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Workers and Automata: A Sociological Analysis of the Italian Case

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Abstract

The aim of this investigation is to determine if there is a relation between automation and unemployment within the Italian socio-economic system. Italy is Europe's second nation and the fourth in the world in terms of robot density, and among the G7 it is the nation with the highest rate of youth unemployment. Establishing the ultimate causes of unemployment is a very difficult task, and the notion itself of 'technological unemployment' is controversial. Mainstream economics tends to relate the high rate of unemployment that characterises Italian society with the low flexibility of the labour market and the high cost of manpower. Little attention is paid to the impact of artificial intelligence on the level of employment. With reference to statistical data, we will try to show that automation can be seen at least as a contributory cause of unemployment. In addition, we will argue that both Luddism and anti-Luddism are two faces of the same coin. In both cases attention is focused on technology itself (the means of production) instead of on the system (the mode of production). Banning robots or denying the problems of robotisation are not effective solutions. A better approach would consist in combining growing automation with a more rational redistribution of income.

1. Artificial Intelligence and Industrial Automation

The concept of 'artificial intelligence' is a vast one which includes all the forms of thinking produced by artificial machines. The concept of AI is therefore strongly related to that of automation, that is, of machines behaving autonomously, albeit in response to certain inputs and in the presence of programs. Any inorganic machine conceived and construed by humans

– be they desktop computers or semi-mobile robots, dishwashers or power looms – and able to carry out the tasks that humans carry out using their own intelligence is an automaton. In other words, «a certain category of sets of elements are 'universal' in the sense that one can assemble such elements into machines with which one can realize functions which are arbitrary to within certain reasonable restrictions» (Minsky 1956). Given this definition, it follows that all functioning automata are endowed with a certain degree of artificial intelligence. The refrigerator is less intelligent than a PC, in more or less the same way as an insect is less intelligent than a vertebrate. And some do not hesitate to compare the various forms of organic and inorganic intelligence (Moravec 1997).

Automation is therefore not something new that has arisen in the last few years, but the fruit of a long and slow historical process that can be taken back to the mechanical calculators of Charles Babbage or Blaise Pascal, if not all the way to Heron's automata. Therefore whoever has a more revolutionary conception of artificial intelligence feels the need to introduce a distinction between weak AI and strong AI – a distinction that has a philosophical dimension and touches on matters such as the functioning of the brain and the ontology of the mind. This however will not be the topic of our article. Rather our intention here is to tackle the sociological aspects of artificial intelligence – whether it is understood as weak or strong, discrete or gradualistic. In other words, we intend to analyse the social, political and economical consequences of the production and use of automata or thinking machines. Let us just set some temporal and spatial limits to our analysis. We will be looking at the artificial intelligence of the third industrial revolution (Campa 2007), which can be situated in the last decades of the 20th century and in the first decade of the 21st. In this period, automation is identified in particular with computerisation and robotisation. And we will chiefly be looking at Italy, which can in any case be viewed as exemplary, given that it is still among the first seven industrial powers of the planet and is one of the leading countries in the world for 'robot density.'

One of the most systematic applications of electronic calculators and of robots has so far been found in industrial plants. Microprocessors are omnipresent. Personal computers are found in every home and in every office. There is no institution that does not entrust some of its task to AI in some form or other. However, it is in the manufacturing industry that one observes some macroscopic social effects of the emergence of this technology.

We have all seen at least once robots that paint, weld and assemble cars, as well as electronic products such as radios, TVs and computers. These are the so-called industrial robots, which in advanced technological societies have come to work alongside and, in many cases, replace the worker on the assembly line. The first industrial robots appeared in the fifties, but it is only in the seventies that their presence in Italian plants began to become significant. They were steel constructions of impressive dimensions, endowed with a rudimentary electronic brain, faculties of perception, servomechanisms and hydraulic engines. The first generation industrial robots were slow and not particularly intelligent, and therefore their work was limited to tasks that do not require a high precision, like paint spraying and car body welding. Precision work was still done by humans. However, as could be foreseen, the situation changed quickly and in the eighties one could see robots able to assemble complex electronic circuits, inserting and welding the devices in a matter of seconds and without errors.

Industrial robots become ever more anthropomorphic. Their degree of freedom[1] increases their precision, velocity and load capacity. In the car and heavy industry they have little by little taken over other tasks that require precision such as piercing, grinding, milling, cutting, but also palletisation and stockpiling. Nowadays they are endowed with laser devices and visual systems that allow them to operate with millimetric precision.

If it is the United States, as producers of the largest number of robots, that show the way, Japan also makes a massive entry into the sector from the seventies and onwards. Indeed, among the characteristic aspects of the third industrial revolution there is also the reorganisation of the processes of production, with the computerisation and automation of the entire factory, with Toyota as the true pioneer. It is not by chance that one tends to oppose Toyota's model to the model of organisation based on the assembly line developed by Ford and Taylor. According to Cristiano Martorella (2002) "thus the Japanese industrial revolution has transformed the factory into an information system and has freed man from mechanical work, transforming him into a supervisor of productive processes. This takes place in a period in history that sees the transition from the industrial society to the post-industrial society. This epochal turning point will be well understood once the transition to the society of services and information will be complete."

Italy contributes as well. FIAT is the first Italian company to make massive use of industrial robots. In general this country tends to import digital electronics from abroad, having lost foothold in this field, particularly after the crash of Olivetti in 1997. However, in robotics one sees very interesting exceptions to this rule. For example *Robogate*[2] is an Italian invention that has since been adopted by the entire car industry.

We will not enter into technical detail that the reader may find in handbooks (Kurfess 2012, Siciliano and Khatib 2008). Rather let us cast a rapid glance at the magnitude of the process of robotisation in the industry. As the Italian newspaper *La Repubblica* stresses, "first generation robots, those that work in the industry all over the planet, number over a million: 350,000 in Japan alone, 326,000 in Europe. In Italy, for every 10,000 persons employed in the industry, there are over 100 robots, a number that makes our nation one of the first in the world in this sector. They are used above all for mechanical work, in welding and in working with plastics. And their price continues to fall: a robot purchased in 2007 may cost a quarter of the price of the same robot sold in 1990. And if its yearly cost was 100 in 1990, today it is not above 25" (Bignami 2007).

More precisely, Italy is the second country in Europe and the fourth in the world regarding robot density, as shown by a more accurate study by the UNECE (2004, 2005). There are already more than 50000 units and the number continues to increase.

2. Effects on the level of employment

Thanks to censuses from the ISTAT, we are able to make very accurate comparisons between the growth of automation on the one hand, and the effects on employment on the other. If one leaves aside the census of the factories of the Kingdom of Italy that goes back to 1911, ISTAT has done nine censuses relative to industry, commerce and services (1927, 1937-39, 1951, 1961, 1971, 1981, 1991, 2001, 2011). The first data of the 9th census (2011) were presented on 11th July 2013. It is not always easy to directly compare the statistics because with time the techniques of survey and the categories under scrutiny have changed: until 1971 the focus was 'industry and commerce', while from 1981 it is on 'industry and services.' Statistical series have been 'harmonised' however, enabling an overall reading of the data. In addition, we are interested now in the manufacturing industry and consequently shifting the focus from commerce to services is of marginal relevance. Let us begin nonetheless with a comparison between the last three complete series of statistics (1981, 1991, 2001) that are fairly homogenous. The table concerns the absolute data:

TABLE 1 - COMPANIES AND WORKERS BY SECTOR OF ECONOMIC ACTIVITY – 1981, 1991, 2001

	1981		1991		2001	
Economic activity	Companies	Workers	Companies	Workers	Companies	Workers
Agriculture and fishing (a)	30.215	110.195	31.408	96.759	34.316	98.934
Extractive industry	4.477	56.791	3.617	46.360	3.837	36.164
Manufacturing industry	591.014	5.862.347	552.334	5.262.555	542.876	4.894.796
Energy, gas and water	1.398	42.878	1.273	172.339	1.983	128.287
Construction	290.105	1.193.356	332.995	1.337.725	515.777	1.529.146
Commerce and repair	1.282.844	3.053.706	1.280.044	3.250.564	1.230.731	3.147.776
Hotel and civil services	212.858	644.223	217.628	725.481	244.540	850.674
Transport and communication	132.164	679.386	124.768	1.131.915	157.390	1.198.824
Credit and insurance	27.775	446.745	49.897	573.270	81.870	590.267
Other services	274.463	911.560	706.294	1.977.334	1.270.646	3.238.040
TOTAL	**2.847.313**	**13.001.187**	**3.300.258**	**14.574.302**	**4.083.966**	**15.712.908**

Although the number of workers as a whole grew over the twenty-year period 1981-2001, it is also evident that the number of employees in the manufacturing industry has remarkably decreased. The data are significant given that in the meantime the Italian population grew as a whole, albeit not at the pace of earlier decades. We can extrapolate backwards the area of investigation to uncover that until 1981 the number of people employed by the industry increased instead. A study by Margherita Russo and Elena Pirani (2006) that spans the half-century is useful. The tables, conveniently reconstructed and harmonised, show first the growth and then the fall of employment, both in absolute terms and in percentage.

TABLE 2 - DYNAMICS OF WORKERS IN ITALY BY SECTOR OF ECONOMIC ACTIVITY, 1951-2001 (ABSOLUTE VALUES)

	1951	1961	1971	1981	1991	2001
Engineering	1.041.962	1.569.306	2.166.813	2.745.513	2.531.295	2.496.658
The rest of manufacturing	2.456.258	2.928.698	3.141.774	3.397.865	3.253.313	2.766.994
Services	100.802	110.194	170.550	702.928	1.147.988	2.208.853
Total economic activity	6.781.092	9.463.457	11.077.533	16.883.286	17.976.421	19.410.556
Total manufacturing	3.498.220	4.498.004	5.308.587	6.143.378	5.784.608	5.263.652

One could therefore think that – given the fall in the number of companies and workers during the twenty-year period from 1981 to 2001 – we have entered into a phase of deindustrialisation. This is partly true (Gallino 2003), but the data relative to industrial output show that the fall in number of workers does not correspond to a fall in output. See on this matter the study by Menghini and Travaglia (2006) on the evolution of Italian industry, where the tables relative to the decade 1981-1991 (the eighties) and 1991-2001 (the nineties) show a noticeable increase in industrial output.

Intermediary surveys during the decade 2001-2011 are less 'linear' because of the two big epochal events that have characterised the 2000s: a) the terrorist attack on the USA and ensuing war in the Middle East; b) the major economic crisis that began in 2008 and is still with us. ISTAT data shows that in the 2008-2010 period, the slump in employment becomes much more pronounced, while industrial output also decreases. This happens in Italy as in other Western nations. However, the first data of the 9th census on industry and services (ISTAT 2011) confirm the trend of a decreasing number of industrial employees coupled with the growth of the total number of workers.

TABLE 3 - COMPARISON OF THE DYNAMICS OF WORKERS IN MANUFACTURING WITH TOTAL WORKERS, 2001-2011

Type of data	Number of active enterprises		Number of workers	
Anno	2001	2011	2001	2011
Total	4083966	4425950	15712908	16424086
Manufacturing industry	527155	422067	4810674	3891983
Other activities	3556811	4003883	10902234	12532103

In ten years, the number of blue-collar workers has decreased by approximately one million units. The following specific data are also quite significant:

TABLE 4 - DYNAMICS OF WORKERS IN MANUFACTURING AND REPAIR OF COMPUTERS AND MACHINERY, 2001-2011

Type of data	Number of active enterprises		Number of workers	
Anno	2001	2011	2001	2011
Manufacturing of computer and other electronic devices	5434	5693	139239	112055
Manufacturing of machinery and other equipment	21263	24584	451806	457956
Repair of computer and other domestic appliances	33659	26152	61512	46837

Here, we can clearly see that workers expelled from other manufacturing industries are not reabsorbed into the computing and machinery sectors. The number of enterprises active in the manufacturing of computers grew, while the number of workers in the same sector significantly shrank. We also notice a decrease of both enterprises and workers involved in computer repair. The only exception is the manufacturing of machinery, where we observe that the number of both enterprises and workers grow. But a growth of 6,150 workers compared with the loss of one million jobs can hardly be seen as evidence that workers made redundant by machineries are 'recycled' by the system as machinery constructors.

Summing up, notwithstanding turbulences connected to wars and financial crises, we can say that on the whole, during the last thirty years, a trend has emerged that is characterised by a fall in the number of industrial workers and an increase in industrial output. This should not astonish if one keeps in mind that productivity depends also on other factors. The other factor that grows noticeably during this same period is precisely automation, that is, the massive use of computers and robots in industrial manufacturing.

All this therefore leads one to think that there exists a relation between the fall of employment in industry and the growth of automation. This is the hypothesis we want to consider.

Allow us to open a bracket. It is known that data are not only read but also interpreted. A statistical correlation does not imply a causal dependence between the phenomena. Therefore the statistical data could just be a starting point, to which will later be added other elements, other considerations. But without statistics one goes nowhere. To those who say that statistics are unreliable and that one can therefore easily do without them, we reply with a well known popular diction: if money does not buy happiness, imagine misery. By analogy we say: if statistics do not give certainty, imagine mere impressions. Close brackets.

To start, we take into account the interpretation of Luciano Gallino, perhaps the greatest expert on the sociology of work and industry in Italy. We are trying to shed light first of all on the question of 'technological unemployment':

> Technology is essentially a means to do two different things. On the one hand one may try to produce more, even much more, using the same amount of

> work. On the other hand one can try to use the potentiality of technology to reduce the workforce employed to produce a given volume of goods or services. And this leads to a very simple equation: as long as one manages to increase production, which means that as long as one manages to increase the markets, technology does not generate any unemployment because the work force remains constant and the only thing that grows are the markets. The markets however, different the one from the other, varied as they are, in general cannot expand forever. When the markets can no longer expand, technology is used mainly to reduce the workforce and then the spectre of technological unemployment begins to loom (Gallino 1999).

Economists tend to underestimate the problem of technological unemployment because one observes that, in percent, the unemployment due to the technological development of the last two hundred years has not been unsustainable. In general one avoids the issue saying that every new technology eliminates one job while creating another. Even if the computer takes an employee's job, there will be the need to build and maintain computers. There is a grain of truth in this observation, but the issue is slightly more complex. This allegation always wafts the idea of the invisible hand, of the self-regulating market. In reality the system has so far had to thank the constant intervention of governments with policies of all kinds. The readjustment of the economic system, following the introduction of new and revolutionary technologies, does not happen in real time and without a price. If it is true that the worker or the employee that the machine has replaced can find another job, perhaps a new kind of job, it is also true that they might not have the skills required for the new job (for example: computer maintenance) and that, in order to acquire them they will need months and perhaps years – that is, if they are successful. Therefore the replacement work can arise one or two years after the work was lost. Humans are fragile machines – they do not survive more than a few days in the absence of a certain amount of calories, adequate clothing and a roof over their head. At the same time, these 'machines' tend to behave violently and disruptively if they come face to face with the prospect of their own destruction. Therefore even if it is the case that the market self-regulates, since it does not do so immediately, if one wants to avoid the instantaneous collateral effects of technological unemployment, one will have to play the public hand in addition to the invisible one.

This is what all governments have been doing, even those most liberal and capitalist. For over a century, governments have systematically obliged employers to reduce working hours, in order to compel them – against their interest – to maintain the number of employees[3]. They have instituted tools such as unemployment benefits or national insurance contributions, at times efficiently, at others creating pockets of parasitism. They have acquired the goods produced by the private sector via public contracts. They have funded retraining schemes and refresher courses for the chronically unemployed. And in the most tragic cases they have patched up the effects of economic crises by starting wars. On the one hand conflicts reduce the population by sending entire generations to the front and on the other hand they allow the war industry to reabsorb the jobless. However cynical this may seem, it has happened and it continues to happen.

These tools, especially the systematic reduction of working hours and benefits to the temporarily unemployed, have so far worked rather well. Today the appearance of two new factors – globalisation and artificial intelligence – has created a new situation with respect to the one generated by the first and the second industrial revolution. Globalisation no longer allows one to operate on the basis of reduced working hours. To do so would be suicidal if not implemented at a global level and adopted by all nations. Although globalisation has created *a*

single large market it has not created a *single large society* led by a government that is its authentic expression. There probably exists a kind of 'shadow world government', otherwise one cannot understand for whom or for what the national states are giving up their own sovereignty, but – if there is such a thing – it resembles a financial oligarchy that understandably defends its own interests, rather than an enlightened elite serving the interests of all. The idea that there could exist a market without a society has, as we can see, critical consequences.

In addition there is the matter of artificial intelligence. The idea that every job eliminated by a technology is sooner or later replaced by a job generated by that same technology is called into question by the nature of automation itself. Gallino (1999) writes: "This minor textbook equation prevails much less at the age of driven automation, the one that I call 'recursive automation.' The jobs that technology used to create soon after it had suppressed a certain number were partly recovered by the enlargement of the markets but partly also by producing technological means, that is, producing the same machines of goods and services that the markets absorbed up to a point. With automation applied to itself the machines produce other machines to automate, the process of automation attains very high levels and thus there is no longer any hope, or at least it is much reduced, to sooner or later find a new job in the sectors that produce the technology that eliminated the original job, the first job."

All empirical evidence shows that technological unemployment is more than a hypothesis. It is on the basis of data and graphs, and certainly not of moral principles, that sociologists criticise mainstream economics. Although it is dated, the book *Se tre millioni vi sembrano pochi*[4] is still instructive; in this analysis Gallino (1998) gives a central position to recursive automation, which until then had been given little heed. In the following review, sociologist Patrizio Di Nicola sums up the main ideas:

- To the myth that the upswing generates employment the author opposes Italian statistical evidence: in thirty years GNP has doubled, but the number of workers has only increased by 2,1%, that is of 400 000 units. But at the same time the number of resident citizens has increased by over 6 million;

- The idea that technology creates, long term, more jobs than it destroys was valid in the past, the author states, but is no longer so. The increase in productivity due to new machines can generate a positive occupational balance only if the markets absorb more merchandise. But in Italy companies function inside mature and partly static markets and export in these sectors is anything but easy;

- The advice to do 'like the Americans,' who seemed to have managed to create a phenomenal *job machine*, is founded on misleading presuppositions. In fact, on the one hand, the increase in the number of jobs is a direct consequence of the increase in the population (which between 1980 and 1995 went from 227,8 to 263,4 million units). On the other hand American job performance is aided by a somewhat relaxed statistical method. Count as employed the following: 6 million students aged 16-24, who nevertheless have been working for at least one hour in the week preceding the survey (maybe washed the neighbour's car or delivered the newspaper before going to college); 20 million *contingent workers*, people who work sporadically, when they can; 23 million part-time workers, who in reality correspond to 12 million fulltime jobs. And in the same way as they overestimate the number of employed – Gallino observes – the official statistics made in the USA underestimate the number

of unemployed that, applying European criteria, ought to be over 12% instead of 5,3%. That is a little over the European mean.

- To the idea that what is most responsible for the poor levels of employment is the welfare state Gallino objects with some 'odd cases': Italy, with its 12,2% unemployed, spends 25,1% of GNP on welfare, while Holland, which has an unemployment rate of 6,5% spends the most: 29,8%. Denmark, the country where unemployment is the lowest in Europe, allocates 32,7% of GNP to social welfare. At the other extreme Spain, which invests less than we [Italy] in welfare, has a level of unemployment that is above 22%.

In brief, the growth of production and of productivity has not necessarily brought about the growth of employment. The relation between growth and employment is extremely weak in a country that does not produce technologies but imports them at best[5]. The American model is an illusion because the occupational data are 'inflated' (and, ten years after the publication of this book, the situation is even worse after the outbreak of the financial crisis). Welfare – considering the graphs – rather than being an obstacle to growth appears to be a factor of production, but almost all Western countries tend to respond to the crisis by dismantling or reducing social benefits.

Not only that. One cannot even hope that someone who is expelled from industry will later necessarily be reabsorbed by the service sector (be it public or private), "because services are just as much susceptible to automation as the production of goods" (Bignami 2007). We will consider this aspect in greater detail.

3. Social stratification and the new generation robot

Automation is already expanding beyond the manufacturing industry. The evolution of robots now has its effects also on the tertiary sector. In addition the presence of robots within the home is growing at the rate of 7-8% per year. According to the predictions of Bruno Siciliano, president of the International Society of Robotics and Automation, "out of the 66 billion dollars that will represent the cost of robotics in 2025, 35% will be that of personal and service robots" (Bignami 2007). This is why, if we have failed in the past to correctly formulate the social problem of robotisation, it would be even more shortsighted not to formulate it now. "So from now on robots are everywhere. In our home, in the office, in our car. They take care of the elderly: South Korea has developed robots that control home electric appliances and remind the elder person when it is time to take his medicine. They serve as nurses to the sick (in the USA some prototypes are even taking their temperature) and they can also transform into tail-wagging puppies (the case of 'Aibo' among others); soon they will act as baby-sitters if it is true that some companies are researching how to 'teach' the automaton to rock a newborn."

Philosophers and scientists talk about all this, once in a while, in symposiums and conferences, but the question seems virtually absent from political agendas. The problem is underestimated for two main reasons: 1) the lobbying power of major industries, that only stand to benefit from robotisation, and therefore feel no necessity to discuss the issue in wider terms, and 2) the widespread conviction that robots will never be able to imitate humans *all the way.* Yet, as Siciliano observes, today there are robots capable of doing the same work as a craftsman. "They are working in the zone between Vietri and Cava dei Tirreni where they

are imitating the master potters." In practice the robot is not just able to imitate the assembly line production and surpass it in precision, but also that human imprecision of the craftsmen that is so characteristic of their product. An optical system records the craftsman's imprecise brush strokes, all different from one another. Using this information one writes a program which, when implemented in the robot, enables it to produce tiles that are all different from one another.

If we proceed in this way, robots could replace humans also for activities involving decision-making. Interviewed by Bignami (2007), Antonio Monopoli makes this forecast: "It is likely that with time one will produce robots with greater and greater ability to teach themselves. In fact we will have robots able to 'decide', a condition they share with humans." Once we have got that far, according to Bignami, "the expansion of robotics will also involve problems of ethics, and it is not fortuitous that one talks of 'Roboethics' at the ICRA conference. One problem that may arise is the possible inadequacy of the robot's response to events. In the case of injury, who would be responsible?" Monopoli replies that: "If the robot is regarded as a machine, the responsibility falls on the owner. But if the robot has a great capacity for self-learning and interaction with the external world, and the idea of robots working autonomously is socially accepted, one could not question the good intention of those who designed and commercialised the robot."

These problems are generally presented as having to do with roboethics, and therefore as *ethical* problems (that concern the whole of humanity and have to be solved with reference to universal principles) and not as chiefly *political* (that is, that concern the interests of a polis, a community, a faction, a social group). Now we should wish to stress that the problem – be it ethical or political – was born before, when the big industrial robots arrived to the factories. The robots' spread from the factories into homes and offices is if anything part of an *evolution* of the old problem that arose already with the industrial revolution. The ruling classes downgraded the problem of technological unemployment into a 'technical' one and certainly not 'ethical', as long as the victim of the process was the working class. It would be interesting if the same ruling classes were outraged should an anthropomorphic robot sit down at the desk of the CEO or an AI replace the manager in the control room of a multi-national. If he were alive, Karl Marx would probably say that that the bourgeoisie wakes up to the ethical problem once the robot reveals itself able to replace also the manager, the artisan, the medical doctor, the teacher, when it acquires the ability to make decisions – and not only the proletarian at the assembly line. Again, the dominant group equates itself with *humanity* and turns its own political problem, its own class interests, into a universal ethical problem.

4. The need for a new socio-industrial policy

With the exception of radical ecologists and the supporters of degrowth, most people - regardless of which side of the political spectrum they are on – would claim that economic growth and a high rate of employment are good things. These are universally seen as goals that should be pursued. Let us therefore ask ourselves if the policies that the last several Italian governments have implemented are effectively rational – that is, do they allow these goals to be achieved. Current Italian political leadership seems to assume that growth and employment have no causal link with automation, given that this factor is repeatedly forgotten in analyses. Basically, politicians accept the thesis of the "Luddite fallacy" elaborated by economists.

Therefore, most policies have the aim of making the labour market more flexible or reducing the cost of labour. It is assumed that Italy would attract more investments, if it were easier for

capitalists to fire workers and if workers were less 'choosy' when looking for a job. The policies based on these assumptions tend to create a favourable ground for brain drain and the immigration of unskilled workers. A mass of immigrants with reduced rights (given that they cannot vote and have temporary resident permits) is much more appealing to companies than skilled and demanding citizens.

Has this approach, adopted systematically since the early 1990s, produced positive results? Everything points to the contrary. As a matter of fact, the deregulation of the labour market and the gradual dismantling of the welfare state have not generated the expected results. Data from the World Economic Outlook Database of the International Monetary Fund (October 2012) show that, in the decade 2003-2013, Italy's growth has on the whole been -0.1%. This means that while the global economy keeps growing, Italy occupies one of the few positions with negative growth, together with Zimbabwe, San Marino, Greece, and Portugal (Pasquali, Ventura and Aridas 2013).

These policies could be ineffective and, perhaps, even counterproductive exactly because the last generation of robots and computers have something to do with structural unemployment. On the one hand, highly automated industries, having not so many humans in the loop, are probably much more preoccupied about the cost of energy than the cost of labour. On the other hand, no matter how much the cost of labour and the rights of workers in a developed country can be reduced, low-tech industries will always find it more convenient to relocate to underdeveloped countries.

In other words, the very problem could be the postulate on which the system is built: its necessity – that is, the idea of the invariance of the mode of production. Hence, the solution to almost any contingent problem is primarily to patch it up (at low cost) to keep the system up and running for now – leaving the serious problems for future generations to sort out.

This is pretty obvious in the case of the politics of development and of social security policies. For decades Italian political leaders *spoken* of the necessity to stimulate scientific research, but talk remains always and only talk. In reality investment in research, both from the State and from private sources, is at its lowest[6]. Hence, it so happens that Italy – a nation belonging to the leading group of developed economies (of the G7 or G8) – has no manufacturers of computers or of mobile phones – to state two driving products of the new economical phase. The result is that technological development is certainly not slowing down, given that technology can also be imported. Rather the result is that one does not stimulate the sector that could reabsorb at least part of the technological unemployment.

As regards the politics of prevention, a now creaking system has been in place for a few decades, and it relies on two remedies: a massive immigration from the less developed countries and an increased age of retirement. The first remedy presupposes that there is an oversupply of jobs in Italy, while the second one shrinks the job market for the young – so this policy appears schizophrenic right from the start. Yet this policy is in fact the fruit of a plan that the Ministry of Work and Social Policies, under the leadership of Maurizio Sacconi, has put in black and white. If we read a document by the Directorate-General dated February 23rd 2011 with the title "Immigration for work in Italy" we discover that the Italian government feels the need to increase the number of immigrants: "In the period 2011-2015 the mean yearly requirement should lie around 100,000 while in the period 2016-2020 it should reach 260,000" (Polchi 2011). So in the next few years we will need to 'import' one million eight hundred thousand workers who would be added to the four million already residing in Italy (data from ISTAT)[7]. The conclusion that we will need six million immigrant workers in the next ten years derives from the following analysis: "The need for manpower is linked at once to job demand and job supply. On the side of supply one foresees that between

2010 and 2020 a decrease in the working population (employed plus unemployed) of 5,5% and 7,9%: from 24 million 970 thousand in 2010 it would fall to a value comprised between about 23 million 593 thousand and 23 million in 2020. On the side of demand the number employed would grow for a decade at a rate between 0,2% and 0.9%, reaching in 2020 23 million 257 thousand in the first case and 24 million 902 thousand in the second" (Polchi 2011).

Where is the error? For a start, one has not at all taken into account that we are not yet out of the crisis and that too many Italian companies, when they have not relocated, are closing down[8]. Among other things, now also 'historic' companies like FIAT threaten to relocate their production abroad. All this while brains are drained. And there is more. If what we have seen about automation is true, the calculation error is macroscopic. One cannot appraise employment on the basis of a presumed increase in production which, among other things, does not include a possible increase in productivity due to automation. Is it too much to ask of the Ministry of Work that they know what artificial intelligence is? If nurses and bricklayers will also be replaced by robots, what will then become of the six million immigrants that no one has really tried to integrate, but that have instead been regarded as stop-gaps to keep pension payments ticking over? What will six million people do – with different languages, religions and customs – when they have no home and no work, and, since they are not even citizens, will have no political rights and not be eligible for many kinds of social benefits? Has anyone ever asked if among these six million there is an even ratio of men and women (the required minimum to favour integration)? Has anyone ever asked what skills they have? If they can be given the jobs of the future? And how they feel about Italians? About Europeans?

Of course, one cannot blame only the centre-right government for this shortsighted policy, given that it is a bipartisan vision, where in fact some left-wingers would turn a blind eye to illegal immigration – and therefore not include them in the census nor ever attempt to plug the leak of the 'Italian system.' Even the Catholics gloat at the government's document. Andrea Olivero, the national president of the ACLI, the Christian Association of Italian Workers, hurried to say that, "these data will expose the demagogy of those who go on about the threat of immigrants. Without them the nation would implode, and to welcome them civilly is not just a humanitarian act but also an intelligent strategy for the future (…). While the last few years have been dominated by an obtuse logic of containment that however has failed, we are happy that the Ministry of Work now looks realistically at the data because only then will it finally be possible to direct the government to the phenomenon of immigration that until now has been unsuccessful" (Polchi 2011).

A wise strategy for the future? Not at all, if the scenario analysis elaborated by futurist Hans Moravec in "The Age of Robots" (1993) is at least partly correct. According to him, in the first half of the 21st century "inexpensive but capable robots will displace human labor so broadly that the average workday would have to plummet to practically zero to keep everyone usefully employed." But since the possibility of reducing working hours is not even discussed, what we can expect is growing unemployment, or the growing precariousness of the labour market, or the creation of pointless jobs. Yet without going too far, it would be enough to familiarise oneself with Moore's Law, the rate of development of artificial intelligence, the prospect of robotics and nanotechnology, in order to understand that not many hands and perhaps even not many brains will be needed to maintain or augment the level of production.

The 'rough guess' planning by the Italian government leaves one therefore somewhat perplexed. If this is the vision of the future of the ruling class, then we should probably expect a gloomy scenario. The possible consequence of an underestimation of the new automation

process could be "widespread immiseration, economic contraction and polarization between the wealthy, the shrinking working class and the structurally redundant" (Hughes 2004).

Actually something even worse may happen. It is unlikely that we will witness the peaceful extinction by starvation of humans replaced by AI in the production process. Before this takes place a revolt will break out. And perhaps this would even come as a surprise to some. Also Gallino (1999) states that we will have to expect social tensions. When asked if he foresees conflicts in the future he replies:

> Yes of course, even if these conflicts will be of various kinds. In the meantime the conflict we have now is due to growing inequalities. In all the industrial nations, including our own (and ours even to a lesser extent that the others) the technological development of the last 20 or 30 years has meant a high increase in inequality between the fifth that earns least and the fifth that earns most from their work. If you then consider the smallest percentages, the differences are even larger, above all in the United States, but also in nations like Great Britain, France, our own, but even in China where inequalities have risen very much. This is a conflict that is as old as the world itself, but which nevertheless the technologies tend to accelerate and embitter. And then there are the conflicts that are, let us say, more intrinsically linked to the technologies. Many technologies meliorate life, allow one to work better, with less difficulty, many technologies entertain, they are intellectually stimulating, can serve as learning tools and so on. And then the difference that is introduced is that between those who can master these technologies, that give them a better life, and those who instead cannot make adequate use of them, either for economic reasons or for cultural reasons, perhaps also for political reasons. Let us not forget that in some states in the world the new technologies are subjected to censorship, limitations, police control and similar. Hence one of the major conflicts of the future will be between those who are full citizens, fully participating in the technological citadel, and those who instead have to camp outside its walls.

The conflict between the owner of the robots (the new means of production) and the unemployed who have been expelled from the processes of production (the new proletariat) is a looming menace on the horizon. Already a rate of unemployment of 10-12% creates social tensions and generates crime. Imagine what could happen if it reached a much higher rate. Obviously, it cannot be excluded that the present technological change is generating only temporary problems, like all the previous technological changes in the last two centuries. All our preoccupations could be dissolved by the birth of new jobs that we cannot even imagine. But we cannot also exclude the possibility that we might have to face a completely novel situation. The machines that will enter our society could be so intelligent that *almost all* human workers may soon become obsolete. We must also be prepared to face this scenario.

If this happens, if this is happening, the best solution is not banning AI, but rather implementing social policies that would permit us to have all the benefits of robotisation and automation without the unwanted collateral effects of unemployment or increasing job precariousness. We must be ready to reactivate the policy of the gradual reduction of working hours and to introduce a citizen's income. We must be psychologically prepared to reverse the dominant economic paradigm. To revitalise the economy, we might not need people working harder. We might need people working less. "Working less means work for all" – as a notorious slogan states. We might need more holidays, more free time, more welfare state,

more money to spend. These policies would certainly make human labour more expensive, but – contrary to what most economists think – this could be exactly what we need. The increase of the cost of labour makes "investments in automation increasingly attractive" (Hughes 2004), high-tech economies are more competitive than low-tech ones, more competitive economies can distribute better 'social dividends' to their citizens.

This is hard to see, if we divide the world into Luddites (those that want to ban the machines) and anti-Luddites (those that label a Luddite whoever dares to relate technology to unemployment), tertium non datur. A third way actually exists: one may want more robots, more computers, more intelligent machines, more technologies, *together* with a consistent change in the system apt to guarantee a rational and fair redistribution of wealth. As sociologist James Hughes (2004) put it: "It's time to make a choice: Luddism, barbarism or a universal basic income guarantee."

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UNECE. 2005. Worldwide investment in industrial robots up 17% in 2004. In first half of 2005, orders for robots were up another 13%. http://www.unece.org/fileadmin/DAM/press/pr2005/05stat_p03e.pdf

[1] By "degree of freedom" of an industrial robot, one means the number of axes of movement (in other words, the quantity of particular movements) that the machine is able to perform. The degree of freedom goes from 3-4 for the simplest robots to 9-10 degrees in the case of more complex ones. For comparison it is considered that the human hand has 23 degrees of freedom.

[2] Fiat has installed its Robogate equipment in 1978. As *New Scientist* (12 June 1980, Vol. 86, No. 1205, p. 247) reported, "each system comprises a series of robot 'cells', each of these containing two to four robots, which are arranged at intervals several metres along the line. The four basic parts to be welded are loaded onto a transporter, a low platform the size of a large tabletop. The transporter glides between the robot cells. Its motor is activated by signals passed along wires underneath the floor and detected by electromagnetic induction sensors. Movement of the transporter is controlled by a central computer." Flexibility is the main feature of the system: "engineers can change the system's parameters, while it is working on one model, to make a new design of car. To do this, engineers alter the software in both the robots and the central computer that controls the whole system; and make some changes to hardware, such as installing new gates for different car bodies. In less advanced robot installations, like those at Longbridge and and in many car factories in the US, operators do not have the benefit of this flexibility." As a consequence, the Fiat "plant requires only two men to run it, compared with 100 in a plant in which the welding is done by hand." *New Scientist* also reported that "Fiat has already sold one Robogate system to Chrysler in the US… General Motors is also interested in buying the system."

[3] Gallino makes the same observation: "In order to avoid reducing the working force and so to take too fast to the road of technological unemployment, one invented over a century ago the tools to reduce working hours. At one time, at the beginning of the [20th] century, one worked 3000 hours per year, in the middle of the century about 2500, and today most workers have a mean annual schedule of around 1600-1700 hours of work. This is one of the advantages of technology, that of being able to keep people employed while decreasing their performance."

[4] This book has not been translated into English. The title means: *If three million seems not much. On the ways to fight unemployment* TN].

[5] "A country that mostly buys a technology researched and developed by other, increases its productivity, and therefore sees the number of jobs decrease but it does not see them recreated by this technology" (Gallino 2008, 17).

[6] The Eurostat 2009 report on science, technology and innovation in Europe is unforgiving and positions Italy among the last. In 2007, the 27 member states invested in a total of less than 229 billion euros, or 1,85% of the European GNP. At the same time, the USA reached 2,67% of GNP, and Japan (in 2006) 3,40% of GNP. In Europe, only Sweden and Finland spent more than 3% (3,60% and 3,47% respectively), then there are 4 countries (Denmark, Germany, France and Austria) that spent over 2%. Italy invests little: 1,09% in 2001 and 1,13% in 2006. But it is data relative to employment that interests us most and these data are very discouraging. According to this report researchers in the EU represent 0,9% of employment, while in Italy they reach 0,6%. See http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/9-08092009-AP/EN/9-08092009-AP-EN.PDF

[7] "Foreign residents in Italy on January 1st 2010 are 4.235.059, representing 7,0% of the total number of residents. On January 1st 2009 they represented 6,5%. During the year 2009 the number of foreigners grew by 343,764 units (+8,8%), a very high increase, but lower to that of the two preceding years (494,000 in 2007 and 459,000 in 2008, +16,8% and +13,4% respectively), chiefly as an effect of fewer arrivals from Romania." (ISTAT 2010).

[8] In 2010 in Italy there were over eleven thousand applications for bankruptcy – about thirty a day – representing an increase of 20% with respect to 2009 (Geroni 2011).