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## TECHNOLOGICAL DEVELOPMENT IN THE NORWEGIAN DAIRY SECTOR

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### HISTORY

Arable land is covering less than 3% of the total area of Norway, and is partly situated north from the Arctic Circle. The remaining part is mainly forests and mountains. The history of the Norwegian people and agriculture was hence a history about poverty. Before the industrial revolution in the middle of the 17<sup>th</sup> century, the population lived on small farms where they grew what they needed for their self-sufficiency. Farmers made their own farm buildings and equipment according to their own ideas and regional traditions. The buildings were small, specialized and normally had a short lifespan. Typical building materials were timber and stone. Indoor climate was far from good. The total workload was high, however, the work force was large as a lot of people lived on the farms. From approx. 1850 a big change took place in Norway as industrial products became available. A lot of people moved to the cities (or immigrated to USA) to live from industry or trade. The cities became a new market for agricultural products, the farmers got an income (as cash) and could buy “modern” factory built farm equipment. As people left the countryside for a better life (!?) in the city, farmers also had to select more efficient solutions to be able to run their farms with less hands involved. The monetary housekeeping also made it possible to loan money. Loan money was invested in more robust buildings, better solutions, e.g. for taking care of the manure and for storing food etc. As these buildings were more expensive, different productions were gathered in fewer buildings. What was called the “unity building” became the new standard. In those buildings, the manure was typically stored in the cellar, animals were kept on the main floor, and food was stored above there again. The gravity became the farmers “helping hand”. A great improvement in work load, animal welfare, hygiene and production was achieved, and traditional housing methods were soon forgotten, however, the debt increased. In the years after world war II, the spread of electricity and combustion motors made room for another change; mechanization replacing manual work and gravity. Milking machines replaced hand milking, and feed and manure work were mechanized using mass-produced equipment. Today mechanization has developed into automation, and at the same time market forces has multiplied production volumes. The unity barn is also replaced with wide one-level buildings. The normal situation today, is also that one person is normally running several farms. Hence, to raise new buildings the work load is too big for the farmer, and the result is that he have to buy both building materials as well as hands to build – and the debt is increasing even more...

### REGULATIONS

In Norway there is a lot of regulations. Two central acts are; *the Building act* with detailed *technical regulations*, and the *Animal welfare act* with species specific regulations. The first animal welfare act in Norway came in 1935 with an aim to “avoid animal abusement”. In 1974 it was revised, and the aim was to “avoid unnecessary suffering”. The focus in present version from 2010 is to “prevent and ensure animal welfare”. Detailed demands regarding cattle housing are found in the *Regulation on keeping cattle*. Regulations regarding construction of a farm building are similar to all other types of commercial buildings.

### HOUSING

Norwegian herds are medium sized (mean: 25 dairy cows), and are traditionally kept in tie stall barns. As late as 10 years ago, approx. 10 % of the herds were housed in traditional tie stall barns. The typical solution was an insulated building with mechanical ventilation, the cows tied with the head facing a central feed bunk, and the young stock housed on a fully slatted floor system above the manure storage. New regulations on keeping cattle (2004), demands loose housing for all animals (within 2024), soft flooring in the cubicles, outdoor exercise, and solid floors for heifers. Today approx. 50% of the cows are loose housed - typically using a free stall system. Fully insulated buildings is still the most prevalent type of building, however, there is a trend towards more use of wood and “low insulated” constructions.

### **MILKING**

As new regulations has “forced” farmers to renew their housing systems, normally mechanization has also been updated. In tie stall barns cows are normally milked using a pipeline milking system. Older loose house barns were typically with herringbone or tandem milking parlors, however, loose housing was not very common until 2000-2002. At that time the first automatic milking systems (AMS) were also introduced in Norway. As Norway is a high cost country, and we had suitable herd sizes, AMS systems soon became very popular. Today close to 100 % of new (or remodeled) barns are ending up with AMS systems. There are 1500 AMS herds in Norway (out of totally 9500 dairy herds), meaning that approx. every third cow in Norway is actually automatically milked today.

### **FEEDING**

Because of long winters, it is necessary to store half of the food needed throughout a year. Hay based storing was replaced by roughage stored in silos after World War II. This was the most frequent solution from the 1950s and until approx. late 1990s. With a more “expansive” agriculture policy, the herd size increased and round baling became more and more popular. All that use of plastic is not very cheap, but it is a time effective method for storing food. Hence today approx. 2/3 of the silage is stored in round bales. Feeding systems have likewise changed from simple electrical delivery wagons, to more automated rail based “cut-and deliver” systems. Today there is a trend towards more TMR systems. However, due to our arctic climate, most farmers have just grass and concentrate – and e.g. no maize etc.

### **MANURE**

Due to the climate, there is also a lack of straw for use as bedding. There are access to some sawdust or turf, however it is also associated with considerable costs. The last century the solution have been a slatted floor solution. The manure from the animals went through the slatted floor (slats 35-40 mm) and beams 13-15 cm) and ended in a manure storage in the cellar underneath the animals. As herds became larger, the problem with ammonia and hydrogen sulphide emissions became more evident. New regulations from 2004 therefore demands “gas tight” connections between manure storage and the animal room. Mechanical scraping systems have been common since the 1960s, and they still are. A survey from 2006 found that in general, farmers were less satisfied with their manure systems, and the majority used more than one hour per day for cleaning out manure. The trend today is to use scraping robots at the top of slatted floors.

### **FUTURE???**

The 2015 dairy barn is actually working quite well, however, improvements will always be possible. One trend is towards animal welfare solutions, e.g. with separation in more groups, with specialized “looser cow” departments (for calving, lame cows etc). The move from mechanical to automation is also evident. In addition, new surveillance systems are entering the barns, e.g. pedometers, climate warning etc. The problem regarding financing all the equipment is, however, also more and more evident. I guess that the “hunt” for animal friendly, time efficient AND cheap solutions will continue!