

The Role of Perception in the Adoption of Digital Platforms in Agriculture

K. Tomičić-Pupek*, I. Pihir* and M. Tomičić Furjan*

* University of Zagreb / Faculty of Organization and Informatics, Varaždin, Croatia
ktomicic@foi.unizg.hr; ipihir@foi.unizg.hr; mtomicic@foi.unizg.hr

Abstract - In these times of global disruptions, digital product distribution platforms are playing a major role in driving the global economy. In the development of such platforms, the scope, architecture, realization technology as well as the channels used are important. However, a well-accepted/designed platform does not guarantee profitable results in a digital business model. There are various soft factors that can significantly affect the reach of a platform. Due to its role in food distribution, the specific lifecycle of products and seasonality, agriculture is an industry where timely reach is crucial. In this paper, we investigate the factors influencing users' perceptions toward platforms in agriculture. We consider both the perspective of the customers/buyers, and the perspective of the producers/sellers. We also examine the perception factors that can influence one's intention to join and adopt digital platforms. The identification of relevant perception factors is based on a literature review and empirical data from publicly available sources. Our goal in future research is to confirm or revise factors that impact perception, and to assess the impact of perception on the design and functionality of digital platforms, as well as its impact on the development of digital business models.

Keywords – digital platform, perception, adoption, agriculture

I. INTRODUCTION

The digital transformation of agriculture requires the use of Industry 4.0 technologies, which transform this industry into Smart Agriculture or Agriculture 4.0 [1], [2], [3]. Scientific research projects carried out in cooperation with the IT industry has resulted in the identification of the potential of digital transformation, which differs from previous efforts to digitize (i.e. to convert analog to digital contents) or digitalize (i.e. making business digital through digital exchange formats relating to business content, automation processes and introducing changes to business models). Digital transformation, unlike its predecessors, requires a more comprehensive approach. We can define it as an effort to organise continuous improvements to user-oriented digital business models and the application of modern technical potentials that enable businesses to be technologically and digitally mature. Disruptive events combined with technological advances and innovations are “transforming economies, societies, and our lives” [4].

These new technical potentials use and combine Industry 4.0 technologies such as the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), Cloud

Computing (CC), Blockchain and other emerging technologies. These technologies support the development of agriculture, and establish an interconnection between producers/sellers and customers/buyers of agricultural products on digital platforms. All of this together digitally transforms agriculture in all phases; from the initial phases of farming and food production all the way to packing and food distribution. It supports the entire supply chain [2], [5], [1].

Based on a report by Haberli et al. [6] on the perception of farmers, the agricultural sector in general is positive towards the expected benefits of integrating information technologies. Farmers are willing to invest jointly with governments in order to create benefits in agriculture and support the digital transformation of this sector [5], [2], [6], [1].

Considering the recent disruptions in global markets, digital platforms for the distribution of agricultural products are a suitable context for us to examine. Utility perception factors regarding digital platforms for agricultural products in rural areas represent perceived values, and influence customers' decisions to use such platforms. In this context, we use the following definitions and terms:

- Digital platform for the distribution of agricultural products: This is a unique digital space that brings together consumers and producers to buy, sell and distribute agricultural products. The term “platform” refers to a unique online website that facilitates the trade of products and/or services. This includes linking auxiliary or concomitant products or services of other providers regardless of the technical infrastructure.
- Utility: This refers to a measurable property of an object in relation to planned effects and the perception of the achieved effects.
- Perception: It refers to a subjective assessment of the objective properties of an object of interest.
- Utility perception of a digital platform for the distribution of agricultural products: This is a subjective assessment that measures the achievement of planned effects connected to the usage of a platform for the distribution of agricultural products.

With all of this in mind, this paper researches and analyzes literature, and includes literature case study

analysis and other sources in order to determine perception factors about digital platforms in the field of agriculture. Particular focus is put on food distribution; however, it should be noted that the conceptual model of perception factors could be considered through all stages of production and distribution across the entire supply chain. This is due to digital platforms having various levels of support. Factors relating to the adoption and perception of digital platforms could help researchers, industry and agricultural producers to transform their businesses at all production stages.

The paper is organized as follows. After the introduction, the methodology is presented. Our literature review constitutes the theoretical background, and prepares the reader for the results, which are presented as a conceptual model of initial utility perception factors for digital platforms focusing on agricultural products in rural areas. The paper ends with future research possibilities and the conclusion.

II. METHODOLOGY

The identification of relevant perception factors is based on a literature review and empirical data from publicly available sources. According to Siddh et al [7], the growth of empirical data and empirical studies is well marked in the agricultural sector. It should be noted though that the researchers emphasize the need to direct similar research within a “intra-functional and intra-firm scope at the organizational and supply chain level.”

The literature review was conducted rather widely in order to find articles of interest for our research. Two scientific databases (Web of Science and Scopus) were used in May 2020 for the research. The search was based on a combination of keywords (described in Table I). The search focused on peer-reviewed articles in journals and conference proceedings. The search results from Web of Science (WoS) included 11 papers, while Scopus resulted in only 7 papers.

TABLE I. SEARCH STRATEGY (2015-2019)

WoS search strategy	WoS Hits
TOPIC: (platform) AND TOPIC: (perception) AND TOPIC: (food distribution); Refined by: PUBLICATION YEARS= (2019 OR 2016 OR 2018 OR 2015 OR 2017) AND DOCUMENT TYPES= (ARTICLE); Timespan=All years.	Results found: 11 Sum of the Times Cited: 51
Scopus search strategy	Scopus Hits
TITLE-ABS-KEY (platform AND perception AND food AND distribution) AND DOCTYPE (ar) AND PUBYEAR > 2014	Results found: 7 Sum of the Times Cited: 46

Source: Authors

Additional analysis was performed after the articles were collected. After merging the results from Scopus and WoS, we excluded one duplicated entry. In the end, 17 publications which were found in both databases were used for the qualitative analysis.

Because we are focusing on perception in the use of digital platforms, we have developed the following criteria for the selection of papers: (1) an article is considered relevant if it covers reports on buyer or producer factors influencing their intention of using digital platforms, and (2) process or technology-related aspects are mentioned.

After applying these criteria, only 4 publications remained for further qualitative analysis [7], [8], [9], [10]. The small number of publications allowed us to analyse the content using qualitative methods. After that, we broadened our search to platforms like Google scholar and ResearchGate in order to gather publications that are similar in topic. We applied the same selection criteria and found more significant publications addressing perception and/or willingness as topics of interest. These publications served as the basis for our conceptual model [11], [12], [13], [16].

Our broader research is oriented on issues relating to the design and development of digital platforms, which means that empirical data also plays a major role in gathering data. Therefore, we have followed and observed several regional “e-market” sites and social media groups for agricultural food distribution over the last two months. This has been conducted to identify some common trading scenarios. Even though we could not apply longitudinal scientific research methods to track regional “e-market” sites and social media groups (due to the COVID-19 pandemic), some experiences from the hype of their acceptance in public seem to be worth investigating in detail.

III. THEORETICAL BACKGROUND

Digital transformation can be characterized by 5 key determinants [14], among which customer centricity¹ and talent, capability and capacity strengthening² are seen as important factors that affect value for users and benefits for producers within a platform-based business model [15]. Platforms provide a virtual place where customers can get access to products and services, and where producers can deploy their services or products. Based on this premise, the implementation of online trading platforms is seen as one of the main objectives of digital transformation in agriculture [1]. Digital transformation in agriculture can also include other technologies that are either related to or integrated within the platform. This is shown in a survey by Lezochea et al. [2] through the analysis of key impacts and challenges that organizations face when applying them. In the next three subchapters, some of these impact parameters and challenges are elaborated on in more detail.

A. Perception as an impact factor

Jayashankar et al. [16] explored factors influencing farmers’ willingness to adopt IoT by investigating the role of trust in technology, perceived value and risk. Taking into consideration general technology trends and concerns (like IoT and farmers’ concerns about data ownership), the authors based their hypothesis on strong theoretical inputs on the transition from goods-dominant logic to service-dominant logic in agriculture, perceived utility, new combinations of technological solutions for productivity improvements and other value-based adoption model

¹ Customer centricity means that the customer is aware of his/her rights and obligations, has certain expectations, gains experience and holds attitudes that he/she shares with others.

² Talent, capability and capacity strengthening means that the employees know how technologies can be used, and they understand how they can be used to improve performance.

elements [16]. An interesting study on user packaging interaction by Mumani and Stone [8] shows that various touchpoints like purchasing, checking out at the cashier, handling, opening, storage, disposal and other interactions with the product are considered important in understanding buyer perceptions. Furthermore, examining the attributes of these touchpoints like graphics, information volume, and size are also relevant for understanding how buyers evaluate products.

B. Process parameters

Process parameters and measures like duration, costs, resource allocation and other performance indicators still play a significant role in assessing operational excellence. The recent global disruption caused by the pandemic has resulted in noticeable changes to the paradigm of buying goods earlier. The supply of food through digital platforms is increasing in various forms; from e-market sites to social platform groups. It is putting customers and producers on to new journey paths. New digital business models are resulting in business improvements and increased efficiency. This indicates that digital transformation is also oriented toward business transformation. In order to achieve production and operational goals, a balanced combination of technological solutions must be designed [17].

According to Siddh et al. [7] in their literature review, around 33% of research publications focus on information management, followed by 16% on sustainability management and 13% on logistic management. Some common issues that are examined as quality factors include product and raw materials, hygiene, nutrition and resources.

C. Technology-driven change

Digital transformation can be a change driven by technology. Technology concepts and applications have been thoroughly researched in that context [18], [19], [20], [21]. The EU Parliament [22] identifies 3 technology categories:

- a) Technologies with a high impact on the agri-food value chain: Internet of things (IoT), Automation and Robotization, Artificial Intelligence (AI) and Traceability and Big Data;
- b) Technologies with a medium impact on the agri-food value chain: Blockchain, GNSS (Global Navigation Satellite System) and Virtual Reality;
- c) Technologies with a low impact on the agri-food value chain: Broadband networks, Information and Communication Technology and Platforms for e-Business.

According to Tariq et al. [9], social media platforms play a relevant role in forming the consumer's attitude, and thereby, their willingness to conduct online impulse buying. Platform features and information cues are critical in efforts to reach targeted consumer segments. Suchiradipta and Raj [23] investigated the usefulness, advantages, purpose, difficulties, and social media preferences in the agricultural sector. Their research shows that social media and platforms contribute to

effective communication at various levels. According to a study from 2018 that included 29 interviews with agricultural knowledge providers in New Zealand [24], the sources of change in perception toward platforms include externally driven demands (like food safety and sustainability), or internal ones (such as the need to implement digital technologies within organizations). The same authors also investigated how knowledge providers in the agricultural sector have responded to emerging digital technologies. They concluded that the examined population can be evaluated at an early stage of response maturity and emphasized the need for strategic thinking in organizations in this sector [25].

IV. THE CONCEPTUAL MODEL OF INITIAL UTILITY PERCEPTION FACTORS FOR DIGITAL PLATFORMS FOCUSING ON AGRICULTURAL PRODUCTS IN RURAL AREAS

The operational efficiency and effectiveness of the process supported by modern digital technologies is just one of the factors influencing the customer's decision on how to buy agricultural products. The process of generating a product or service itself can be very efficient and effective; however, these features stem from the perspective of the process owner and his/her understanding on how the process should be formed. From the customer's perspective, it seems that the focus has shifted from being on how the process is operationally good, and more toward how well the process solves the customer's problem. Therefore, focusing on the customer by understanding the customer's expectations, needs and goals, increases the chances that the product will be accepted in the market or that the service will come to life. In short, the process is considered successful because it solves the customer's problem, and not because the delivery process is efficient and effective. In order to investigate the factors influencing the gap in customer and producer expectations, a conceptual model of initial utility perception factors from the perspective of customers and the perspective of producers can be made. This can then be used to reflect on ways to bridge the gap.

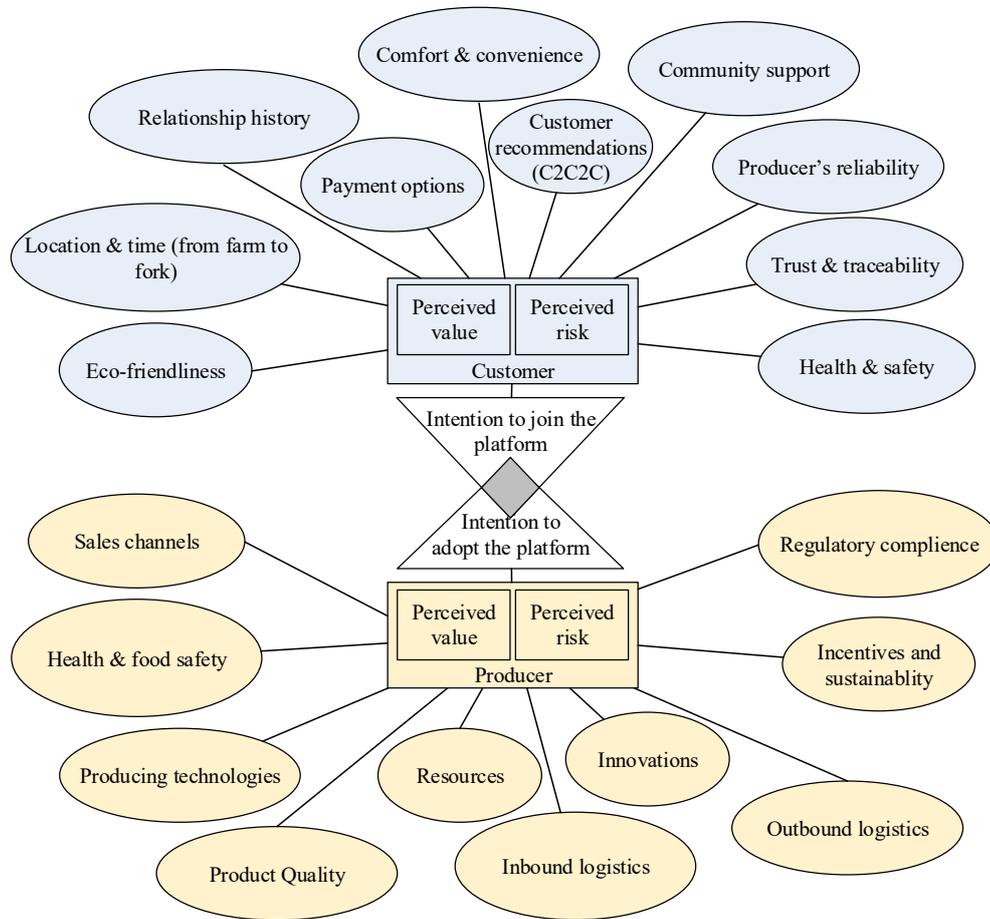
In order to examine utility perception factors regarding digital platforms for agricultural products in rural areas, we developed a conceptual model of initial utility perception factors.

It has been designed by relying mostly on the value adoption model [11], the holistic narrative of perceived value and the concepts of perceived risk and trust with IoT technology from Jayashankar et al. [16], Tariq et al.'s research model [9], Almquist's Elements of Value model [12] and the B2B Elements of Value [13].

Figure 1 shows the factors from the perspective of customers and producers. These factors can be in convergent or divergent relationships with each other, which influences the perceived value or perceived risk. This is applicable to both sides, i.e. to the producer and the customer. For the customer, the balance between perceived value and risk determines his/her intention of joining the platform in order to buy. For the producer, it impacts their intention to adopt platforms in order to sell. For each group (consumers and producers), 10 factors have been identified that determine the perception of

consumers and producers regarding the utility of a platform for the distribution of agricultural products. The factors are listed in Table II and Table III. The factors are

classified within each group (customer or producer). For each factor, the process and technological key terms are described.



Source: Authors

Figure 1. Conceptual model of initial utility perception factors for digital platforms focusing on agricultural products in rural areas

TABLE II. INITIAL FACTORS OF PERCEPTION REGARDING THE UTILITY OF THE PLATFORM FOR THE DISTRIBUTION OF AGRICULTURAL PRODUCTS - CUSTOMERS

Group	Factor	Process key terms	Technological key terms
Customer	Eco-friendliness	Reducing the eco-footprint, avoidance of artificial additives, seasonality of products, eco-friendly packaging options	Open data on ecological footprints
	Location & time (from farm to fork)	Buying locally fresh products in the shortest time possible time from the farm (or field in use)	Blockchain
	Relationship history with the producer	Existing relationships with the producer, existing experiences (positive and negative)	CRM systems
	Payment options	Price, Price Volatility, Payment security, avoiding cash	Contactless payment, card payments, digital wallets (Revolut)
	Comfort & convenience	Remote ordering, time saving, reliability of delivery	Social media and platforms
	Recommendations (C2C2C)	Choosing a supplier based on recommendations and recommending it to others based on their experience (Customer-to-Customer-to-Customer, C2C2C)	Social media and platforms
	Community support	Purchasing from local producers to support the sustainability and development of the local economy, local production	Social media and platforms
	Producer's reliability	Product quality, delivery time, price	ERP systems, Blockchain
	Trust & traceability	Trust in the production process, traceability of products	Blockchain
Health & safety	Disruption challenges such as epidemics and pandemics	Open data on disruptions	

Source: Authors

TABLE III. INITIAL FACTORS OF PERCEPTION REGARDING THE UTILITY OF THE PLATFORM FOR THE DISTRIBUTION OF AGRICULTURAL PRODUCTS – PRODUCERS

Group	Factor	Process key terms	Technological key terms
Producer	Sales channels	Customer-preferred sales channels versus producer-preferred channels, channel integration	Social media and platforms
	Health & food safety	Quality of products, production process and supply chain in the delivery of health products to the end customer	Blockchain
	Production technologies	Green deal, operationally efficient and effective production process, process monitoring, climate change	IoT, drones
	Product Quality	The quality of the production process and the final product	Blockchain
	Resources	Human labour, machines, robots; a culture of continuous investment in new skills, knowledge and capacity to increase the efficiency of the production process	Robotics
	Inbound logistics / Supply Chain	Suppliers of raw materials (seedlings and seeds, fertilizer), time spent on improving the supply chain	Platform-based Supply Chain Management
	Innovations	Innovation potential, innovation process monitoring, innovation implementation, consulting services	Innovation Management System (IMS)
	Outbound logistics / Distribution chain	Downloading and preparing customer orders, delivery planning, packaging, delivery	Social networks and platforms
	Incentives and sustainability	Long-term sustainability and capacity increase, incentive system (not in the scope of the project, but affecting the readiness of producers)	Drones, digital certificates
	Regulatory compliance	Regulatory compliance requires administrative approval	Digital Certificates

Source: Authors

Different perception factors may have different impacts on the perceived value and risk. Further research is needed to confirm, revise or reject the perception factors. The customer's intention of joining a digital platform in order to buy products is the first issue impacting a platform's reach, and other factors as well as experiences could be significant with regards to customer retention on a platform.

Regarding producers, the perception factors which impact a producer's intention to adopt a platform could also be connected to the intention to develop an additional channel for product distribution. Also, other impact factors regarding platform retention need to be systemized.

Confirmed and revised perception factors impact the design of digital business models, which encompass personalized approaches to various customer segments and channels. They also impact efforts to create profitable value propositions, efficient cost structures and revenue streams.

This has an impact on the platform architecture, especially on the necessary functionalities like producer-buyer matching and filtering, presentation of offerings, delivery and payment options and even technologies used for platform implementation.

V. FUTURE RESEARCH

As our current research focuses on identifying and investigating utility perception factors of digital platforms for agricultural products, our future research will be oriented toward testing the model and examining correlation weights. This will be conducted via a focused survey with producers and consumers. Furthermore, due to the limited research on this topic, we note that there is a need to create appropriate propositions for designing digital platforms for food distribution. This can be conducted by assessing the impact of the design and functionality of certain digital platforms, and by assessing the impact of digital business models, clear value propositions and operating business models on food

distribution. Within that scope, the role of technology providers should also be examined.

VI. CONCLUSION

We have investigated perception factors influencing the intention of consumers and producers to join and adopt digital product distribution platforms focusing on agricultural products. Based on the literature review and empirical data from publicly available sources, we identified 10 perception factors for each of the collaborating parties: a) consumers: eco-friendliness, location & time, relationship history with the producer, payment options, comfort & convenience, recommendations, community support, producers reliability, trust & traceability and health & safety; b) producers: sales channels, health & food safety, production technologies, product quality, resources, inbound logistics/supply chain, innovations, outbound logistics/distribution chain, incentives and sustainability, and regulatory compliance. Understanding these perception factors may contribute to determining their intention of using a digital platform, the reach of the platform and the volume of users. In our future research, we will gather user inputs to confirm or revise the identified perception factors and to assess their impact on the design and functionality of digital platforms.

We believe that the proposed conceptual model is a valid contribution that allows for the simultaneous presentation of perception factors for producers and consumers in one place. The conceptual model should be confirmed and the influence of individual factors should be investigated, but we believe that the model can help in the following manner. First, it assumes that perception factors are possible barriers regarding the consumer and producer's intention to join or adopt digital platforms for trading agricultural products. Secondly, it can serve as a means to create mutual understanding and facilitate better matching between producers and consumers. Moreover, the model acts as a tool for prioritizing key features that producers/sellers want to emphasize when communicating their strengths; and has the capacity to provide the value

proposition that customers expect. Lastly, the model could support producers in choosing the most suitable digital platform.

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