Compressed growth – the transforming power of the round bale technology

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- *The hand mill gives you society with the feudal lord, the steam mill, society with the industrial capitalist* - Karl Marx, the poverty of philosophy (1847)

Abstract

Silage bailer technology preserving harvested grass and turning it into silage by a baling machine attached to a tractor is common in most rural regions in Norway. In this paper, we argue that not only have silage bales become a common sight in rural areas, in certain cases, silage bales have also had profound significance for agricultural development without much attention paid to their profound role and implications. Norway represents such a case, and a deeper understanding of how such a now common agriculture technology became established could shed light on how the introduction of new technologies affects agricultural change on societal and structural levels. This includes how technologies interact with societal and organizational aspects of agriculture – the co-production of technology and societal practices on different levels. How does new technologies connect – influence and become influenced by – socio-cultural farm practices and societal, organizational and structural features of Norwegian agriculture? We use the introduction of the hay round bale press in Norway as a case study to shed light on this implementation process and its significance for the Norwegian agricultural sector.

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Introduction

Modernization of agriculture is often seen as a result of the introduction of new, disruptive technologies like the milking robot (Vik et al 2019), the tractor (Olmstead & Rhode, 2001), the plough, that “arrived in human history without fanfare” (Pryor, 1985). Currently, automation, robotization, digitalization and various forms of precision agriculture are at the front of agricultural technological change. These technological innovations are unquestionable important. Yet, in this paper we argue that technologies that do “arrive without fanfare”, the more modest and unnoticed technological innovations may be just as important, because they lay the groundworks for other technological and, not the least, structural and organizational changes. The silage bale technology can provide an example of such an innovation, and its introduction in Norway provide key insights on how the introduction of new technologies affect agriculture on a structural level.

Everybody that has ventured into rural areas during the last decades have probably seen big white round balls spread across the agricultural landscapes. These strange, white, egg-like objects (popularly called ‘tractor eggs’ in Norway) contain harvested grass for feeding of cattle, sheep and other domestic animals. The grass is harvested and turned into silage by a baling machine attached to a tractor. While silage production as such has happened in Norway since the 1960s (Almås, 2004), the baler is a more recent innovation dating back to the late 1970s, and did not become common until the early 2000s. The introduction of this technology in Norway has received little attention in analysis of agricultural and rural development. In this paper, we argue that not only have the round bales become a common sight in rural areas, silage bales have also had profound significance for current agricultural development in Norway without much attention paid to their role and implications.

In our study of the silage bale we ask how it was implemented and what it could teach us about the implementation of new agricultural technologies? In order to do this, we first describe the development and implementation of the use of round balers in Norwegian agriculture, we analyze how and why this technology became so omnipresent in the sector. Thereafter we discuss the role of the new technology in the subsequent developments of the agricultural sector. The analysis is based on six semi-structured interviews with farmers/ silage bale entrepreneurs and agricultural advisors, as well as on written, historical sources, primarily agricultural magazines, public research reports and sales material for the silage baler.

Transitions and their consequences

Technology implementation tend to be very context dependent (Sørensen, 2006, 40-57). Even though a new technology potentially has global reach, the actual introduction, its actual use and consequences are likely to vary strongly according to a wide and unknown number of variables (Van der Vleuten 2008). The implementation of technology as well as its use and various adaptations influence policy, social organization, cultural practices, economic results and distribution (Knickel et al., 2009; Lapple at al., 2015). At the same time societal matters influence technological choices, developments and implementation (e.g. Bijker, Pinch, and Hughes 2012; Jasanoff et al. 1995): Therefore, we may say that society and technology are being co-produced (Jasanoff 2004). The profound impact of technology on societal development in general has been pointed to at least since the time of Karl Marx. Many interpreters of Marx's work has been mainly interested in labor, and has been criticized for technological determinism because of a lack of interest in the construction of technology and a less than satisfying empirical grounding of claims about the consequences of new technology (MacKenzie and Wajcman 2005, 3-27). However, newer studies of technological transitions within specific sectors and related to specific technologies have done a lot to go beyond determinist theories of technological change (Geels, 2002). Geels for instance, writes that present day studies of technological transitions investigates:

> major technological transformations in the way societal functions such as transportation, communication, housing, feeding, are fulfilled. TT do not only involve technological changes, but also changes in elements such as user practices, regulation, industrial networks, infrastructure, and symbolic meaning (Geels, 2002, p 1257)

In this perspective, investigating technological transitions is not about investigating how technology drives social change, but how technological transitions are actually socio-technical processes involving broader work than that concerning the "technological". That is, a new technology does not drive transitions alone, but technology together with active work to change societal factors can lead to transitions in energy, mobility or communication systems, or indeed in food systems. While much of the transition studies literature are interested in deep transitions in large technological systems (for instance from carbon based energy to renewable) and thus show that transitions are rare events (the previous big transition was the industrial revolution) (Schot and Kanger 2018), we draw inspiration from the perspective when investigating technological transformation in agriculture on a smaller scale.

Historically we have seen, for instance, that the political regulation of agricultural production in terms of volume and location develops closely together with new technologies, market conditions and land usage. An illustrating example is how the joint development of automated milking systems and regulation of quotas and joint farming took part in reshaping the Norwegian dairy industry and farm structure (Almås and Vik 2015; Stræte and Almås 2007; see also Butler et al., 2012; Hansen 2015; Vik et al 2019). In order to investigate the transition from silo's to silage baler, we approach it as a process where technological, societal (including economic) and natural factors together laid the foundation for change in Norwegian agriculture. We relate to studies of the consequences of technological change in agriculture. These often focus on the consequences of such changes in terms of economics or labor. That is, they share the question with industrial sociology or labor studies, in that it is interested in how technology affect the everyday work of the farmer, or the profitability of farms (Armstrong and

Daugherty 1997; Meijering et.al. eds., 2004). While these are important topics, socio-technical transitions also have more surprising consequences. The introduction of railways for instance, was intended to move people and goods faster. However, as Hård and Jamison (2005) has pointed out, it also brought with it new ways of socializing, centralized forms of management and business, standardized time, need for fencing to keep livestock away from the tracks etc. This shows us that the surprising effects of socio-technical transitions might be as important as their intended effects. This is also the case for the transition to the silage baler in Norway. We approach this transition as something that has changed Norwegian agriculture – primarily through unintended "side effects".

The problem of distance in Norwegian agriculture and the making of a sollution

In 1979 a research and development project at the Department for agricultural technology at the Norwegian Agricultural College found that new cultivation of land in Norway often took place in mountain areas. This represented two major problems: 1) Harvesting grass in general, including ways of preserving the grass, and 2) Harvesting with considerable distance between the place of harvest and the place of feeding. While the problem of harvesting and preserving grass had received a lot of attention in the past, the problem of transport over distances had been overlooked according to the project report. However, it was pinpointed that these two problems were interrelated. The project then, was to investigate, evaluate and develop, harvesting and transport methods for growing foods in the mountains. And, not least, they set out to gather data about grass harvesting and adapt them for use in economic calculations of which methods were most cost-effective (Hilmersen, 1981).

The above project must be seen in the context of Norwegian agricultural policy at the time. One of the main goals of the agricultural policy during this time was to secure national self-sufficiency at the highest possible level – following WW2 and the then current Cold War era. This goal was coupled with the idea of keeping agricultural production in all parts of the country, and with a goal to increase the income of agricultural workers at least to the level of the average industrial worker. In 1975, there had been a protest by dairy farmers at the Norwegian island of Hitra, voicing concerns about falling income and the rapid closing down of farms. The protest achieved national attention and was a triggering factor for the 1976 agricultural agreement in the parliament where it was agreed to strengthen the focus on the above-mentioned agricultural goals (Almås, 2004).

The researchers then set out to "help" politicians reach their goal of cultivating new land, while also helping the farmers figure out how to do this in an economically rational way. In order to solve the problems of how to cultivate new, distant land areas, and to do so profitably, the researchers visited farmers that used the methods they wanted to evaluate in the eastern parts of Norway as well as the middle-country regions of the lush Nord-Trøndelag and the mountainous Gudbrandsdalen areas in central Norway. A figure in their report shows what kind of operations were involved in harvesting grass: “cutting”, “loading”, “transport”, “tearing” and “filling of silo”, “pre-drying”, “transport”, “unloading”, “filling” and “processing”. The figure is a labor process-oriented representation of how the researchers made the process of harvesting operational for their research, that was combined with a evaluation of the technologies and operations involved in the process of grass harvest. One of the evaluated technologies were the silage bailer combined with various transport technologies (Hilmersen, 1981).

While the researchers did not land on a conclusion of which methods would be best suited for “Norwegian” agriculture, they suggested that in order to procure high quality roughage, it was necessary to develop a “well-dimensioned harvest apparatus and a good organization of labor”, that harvesting grass for ensilage made it possible to cover a larger area than when gathering hay, that transporting feed with a truck was preferable, that harvest method needed to be adapted to the individual farm (Hilmersen, 1981). As such, the report did not conclude on which method was the best, but rather stated that “the best” depended on the conditions of the individual farm. However, we see that flexibility and mobility came up as important criteria. One of the charts of the report, showed that if round bale was done in a successful way, it would allow the farmer to cultivate and harvest land located far away from his farm, but the researchers stated that they did not have enough experience with such methods.

Overall, we can say that even in such an early stage of the introduction of silage baling technology, it was presented as a technology that might allow the farmer to increase the amount of land she cultivated. So, the baler was seen as a potential rationalizing technology that could solve the distance issues that hindered the realization of agricultural policy of growth in production and self-sufficiency. What seemed to drive the interest in silage baling in this early phase, was not technology, but a political wish to maintain a dispersed Norwegian agriculture while increasing the size of the farms.

During the 1980s and -90s, we see an increased effort to investigate the potential of various ensilage technologies in Norwegian agriculture. The company Norsk Forkonservering (NOFO), established in 1932 and owned by Norwegian Hydro, Norske Melkeprodusenters Landsforbund, Norges Bonde- og småbrukarlag, Norges bondelag, Felleskjøpet and Det kongelige selskap for Norges vel, is one example. This company had been a central actor in the introduction of various ensilage techniques for making and preserving animal feed in Norway (Prestrud et.al. 1982). In the early 1980s NOFO experimented with silage baling at the experimental farm Hellerud gård. The project found that while baling was an effective way of storing grass, there was some doubt concerning the quality of the plastic wrapping used for preservation purposes (NOFO 1982, 62). During the 1980s and 90s, this company published reports and educational leaflets on the topic, as did public research stations, agronomists, agricultural economists research councils etc. (NOFO 1983; Kjus et.al. 1996; Valberg 1994; Bardalen 1993).

Many actors were exploring the rationalizing potential of ensilage technologies during the 1980s and 90s. This shows us traces of an expert system located at the nexus between state, industry and farmer organizations that facilitated agricultural transitions by way of research and information directed to farmers and farmer organizations in the form of manuals, advisory booklets etc. In this stage of silage bale technology introduction, such work established a knowledge foundation that served many purposes in the introduction of technology. First of all, it would be important for judging if this was a rational technology in a Norwegian context, second it took part in establishing a national expertise that could educate and advise farmers in the use of silage baling, third the expertise identified issues with the technology, and fourth it could assist users, importers and sellers select between various available technological designs (Oudshoorn and Pinch 2003).

While the mediators we have investigated so far focused on "handling lines" and rationality from the perspective of the farmer, more actors would be affected by silage baling technology than its immediate users. As an advisor from Norsk landbruksrådgivning (Norwegian agricultural advisory service) points out in our interview with him: "the results from round baling were surprisingly good. And eventually this method was seen as even safer and better than the use of a silo." Round baling became more and more dominating in Norway during the 1990s and the 2000s. Although the first field investigations of feed quality had showed great variation, research and experiments increased the knowledge about how to do round baling to get feed of a certain quality, while farmers practical knowledge also increased. By the early 1990s, the tone amongst experts were that "Round bale ensilage is not seen as a high risk method as it used to be seen" (Randby 1994, 84).

Growing without investments

The silage baler never became part of Norwegian agricultural policy in a financial sense. On the contrary, it was the farmers, despite lack of incentives from public authorities, who together with the expert system initiated the use of round baling technology. As one advisor from Norsk landbruksrådgivning (Norwegian agricultural advisory service) puts it:

> The initiatives to use round bales came from "the ground" all the way. There were no initiatives from above … No funding was given for investment in round balers

Thus, the round baler came gradually into Norwegian agriculture "from below", as farmer's learned about the potential of such technologies, a potential that had partly been constructed by the existing expert system of mediators as seen above. The potential can be seen as directed towards a particular development in the agricultural sector. Since the early twentieth century, Norwegian agriculture had been characterized by an ownership structure consisting almost exclusively of individual, independent small holding farms. The number of active farms expanded and reached its peak around 1950, after which the number of farms started to decrease rapidly. From this time on wards, there emerged an ideal of creating a structure of viable family farms. After the 1950s, an important principle in this policy became on-farm mechanization as part of making the farms both more productive, and to make them viable as family farms (Almås, 2004). One advisor from Norsk landbruksrådgivning (Norwegian agricultural advisory service) also emphasizes this when discussing the silage baler:

> Full mechanization on each individual farm has been a guiding principle in Norway […]In Norway the smaller farms were thus for a long time a central feature of the agricultural structure, and when these farms had to expand, the baler became an optimal solution.

In other words, the baler turned out to be a practical technology for use by farmers in the expansion of production of such relatively small but independent farms. The 1980s was a time when the economic situation on Norwegian farms, combined with marked and political incentives to keep expanding production under a neoliberal regime meant significant changes in the needs to rationalize feed harvest and storage. From the late 1980s onward, the neoliberal turn in politics affected the agricultural sector with it dual demand for economic rationalization and increased production in the frame of international free trade agreements such as GATT (later WTO) and the EEA. This meant the change from a monopolistic agricultural model to a more market oriented system (Almås, 2004)). For farmers, this led to more competition from international markets, and often pressing apparent needs for large scale investments in a pressed economic situation.

In order to compete and meet demands set by government and by the market, farmers needed more land. Only 3 percent of Norway is agricultural land (Forbord and Vik 2017). This scarce agricultural land is scattered-in between fjords and mountains, hills and forests, with an average piece of agricultural land in Norway is around 1 hectare (Vik 2016). The fact that the average size of farms has increased from 7,6 to 25 hectare therefore means that the farmers need to gather grass from an increasing amount of small parcels of land – often far away from the center of the farm. Another part of this picture is that currently, on average 50 percent of the land run by a farm unit is rented land (Forbord et al. 2014). In 1979, just before the silage bale technology started to spread in Norwegian agriculture, there were 125 302 farms in Norway, which has been reduced to 39 621 in 2018, a 69.4% reduction (Statistics Norway 2019). Most of the increase in size happened as many of the smaller farms were abandoned, their land being added to the remaining farmers through renting or buying. This lead to a shift towards larger farms with more land spread around a larger area. Thus, it was imperative that silage was being prepared, transported, and distributed in larger amounts than before, at the correct season.

Several technologies played important roles, and the baler seems to have played a key role in this growth as it allowed for relatively easy harvest and storage of silage from the small and scattered fields. The advisor for the Norsk landbruksrådgivning (Norwegian agricultural advisory service) points out that "larger distances and fields that are more spread are all factors that are in favor of getting a silage baler when I give advice to people". One farmer mentioned, on the topic of why he choose to use bale technology, that "it made harvesting much more efficient and it required a lot less people to work – it also made the use of rented land much easier." Efficiency is also a key point of the silage baler. One farmer said that with the silage baler he could harvest his farm in a bout a day or two, whereas before this would have taken a week. In addition, with fever farmers around, and less people in general that could help in the harvest, the baler was also practical because it only requires one person to do the job. This, in contrast to harvesting in silos where the farmer generally needed about 4 or 5 people to help with the harvest.

The issue of storage space and maintenance of the old silos was another central issue. By the late eighties and the early nineties many of the silos that had been built during the preceding decades (especially after the boom following the parliament's decision to boost Norwegian agricultural income in the mid-seventies) needed maintenance, while they had also often become too small to store all the silage that was needed for expanding flocks of animals. "People couldn't afford to upgrade their silos, or couldn't be bothered. It could cost close to 120 000 kr to make your silo tight with fiberglass. That was a lot of money in those times," the farmer entrepreneur continues.

Two other interview subjects, one active farmer, and one retired farmer and round bale entrepreneur, confirms that the costs of maintaining or building new silos were a central aspect as to why many farmers preferred the use the round baler rather than continue using the silo. There was an issue of storage space in the silos, whereas the round bale storage space was mostly limitless if you had enough hay and wrappings. Farmers wanted to, and needed to "grow", but were often reluctant to do so in large scale. Building silos was expensive, and round bales was a fairly cheap temporary solution. As one advisor in the Norsk landbruksrådgivning (Norwegian agricultural advisory service) points out: "A lot of investment have been short sighted. The round baler fitted this line of thinking quite well." Lack of space in silos, and the farmers urge to expand their farms through increasing livestock numbers, and thus the amount of grass to harvest, seems to have been a central driver in establishing the round baler in Norway—as has the distance between parcels of farmable land. The farmers magazine Bondevennen writes about a dairy farmer in 1987 who feels the pressure to increase his production. One of the issues with this is that he does not have enough storage place in his silo, and is thus considering to invest in a round baler:

> If I had had better capacity in my silos, i could have been more flexible in the running of my farm, says Bieltvedt. He is going to invest in a baler and do the harvest this way.

The farmer and entrepreneur referred to earlier also points out how the round baler made enlargement the farms possible: “with the large number of cattle farmers have today, a silo would be very unpractical. It would be emptied in a month or so! Much easier and cheaper then to keep the silage in bales” . The magazine Bondevennen states in 1987 that:

> Making silage in round bales has caught the interest of farmes across rural Norway the last five or six years [...] The benefits of this method is that it can be an addition to traditional ways of storage, and the method is relatively cheap compared to storage in silos.

In the same issue of Bondevennen there was a story about farmers in the area of Hovsherad in southern Norway that had invested collectively in round baler technology. The conclusions of the farmers was that the lack of silo capacity drove them to investing in round bale technology.

Discussion

It has been noted about the effects of the silage baler internationally (in this case in the US) that:

> The introduction of the big baler was an important milestone in forage conservation. For the first time, silage could be made in transportable packages that, like hay and straw, could be traded easily between farms. Big bale silage, typically 600–800 kg fresh weight per bale, gained popularity on smaller farms with limited labor and financial resources to invest in the construction of silos (Wilson and Rinne, 2018: p 43).

In the American context then, the silage baler became a technology used by smaller farms because it was relatively cheap, provided a preservation and storage method that allowed easy handling of the feed etc. Further, the silage baler was one of the technologies that made it possible for smaller farms to modernize along other lines than those of the larger industrial farms, and it is therefore possible to say that in the U.S., this technology has been connected to an alternative route of agricultural modernization. A similar trend emerges in in Norway as well.

From the above presentation of the introduction of the silage baler into Norwegian agriculture, two main points emerge.

> 1: the interplay between political and economic trends towards fewer and larger farms, and the gradual emergence of the silage baler.

2: a relationship between the emergence of a system of rented land and the use of the silage baler.

While early government and research incentives started to see the silage baler as one potential solution to problems related to cultivation of new distant land, the baler actually became the answer to a second and later problem of distance, which came from the practical needs of farmers when expanding their farms by the use of rented land. In the formulation of the first problem of distance, the issue had been how to raise agricultural production by cultivating new land – and increased production was also what the silage baler actually helped to facilitate, but in a different way. When the trend towards fewer and larger farms continued to mark Norwegian agricultural development, the silage baler became a technology that made it possible to keep in use the same amount of agricultural land, despite the fact that the number of farms were drastically reduced. This meant higher production per farm. The bailer went from being understood as a technology of agricultural (land) expansion to being used as a technology of maintenance.

Today, grass-based production is largely based upon rented land, and as we have mentioned, almost 50 percentage of the land in use in Norwegian agriculture today is rented land, with one farmer often renting land at many different places far from each other. From the data we have, it seems reasonable to suggest that the silage baler is one of the key factors that has made such a high use of rented land possible in the grass based productions. In this picture, the round bale technology is something else than a technology that increase harvest capacity: it is a technology that allow the farmer to have larger geographical reach in a situation with fragmented ownership and scattered landscapes with large distances.

Thus, to use an exaggerated image, it is almost as if the silage baler has turned Norwegian farms into mini "colonial powers", extracting recourses from far away recourse colonies in the form of distant fields. This has been the results of farmers wanting to, and needing to expand their production in a context where the economic situation has been felt as insecure. Instead of investing in construction of expensive new barns, farmers choose to increase their fodder production through the use of the silage bales which is less of a permanent long term investment than a new barn.

We can perhaps say that the silage baler became a temporary solution to a permanent problem of increasing production under relatively marginal economic conditions. Although some farmers did invest in new barns, and especially since the early 2000s almost all new barns for milk production were built with automated milking systems (AMS). The system gives the farmer more flexibility work days and result in more milk per cow. The capacity of one robot is around 50-60 cows per day. This is a large investment, and farmers need to have more than 35 cows for the investments to be economically sound compared to traditional milking systems (Hansen, Herje et al. 2019). Since the average number of cows in Norwegian agriculture was 14.4 in 2000, and around 27 in 2018, the drive towards milking robots has – and continues to – drive the average production level up (Vik, Stræte et al. Forthcoming).

In this situation, the access to ensilage in the form of an easily transportable silage round bale fits well. This makes the farmers able to harvest grass on different sites during the summer and transport it to the barn when needed. The relationship between the round baler and the milking robot is therefore that the round bale technology makes the introduction of the milking robot possible – or at least easier – in a context were nature does not fit well with a large scale agricultural structure.

On a theoretical level, it seems clear from these findings that the silage baler has played a significant role in the restructuring of Norwegian agriculture during the past 30 or 40 years. In retrospect, it seems clear that political and economic developments since the late 1970s have happened in tandem with the emergence of the silage baler.

Political goals since the 1970s has been geared towards national-self-sufficiency combined with growth in production on each farm. The way in which these goals were pursued, has, as statistics demonstrate very clearly, lead to a drastic reduction in the number of farms, and an equally drastic increase in the size of the remaining farms (although still very small by European or American standards). In this context, each individual farmer was faced with the challenge of increasing the production of the farm without large investments in barns or other buildings.

These factors combined resulted in a market for the renting of land, leading to a spreading out of the land that each farm harvested, and thus to a change in the way in which harvesting was done: from storing in silos to the use of the baler. Here we might speak of the silage baler as representing a sociotechnical transition, as "long-term technological changes in the way societal functions are fulfilled" (Geels, 2002, p 257). Indeed, if we connect the silage baler with the emergence of automated milking systems in Norway we might speak of the silage baler and the new milking systems as combined forces of production in the Marxian sense, which together with agricultural policies has transformed and burst asunder the mode of production under which they emerged. From a structure of small dairy farms with an average of 14 cow, where every farmer owned his own land, we have gone to a system where 50 percent of farms lease land and where the average farm has 27 cows (and a large minority as many as 60 cows). From a fairly labor intensive form of production with harvesting in silos, to the one-man operation of the silage baler. Although this was, in the first instance, a way for farmers to save labour and investment costs, it turned out, it seems, that the silage baler became a major force in reshaping the Norwegian agricultural structure.

Conclusions

The emergence and consolidation of the round baler in Norwegian agriculture is a clear example of how the unintended consequences of a technology may have profound effects. In the Norwegian case the round baler went from a technology discussed by researchers as one solution as to how to harvest new cultivated land in mountain areas, to becoming the most common way of harvesting grass a few decades later. Although some of the first discussions of the use of round baler in Norway appeared in the historical context where increased production was a political goal, the baler itself never got any place in the agricultural policy. One of the main function that the baler acquired as was as a temporary solution to the permanent problem of increasing production on farms. Instead of investing in new barns or silos, the round baler was used as a way of storing more grass, and as a way of acquiring more land that was often far away and dispersed.

As research and advisors tested the method and establishing it as a safe and economic way of harvesting gras, farmers in need of more land gradually started using round bales as their major way of harvesting and storing silage. Farmers saw the round baler as a way of being able to store more grass without investing in expensive silos, and it was also a technology that made it easier for them to utilize far away plots of land that became free as other farmers closed down operations. This lead helped facilitate the process towards larger farms with a high use of rented land that is now a distinct feature of Norwegian agriculture. It is especially interesting to note the correlation between the more recent emergence of automated milking systems and the round baler. Automated milking systems require larger herds of cows and thus more grass, and the round baler seems ideal in supporting this as it makes it possible to harvest additional fields of grass far away from the farm itself.

We cannot make an absolute statement based on this one study, but it does seem likely at least that the round baler has had a major role in transforming the Norwegian dairy structure at least into a structure of larger farms and rented land. Implications are often difficult to discuss in advance because it depends more on how the technology is implemented. If discussed in advance, the discussion tends to center on quite obvious implications in terms of (economics, environment, labor etc.), while the unexpected implications are left out. However, in hindsight, we may learn something from studying the various implications of new technologies. The process through which this happened, and the stages the adaption of the technology went through, may teach us that such processes needs to be carefully watched if we want to understand what wider societal consequences the implementation of new technologies may have.

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