

Summary

Robotics and the quality of work

A knowledge synthesis

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Summary

S.1 Purpose and scope of the study

Further technological development affects the quality of our work, both now and in the future. Further mechanisation and automation in the form of increasing robotisation can lead to shifts in the amount of work, in the nature of that work, and in the skills that people need in order to perform their work. In the following knowledge synthesis, we offer an overview of the effects of robotisation on the quality of work, and of the developments that are expected in this area. The research question at the heart of this is as follows: *What opportunities and threats does robotisation entail for the quality of work, and to what extent do these opportunities and threats differ by social group?*

To answer this key question, we have formulated the following subquestions:

1. To what extent is work being robotised in the Netherlands?
2. What are the consequences of robotisation for the quality of work, and to what extent and how will the consequences of robotisation differ for various groups of workers?
3. What are the expectations regarding future developments in robotisation, and what will this mean for the quality of work in 2030?

Robotisation refers to the process by which work is increasingly being done by robots. In this knowledge synthesis, we have looked at both industrial and professional service robots. An industrial robot is a machine that can be programmed to perform a variety of tasks independently. It is distinct from other machines because it can be used for different tasks, and can be reprogrammed for each of these tasks. Service robots support tasks that are done by humans, or perform a more service-oriented role. In this knowledge synthesis, we have focused specifically on professional service robots, which are designed to perform tasks in the workplace. These include automatically guided vehicle systems (AGVs), which are used for logistics tasks, agricultural robots such as milking robots, and inspection robots.

Where the quality of work is concerned, in this knowledge synthesis we have looked at what robotisation means for workers' job security, their income, the work pressure they experience, and the extent to which their work is meaningful to them. We have also looked in some detail at the extent to which workers can combine work, care for their families, and learning.

For the first subquestion, we examined the extent to which robots are currently used in Dutch business and how the robotisation of work has developed over the past ten years. Developments in the Netherlands are also placed in an international context. For the second subquestion, we analysed what empirical research can tell us about the effects of robotisation on the quality of work and about what mechanisms play a role here. The sec-

ond subquestion looks specifically at possible differences between groups of workers, to see whether mechanisms work differently for certain social groups than for others. These include level of education attained, age, and gender. In order to reveal what underlying mechanisms are at work, we carried out a systematic review of the literature, looked at additional literature, and conducted interviews with experts in the field. For the third subquestion, we looked at the extent to which the scholarly literature and the interviews we held with experts revealed expectations regarding the consequences of robotisation for the quality of work.

5.2 The extent to which work is being robotised

Robotisation has so far found only limited acceptance in the Netherlands. Only a relatively small proportion of workers have to deal with robots in their jobs. These are mainly employees of medium and large industrial companies – specifically companies in the automotive, electronics, and e-commerce sectors. In other sectors, such as financial and business services, construction, transport, healthcare, and education, robots are being put to work either not at all or only to a small degree. Although the current use of robots in the workforce is limited, it is on the rise. Whereas robotisation increased sharply in several other European countries from 2000 on, it remained relatively limited in the Netherlands. In the past five to ten years, however, the Netherlands has been catching up. Between 2013 and 2018, the growth in the number of robots was significantly higher than the average for Europe. This relatively strong growth has made the Netherlands one of the more robotised countries in the world. Recently, the growth of robotisation in the Netherlands seems to be levelling off, and fewer new robots are being adopted each year than was the case a few years back. The corona crisis is expected to further slow this growth.

5.3 Consequences of robotisation for the quality of work

Consequences of robotisation on employment

No studies have yet been done in the Netherlands on the effects of robotisation on employment. Over the past few years, however, a number of international studies have addressed the effects on employment, including some that cover the Netherlands. These mainly concern macroeconomic research that looks at the effects of robotisation in an industrial setting. While some of the studies find that robotisation has small positive effects or no effects on employment, a larger number of empirical studies indicate that robotisation leads to a decrease in job security for workers. Thus, when it comes to individual workers' job security, further robotisation in their industries will lead to a higher chance of dismissal or, for young people, will make it more likely that they will have less of a chance of finding work in the sector in question. If they do not have enough skills to switch to another industry, their job security will be under threat.

Consequences of robotisation for workers' income

Macroeconomic studies on the effects of robotisation employment often focus, too, on its effects on workers' income.

Robotisation seems to have positive effects on the hourly wages of workers. On the other hand, the effects on income seem to be rather negative. One possible explanation is that the productivity gains from the introduction of robotisation allow firms to increase workers' hourly wages. At the same time, however, the average number of hours worked drops, thus cutting total labour costs. That being said, the lack of data at the individual level means we can only speculate about what the exact effects on individual workers are. For example, it is possible that employees, or some of them, will work fewer hours but will be paid more for each hour they work. It is also possible, however, that the effects that are found will have been caused by staff changes. This may happen if, for example, a large number of low-paid workers who previously performed operational tasks are made redundant and some better-paid workers are hired for new tasks that have been created by robotisation.

Consequences of robotisation for the work pressure on workers

Only a small number of studies focus on differences in work pressure between tasks that are carried out with or without a robot. Besides a few qualitative studies within the agricultural sector, they have mainly involved qualitative research within healthcare. The research that is available shows that the degree to which workers experience physical or mental work pressure depends to a large extent on the way in which the robot is used in one or another work process. In this respect, both the actual work pressure, in terms of the amount of work to be done and the time pressure associated with this, and opportunities the worker has to control how they carry out their work, seem to determine the work pressure they experience. Robotisation can relieve this pressure, for example by carrying out tasks that reduce the actual workload, but it can also limit the worker's autonomy.

Consequences of robotisation for meaningful work

With the content of work and tasks changing as a result of robotisation, the meaning of work also seems to be changing for groups of workers. However, little empirical research has been done on this – particularly case studies on how workers perceive the introduction of robots into their workplaces. The expectation that work will become more – or less – meaningful for workers is mainly derived from what kind of work is taken over by robots and thus no longer needs to be done by employees. The studies that have been carried out on the extent to which workers feel their work has become more challenging, more monotonous, or more interesting show that this differs greatly depending on the work situation involved or the position a worker has. The interviews with experts revealed similar assessments and observations. Robotisation can make work more meaningful – that is, more interesting, less boring, or less demanding. But it can also make the work more tedious, and thus less meaningful.

Consequences of robotisation for the possibilities of combining work with care for family members and with education

Empirical research on the consequences of robotisation for the combination pressure that workers may or may not experience is still lacking. A few case studies suggest that, through the deployment of professional service robots, robotisation can lead to greater flexibility, given that time-dependent tasks are carried out by a robot. In addition, the number of tasks may decrease as they are taken over by a robot. When there is greater flexibility in terms of the work to be done, it is relatively easier to combine work with tasks involving care for family members, and with learning activities. The lack of research analysing in more detail the extent to which workers actually have the scope to fulfil other tasks in addition to their work, and the very specific context to which the available case studies relate, mean that no clear conclusions can be drawn here for the time being.

Consequences of robotisation for different groups of workers

The consequences of robotisation may differ for specific groups of workers. As far as differences by level of education are concerned, previous research on the consequences of automation shows that those with a senior vocational education experience particular disadvantages. It is especially jobs in the middle segment of the labour market that involve a relatively large amount of administrative work and that are thus more sensitive than average to automation. The research into the effects of robotisation on the quality of work also indicates that some of the jobs done by those with a senior vocational education are under pressure. At the same time, the negative effects of robotisation on low-skilled work seem to be farther-reaching. One possible explanation for this is that automation relates primarily to cognitive tasks that can be taken over by a computer, whereas robotisation often involves a combination of physical and cognitive tasks. Due to the combination of automation and mechanisation, robotisation has a relatively stronger impact on production at the operational level, especially where industrial robots are involved. This affects the job security of, but also how much income is earned by, lower educated workers and – to some degree – those with a senior vocational education. The effects on income are more pronounced for lower educated than for better-educated workers.

From the interviews with experts, and partly from the case studies in literature, it turns out, too, that robotisation often eliminates mind-numbing, dangerous, or physically demanding work, and replaces it with more-challenging, technically more-advanced work, which is of particular benefit to those with a higher education.

Studies on the effects of robotisation rarely distinguish between specific age groups. Where this is done, it does not reveal any clear effects for different age groups in terms of job security or earnings. One study from Germany has concluded that robotisation has an effect on the creation of new job openings in companies where it is taking place. It seems likely that this will primarily affect those who are starting out on the labour market – mostly young people who have just completed their education. However, it is unclear to what extent these findings also apply to the Dutch context.

Research on robotisation does not explicitly address differences in effect by gender. At the moment, robotisation mainly takes place in production companies, and less so in service professions such as healthcare and education. Since it is precisely in the service sector that relatively more women work, it is likely that, in the current situation, they will be less heavily affected by the consequences of robotisation than men will.

S.4 Future developments related to robotisation and potential consequences for the quality of work in 2030

It is generally anticipated that the impact of robots will grow over the next decade. This goes for both industrial and professional service robots. Professional service robots in particular are expected to see the greatest growth. The corona crisis will reduce growth rates this year, and possibly next, and sales may dip, but based on experience with previous crises, it is expected that this will be an anomaly. At the same time, growth is expected to be gradually up until 2030. A reason for this is that many expectations and forecasts are based on the potential of technology and therefore tend to paint too rosy a picture, at least in the short to medium term. According to some experts, this does not alter the fact that in the next ten years there may be technological breakthroughs that accelerate robotisation.

Consequences of increasing robotisation on employment

If robotisation continues at a pace similar to what we have seen in recent years, the number of industrial robots in our country will continue to grow by between 800 and 1,400 annually. Existing studies estimate that the purchase of each industrial robot eliminates anywhere from two to three jobs. This would mean that between 1,600 and 4,200 jobs would disappear each year as a result of robotisation. Estimates are beset with considerable uncertainties. They are, moreover, based on a net change in the number of jobs, which also includes newly created – and often different – jobs. This means that the number of workers who will see their work taken over by a robot will actually be higher. It is anticipated that this will primarily affect the lower educated, and possibly some of those with a senior vocational education.

If future growth is seen mainly in the number of cobots in the workplace, significantly fewer jobs are likely to disappear. There are still no studies available on which to base estimates on these figures. And this is true, too, of professional service robots. Some of these will have an impact on the number of jobs, for example in AGV systems, but others will have no impact or will even lead to an increase in new jobs – particularly where workers use robots to be better able to perform their job.

Consequences of increasing robotisation for workers' income

It is anticipated that further robotisation in the industrial sector will lead to a relative drop in workers' income. Studies differ on the magnitude of the effects on income: those done in the United States and China are finding larger effects than those based entirely or largely on European data. If we go by data from Germany, it would seem that the effects will be

relatively minor. Although these are rough estimates, and though this data cannot be directly extrapolated from Germany to the Netherlands, partly because of the relatively high density of robots there, they nevertheless indicate that the differences in income for a large group of workers in industrial companies may remain limited. The negative effects of robotisation on workers' income primarily affect the lower educated and those with a senior vocational education degree. Those with a higher education, and especially those with a technical background, seem more likely to see their income go up as a result of increasing robotisation.

Consequences of robotisation for work pressure and the value of work

Studies on the effects of robotisation on work pressure, and on the extent to which employees regard their work as meaningful, make it clear that these effects seem to depend to a large extent on the way in which the work is organised at the practical level. If robots are introduced to support workers in their tasks, the work pressure is likely to drop. As robots take over tasks, workers have more time for their other duties. In situations where robots are used to relieve staff of their workload by taking over tasks that are felt to be burdensome, or where they are used to free up time for new, interesting tasks, then robotisation, and automation in general, leads to a reduction in work pressure. However, the workload can also increase when all mundane or straightforward tasks are automated. That can make work more stressful and less varied. The lack of a healthy mix of challenging and routine work can lead to work pressure and stress. In addition, in situations where workers feel they are no longer in control because the machine is setting the pace of work, or if they feel that the machine is being used to control their output, they may experience an increase in work pressure. Robots can also be configured so that people can barely keep up with them – this for the sake of productivity gains. That can in turn undermine workers' autonomy and thus increase the work pressure they perceive. The degree to which workers experience their work as meaningful also depends to a large degree on the choices that organisations make. It would seem to be important to get a clear picture of the system of interdependent activities. Studies show that work practices in an organisation can be changed by robotisation. Some employees experience this as an enrichment of their role or of the work they do, while others within the same organisation see it as detracting from their role and their work.

5.5 Implications for policy and practice

Limited knowledge about the consequences of robotisation

In this study we describe the knowledge we have gathered through a literature review and interviews with experts about the consequences of robotisation for the quality of work. The overview reveals that for some aspects we gained insight in what the effects are, but that our understanding of other consequences is still lacking. In addition, there is still only a limited understanding of the mechanisms that play a role here. Because specific empirical research on the consequences of robotisation for the quality of work in the Dutch context

is still lacking, we rely heavily on insights that have been gained in other countries. For the sake of an empirically based labour-market policy, it would therefore seem to be advisable to carry out more focused studies in the coming years on the effects of robotisation in the Netherlands too.

Robotisation is not an exogenous force. Rather, it calls for choices to be made at the level of both policy and practice

Robotisation is often erroneously seen as an autonomous phenomenon that is difficult to influence. This study indicates that technological development has its own dynamics, and that these cannot always be managed or predicted. At the same time, the results also show that it is possible to influence how technology is introduced and used. The actual outcomes depend on the choices made by companies and countries alike. Using robots in order to reduce dependency on the labour factor has a consequence that is completely different from that which results from using them to support employees. These choices are made primarily by companies and other organisations, but the government has a role to play in providing the frameworks within which companies and employees must make their choices. In order to exploit the potential that robotisation offers, not only from the particular perspective of business but also from the social perspective, a robotisation agenda that is broadly shared by all stakeholders should be showing the way forward. It would be a good idea, it seems, for the government to get such an agenda up and running.

Retraining low-educated workers

If robotisation continues, as it is generally expected to, it will have a particularly negative impact on low-educated workers. They are more likely to lose their jobs, and the low level of employment that robotisation will bring about for the lower educated will make it harder for them to find another job when they are laid off. Because of the falling number of employment opportunities for the lower educated, their income will also come under pressure, especially as investments in robotics become cheaper. In addition, a number of case studies show that the lower educated are more likely to perform work that is less meaningful to them. Companies that integrate robots into their work processes can be encouraged to create opportunities to keep low-educated workers in their jobs, for example by providing further training aimed at managing or checking the work done by robots. In Germany, there have been positive experiences with this, as a result of which employees have been able to hold on to their jobs. This responsibility for encouraging businesses could be assigned to the social partners.

Retraining and upgrading to other roles

Particularly if robotisation takes place faster than is currently anticipated, and if companies decide to let robots do the work, it is likely that not all workers will be able to keep their jobs. As they move from one job to another, these workers could be supported by training that would help them make the transition. The action agenda for lifelong development, which has been drawn up by the Social and Economic Council (SER), offers a number of

useful starting points on this score. The SER has identified a large number of promising projects based on initiatives to which various local or regional stakeholders have committed themselves. These projects could be scaled up, even as they retain their local character, in order to compensate for the loss of work that robotisation causes.

Need for technically trained staff

If robotisation continues, there will be a need for technically trained staff. Key among these will be technical staff with a higher education who can programme robots and develop them further. This will also involve staff with a senior vocational education, who can maintain the robots, for instance, and who, next to lower educated workers, can work with robots on the shop floor. This means that employees should be encouraged to retrain for technical jobs, but also that young people should be encouraged to take up technical training. Senior and higher-vocational-education courses should anticipate the need for future technical staff. The government can set up an information campaign to encourage young people to opt for a technical education.

Taking the consequences of robotisation into account in any revision of the labour-market

The Borstlap Commission has made recommendations for revisions to the labour market. The robotisation of work leads to a different division between capital and labour. When robotisation takes off, a smaller share of productivity gains will be provided by labour, and a larger share by capital goods. The revenues from productivity gains will therefore also increasingly go to those who own these capital goods, and less will go to income from work. This will put pressure on workers' income, but it will also widen the income gap between those who own the capital assets and those who do not. A revision of the labour market should include measures to ensure that all workers continue to receive an adequate income.