, this study opens new research avenues - historical as well as analytical - about these classes of mechanisms allowing to give credit to individual inventors while supporting strongly the disclosure as well as the reproduction of knowledge; those mechanisms which strictly govern the solidity and stability of open systems, as Paul David has it so clearly demonstrated in the case of science and academic research.
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