JAPANESE-DANISH DAIRY FARMING COLLABORATION
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Japan report made by SEGES P/S for the Royal Danish Embassy, Tokyo, December 2015. It is a part of the overall strategic Japanese-Danish sector cooperation – the project called “Strategic Sector cooperation within the Agroindustry”.

Photos: LandbrugsMedierne

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December 2015

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This report highlights relevant key focus areas, where the Danish Dairy model could support the Japanese development in securing their future industry of dairy farming.

The aim is to describe the present situation of the Japanese challenges within the dairy farming (primary production), and where the Danish Dairy model offers know-how and products to support the further development of this sector in Japan. This report should be seen as a catalogue of different relevant focus areas, which each can be activated independently, and where the effect of each activity will influence the total output positively in increasing the effectivity and attractiveness of working as a dairy farmer in Japan.

This report will however not focus on the political, financial or legal (macro-economic) areas, but concentrate on subjects related to technical and daily management within dairy farming.
Both Japanese and Danish dairy farming traditions go back many years, and is today still an important sector in both countries when evaluating the influence of economic and general contribution to the entire society and lifestyle. In both countries you can also find the same overall trends – like long term higher productivity (milk yield per cow); less number of farms but in the same time an increasing number of animals per farm, and many other similarities – even though the levels of course differs.

Here is a brief overview to give more insight of the development and present situation of the two countries dairy farming industry.

**Number of dairy households**

In both countries there has been a structural change over the last decades, and a constantly decreasing number of dairy farming households. Also the average age of the owners is increasing, and today it is very difficult to get young people into the industry – in Denmark mainly for financial reasons, and in Japan there is a general low interest among the young people to become dairy farmers due to several reasons. However the picture is very similar, that each year a less number of dairy households remain to secure the total production of raw milk.

**Number of dairy cows**

In Denmark the total number of dairy cows has been slowly declining over the last decades mainly due to the overall quota regulation, where the maximum milk production has been reached with improving the productivity of the single cow, and thereby reducing the overall number of cows needed. The average number of dairy cows (cows above 2 years) is now around 175 cows per household in Denmark – in Japan the equivalent number is around 53 cows per household. However in Denmark this number has almost doubled over the last 10 years, whereas in Japan the increase of dairy cows per farm has only been around 25% in the same period. And overall the number of dairy cows in Japan is decreasing quite fast, and only in the last 10 years to quantity of dairy cows is reduced with 23%.
In Japan the main raw milk production takes place in the northern island Hokkaido, which account for just more than half of the total production. In Denmark the total production has been controlled via European quotes, which have just been cancelled in 2015, and we expect overall to see an increased raw milk production in Denmark going forward.

Since the production peak in 1995-96, the Japanese raw milk production has decreased 15%.

The Danish productivity (measured as ECM kg/year per cow) has increased significantly during the last years, and is now on average above the 10.000 kg. Furthermore we have in Denmark approximately 70% of the cows being Holstein – in Japan the Holstein accounts for around 99% of all dairy cows. Looking only at the Holsteins in Denmark the average productivity is now above 10.500 kg (ECM).

In Japan there has also been an increase in the productivity, but not to the same level as in Denmark. Looking at the last 10 years the Danish milk yield has increased around 13% where in Japan the increase has been around 7.5%. Also Denmark is coming from a relative higher level meaning an increase of almost 1200 kg/year per cow, where the Japanese increase is almost 600 kg/year.

Following the abolition of the EU quota system in 2015, Denmark expects an increase in raw milk production.
Based on the above facts, various sources and different information the below points highlight some of the main identified challenges within the Japanese dairy farming as it is seen here ultimo 2015. They are not prioritized or quantified in details and further analyses needs to be conducted to get deeper into each subject. The purpose of listing these challenges is to indicate where to start working further on finding areas where the Danish and the Japanese dairy farmer could benefit from making a closer cooperation.

A: The production per cow is not at a sufficient high level. The demand for dairy products in Japan is higher than what can be produced in Japan with the present number of households, number of cows and milk yield per cow. And it is expected the overall demand will increase in the future as the potential for dairy products is very high in Japan when comparing to other countries. So clearly there is a challenge in increasing the yield per cow.

This leads to the challenge of securing the total production, which is declining comparing to the peak production in the mid 90s – looking at the last 10 years the production of raw milk in Japan has decreased 13%. Several times during the last years there has been a clear shortage on for instance butter, when the production of fresh raw milk has been low, e.g. during the summer time.

So overall raw milk production needs to be increased either by increasing the number of cows, by increasing the productivity per cow – or both.

B: It is difficult to get young people into dairy farming. They are more interested in working in the cities, and do not find the working hours attractive. Today the Japanese farmer is getting older, and has troubles finding someone to take over the farm, when he wants to retire.

One reason for these challenges getting young/new people into dairy farming is like in Denmark the relative poor financial attractiveness being a dairy farmer, one clear factor is the initial high investments needed to buy a farm.

Another reason being mentioned is the entire regulated system of raw milk supply and control of the subsidies, which for some people is seen as a barrier for developing and investing further in making a larger business. So fewer farmers, less cows and limited growth in productivity of the remaining cows have actually led to a decreased supply of Japanese raw milk.

Lately the agreement of the TPP (Trans-Pacific-Partnership trade pact) have created further insecurity of how the domestic production in Japan will develop going forward, and this insecurity is also addressed as a challenge to get young people into being dairy farmer – however the effect of this initiative is still not predictable.

C: Data management, how to register and use data in the best way. Not all cows in Japan are registered, and for those who are, data is handled in some local database – and not centrally available. The data is thereby not generally used as a method to follow-up and improve values around the dairy farmer.

If the aim is to increase the number of cows per household (in order to make it more financial attractive to be dairy farmer), it is also necessary to keep the overview of the most important factors to secure productivity, health and similar issues. Data is able to support the farmer in this process, and with the increased use of technology in the dairy farming, it is important to lift the competences around data and usage of the data. E.g. the public incentive program of increasing the number of milking robots will also influence the access and use of data by the dairy farmer.

D: Manure handling – sustainable production. Like in many other countries the Japanese dairy farmer is also challenged with the handling of the animal wastes. There are strict rules to prevent environmental and pollution problems, and as a farmer you need sufficient crop land to get the manure and slurry distributed accordingly.

As an opposite effect of the rules regarding animal wastes is the long term consequence of not adding enough organic fertilizers and nutrients to the soil – thereby declining the soil fertility. As a result there is now a high use of chemical fertilizers, which is a relatively expensive approach. So keeping the balance right looking at both the animal wastes and the need for keeping the soil output high- and thereby making a sustainable production – is challenging the Japanese dairy farmer.

E: Livestock feeding – Japan depends today on imported feedstuff, and is thereby very depending on external factors influencing the livestock feed prices. This also challenges the dairy farmers, as a big proportion (almost 50%) of the total lifecycle cost for a dairy cow is the feed cost. Of course the actual climate zone and crop field areas available will influences the level of domestic livestock feed production, but improving the effectiveness and overall production significant of will have a great financial benefit.

Overall there is a clear strategy of increasing the self-sufficiency rate for livestock feed, and this issue needs to be addressed to support the Japanese dairy farmer.

F: Increasing know-how among the Japanese farmers – how is information and new knowledge most optimal distributed to relevant farmers.

A general challenge – linked to the others – is how to get information and knowledge around to the Japanese dairy farmer. If there should be an increased productivity and improved animal waste handling, there needs to be a strong structure for getting the right knowledge to the farmer in an efficient and fast way. This structure is today more complex and un-clear for the dairy farmer, where different interests influence the decision process. So the advisory system would need to be updated for handling the support to the dairy farmer going forward.
Overall we have in Denmark a very strong collaboration between the different organizations working for and together with the Danish dairy farmer – the entire value chain being part of the same community. This goes from the education institutes (colleges), to innovation centers (universities), test stations (e.g. DKC), the advisors, dairy companies, vets, grain handlers, reproduction (Viking), and many others. Common for these institutes/organizations is, that most is owned by the farmer in cooperatives. Another common denominator is the cattle database, which is a national database where all cows have to be registered (by law), but where almost all data about the cow and the herds are collected by the above list of organizations. This gives the basis for continued development and follow-up on implemented activities, so the effect can be evaluated based on analyses rather than feelings.

1: Education of dairy farmers in Denmark

In Denmark we have a strong foundation within the education of farmers with a high degree of collaboration between the different knowledge centers and colleges. In order to actually manage a farm, you need to have passed certain minimum courses. However it is now possible to invest/buy a farm and then manage it like a company e.g. hire in professional farmer managers, and optimize the organization, crop production or other focus areas.

The education system based on alternation training between practice in farm jobs and theory at the schools – approximately 2/3 of the time being on a farm and 1/3 of the time being at the school. This set-up is seen as very attractive by the students, and in general they are attracted by the possibility to work with the animals and the nature around them. Also this set-up gives very fast the students a high degree of responsibility to take care of certain functions at the farm – and being part of a strong culture and teamwork. Very soon they will also get the responsibility to manage the whole farm e.g. for a weekend or during holiday periods, which is very motivating.

Earlier almost all the students where sons of farmers, but today the majority of the students comes from a non-farming family, however most still have some sort of relations to the farmer sector. Also the number of girls/women going to these schools is relatively increasing, so general this gives a better student mix. Overall the total number of students is decreasing, but here also the structural changes with fewer farms and use of non-Danish workers is influencing the picture.

Another positive element is the specialized and relative small farming schools, where there is a strong connection between the students and the teachers and others working at the school. Often the students live at the school during the week, and overall the number of drop-outs is very low – around 85-90% of the starters pass the final exams. And in the last years the educational structure have changed, so you can now mix your education between different areas of interest, giving the students more possibility to continue studying after the first exams – opening the possibilities of choosing a different future career than being a farmer.

2: Milk quality as part of increasing productivity

An effective way to increase the productivity (milk yield per cow) is to focus on the milk and milking quality. This system has been driven very successful in Denmark and contributed significant to the increasing productivity of Danish cows.

The system of improving the milk and milking quality is build up around a team of highly qualified and trained technicians/advisors covering the entire country. They visit relevant farms and take the farmer all the way through the milking process, from how the barn and milking parlor is designed, how the milking process is optimized, technical check of the milking equipment, and finally based on actual tests and indicators, how the different health issues can be followed and improved.

Main tests are made concerning the somatic cell count in the tank (indicating mastitis) and the freezing point, but also the bacteria count, spores and residual inhibitors tests can give information of where to focus on the farm.
and what to improve in order to overall reduce the numbers of diseases - and increase the overall productivity due to better animal welfare and higher yield per cow, higher milk quality, less cost/time for taking care of sick cows etc.

In the same time the team do control visits in corporation with all the Danish dairies, in order to follow up the general status of the milk suppliers and report points which could/should be improved in order to keep a high level of milk quality and reduce animal health issues.

3: Feeding management to get high utilization
Control of the livestock feed is essential when optimizing the milk production, and in Denmark this subject have had a high focus as the feedstuff is the single highest cost factor at the dairy farmer. Today we have strong systems for making sure the different cows gets the optimum level of all nutrients at a low cost – and we know what the effect will be when changing the mix ingredients/volumes. Thereby we can support the farmer in making feed rations planning and optimize this for all cows depending of which group they belong to e.g. dairy cows, dry cows or heifers. There are a system to follow-up and control how the actual results came out in relation to the plans, and what could be changed going forward. And finally we have the infrastructure and advanced equipment for analyzing and make sure the actual feedstuff have the right quality to secure the optimum milk production results at the right cost/effort.

Over the years we have been able to reduce the actual feed intake of the cow relatively to the milk yield output, by having a very high utilization of the energy (Feeding Units) and nutrients. We can bring in experts who can overview the entire supply chain from field/grain handler to the farmer stock and via the mix to the cows. And the knowledge and use of the TMR (Total Mixed Ration) method is already well accepted among Danish dairy farmers, and the method is still being developed further to obtain continuous improvements and even higher feeding effectivity.

4: Data as a central tool to make improvement activities
Since 1980’s dairy farmers have started to register on cow level (using ear tags), and in the 90’s it became obligatory in Denmark to register all cattle in order to control spreading of diseases and similar health related issues. This system has developed during the years, and today we have centrally cattle database with collected data for all cattle in Denmark. This gives the possibility for universities and other research centers to analyze different data in terms of improving the overall development of certain factors. Based on these analyses new activities can be tested and implemented, where you can follow-up on the figures from the data.

Denmark has strong systems to ensure that each cow gets the optimum level of all nutrients at a low cost.
However the data on the farm can also be a very strong tool for the people working on the farm, giving them insight of where to focus and which parameters could be improved in order to reach better results. The dairy farmer owns all data about productivity, milking, breeding, feeding, health etc., and they can alone or together with their different advisors use these data and find out new ways of improving and optimizing their dairy farm. Some also use the data to keep an overview of the farm status, and as a management tool, but generally the use of data is getting more and more important to keep control of how the farm is run.

5: Milk recording system
In order to generate data, for the dairy farmer to make his decisions, we have a systematic set-up for testing especially the cow/heard health and re-productive status. Most milk delivering farms in Denmark (around 90%) are part of this milk recording system, where the farmer typically gets data per cow once per month.

Besides the standard tests for fat, protein, somatic cell count etc. the farmer is also able to order other tests. This set-up has been made very easy and flexible for the farmer, so only the relevant areas are being checked. Key factor in the whole process is the link between test and cow – and finally uploading the information to the dairy farmer, so the right basis for making important decisions is available. So high degree of secure connection between cow and test; fast response of test results, and easy feed-back to the farmer is some of the elements carried out by the Danish Milk recording system.

<table>
<thead>
<tr>
<th>Standard milk recording in Denmark</th>
<th>Additional tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat content</td>
<td>Paratuberkolosis (Antibody, Eliza)</td>
</tr>
<tr>
<td>Protein content</td>
<td>almonella Dublin (Antibody, Eliza)</td>
</tr>
<tr>
<td>Cell count</td>
<td>SPCR (3 to 16 bacteria’s)</td>
</tr>
<tr>
<td>BHB surveillance</td>
<td>Pregnancy test (IDEXX, PAG Eliza)</td>
</tr>
</tbody>
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6: Breeding plans based on professional evaluation
As part of improving the management around our cows we have made a Nordic evaluation system, where we based on different criteria’s are able to rate the cows and classify them individually – making sure we use the best female cows for further breeding. Long term this will optimize the productivity, health, fertility etc. – all important factors to improve the overall economy.

For handling the breeding data, we use in Denmark a software tool, where the dairy farmer can get an evaluation of his cows and herd, and based on this information the farmer will be able to make an optimal mating plan. Typically the farmer will use a breeding advisor for actu...
ally making the plan. Practically the classification of the different criteria’s is based on a visual evaluation made by a group of trained people. Another method is based on genomic tests of the cows, where you can get a faster evaluation and with more factors compared to the visual method, however these tests are more expensive and demand a larger set-up to get the optimal benefit.

However both methods have helped improve the herd results, and they are today the base for the continuous genetic progress we see in Denmark – and for the overall improvement in milk yield etc.

7: The Danish Agricultural Advisory system

We have in Denmark a so-called 2-layer advisory system within agriculture, which also includes the cattle/dairy sector. Overall it means that the farmer have a local/regional advisory center where there is access to all general issues about economy, management, feeding, crops, environment, legislation etc. In order for each local/regional center to have these competences up-to-date, there is also the national advisory level (SEGES), which makes sure to educate and make all new research and information available for the local centers. So in the national organization many of the employees are specialist, where in the local/regional center they are often more generalists.

The close cooperation between the “2 layers” is a very strong way of implementing new knowledge and development from the research projects to the farmers, and in the same time it is also very helpful in designing/testing new projects with involvement and comments from the farmers - either direct or via the advisory centers employees.

Finally it helps many surrounding authorities to get easy access to one national organization who can coordinate, speak on behalf, make national actions and inform the entire industry of dairy farmers – and in the same time you still have the local advisor to be in close contact with the individual farmer.

Besides the general support from the agricultural advisor, there are certain areas where the farmer gets support from other suppliers. It could be the veterinarian, or the mentioned special milk quality team, or a breeding consultant and others, who have special areas of competences. The farmer can choose himself between all the different advisors whom should help in order to get the best possible support and advice.

8: Sustainable dairy farming (animal waste handling)

A high degree of utilization of the animal wastes is an important part of reducing the cost for the livestock feed in Denmark, and thereby the focus for handling these
“resources” rather than “waste” correctly, can generate significant value for the farmer.

Primarily the animal wastes are handled as liquid manure, and are put in the soil with special equipment reducing the smell level and increasing the utilization of the nutrients. Over time Danish dairy farmers have increased the milk yield/production in the same time as the climate effect have been reduced. Today the Danish dairy cows have the lowest negative climate influence per kg milk produced. And especially the loss of ammonium and phosphor has been reduced significantly since it became a focus area in the 1990s.

The continuously improved technics for distributing and storage of the animal wastes is the main explanation of the improved utilization of all the nutrients. The technological development is taken place between research institutes in Denmark and several producers of equipment to the farmers, all in all resulting in creating sustainable dairy farms.

9: Crop production

A goal for Danish dairy farmers is always to have a high degree of self-sufficiency rate of their roughage, which of course has to have a high quality at the lowest possible production price. A high self-sufficiency rate gives the farmer a stable and secure livestock feed supply – and is also linked closely to an optimal utilization of the animal wastes.

The production of roughage is in Denmark based on grass and maize. The climatic conditions in the different areas of the country is influencing heavily which exact variety of these crops has the highest yield/lowest production cost, and thereby how big ratio each variety accounts for in the total feeding mix.

Through national tests of the quality and the yield, we have in Denmark had a positive development of the feeding value for each sort and big success with cross breeding. We have developed a fast and effective test and trial system called the Nordic Field Trial System, which manage planning and data of new tests made around the country. Yearly we make around 1,000 tests with new varieties and optimizing of the crop production, which forms the basis of further development and new products for the seed producers. All results of these tests are published within 1-1½ month after finalization, which secures the farmer can implement these findings in the first-coming season. Besides the system for tests we also use tools for optimizing on quality and yield in relation to time of harvest of both grass and maize. And the entire process of harvesting the roughage can also be analyzed and optimized by experienced advisors.
**SUGGESTIONS FOR COLLABORATION BETWEEN JAPAN AND DENMARK**

Based on the presented descriptions the following areas have been identified as most relevant for further collaboration between Japanese and Danish dairy organizations. The recommendations should be seen as areas where most potential in working together will support the Japanese dairy farmer, but also areas which are of fundamental importance in how to generally develop the Japanese dairy farming industry to a higher level have been prioritized. Next step will be a deeper discussion between the involved parties of how to operationalize relevant activities into specific actions.

**A: Data management**

In order to get a strong and effective control, follow-up and decision system for the dairy farmer it is important to have a valid data management system. We have in Denmark a high level of experience and expertise in setting up a data structure, where we get input from different sources, including milking robots etc. We can combine this with a milk recording system, so we get data per cow, and not just from the entire herd.

Due to our experience and expertise we can support on the technical/IT foundation, setting up the data collection structure, training in the use and implementation – and finally introduce how to use the data to improve the performance at the farm. This data set-up can be made both very simple and very complex – depending on the level of the farmers and advisors, but it will provide the basis for further development of the Japanese dairy farmers.

**B: Milk production**

By having a focus on the milk quality and control of each farm, it is possible to increase the production (yield per cow) and in the same time increase the quality of the milk, so it can be used for more high value/quality dairy products at the dairies. We have good experience in taken our knowledge and techniques of the milk quality team to other markets outside Denmark, and we have cases from China, Tunisia, Russia and other European markets, where we have supported the up-skill process and local implementation of a milk quality program.

**C: Feeding and crop production**

In order to secure both a higher milk production and having control of the entire livestock feed supply (including the animal waste handling), we can support in setting up a system, where the goal is a higher self-sufficiency rate and a higher quality for the roughage. This will consist of a test set-up for making new and better varieties of the different crops, and bringing all this into a better mix for the cows, and finally closing the circle by having a higher utilization of the animal wastes. All elements are part of creating a sustainable dairy farm, but which in the same time results in a higher milk production for the single dairy farmer.

**D: Education system**

To generate interest for the young people to become dairy farmers, there are some politic and economic factors, which could be changed to make it more attractive. In Denmark there is generally a trend from seeing the farmer as a “farmer” to see the person as a “company manager”. It is of course influenced by the structural changes, where there are gradually fewer farms, but where each farm is getting larger, and therefore becoming a more complex business to control, more people to manage and big scale economy. This is appealing to the young people.

In the same time the education system is built up very flexible, so the young people get a high degree of responsibility in the practical part of the education, but in the same time the education opens a lot of different doors in the rest of the education system, if the person decides to change the career way after some time.

There we will be able to supply our knowledge and experiences to the Japanese system and in the same time build up the possibility for making exchange-programs for the students.

**E: Breeding program**

In the process of building up a higher production, we can also supply knowledge and systems to improve the breeding program for the Japanese dairy farmers. Again we have both very simple and very complex set-ups that can be applied according to the present level, the needs and the local possibilities.
To assist and improve the breeding programmes for the Japanese farmers, the Danish set-ups can be adapted to fit the present level, the needs and the local possibilities.
This report has highlighted several areas of possibilities where Japan and Denmark can work much closer together to support the Japanese dairy farmer in setting up a long-term sustainable and profitable business – in the interest of the dairy farmer, the Japanese consumers, the history and traditions within the Japanese culture, and finally supporting the overall economy of Japan.

To actually implement these activities, systems or programs, a recommended next step will be to go in direct dialogue with the relevant stakeholders from both countries – finding a suitable way to get the highest effect with the optimal allocation of resources, setting up the smart goals and making the best plans.

It will require investments and a long-term view, but reaching the common goals of improving the Japanese dairy farmer sector, is for sure possible, with the right support from all parties. And there we can from the Danish side supply enormous experience, knowledge and tools that have already proven to work both in Denmark and in other countries, where they have been applied.
ABOUT SEGES

SEGES offers solutions for the agriculture and food sector of the future. Our prime objective is to identify the commercial potential in agriculture to provide Danish farmers and horticulturalists with the best tools for running their businesses more profitably and in a way that takes account of the environment and animal welfare.

SEGES covers all aspects of farming and farm management – from crop production, the environment, livestock farming and organic production to finance, tax legislation, IT, architecture, accounting, HR, training and conservation. This is carried out in close partnerships with universities, government departments, businesses and trade associations.

HEALTH PROMOTION
Our development work also involves the integration of health promoting products. As an example, we are currently investigating the health promoting properties of rapeseed oil and oats. You could say that we endeavour to make the healthy even healthier.

TECHNOLOGY
Danish farmers are among the most efficient in the world at adopting new technologies and methods. At SEGES we trial new methods on behalf of farmers, including a concept known as FarmTest, which puts new technologies into practice on farms.

SAFETY
We are working to improve the safety of farmers and their employees. Our working environment consultants are also experts on the safe handling of machinery.

SEGES is owned by the Danish Agriculture & Food Council.

SEGES BUILDERS BRIDGES

SEGES builds bridges between research and practical farming. At the same time, we aim to develop our products and services in partnership with our users. We ensure that the latest knowledge and technology is deployed by Danish farmers on their farms as rapidly and efficiently as possible.

Some of our findings are the result of our participation in national and international projects and through our extensive research work. We collaborate with research institutions, public authorities and private companies from across the world, which enables us to draw on public research and development funds to promote innovation within the agriculture and food sector.

SEGES sells specialist advisory services, IT programs and other products, and we also manage a number of development and service functions for the 30 farmer-owned advisory companies throughout Denmark. These services and our commercial activities account for a large part of our turnover.

SEGES is part of Agro Food Park, which combines knowledge and entrepreneurship. The dairy company Arla Foods, for instance, is building its new global innovation centre here, and in 2018 Aarhus University will transfer its food research facilities here, too. 50 companies and 925 jobs are currently based at Agro Food Park, which opened in 2009 and was developed on the initiative of the then Knowledge Centre for Agriculture.
SEGES P/S is a limited partnership company, which offers solutions for the agriculture and food sector of tomorrow. We develop business opportunities and services in close partnerships with our customers, research institutions and companies worldwide.