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► **To cite this version:**

Elton Muachambi, André Henrique Ivale, Raquel Silva, Irenilza De Alencar Nääs. Farm Management of Pig Production: Mobile Application Development Concept. IFIP International Conference on Advances in Production Management Systems (APMS), Sep 2022, Gyeongju, South Korea. pp.50-56, 10.1007/978-3-031-16411-8\_7. hal-04768927

**HAL Id: hal-04768927**

**<https://inria.hal.science/hal-04768927v1>**

Submitted on 6 Nov 2024

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# Farm management of pig production: Mobile application development concept

Elton Gil R. Muachambi <sup>[0000-0002-5463-9673]</sup>, André Henrique Ivale <sup>[0000-0002-4901-1195]</sup>, Raquel B. T. R. da Silva <sup>[0000-0001-7184-8162]</sup>, Irenilza de Alencar Nääs <sup>[0000-0003-0663-9377]</sup>

Paulista University, Rua Dr. Barcelar 1212, São Paulo, Brazil  
elton.muachambi@aluno.unip.br, andre.ivale@aluno.unip.br,  
raquelbaracat@gmail.com, irenilza.naas@unip.edu.br

**Abstract.** To ensure the farmer follows up on the new consumer demand for pork traceability and welfare during production, we developed a concept of applying the good practices during on-farm pig production. The productive meat sector has undergone technological transformations in recent years by searching for products with better quality, social responsibility, and sustainability. The worldwide good-practice norms are already known, and further information is already published by breeders, technical manuals, and scientific papers. New advancements in information and communication tools (ITC) can allow farmers to access real-time farm data and check their compliance with the established good-practices norms. The present study aims to conceptualize a digital solution suitable for evaluating the compliance of the pig farming management conditions. A mobile application will be made based on the standards of good practices as a digital transformation. The producer will be able to continuously check in real-time through the mobile application, assuring that his herd complies with the worldwide standards during production.

**Keywords:** mobile App; pig farm; good practices of production; technology.

## 1 Introduction

Brazilian swine farming is among the ten largest meat exporters. However, it faces numerous challenges; animal welfare stands out due to the high-value investment in technologies, management, and facilities to promote well-being as agreed with the European Union [1;2]. Consumer behavior change has encouraged the automation of farms, causing the productive sector to suffer transformations in the search for better quality products and sustainability in recent years. Pig farming is an activity practiced in several regions of the world, and pork is the most consumed meat worldwide.

Animal production standards rely on worldwide norms based mainly on EU norms, legislation, and farm assurance schemes. The EU norms are based on scientific information and aim to safeguard the species' welfare [3]. Variations in environmental factors such as sunlight, temperature, metabolism characteristics, humidity, and thermal regulation can cause imbalances in the animal's body, and temperature causes stress. It is considered one factor that negatively affects animal production [4]. These factors

compromise feed consumption, growth, the composition of animal products, fertility, and mortality, impacting productivity and profit [5].

All the losses caused by problems related to the lack of instruction in the Manuals of Good Practices can reach 0.15% of the animals unloaded in the slaughterhouses. Although this rate may seem small, the swine production chain has large proportions, where Brazil is the fourth-largest pork producer in the world, this percentage represents very significant annual losses, with approximately R\$ 30 million [6,7]. According to data from the Business Benchmark on Farm Animal Welfare [8, 9], consumer demand is increasingly growing worldwide regarding product quality and concern for animal welfare, making it a critical point that affects buying decisions.

New Technologies are helping livestock production for both efficiency and more focus on the welfare of the animals. These advances are necessary to ensure innovations from applications using cameras, microphones, and sensors to enhance the farmers' presence in everyday farming and technology for remote livestock monitoring. With the increasing use of mobile technology, the mobile application allows the ability to track individual livestock in real-time [10] automatically. Methods based on newly developed technology, such as sensor and machine vision technology, are non-contact and developed as an alternative to direct measurement methods [11-13]. Advanced technology increases productivity and improves production quality [14,15]. The general application of digital contributes to the rapid development of indirect measurement methods [16,17].

This study aims to conceptualize a digital solution suitable for pig farming. A mobile application will be made based on the standards of good practices as a digital transformation. From there, the producer will be able to know through the mobile application if his farm complies with the pork standards of production.

## **2 Methods**

### **2.1 Mobile App conceptualization**

The digital mobile App conceptualization phase involves drafting the scope of that project and the documentation of all the desired features and requirements [18]. Creating the real digital is critical for successful product development, as it forms the fundamental basis of the project. The digital conceptualization of a couple of scattered ideas and visions requires an extensive amount of knowledge on how to target an audience and how the market of digital products functions [19]. This is an essential part of the problem when creating a tailored solution.

The application development software platform in swine farming is responsible for coding the application and executing management to develop and monitor results obtained on the farm. Android Studio will obtain better results in developing the software application providing agility and flexibility, enabling the system to analyze the conditions and variations of the development index to assist the farmer in monitoring management through physiological data and measurements. [20,21,22]. The software will define evaluation criteria of management and control of the development of the animal, where the software monitors the interfaces of the storage and treatment of data based

on the information comparing control methods and parameters of its development. Fig. 1 shows the mobile conceptualization scope.

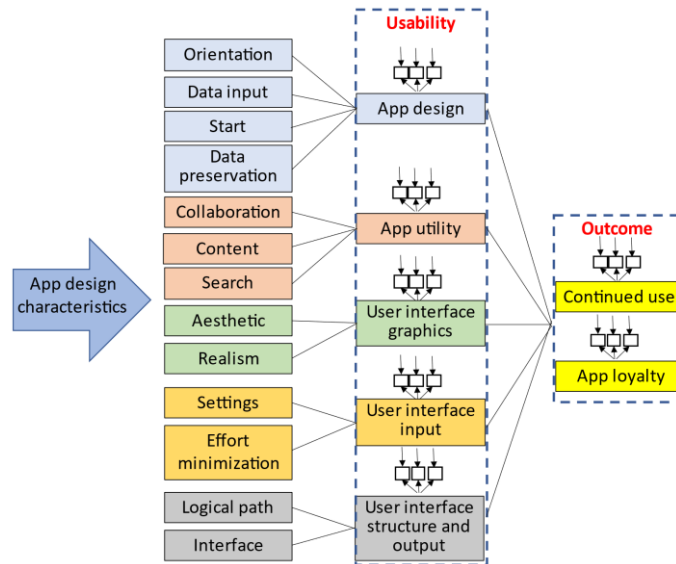


Fig. 1. Structural model of the mobile App. Adapted from [23]

## 2.2 App development

The variables or classes included in the application are shown in Fig. 2. The associations between the application classes were based on the most critical factors in the pig farm production process.

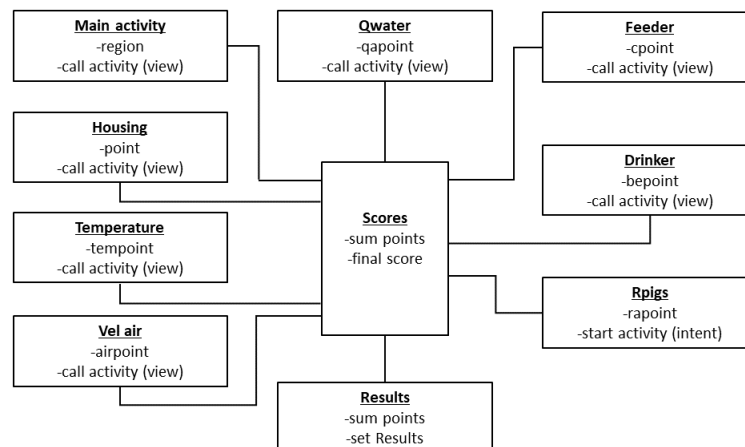


Fig. 2. Proposed flowchart of the App Pig's development

We propose the input of the region characteristics (where the farm is located), the housing characteristics (height of the building, herd density - pigs/m<sup>2</sup>, roof material, management data), data on housing temperature, and air velocity. The input will also come from data on drinkers, feeders, water quality, and specific details of management. We will give weights to each input based on the literature, and a final score is proposed based on the good practices used.

The calculation of the final score (scores) resulting from the diagnosis of a swine production good practices by the App is obtained by assigning weights to each class/variable or question. According to the production phase (week), the different categories of questions are based on factors of importance. Thus, scores are calculated according to the chosen region and the production phase (Eq. 1).

$$S_n = x1q_1 + x2q_2 + x3q_3 + \dots + xnq_n \quad (1)$$

where  $S_n$  = diagnostic score of good practices in n weeks of production and q = questions asked to a farmer. The weights attributed to each question are proportional to the importance of the question.

The interaction diagram between the user and the App functions like this: (1) the user selects the region the farm is located; (2) the user enters the answers to the questions corresponding to the phase of the production process in which the batch is located; (3) after answering all the questions, the user receives an output answer with scores of good production practices is presented. The questions will be related to parameters considered for the elaboration of the questions about good practices of production, were about rearing environment, the temperature and relative humidity of the environment, the airspeed, the amount and quality of water flow from drinking fountains, the regulation and flow of feeders, and the quality of the water. The weights (1 to 5) will be given following the instructions shown in Table 1. The idea is to give a higher weight to the highest impact the compliance with that specific variable affects the total output.

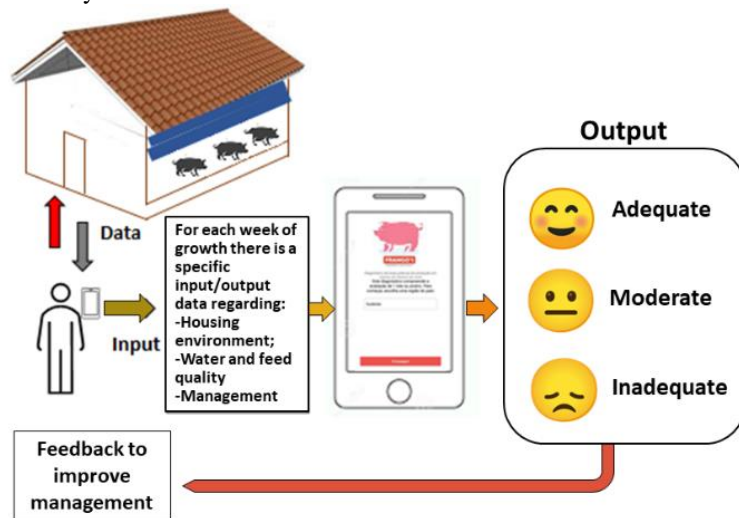
**Table 1. Variables, limits, and observations related to the importance of the attribute.**

<b>Variable</b>	<b>Limits</b>	<b>Observation</b>
<i>Rearing environment</i>		
-temperature	25-20 °C	Depending on the age range [2,5,24]
-relative humidity	60-85%	Depending on the age range [1,24]
-air speed	0.8-1.5 m/s	[4,24]
<i>Water</i>		
-quantity	~8.5 L/day	Depending on the age range [7,12,24]
-quality	Clean and potable	[24]
<i>Feeder</i>		
-feed quantity	~1.9-3.0 kg/day	Depending on the age range [24]
-feed quality	With proper components	[3]

### 2.3 Mobile App concept results

The schematic of the Pig's App concept and use is shown in Fig. 3. This mobile application will be used in an integrated analysis platform for producers and technicians in pig production based on the (24, 25).

Fig. 3 shows the schematic of the mobile application concept that transforms data entered by the user into information on the farm level and allows users to collect and communicate best practice diagnostic recommendations digitally, providing real-time production analysis.



**Fig. 3.** Schematic of the App concept with the input data and the output results as input for decision-making.

The methodology used in developing the swine application is customized and optimized in the procedures for monitoring swine development in swine farming by analyzing the monitoring processes through the usability and functionality of the application activities. According to [26], the App guarantees improvements and adaptations of the execution according to the user's needs, benefiting his purposes.

The application structure is related to the swine monitoring system provided in the graphical interface. More information is applied to the functions of the concepts of understanding the user interface, the use of monitoring and development of the swine is interconnected in the connection of the physical part and the logical part of the software. Software is the visible part of the system that interacts in the user interface communication system in a direct communication system—providing usability and ease of platform interaction and performing tasks in monitoring the pig growth.

### 3 Final Remarks

We conceptualize a mobile application based on standards of good practices for pork production, allowing farmers to comply with the norms and evaluate the herd in real time. Such an initiative might increase farmer control of the herd and reduce losses in pig farming since the farmer might follow up continuously on the data.

Using mobile data to record quantitative and qualitative data might enable analyzing environmental and swine management data. It might also prioritize and communicate technical visits and share the diagnosis with the entire management team.

It might manage and track essential communications from the farm with the technical team/company, visualize the best practices indicator with easy-to-view information, make decisions guided by insights and reduce losses in the production process.

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