



## Slutrapport

# Digitaliserad grisproduktion: Hur långt har vi kommit och hur går vi vidare?

**Projektnummer: R-18-62-991**

**Projekttidsperiod: 2018 08 01 – 2019 02 28**

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**Del 1: Utförlig sammanfattning**

Syftet med projektet var att:

- Ge information och förbättra kunskapen om hur managementstrategier i produktionssystem för gris påverkar lantbrukares dagliga arbetseffektivitet.
- Ge information och förbättra kunskapen om datarelaterad infrastruktur på gårdsnivå samt möjligheter till datautbyte mellan olika parter; lantbrukare, forskare, rådgivare, veterinärer.
- Ta de första stegen i utvecklingen mot en lantbrukar-orienterad smartphone-app för bättre produktionsmanagement. För att uppfylla projektets mål undersöks det dagligt arbetsflödet, datarelaterade rutiner och faktiskt behov av digitalisering hos lantbrukare, rådgivare och veterinärer. Utvalda grisproducenter följs i sitt dagliga arbete för att samla in detaljerade uppgifter för att kartlägga grisproducenternas specifika behov och göra ett första försök att utforma en mobilapplikation för datahantering och presentation.

Projektet bestod av två delar. Den första delen utgjordes av intervjuer (ansikte mot ansikte liksom genom en enkät som skickades online till grisuppfödarna med hjälp av LRF Skåne). Den andra delen bestod av samtal med utvecklare av mobilapplikationer från Sony AB i Lund, om möjligheten att ta fram ett ramverk till en app för bättre hantering av det dagliga arbetsflödet (baserat på slutanvändarens behov).

Projekt har fått finansiering genom:



Resultat från den första delen visade att attityden till teknik inom grisuppfödningen är huvudsakligen positiv och att uppfödarna ser en potential att förbättra arbetets effektivitet om bara rätt applikationer kunde utformas för specifika arbetsmoment (t.ex. checklistor och att göra-listor, sjukjournaler, hantering av produktionsdata). Intervjuerna gav även indikationer på en uppfattning bland uppfödarna om att “digitala” arbetsmetoder i det moderna jordbruket skulle kunna locka yngre människor till branschen och även bidra till att förbättra konsumenternas bild av grisuppfödningen. En sådan förbättrad bild skulle kunna bli resultatet av de möjligheter som tekniken medför: digitala arbetsflöden och sensorer som sparar tid, som uppfödarna istället kan använda till att vårda eller observera djuren.

Studiens andra del resulterade i en “demo”-app baserat på data från intervjuerna och tidigare pilotstudier kring apputveckling. En hel del extra arbete krävs dock fortfarande för att appen ska kunna användas i uppfödarnas dagliga arbetsflöde. Uppfödarna kommenterade under intervjuerna att enkla “att göra”-listor, med påminnelser och tydliga funktioner för “personligt ansvar” bör prioriteras för att en sådan app ska ge verkligt mervärde.

Ett annat viktigt resultat från projektet var en indikation på bristande förståelse av termerna “teknik” och “digitalisering” inom grisuppfödningen. För att dessa metoder ska kunna accepteras inom produktionen tycks det finnas ett stort behov av effektiv kommunikation mellan olika aktörer (universitet, företag, uppfödare och rådgivande organ). Just detta resultat skulle kunna utgöra ett viktigt första steg mot en förståelse av grisuppfödningens behov av tekniska framsteg, liksom en möjlighet att belysa de praktiska utmaningar som skulle kunna lösas om dessa behov kunde tillfredsställas.

## **Del 2: Rapporten (max 10 sidor)**

### **Inledning**

Population growth is increasing the demand for meat, especially pig products. Domestic pigs are a fast-growing species with efficient feed conversion rates which make it particularly suitable for producing human meat protein. Demand for affordable food means that cost efficiency pressure exists towards the operation of fewer, but larger pig farms that are highly rationalised. As a result, the animal care providers (e.g. farmers, veterinarians, farm advisors) have less time to monitor and provide the proper care for each animal (Labajova et al., 2016; Eurostat, 2017b). To address these issues, means are required whereby the welfare of individual animals could be supported while at the same time maintaining the economies of scale that can be obtained with intensive farming (O'Donnell, 2010; Rydberg et al., 2011). Monitoring of individual animals through sensor technologies within different production systems and care strategies, in combination with health recordings, may provide crucial knowledge about important principles for sustainable animal production (Magne et al., 2010).

However, even considering the recent advances in digital technologies as well as the amount and complexity of data acquired from them, the practical “on-site” implementation of sensor-based solutions is still slower than expected (Fountas et al., 2006). As Van Hertem et al. (2017) state in their recent publication: “Most farmers do not have the skills and time to utilise new Precision Livestock Farming (PLF) technologies effectively”. One of the reasons for that could be that it is time-consuming to combine and analyse the data coming from sensors in different formats and frequencies, as well as plausibly represent that data (Kaivosoja et al., 2014). Nevertheless possible pitfalls of data management or complexity of the existing PLF products/solutions, there is no clear explanation of farmers’ need or “acceptance levels” to move towards digitalised agriculture. The shift from “classical” farming to “digital” requires, aside from technological development, specific workflow optimisation to secure the successful integration of new solutions into the existing framework (Kaloxylas et al., 2012; Blank et al., 2013). The workflow optimisation can be defined as determining the input-output combination that results in the highest work efficiency per unit of time. Considering the factors mentioned above, the optimisation of pig production becomes, more than ever, essential to maintaining the profitability of the industry (Cardin-Pedrosa and Alvarez-Lopez, 2012). Indeed, as a competitive industry, pig production is characterised by small profit margins (Olsson et al., 2009; Rydberg et al., 2011), making every improvement viable and essential.

Over the course of past 10-15 years, Farm Management Information Systems (FMIS) in animal production have evolved from simple “record keeping”, where information often spread over different sheets of paper and/or whiteboards, into sophisticated computer systems with separate databases and multiple sensors attached to animals/building control systems/equipment (Parsons et al., 2007; Kitchen 2008; Cabrera et al., 2010). The core purpose of the existing FMIS is to meet the increased demands to reduce production costs, optimise the existing workflow and comply with good animal health and welfare. One of the core components responsible for enhanced decision making is the availability of timely, high-quality data (Verstegen et al., 1995; Magne et al., 2010; Kajvosoja et al., 2014). However, the current situation in pig farming is that most data and information sources (e.g. from farmers themselves, veterinarians or advisors) are fragmented, dispersed, complicated, and time-consuming to use. This indicates that the full potential of such data and information are not being fully exploited. According to latest AGRI Strategy paper (AGRI Strategy, 2016), all the smart- and mobile technologies are hailed as one of the most important recent innovations for all actors in the agricultural sector (Kruize et al., 2013). It is also clear that digital/mobile technologies will also be enablers in the research process (e.g. the generation, use and sharing of research data and applied science).

One of the crucial aspects of “real value of PLF” is whether commercial FMIS are capable of capturing the “idea-to-production” concepts developed in academia. The transfer of knowledge from “cutting-edge” research projects to “casual-every day-use” commercial product is of great importance and could determine further acceptance of technology in agriculture. Another question is whether the increased demands from “big-data-filled”

Precision Agriculture (PA) is being met by current development trends regarding matching application design, functionalities, attitude towards the end-user and actual “user-friendliness”. The answer to these questions will provide pivotal guidelines for future research development as well as provide knowledge on possible redirections for software and tech-developing companies.

## **Materiell och metoder**

The project was divided into two parts:

1. The first part was a qualitative study aiming to understand the definition and use of the word technology in pig production as well as the role of digitalisation in day-to-day farm management.

The questions for the qualitative study were separated in three areas:

- General information about production system (the farm);
- Concurrence and public interest/attitude towards Swedish pig production;
- Technology and digitalisation, their role in farm workflow and potential for development;

Due to the scope of the study (regional funding), the decision was made to split the qualitative study and perform face-to-face interviews, and further complement them with an online survey sent out by LRF Skåne. Initially, four interviews were planned (three in Skåne and one in Denmark to get a broader perspective on the topic and stimulate the discussion around cross country competitiveness). However, our Danish contact decided not to participate in the study, and we were not able to find a replacement. The selection criteria for interview candidates was based on farmer’s previous experience with technology (different solutions in place or planned) and their willingness to share the experiences.

The idea behind pre-selected candidates is called purposeful sampling: selecting “information-rich cases” (Patton, 1990) for deeper research. The purpose is to “select information-rich cases whose study will illuminate the question under study.” (Patton, 1990).

Secondly, an online survey was designed as a complementary source of information, covering as many respondents as possible. The survey was sent out as part of an information letter from LRF, Skåne to all their members working with pig production. The Netigate online survey service was used, allowing the opportunity to answer the questions on any device/platform, while also providing a more straightforward visualisation for the obtained information subsequently.

Questions and answers from both interview and survey can be found in Attachment 1.

2. The second part of the study, which was based on the feedback from the qualitative study (e.g. actual needs of farmers, desired functionality), was oriented towards the development of the smartphone app. In collaboration with software engineers and designers from Sony AB, Lund suggestions on how the application could and should look like were implemented in the form of internal build (the smartphone application used for testing) for both iOS and Android devices.

## Resultat och diskussion

The below discussion of the project's results and the outcome is divided into two sections corresponding to the projects to areas; 1) interview and survey results, and 2) smartphone app "preview build" layout and functionality. Due to the multi-disciplinary nature of the project and the holistic aim, results from both qualitative and digital parts should be considered as first foundation stones in the establishing framework of "digitalised" pig production.

1. *Qualitative part: towards the understanding of what word "technology" actually means.*

Initially, interviews were planned as one-on-one sessions (with farm owner/manager), however, when being on-site, more people employed at a farm expressed great interest towards the study, resulting in rich group discussions. As answers to question 3.5 "Attitude towards technology" indicated, all people involved in three face-to-face interviews showed "Very positive" attitudes towards technology and digital development on farm. The additional value of the interview answers comes to light when "personal" comments from farmers are taken into account as well. The aim of the project was to show the trends in and motivational factors behind the attitude towards new technology, therefore comments like "Teknik + forskning = trovärdighet!" or "Vi behöver teknik och forskning runt den – det ger bättre lönsamhet och skaffar förtroende" indicate the focus areas that should be considered in digitalisation of the pig production sector and agriculture in general.

The attitude towards technological novelty and its added value for the farmers quite often correlate with the potential economic outcome and situation on the market. To understand the farmers and their willingness to invest in specific digitalised solutions, one should also think about consumers' perception of pig production and how it affects the prices as well as opportunities for economical development. The questions 1 and 1.1. from the "Concurrence and public interest" block aimed at understanding the public perception of pig production as well as the possible ways to affect that perception. As Farmer C mentioned during the interview: "Folk har ingen förståelse av hur produktionen fungerar och väldigt lite kunskap runt vart maten kommer ifrån (och hur mycket arbete det är...)". Despite the "negative tone" to the answer, the follow-up comment about possible solution underlines the importance of the "digitalisation" of agriculture in general and pig production in particular: "Teknologi och utveckling kan rädda produktionen. Investera mer i teknologi att kunna övervaka djur kontinuerligt (att visa för konsumenter att vi bryr oss om djuren och vill veta vad som händer med dom)".

Figure 1 illustrates the distribution of words and terms which the farmers associated with the word “technology”. The size of the word indicates the frequency by which the particular word or term appeared in the interviews and survey:

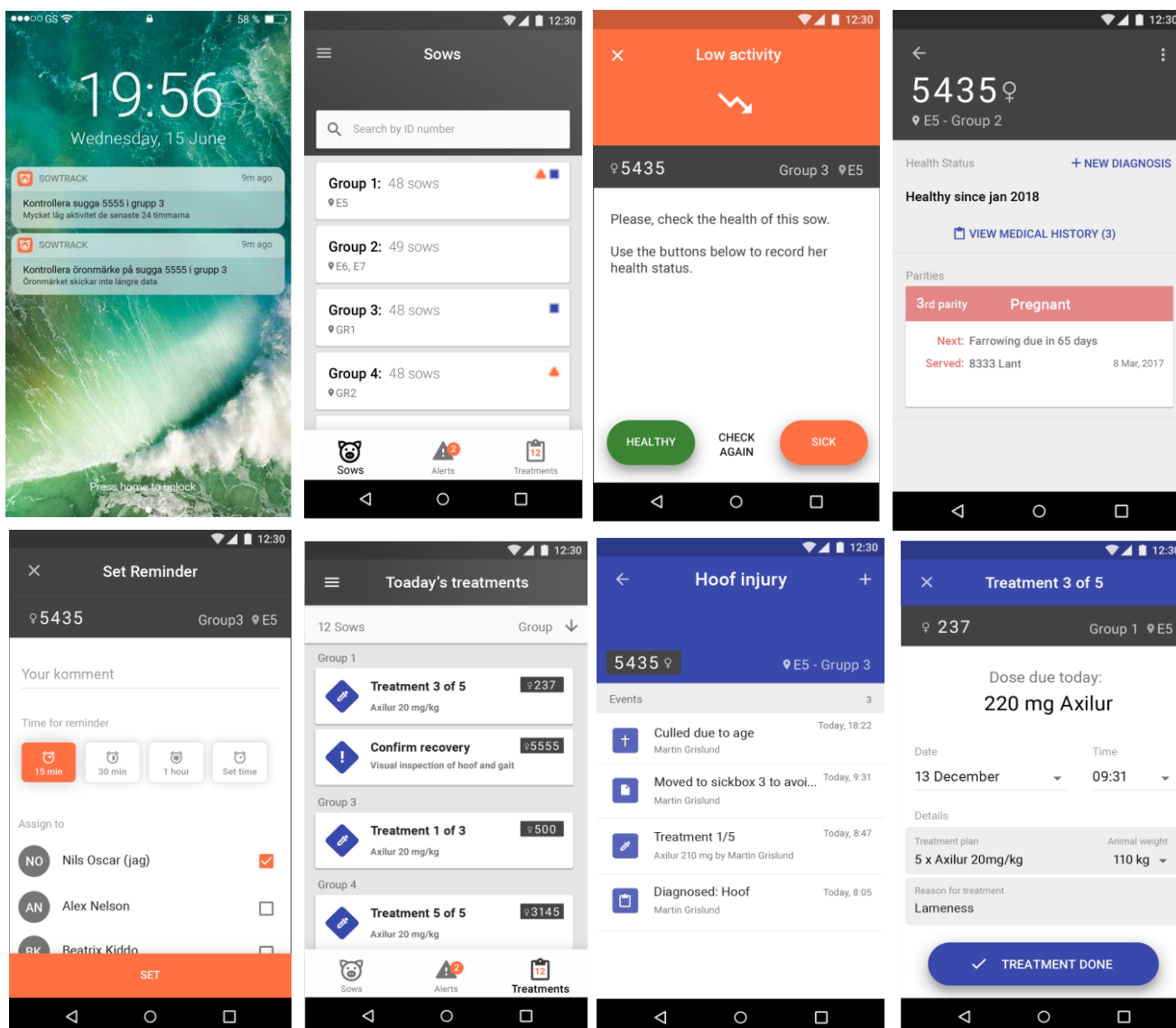


One of the comments stated that the use of technology could potentially lead to: “Effektivare arbetssätt. Färre gårdar med bättre lönsamhet och strukturerad arbetsflöde”.

Figure 1. Word cloud illustrating the most used words from the interviews and survey related to technology and its implementation on farms.

## 2. *Digital part: could smartphone app be a solution for a better workflow?*

One of the expected outcomes from the face-to-face interviews was an overview of the most time-consuming tasks in the pig farmer’s daily workflow and possible ways to streamline these. Although the answers varied (e.g. looking for animals, creating/managing different to-do lists, working with production numbers, communicating), the primary challenge was related to effective time management and communication between people responsible for different tasks. Variety in management routines is something that is very difficult to bring to the same standard in animal production but having control over the daily “to-do’s” and having clear definitions to the “responsibility-responsible chain” could be a first step towards the digitalisation of routine tasks. Many answers that came from farmers touched upon a need for a simple communication app combined with “to-do lists”. The idea is that people working on a farm will be able to create effectively, edit and exchange to-do lists for their daily tasks as well as keep track on actual status of the specific task (e.g. see who and when “checked” a certain task) as well as other necessary aspects of daily farm work (e.g. finding individual animals, keep track on treatments/use of medicines). As a first step, designers and application developers from Sony AB made an internal “demo” build of what such an app could look like. The crucial part of any functional digital system (e.g. smartphone apps and their further connection to Data Infrastructure) is the link between data-connected alert and decisions and Standard Operating Procedures (SOPs). Therefore it is essential to plan the layout of the application that includes a smooth flow of information involving all these steps (See Pictures 1 – 8, left to right).



Pictures 1 – 8, left to right: The example of the app layout, including the initial lock screen of the phone with an alert that should be addressed, followed by different levels of the presented information. Simplified design and clear structure in such apps help with effective time management and remove the need of double work (e.g. filling in the personal “animal cards with health status and eventual treatments”), shifting the focus towards the more important aspects of day-to-day work, like “looking after animals”.

## Slutsatser

The project showed the importance of communication around technological development in pig production and which consequences it could lead to. Showing academic interest towards this area and stimulating the discussion with different actors, solutions (e.g. mobile apps, software platforms or new sensors) for effective pig production systems could be implemented in a good, user-oriented way. The pig industry shows an interest towards new ways of “digitalising” their routine tasks, and it could potentially lead to better economic profits and sustainable, up-to-date vision around Swedish pig production.

## Nytta för näringen och rekommendationer

The foremost outcome for the pig sector is the “discussion starter” since the information about interviews and possible ways to bring technology into production was brought to light in media, on the theme-day at SLU, Alnarp as well as “word of mouth” from farmers involved in the project. This highlights the needs of people involved in pig production (on different levels) and underlines the importance of “end-user” or “user-friendly” solutions if those are about to be deployed on real farms. The demo app could be used as example of something that could be developed further and made into a free tool for bringing “modern” options into the established ways of data/information management at farm levels.

## Referenser

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### Del 3: Resultatförmedling

<b>Vetenskapliga publiceringar</b>	<b>LTV-faktablad</b>
<b>Övriga publiceringar</b>	<b>Intervju i Lantbrukets Affärer (kommer under sommaren 2019)</b>
	<b>Artikel i Sveriges Grisföretagare "Ny teknik i fokus på Alnarps Grisdag", <a href="http://www.grisforetagaren.se/?p=24566&amp;m=3258&amp;pt=114">http://www.grisforetagaren.se/?p=24566&amp;m=3258&amp;pt=114</a></b>
<b>Muntlig kommunikation</b>	<b>Alnarps Grisdag 2018, <a href="https://www.slu.se/ew-kalender/2018/10/alnarps-grisdag-2018/">https://www.slu.se/ew-kalender/2018/10/alnarps-grisdag-2018/</a></b>
	<b>PLF Workshop 2019, Copenhagen, <a href="https://pigit.ku.dk/plf-workshop-seminar">https://pigit.ku.dk/plf-workshop-seminar</a> "Digitalisation in pig sector: illusion or reality?"</b>
	<b>Elmia 2018</b>
<b>Studentarbete</b>	
<b>Övrigt</b>	