Robot in Agriculture an ethical imperative to explore

Nicola Petkovic

Febraury 2023

1 Abstract

The term imperative in the title has just the role of provoking, indeed in literature there is a common behaviour of stressing that the decision is not so easy to take and often there is no conclusion. Given that, this section has the aim of clarifying that there is no presumption to establish that robot must be adopted. I adopted this title because ,as a computer engineer, is more challenging to defend this type of technology against strong counter arguments and understand if it is really a viable option from an ethical perspective. Moreover I tried to develop a my own argumentation , that's why in the last part there are no citations. In this paper I will defend the following thesis: "The adoption of robot in the agriculture industry can bring wealth and make the agriculture system reach a better level of sustainability". Wealth has to be intended from yield and productivity point of view, while sustainability has a wide interpretation, i.e. that the system will change in better, by tackling the actual environmental challenges without making imbalances in the society. How will I do? By discussing the implications of adopting such technology. The term implications here denotes the following six aspects: environmental, economic, political, social, cultural and ethic. [7] There are then multiple ways of approaching the tangle of ethical issues environmental robotics may pose. In the tradition of applied ethics, one might use a particular ethical theory to evaluate any kind of robot's impact in different scenarios (e.g. consequentialism, deontology, virtue ethics, and so on). Evaluating their impact could also be done in a variety of ways, for example looking at the ways in which robots could offset environmental problems or one could address the impact that robots have on the environment. [6] In the following I will start from an analysis of the impacts and then exploiting the ethical frameworks to validate the adoption of robots.

2 Context

Since there is a little bit of confusion in literature about the meaning of the word "robot", it is required to assume a definition. I assume those mechanical system, empowered by Artificial Intelligence technologies that can end autonomously a task. In particular must be underlined that, the robot I consider to develop the reasoning are of small size, as will play a key role. In order to get some insights one can think about a little rover that is capable of going around in the field and collecting measurement about soil moisture in specific area. [6, 3] Other example are the following: GPS-enabled, teleoperated, and autonomous tractors and harvesters, the use of automation in food handling, processing, and packaging, the use of automation in slaughterhouses, automatic and robotic feeding stations for livestock, robots for meatpacking, robotics and automation in textile production, drones for remote inspection of agricultural infrastructure, especially fences and irrigation systems, the use of automation in intensive livestock production, drones for rounding up livestock and crop-dusting, driverless trains, robots for weeding, robotic shearing, robotic fruit and vegetable pickers, autonomous trucks for haulage.

I won't take into account the environmental impact of the type of materials used to make the robots; the environmental impact of the degradation process when the robot is no longer in use; the process for testing the robot; and the amount and kind of evidence to show the robot meets its goal.

3 Thesis and Antithesis

Nowadays is a fact that agriculture is facing challenges like food security, water scarsity, soil consumption, loss of biodiversity, climate change and growing number of people. [1] Hence several authorities have argued that robots may help farmers confront these challenges by improving yield and productivity [3].

This is easy to imagine by looking at the change provided by the robotic arms in the production factories. [2] It is argued that the introduction of robots can minimize the use of pesticides as well as water wastage, moreover replacing heavy machinery with lighter teleoperated or autonomous machines may reduce problems associated with compaction of topsoil in agriculture. [3] That from both an ethical and an environmental perspective is the main point supporting the thesis, because the actual generation has the duty, by assuming it have environmental values, to delivery a better world to the future one. The active responsibility, behind the previous statement, according to the assumption stated in the context, where a tiny rover is more suitable to preserve biodiversity and avoid damage related to the soil, make the introduction of robots a more valuable task, in the sense that people chose to automatize the agricultural sector for worthy cause.

At this point the main issue underlined by most of the papers is that, whether or not this potential is realised will depend upon economic and political choices.

For example pesticides might be used even if human beings were no longer directly involved in their application, moreover if are exploited heavy robot instead of little rover, the phenomena of soil compaction might arise. By following this kind of reasoning, the criticism stress the fact that that economy of scale becomes more crucial when it comes to robot. An additional economic risk has to be considered here, since can make the previous statement even stronger. Given the typical pursuit of benefits, such as the massive increasing of yields and productivity, while reducing the wastage will make explode other issue, an example is the possible barrier to entry into farming, which arise from the higher capital costs associated with the need to employ robots to compete with other producers. Thus means that only big corporation can handle these expenses, hence the scenario in which little companies exploiting little rovers with different type of crops in order to tackle the challenges related to the biodiversity, seems to be unrealistic. According to that the environmental argument, which is the one that can give strong reasoning to the adoption of robots, seems to fails.

However in this big counterargument is not considered the role of the technician or of the engineer in a company, because it is implicitly accepted as true that someone will design, for example, heavy machines that will deteriorate soil consumption or that the agricultural system will be made of only huge standardized crops, where the nature is forced to assume a certain structure, because from a technical point of view is more easy and cheaper.

Indeed there is the possibility that an engineer may opposes the business decision by providing the effective impacts, this behaviour, if extended among the majority of the employees, can avoid the economy of scale by redirecting the direction of the company. However this statement in turn may be contested because taking choice, as the one discussed above, it is not easy, since issue like fear of lose the job can arise. However without going into a recursive reasoning into a subtopic here (i.e. the ethics and the responsibility of the single person), the fact that technicians can participate to the decisions make the economy of scale less a risk, since it opens the possibility of the dispute. With this mind a recent approach stress that by mean of the expression "ethics in robotics" must be underlined: the ethical system built into robots, the ethics of people who design and use robots and the ethics of how people treat robots (i.e. a socio-technical system). [6] By reasoning on the possible negative impacts of the economy of scale, it's unavoidable to face an upper bound, i.e. a limit on what can be done that let delineate a direction for the research and developing of robots. At this point are known technical and economic boundaries to take into account, and by assuming to have found all the boundaries which allow robots to help solve environmental challenges it's possible to take a step further. This assumption it is allowed, since the impacts discussed above are enough to let know the tangle of aspects. It has got to be said that one of the questions that arise most frequently is if in the longer term robots will displace many jobs and put significant number of people out of work in rural areas. [7] Because as consequences of the displacement of jobs there will be the loss of income for many workers. To denote the nature of the future debate, must be underlined that here as a solution of the loss of income is often proposed an universal basic income (UBI). However it is not clear that a UBI would address the social and political impacts of inequality provided by the technologies related to artificial intelligence. [4] From the previous reasoning arise that the pursuit of the efficiency and the effectiveness without any form of responsibility from the political stakeholders to the other human kind can bring to an undesirable scenario. However here a common mistake is to not consider that behind the large scale production of robots and the software maintenance are required a lot of people to work and design. Although the huge differences of the daily task required to perform the new jobs, at least for sure is clear that the request for job will not disappear from one day to another. [2] [5] Here from the criticism is pointed out that the intrinsic meaning of the manual labour must be taken into account, in particular many societies enhance the idea of a "connection to the land. Indeed it's reported that people that have a manual labour tell that take care of a plant and see it grows bring a sense of realization and others seem to draw comfort in hard times from a self-image that emphasises the value of their struggle to draw a living from the soil. If farming overcomes to be mostly a matter of deploying and supervising robots these cultural reasoning may be impossible to hold, which in turn can impact negatively on the social and psychological well-being of rural communities as well as on their relations with the larger society. On the other hand, Some of the jobs related to agriculture are characterized by repetitive tasks, otherwise an high level of automation wouldn't had been possible, that can bring a sense of alienation, specially if the specific tasks are not strictly related to the land.

By recalling the assumption of the type of robots analyzed, a possible counter arguments can be on the fact that the task of designing them is of the same importance, since the main aim is the one of taking control of the environmental parameter in order to act accordingly to the environmental value, in addition these are job full of creativity, in the sense of coming up with a new unseen solution since these are problem not yet tackled. Here even if the moving of people , from one type of job to one another, is not totally matched in term of number , maybe a large chunk of people can be moved from a manual labour to a designing one. Obviously this may can arise the problem of the specific knowledge required and again policies and choice must be taken into account to cope with this transient in which people must be re-educated. It is evident that the skills required to work in the robotic field are different from the ones own from the people living in the

rural areas, this may force them to go looking for a new place to find a job. An example of a possible implications is that people will be concentrated in the city and rural area might be empty with all the task controlled in remote.

That in particular is difficult to asses as a good or negative aspect but what is well known it's the fact the huge migration of people can generate new equilibrium, which must requires new political choice. Hence what arise is the fact the adoption of such technology is changing the way the labour is thought, and with the right strategies the negative aspects can be avoided. This require an active responsibility approach, since the aim is the design the future of the labour and of the society.By recalling a previous notation, it can be concluded that from a cultural point of view is more difficult to find those boundaries, which can be used to delineate the field of existence of ethical robot.

The idea of active responsibility must be adopted also on more technical aspects, for example the risk of cyber attacks assume a more relevant importance, since object of discussion are technologies that sense and act on the world. Here is important to underline that is very different from a cyber attack to the databases, which contains airplanes invoices for example, because in this way the food production can be blocked for a while. Moreover the data about the production of certain food drive the markets and steeling such data can bring advantages in term of choices and strategies. The strategic meaning of data let arise consequently the data ownership question, indeed here the fear here is that the privatization of the status and of the diagnosis related to the environment might go in the hands of the companies which own the robots. This may let arise a scenario in which a sort of obscurantism about what is happening is created. This underline the possibility of a discrepancy between the values that allow the adoption of robots and what will happen, because if there is no possibility from the single person to have a metric to asses the improvements, from a quantitative perspective, the possibility from a company to act according their benefits may be a problem.

By retracing the argument I used and the attempt to provide as much counterargument is evident that as the last step to establish if the robots will have a positive impact in a wide sense, must be considered the fact that treating that as a socio technical system it's necessary. To move a step forward it's right to ask what is in particular robot ethics, can really exist in practice such a system and how to obtain it. Firstly robot ethics is both prospective and retrospective; it deals with the various life phases of the robot, i.e. the design phase, production phase, use phase, and removal phase. Thus, a full ethical analysis of environmental robotics must address the various life phases of the robot in question; the multiple actors who bear responsibility for the robot's impact; the various environmental and stakeholder values that may come into play at each step; and considerations of trade-offs between anthropocentric and eco-centric goods. [6] Then another key point here is to choice what ethical aspects are essential, for example is more valuable that people will not lose their job in the immediate, avoiding the implications of creating a poor class, or to reach the environmental standard prefixed such that the specific amount of water usage the protection of the biodiversity etc. Here arise a trade-off and obviously the final choice at least must take into account the ethical framework. The most common used in the tradition of applied ethics are for example the utilitarian, deontology and virtue ethics. The validation strategies that can be exploited could be the one of applying all the framework on the same claim, in this way at least for sure that the specific claim has much more relevance. As an example can be considered the environmental point of view, is it clear from the above discussion, that robot by sensing the necessity of the plants and providing the right amount of nutrients are helping to reach the desired standard. From an utilitarian perspective seems easy to conclude that is an efficient way to reach the goal so is validated, further from a deontological perspective taking care of the environment is taking care of the other human kind since a cleaner world means a better life style and lastly taking care of the world that will be delivered to the next generation is a form of justice and so virtue ethics. More difficult is to evaluate in the same way the possible implications, since as established above the possibility of negative impacts are related to the policy adopted, hence every single policy must be evaluated from all the frameworks. However to have at least an insight on how the future will be some possible policies must be taken into account. By considering the fact that rapidly a lot of people will lose their jobs, a scenario to take into account is the migration of people from rural areas, this example is of relevance since the transient, after the robots introduction, is one of the most difficult phase, after that of course there will be a new equilibrium that can either desirable or undesirable. However here there is a contradiction based on the same ethical framework, if it is assumed for sure that such transient there will be, because the robot are adopted since are helpful for other human kind(i.e new generation) but the(i.e. human-kind) people that will lose their jobs aren't helped. Thus the raised contradiction highlight both the fact that the ethical frameworks are not a proof (in the mathematical sense) and that this tricky challenge, and others like that, must be tackled to asses as valid, the reasoning provided in which robots are validated. Let's suppose collateral effects like the previous one doesn't occur, the reasoning to validate robots from an environmental perspective, under the assumption of the context, holds true. Hence from the analysis that lead to a contradiction, the real question is not if the adoption of robots will bring wealth, but if people are able to create the suitable configuration to let such technology really help to cope with environmental challenges, while avoiding collateral effects. Configuration, here stands for the adopted policies, the change in the economic market and the transformation of the social and cultural attributes, that must be taken into account.

4 synthesis

Synthesis denote the behaviour in which a new claim is proposed according the previous claim modified by a counter argument. The structure of this paper is the same, I started by the strongest reason for validating the adoption of robot, but evaluating the possible implications under different aspects according to the ethical frameworks has lead to a less stronger claim in general but still true under specific assumption. Hence, although the clear difficulties on deriving suitable policies, the environmental benefit still holds and under specific assumptions there are no negative impacts so an attempt can be taken into account as viable option if the environmental challenges still not addressed.

References

[1] Michael Jahi Chappell and Liliana A LaValle. Food security and biodiversity: can we have both? an agroecological analysis. *Agriculture and human values*, 28:3–26, 2011.

[2] Wolfgang Dauth, Sebastian Findeisen, Jens Suedekum, and Nicole Woessner. The Adjustment of Labor Markets to Robots. *Journal of the European Economic Association*, 19(6):3104–3153, 05 2021.

[3] Tom Duckett, Simon Pearson, Simon Blackmore, Bruce Grieve, Wen-Hua Chen, Grzegorz Cielniak, Jason Cleaversmith, Jian Dai, Steve Davis, Charles Fox, et al. Agricultural robotics: the future of robotic agriculture. *arXiv preprint arXiv:1806.06762*, 2018.

[4] Thomas Gries and Wim Naudé. Artificial intelligence, jobs, inequality and productivity: Does aggregate demand matter? 2018.

[5] Vasso Marinoudi, Claus G. Sørensen, Simon Pearson, and Dionysis Bochtis. Robotics and labour in agriculture. a context consideration. *Biosystems Engineering*, 184:111–121, 2019.

[6] Marsela Polic, Marko Car, Jelena Tabak, and Matko Orsag. Robotic irrigation water management: Estimating soil moisture content by feel and appearance. In *2022 19th International Conference on Ubiquitous Robots (UR)*, pages 16–22, 2022.

[7] Robert Sparrow and Mark Howard. Robots in agriculture: prospects, impacts, ethics, and policy. *precision agriculture*, 22(3):818–833, 2021.