Inauguration speech
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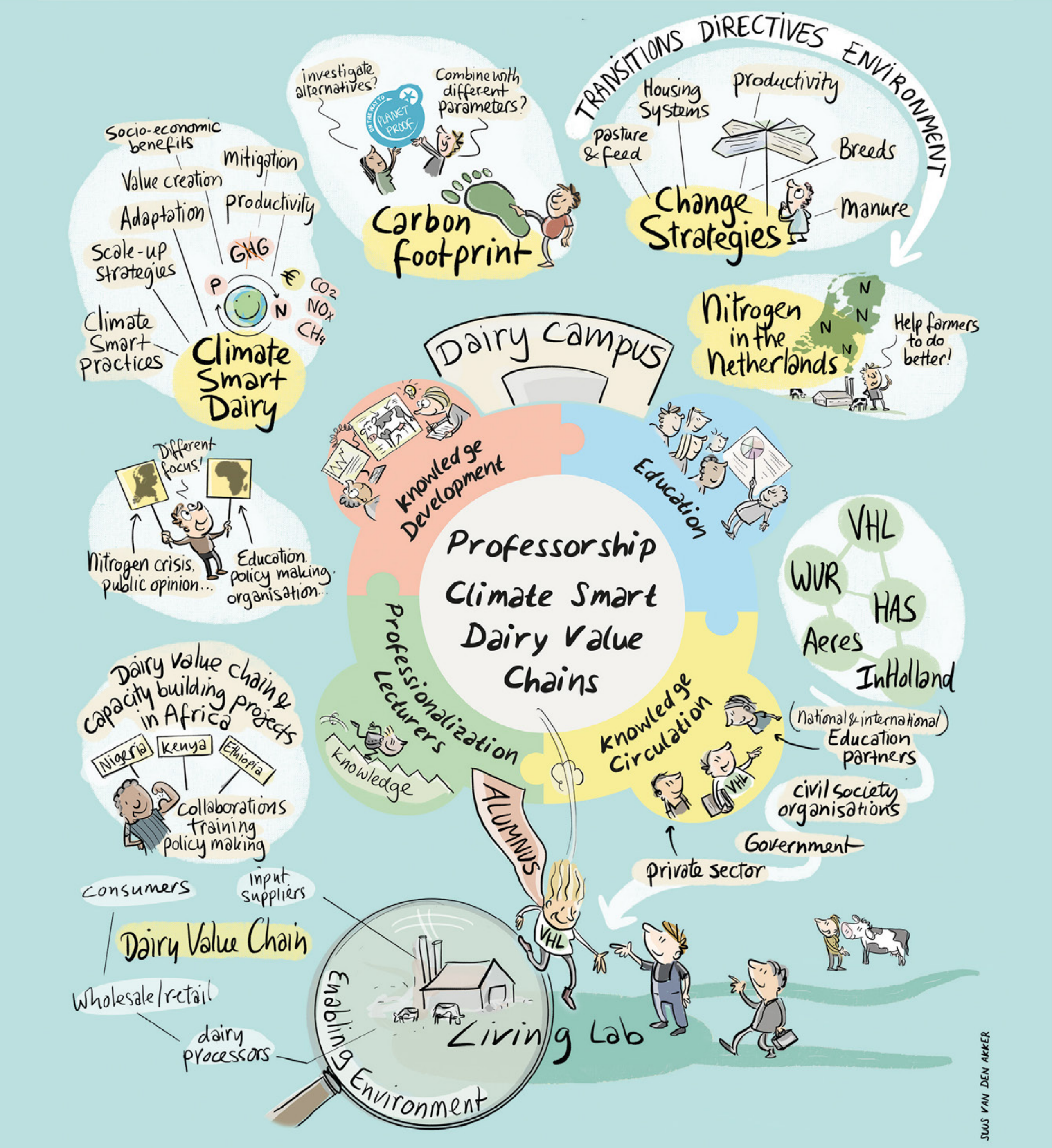
van hall larenstein
university of applied sciences



HAPPY COW, HAPPY FARMER
HAPPY CUSTOMER, HAPPY LANDSCAPE, HAPPY ENVIRONMENT!

CLIMATE SMART DAIRY VALUE CHAINS - THE DUTCH AND INTERNATIONAL CONTEXT

Speech by dr. Robert Baars at the official inauguration as Professor in Climate Smart Dairy Value Chains

Van Hall Larenstein University of Applied Sciences

24th September 2021
Dairy Campus, Leeuwarden, The Netherlands

The professorship is financed through the "Education Programme" of the Dairy Campus. *Samenwerkingsverband Noord-Nederland (SNN)* provides the main subsidy to implement the Education Programme.

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◂ Photograph: Chair of the Executive Board of Van Hal Larenstein, Mr. Jan van Iersel (right), officially endorsing the inauguration of Robert Baars.

OUTLINE

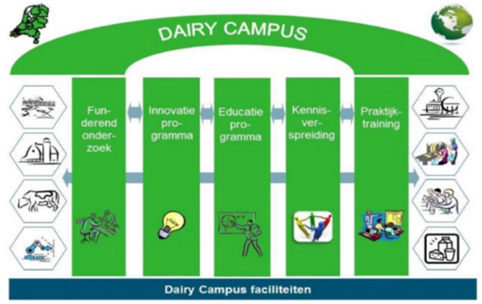
My aim in this presentation is to focus on five topics. First, I am going to address the focus of the professorship, but also explain what a professorship is as many of you are not familiar with professorships in the context of Universities of Applied Sciences. This will be followed by "What is Climate Smart Dairy?" and then in relation to this the concept of carbon footprint. Topic four is on nitrogen with a focus on the Netherlands and finally I will address a number of potential change strategies.

The figure on the first slide (and on the cover of this publication) forms the basis of my presentation.

1. **Focus professorship CSDVC**
2. **Climate smart dairy**
3. **Carbon footprint parameter**
4. **Nitrogen in the Netherlands**
5. **Change strategies**

COLLABORATION WITH THE DAIRY CAMPUS

First of all, I would like to indicate the relationship with the Dairy Campus. This professorship is, among other initiatives, financed through the education programme of the Dairy Campus. This is the reason why this inauguration is celebrated here on the Dairy Campus in Leeuwarden.



The education programme is one of the five pillars of the Dairy Campus:
1. fundamental research
2. innovation programme
3. education programme
4. knowledge dissemination
5. practical training.

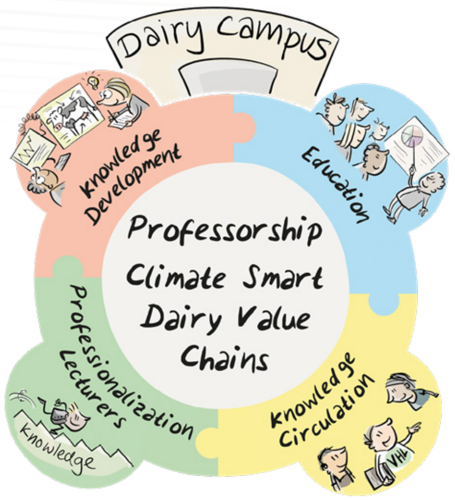
The first phase of the education programme was in 2015-2018 and had four professorships; phase two 2019-2025 has two professorships.

Phase 1 (2015-2018)	Phase 2 (2019-2025)
Sustainable Dairy Farming	Sustainable Dairy Farming
Herd Management and Smart Dairy Farming	Climate Smart Dairy Value Chains
Cost-Effective Dairy	
Dairy Value Chains	

PROFESSORSHIP IN CLIMATE SMART DAIRY VALUE CHAINS

Professorships at VHL have four main tasks:

1. Knowledge development: contributions to the development of knowledge through applied research.
2. Educational development: contribution to and involvement of the professorships in the development of lectures and the curriculum.
3. Professionalisation of lecturers: contribution to the professionalisation of lecturers, including PhD programmes.
4. Knowledge circulation and valorisation: the research results shared with the business community, knowledge institutes and civil society organisations.

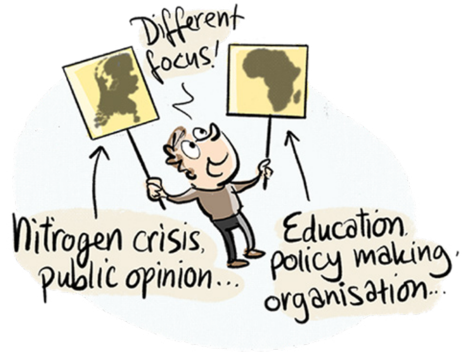


These four core elements are integrated in professorships in Universities of Applied Sciences, not only this professorship, but all over the Netherlands. The objective of all these professorships is to stimulate knowledge development through the involvement of teachers and research staff in applied research and education as well as in knowledge circulation among partners.

In the professorship "Climate Smart Dairy Value Chains" the focus is on three main topics: 1. climate smart dairy practices, mainly at farm level, 2. the socio-economic benefits of these practices, or their effects on the environment, and 3. Scaling-up, or how the adoption of good practices can be triggered. An example of scaling-up is the Gazoo from JOZ that was explained by one of the guest speakers. Once a technology is working, how can implementation then be stimulated by a larger group? This is what scaling-up is about.

NATIONAL AND INTERNATIONAL FOCUS

The professorship deals with two different regions, the first one being the Netherlands and the second is the international focus. The figure shows the map of Africa, as it is here where the focus will be. It is a strategic choice made with colleagues, some of whom focus on other regions.



There are huge differences between dairy in the Netherlands and in Africa. The Dutch agricultural system is high input - high output, whereas in Africa it is low input - low output, with all kinds of positive and negative consequences. In the Netherlands there is a high level of nitrogen emission, in Africa there is not. In the Netherlands milk is produced with a low carbon footprint per kilogramme of milk, while in Africa the carbon footprint is high. There is well-balanced quality feed for cows in the Netherlands, cows in Africa face serious feed shortages. The Netherlands exports most of its milk products, Africa imports, and so on. The situations are therefore completely different, but one thing remains the same, i.e. dairy involves on the one hand technical dairy practices and on the other hand the socio-economic environment. These two disciplines are also interrelated.

In the chart below the blue and orange bars represent four countries. The blue bars are what we call formal dairy chains, where milk is collected every day, processed in factories and quality is controlled. The orange bars represent the informal dairy chains where there are no processors and no quality control, but where milk still reaches the consumer. In most countries both formal and informal dairy chains exist. This is true in the Netherlands too, with in recent years a slight increase in farmers selling milk directly from their farms, mainly for economic reasons. The graph shows a small proportion of informal chains in the Netherlands but in Africa it is the reverse. This is also why this professorship is called Climate Smart Dairy Value Chains. Dairy Value Chains forms part of it.

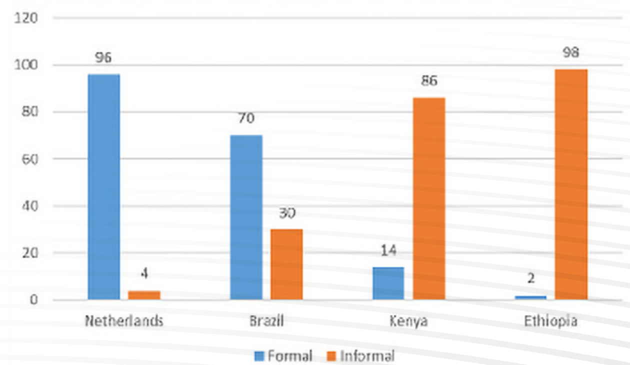
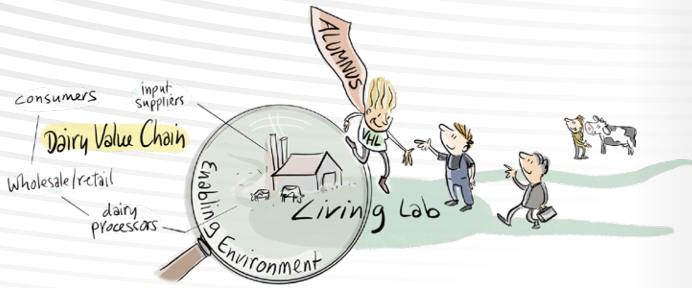
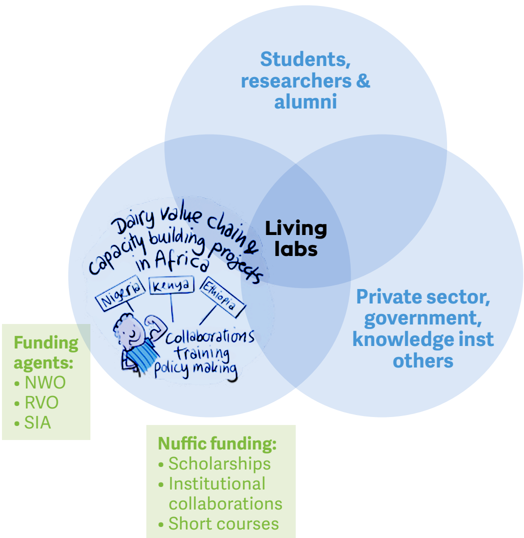


Chart: Milk delivered to formal and informal chains (situation 2015)

LIVING LABS



Our projects are implemented by means of the living lab approach. This was also mentioned by our guest speaker from FrieslandCampina in the context of dairy development in Nigeria. FrieslandCampina is actually the key partner in this living lab, VHL is a partner, as are local institutions. A living lab is not a lab, but it is a network of partners working together on certain challenges. Projects and concepts of climate smart dairy are brought together in the living labs.



Van Hall Larenstein University of Applied Sciences would like to involve students, teaching and research staff and also alumni in these living labs. Of course, this will take place in collaboration with other partners, such as private sector partners, or other knowledge institutions. In the African

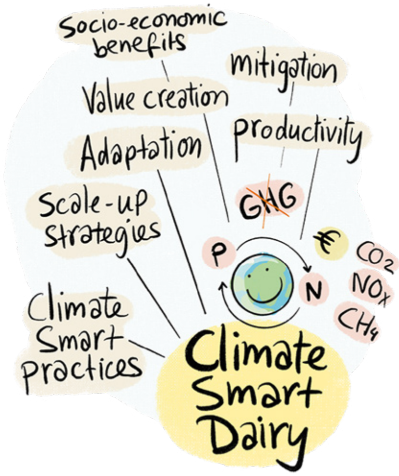
context both research and capacity building projects are being developed. These capacity building projects are very often short courses in which alumni participate. It is through these courses that alumni become partners in living labs. This was exactly what guest speaker Dr. Simon Omondi from Kenya was talking about.

The group photograph shows participants of a short course in Kenya, which was linked to the living lab network. In the context of Nigeria, VHL colleagues developed a similar short course on capacity building in dairy and gender which will be linked to the living lab. This is how a living lab works. It has a long-term vision and a long-term strategy by bringing all the partners together through different initiatives. All individual projects add to the living lab. Thus a project is not a living lab, rather the whole set of projects that are being implemented over a period of time forms the living lab.

CLIMATE SMART DAIRY, WHAT IS NEW?

So far the discussion has been about "what is a professorship?", and "what is the focus or strategy?", and now it is time to take a look at the content.

The second topic of this presentation is the elaboration of climate smart dairy. There are three elements in the definition of climate smart dairy, or in the larger context of climate smart agriculture: 1. Reduction of greenhouse gas emissions, 2. Consideration of resilience in the context of climate smart dairy through adaptation and mitigation practices, 3. Maintaining the income of farmers by means of sustainable practices. This is a huge challenge, and applies both for Africa and for the Netherlands. The above-mentioned topics of the professorship (climate smart dairy practices, their socio-economic context and scaling of good practices) are also linked to this.



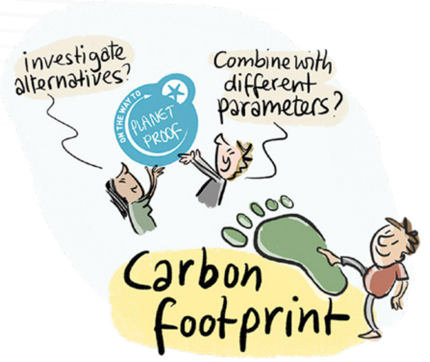
There is one particular aspect of climate smart dairy which I would like to share with you. "Climate Smart" sounds like the latest trend. Suddenly lots of people are talking about climate smart agriculture. Yes, this is true, and we call this a paradigm.

The definition of a paradigm is a standard, perspective, or set of ideas. A paradigm is a way of looking at something. We are now looking at dairy through these new glasses. The new glasses are climate smart dairy and this means looking at dairy from the perspective of global warming and climate change. Science has changed the glasses it looks through. But the farmer is still the farmer, and the cow is still the cow. Climate smart dairy is a new way of looking at the dairy industry.

The discussion on nitrogen is different and is not part of the general discussion on climate change, as will be considered later.

OBJECTIVE MEASUREMENT OF CARBON FOOTPRINT

Global greenhouse gas emissions are estimated in terms of carbon footprint. I would like to explain here how this is measured. Reference is made to the table below.



The focus is on the three main greenhouse gasses that are important in dairy production, but in reality there are several more. These are carbon dioxide, methane and nitrous oxide. Measuring these three gasses is difficult enough. In the table a value of 25 is shown for methane which means that the 100-year global warming potential of methane is 25 times higher than that of carbon dioxide. The main causes of greenhouse gas emission at dairy farm level are for carbon dioxide the use of fuel in machinery, and the disturbance of soil through land clearing and ploughing; for methane mainly rumen fermentation and to a lesser extent manure storage; and for nitrous oxide the manufacturing of artificial fertiliser as well as manure storage and application on the field. Guest speaker Andreas Wilkes mentioned in his presentation that about 85% of methane emission is due to fermentation.

Gas		100-year GWP	Main sources
CO_2	Carbon dioxide	1	Fuel consumption, organic matter soil
CH_4	Methane	25 (28)	Rumen fermentation, manure storage
N_2O	Nitrous oxide	298 (265)	Artificial fertiliser, manure storage & application

Source Greenhouse gas protocol (4th (or 5th) IPCC assessment report)

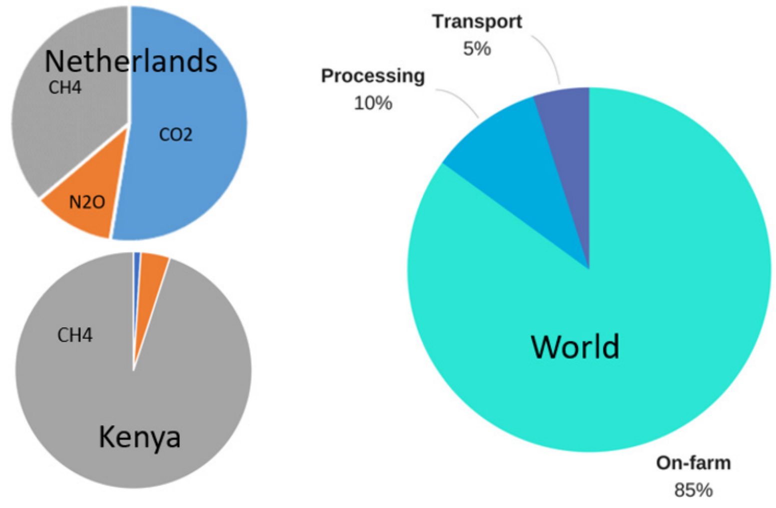
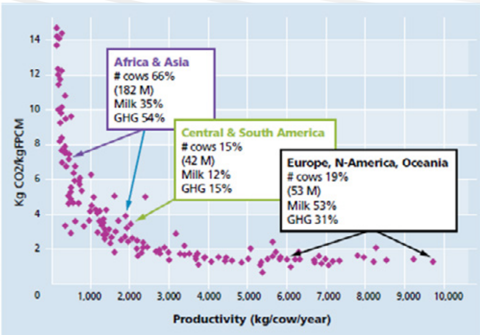


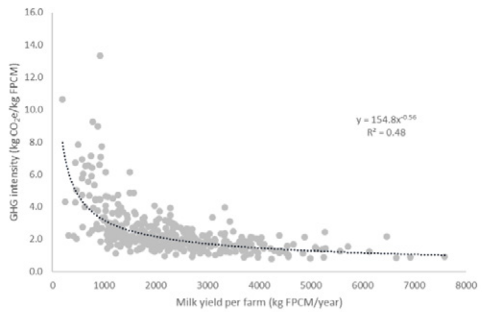
Chart: Greenhouse gas emissions in the Netherlands (Source Doornewaard et al. 2017) and in the Kenyan small holder dairy farming system (Source GLEAM 2017).

Referring to the pie charts above, and specifically the pie chart to the right, it can be observed that in the total dairy chain, greenhouse gas emissions are mainly (85%) created at farm level. The other 15% are due to inputs, processing of milk, transport, among others. The main challenge of greenhouse gas reduction is therefore at farm level.

Looking at the pie charts on the left above, it can be observed that the relative contribution of methane is much higher in Kenya than in the Netherlands. In absolute terms the situation is completely different. The relative low production of methane in the Netherlands is a result of dividing the methane of one cow over many (30) kg of milk produced, while in the Kenyan context methane is divided over only few (2) kg of milk. The absolute methane emission of a Holstein Friesian cow in the Netherlands is probably higher than the Kenyan crossbred cow because she is bigger in size and because she consumes much more feed.



Charts: Carbon footprint expressed in CO_2-eq/kg milk in the world (top, source Andeweg et al. 2020) and in Kenya (below, source Wilkes et al. 2020).



The chart at the top explains the relationship between greenhouse gas emissions versus milk production and is expressed as kg CO_2-equivalents per kg milk. In fact, it is common to use Fat and Protein Corrected Milk (FPCM), but in this presentation simply kg milk is used. The higher the milk production (in kg/year), the lower the carbon footprint (in kg CO_2-eq per kg milk). And vice versa. Each dot in the graph on the left represents a country average. Countries with well-developed dairy systems, like the Netherlands, are in the good part of the graph (bottom right) with high milk production and low CO_2/kg milk. This means that the Netherlands is performing well.

African countries such as Ethiopia, Kenya, Nigeria, are in the wrong site of the graph (top left). The bottom graph was presented by Andreas Wilkes earlier in this event, and shows the variation within one Kenyan dairy system. This variation within one country indicates room for improvement.

There has been and still is a considerable promotion of the low emissions per kg milk in the Dutch dairy system by Dutch experts in the international context. Based on this "excellent" figure, African countries are encouraged to boost production – which they were already doing of course - and achieve lower emission per kg milk.

But there is a problem with this parameter as in isolation this parameter or concept does not tell us much. The parameter is a good measure of efficiency but not of sustainability in dairy farming systems, yet it is often used for this purpose. If it were a sound parameter for sustainability, the Netherlands would not be facing all the environmental challenges of today. But these challenges exist, e.g. phosphorous and nitrogen pollution to the air and or groundwater and reduced biodiversity. In conclusion, kg CO_2-eq per kg milk is a very useful parameter for measuring efficiency, but not for sustainability. Additional parameters are necessary to monitor greenhouse gas emission in relation to sustainability. Alternatively, we should reconsider when to use it or when not to use it.

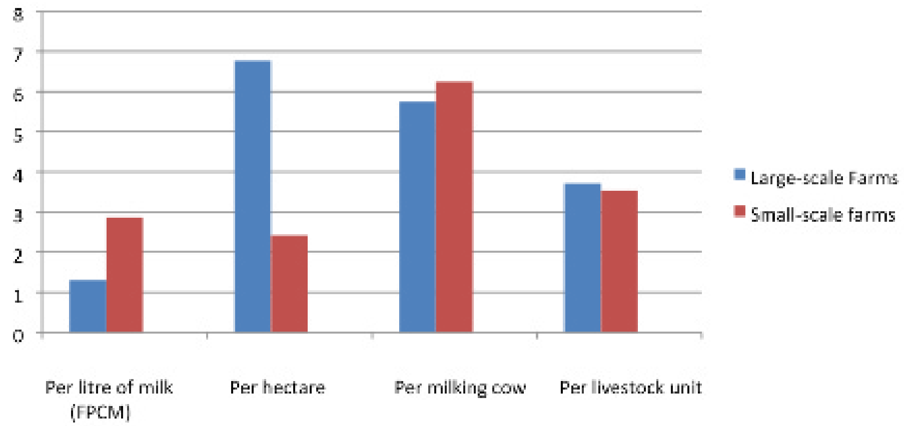


Chart: Emissions on small and large-scale dairy farms in Zimbabwe (Source Hore 2021).

I am going to demonstrate this in the next example using the chart above. This chart is actually a result from the thesis of one of the Van Hall Larenstein Master's students who carried out research in Zimbabwe. It reports latest outcomes since the student defended the thesis very recently. In this chart two farming systems are compared.

One is large-scale dairy farming (in Zimbabwe approximately 100 dairy cows per farm), the other small-scale dairy farming (approximately 25 cows). The first two bars on the left in the chart represent the carbon footprint per kg milk. What we can observe, like in the Netherlands, is that larger farms with high intensive management and higher production levels have a lower carbon footprint per kg milk compared to the small-scale farmers. But when we look at the next set of bars in the chart, we see the reverse. The first set of bars concerned the carbon footprint per kg milk and the second set of bars the carbon footprint per hectare. Which is better?

We have embraced a very useful parameter as a key indicator measuring carbon footprint used in policies and implementation of practices, but from the sustainability point of view it falls short. It is probably better to combine it with additional factors and it must be possible to find practical ways to do this. People may find this strange. What I would like to do is to work with partners to reconsider how the parameter can be adapted to better fit dairy practice by combining it with other parameters.

This is not about Zimbabwe only, it is also about the Netherlands. For example, the same situation applies when considering normal dairy farms in the Netherlands, and comparing them with organic farms. The normal farms are represented by the blue bars and the organic farms by the red bars. Indeed, this is not an issue just in Zimbabwe, but is an issue that applies worldwide.

Another aspect that I would like to highlight is a research output from Ethiopia, also a result obtained by our PhD students with regard to CO_2-eq/kg milk! In the Netherlands dairy farms produce milk, and more milk. And finally, at the end of the productive life of the cow, there is meat. But in the African context there are more important products besides milk. Guest speaker Jeroen Elfers mentioned this for Nigeria where farmers have a meat-based system. Thus it is difficult to compare milk in the Netherlands with milk in Nigeria. Milk in the African context is different because milk is one of the many products. In the table below it is obvious that the CO_2-eq per kg milk declines when the emissions are allocated to other products. The parameter CO_2-eq per kg milk therefore needs further discussion.

Allocation (Ethiopia)	Urban	Peri-urban
Unallocated	1.79	6.52
Food (milk, meat)	1.71	6.28
Economic	1.52	4.61
Livelihood	1.02	3.45

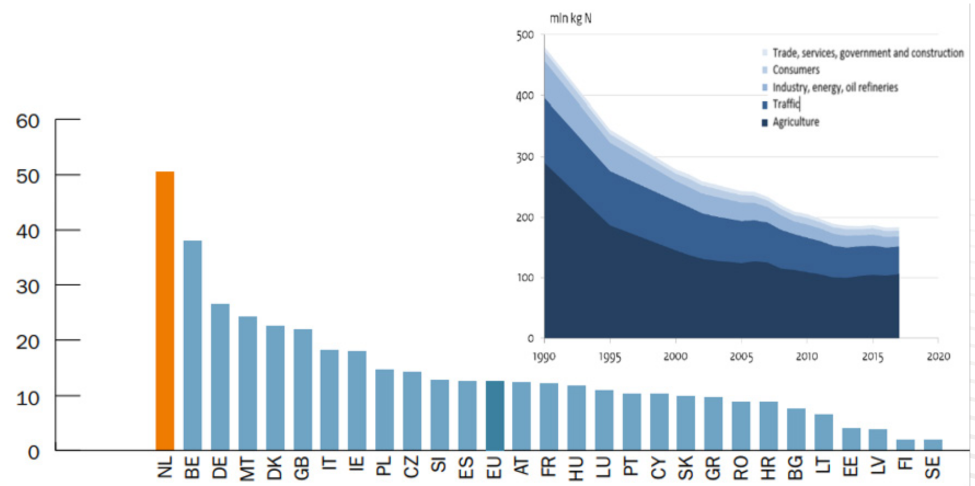
Table: Carbon footprint (CO_2-eq/kg milk) in Ethiopia allocated to different outputs (Source Biruh et al. 2019). Methodology based on Weiler et al. 2014.

A LOT OF NITROGEN

I have said enough about CO_2. The next few slides will deal with nitrogen in the Netherlands. Nitrogen is a serious problem in the Netherlands. In Africa there is a shortage of nitrogen. Here again, the difference is based on low input – low output versus high input – high output.

Referring to the top right line graph in the chart below, it can be observed that nitrogen emissions in the Netherlands have been reduced considerably from 1990 to 2017. Three practices that can be mentioned in this respect are 1. the injection of manure into the soil instead of spraying on the fields, 2. the reduction of crude protein (cp) in the diets of dairy cows from 25% cp in 1990 to about 16-17% today, and 3. reduction of fertiliser application per hectare. These are the main sources of nitrogen. However, when looking at the bottom bar chart, despite the success story of reduced nitrogen emission, the Netherlands was in 2017 and still has the highest ammonia (NH_3) emission.

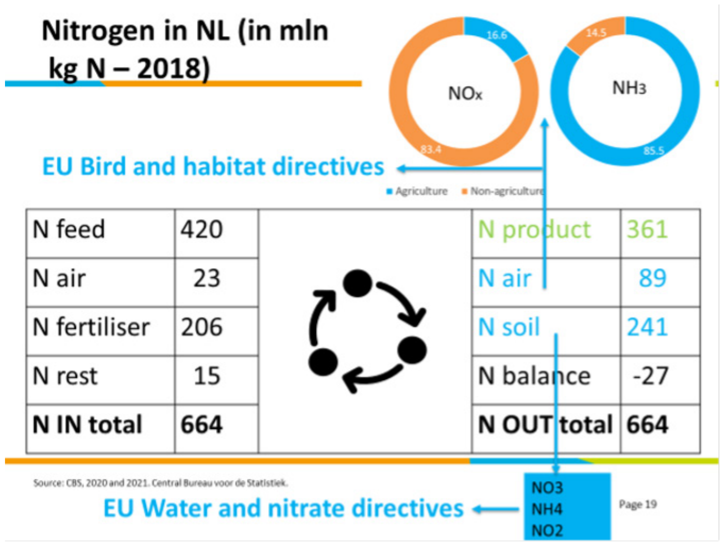
The bottom bar chart shows that the Netherlands, despite all these efforts, is still number one in Europe when it comes to nitrogen emissions. In conclusion, a lot of progress has been made, but it is still not enough. We need to go much further than what has already been done so far, and particularly when comparing the Netherlands with other countries.



Charts: N emission to the air (kg N/ha), situation in 2017. Source bar chart (bottom left) TNO, 2019; source line chart (top right) RIVM, 2019.

The next slide contains a lot of information, which I would like to summarise. On the left there is a table with nitrogen inputs to the farming systems, actually not only dairy but agriculture in general, and the table to the right indicates what leaves the agricultural system. A closer look here shows that the inputs are mainly feed and fertiliser, while the outputs are in the first place products such as milk, cheese, etc., which is desirable, but N-air and N-soil indicated in blue are nitrogen losses escaping to the air and to the soil. These are considerable, and almost the same as what leaves the system in the form of products. This reflects the current situation and forms a huge challenge.

There are a lot of rules and regulations in this area, particularly EU directives, and four of these are stated in the slide (bird, habitat, water and nitrate directives). These directives are forcing the Netherlands to take action. I wonder where the Netherlands would have stood without these directives. The push by the EU stimulates the Netherlands to take action.



Slide from presentation. Nitrogen input and output NL (in million kg N – 2018). Source CBS 2020 and 2021.

The following is an interesting question, when combining the topics of climate smart dairy and nitrogen. Why is carbon footprint expressed per kg milk, and why is nitrogen emission expressed per hectare? Discussions with my colleagues and partners have not resulted in any clarity here. Why is carbon footprint also not measured per hectare? Because this would provide other information and enable comparison from different perspectives. Also, why is nitrogen emission not expressed per kg milk?

	/kg milk	/ha
Carbon footprint	✓	x
Nitrogen	x	✓

Referring to the graphs presented earlier, with the low CO_2-eq emissions per kg milk: if the same graph were to be made for nitrogen, we would see the reverse: high N-emissions per kg milk. Then it is Africa that is setting the good example.

My ambition is to work on this topic through this professorship together with all the partners involved. And I aim to find ways and means to obtain clarity on this. Maybe parameters can be combined, or new ones developed. This is the challenge, and at this moment, two VHL Master's students are working on this topic as a pilot commissioned by this professorship. They are calculating all possible combinations of nitrogen, CO_2, kg milk, hectare, intensive, extensive, Europe and Africa.

WHAT CAN BE DONE?

What can be done to address the above challenges in the Netherlands and in the world? What change strategies can be applied? Personally I like the focus on "change strategies". Van Hall Larenstein University of Applied Sciences has included the concept of "facilitator of change" in the multi-year strategic plan, which I am really pleased about.

In the figure two levels of strategies are illustrated. The outer circle illustrates strategies at macro or national level: transitions based on laws, regulations and directives driven by environmental challenges.

The inner circle is under the influence of dairy farmers and partners in the sector. In the inner circle there are five main elements: 1. pasture and feed, 2. housing systems and in relation to this 3. manure management, 4. breeds and finally 5. productivity. In the Netherlands productivity is not on the agenda. It is nevertheless important, but it is not top of the research agenda. Breeds are also not on the research agenda, but it is likely they will be high on the agenda soon in relation to individual cow variation in methane emissions.

In the table on the next page transition pathways of the outer circle are considered using two strategic documents. The left column focusses on international dairy development pathways from the perspective of the Dutch "international dairy cooperation community". Many people contributed to this document and it is a great effort supported by many. In the right column reference is made to transitions in the Netherlands in a recent report by the Sociaal-Economische Raad (Social and Economic Council), the main advisory body to the Dutch government.

In the Netherlands the seven transitions represent different levels of intensity, from high intensive closed systems on the top towards more extensive systems going down the list. All these seven pathways are potential pathways dealing with climate smart agriculture and nitrogen. The Gazoo (N-stripper), described by guest speaker Peter ten Hoeve from the company JOZ, will fit in some of these pathways, but not all. The leverage points indicated on the left side of the table correspond with the other guest speaker, Mr. Jeroen Elfers from FrieslandCampina, who explained dairy development in Nigeria. The ten building blocks approach of FrieslandCampina corresponds with these six leverage points on the left side of the table.

Transition pathways for **dairy production, dairy chain** or **exit**

Africa/Asia	The Netherlands
Affordable nutritious diets	**High-tech closed systems**
Keep milk safe	**High-tech open systems**
Inclusive competitive chains	**Sustainable dairy production**
Sustainable dairy production	**Organic farming (+)**
Capacity building professionals	**Social enterprises (care, etc.)**
Development, trade policies	**Nature and landscape inclusive**
	Stop farming
Source: Andeweg et al. 2020	*Source: SER 2021*

I have coloured the transition pathways from the perspective of dairy production (green), dairy chain (blue) or exit (orange). In the Netherlands transition pathways are more focused on dairy production, whereas in Africa the focus is more on dairy value chain development. In Africa it is not possible to boost dairy production without encompassing the entire dairy chain including supporters and influencers.

In the Netherlands, there are basically three clusters of practices in relation to greenhouse gas and nitrogen emissions. One is related to housing systems and particularly floor systems, the second is manure management and the third is related to pasture and feed. The Dairy Campus, recently developed four relevant high-quality webcasts on this topic which are available online.

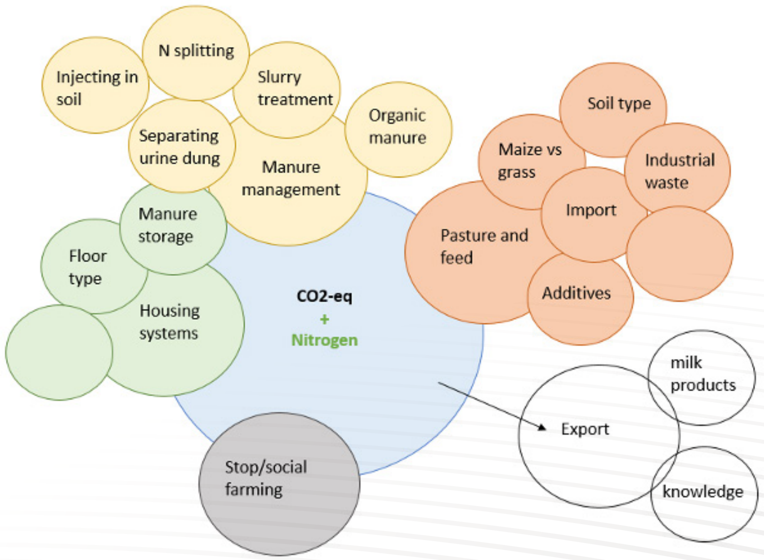


Figure. Topics Climate Smart + N Dairy agenda in the Netherlands

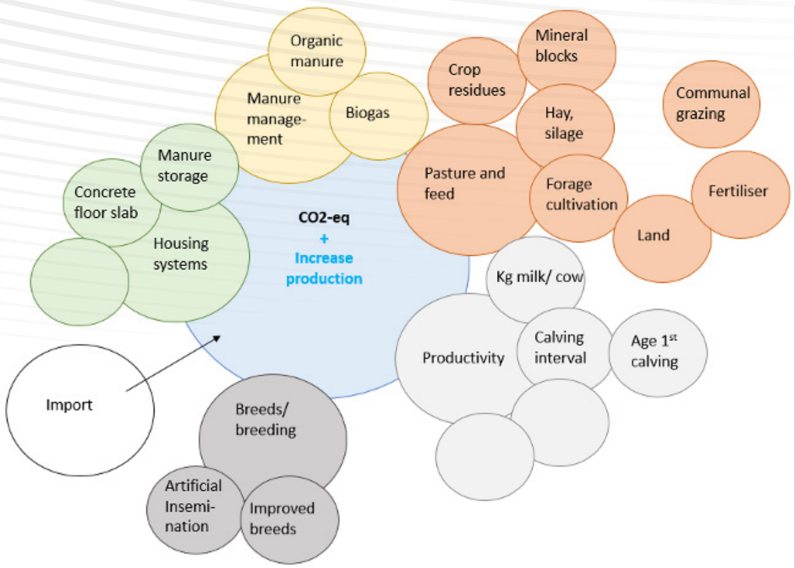


Figure. Topics Climate Smart Dairy agenda in Africa

In the African context the same three clusters are relevant: housing, manure and pasture/ feed. But the content of these clusters are quite different. In Africa again there is the issue of productivity. When I was a student some thirty-five years ago, we were talking about the same issues, i.e. housing, feeding, breeding, etc. The same topics are shown in this figure, and they have remained on the agenda all this time. The difference is, as mentioned earlier, that the glasses we look through have changed. Developments have not progressed sufficiently to replace these with more detailed approaches like in the Netherlands.

The figure shows that Wageningen University and Research as well as the four "green" Universities of Applied Sciences are working together on many projects. This applies for projects in the Netherlands, but also for international projects or projects in Africa. It is true that the Dutch green education sector is well integrated. However, Wageningen University and Research on its own is many times outperforming the other four together in terms of capacity.

Within the institutions indicated there are again different professorships that are working together. The agendas of the different professorships overlap. This is an advantage because the challenges the dairy sector is currently facing call for an integrated approach.

Some critical statements have been made here and there, but I did this to stimulate objectivity in judgements when comparing different situations and conditions. At the same time, there are many technical innovations that are available today, which are actual technical climate smart practices, for example the nitrogen stripper of JOZ, the Gazoo, as explained by guest speaker Peter ten Hoeve. But there are also innovations in the area of feed and manure management. I am fairly optimistic about the challenges that lie ahead. It will be difficult to implement solutions to all of these challenges at the same time. A lot of rules and regulations have to be taken into account and sometimes it seems that these hinder rather than help. But we also have to make sure that our farmers can stay in business. We have to help them to move forward. Farmers operate in difficult circumstances, with known effects on the environment, with expensive innovation pathways to deal with. The sector must work together to bring about sustainable change.

Dutch politicians are famous for their poldermodel (consensus model). The Dutch are very good at this on a political level, but when looking at the dairy sector, I do not see this. Camp A opposes camp B and both camps challenge one another, even taking each other to court. How great it would be to have a consensus model with camp A as partner of camp B. This is what is needed to take the next step.

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PROGRAMME

Date: Friday September 24th
Venue: Dairy Campus, Boksumerdyk 11, 8912 CA Leeuwarden
Due to COVID-19 physical attendance is limited to 50 persons
Online: CET 13:30-17:00 hrs
Link click here

13:30 hrs **Excursion Dairy Campus (optional)**

14:30 hrs **Arrival/coffee**

15:00 hrs **Welcome**
Niek de Boer, Director Applied Research Centre Leeuwarden, Van Hall Larenstein University of Applied Sciences

15:10 hrs **Partners in Climate Smart Dairy Value Chains**
- Pan African Dairy Alumni Forum
Dr. Simon Omondi. Assistant Director Value Chain Development, Kenya Agricultural & Livestock Research Organisation
- Backward Dairy Value Chain Integration in Nigeria
Jeroen Elfers (M.Sc.). Corporate Director Dairy Development & Milk Streams, FrieslandCampina, the Netherlands
- Green House Gas Emissions in Ethiopian and Kenyan Dairy Farming.
Dr. Andreas Wilkes. International consultant, Unique Forestry and Land-Use, Germany
- N-stripper - Manure Processing to Reduce Ammonia Emission.
Peter ten Hoeve. Product Developer, JOZ - Home of the clean stable, The Netherlands

15:50 hrs **Inauguration speech**
Climate Smart Dairy Value Chains - the Dutch and International Context.
Dr. Robert Baars. Van Hall Larenstein University of Applied Sciences

16:30 hrs **Reflection guest speakers on inauguration speech**
Dr. Simon Omondi, Jeroen Elfers, Dr. Andreas Wilkes, Peter ten Hoeve

16:45 hrs **Inauguration Robert Baars as Professor in Climate Smart Dairy Value Chains**
Jan van Iersel. Chair Executive Board, Van Hall Larenstein University of Applied Sciences

17:00 hrs **Closure and drinks**

VHL University of Applied Sciences (VHL) is a sustainable university of applied sciences that conducts high-quality applied research. This research carried out by professors, researchers, lecturers and students is always aimed at improving professional practice. The research generates applied, innovative solutions to issues from (international) business and society that contribute to a more sustainable world.

Thanks to this link between education, applied research and the labour market, research results can be incorporated into education and students are able to acquire competences that meet the demands of the labour market. The research therefore directly contributes to the mission of our university of applied sciences: to train professionals who contribute to a sustainable and better world.

Colofon

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