


## Article

# Changes in Use of Communication Channels by Livestock Farmers during the COVID-19 Pandemic

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**Abstract:** The study aims to identify any changes in the communication channels used by Slovenian livestock farmers before and during the COVID-19 pandemic, as well as the main (dis)advantages of relying on them. An online survey was completed by 502 Slovenian farmers of various farm enterprises in winter 2020/2021. Most respondents generally used telephone, e-mail, and the internet to obtain agricultural information before and during the COVID-19 pandemic. During the pandemic, farmers increasingly relied on online conferences and social networking sites. At the same time, younger farmers and farmers with a higher education level used digital channels the most frequently, with men doing so more often than women. Digital channels were primarily used by cattle and horse farmers, while cattle farmers showed the greatest online conference participation. Respondents reported having more time to spend with their families and animals as an advantage and the lack of face-to-face interaction with other farmers and advisers as a disadvantage of such communication patterns. As the study reveals differences in the use of communication channels during the COVID-19 pandemic by various farmers, a new communication strategy is needed that involves the use of appropriate communication channels to provide farmers with agricultural information both during the COVID-19 situation and later.

**Keywords:** COVID-19 pandemic; livestock farmers; communication channels; (dis)advantages of communication



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## 1. Introduction

The COVID-19 pandemic has had a particularly strong impact on the agricultural and food sectors, mainly due to transport problems, reduced demand, lower prices for agricultural products and other systemic uncertainties [1–3]. Such crises as the COVID-19 pandemic highlight the need for communication using an effective communication channel [4–6] as communication is a fundamental element of modern farming [7]. The implementation of sustainability communication, broadly defined as the use of appropriate communication content and channels to inform various stakeholders about the application of a sustainable approach and as continuous communication without compromising the ability of present and future generations to meet their needs [8,9], was significantly limited as a result of the COVID-19 pandemic.

There is a variety of communication channels, defined as methods, pathways or vehicles by which information is transmitted or received or, in other words, communicated [10,11], such as the mass media, the internet, and social networking sites or social media. Studies on the use of communication channels during the COVID-19 pandemic show that the general population living in Slovenia and other Central/Eastern European

countries [12] and other urban areas [13] has preferred regular information updates via the internet, social media, and television. Although rural areas have seen a greater use of information and communication technology (ICT), and the spread and application of ICTs such as mobile phones and the internet hold the potential to mitigate or eliminate the time and spatial barriers to accessing information, these digital communication channels are not very popular in rural areas [14,15]. Therefore, the question arises as to which communication channels are being used by Slovenian farmers as typical Central/Eastern European farmers.

To answer this question, this study draws on the sustainability communication approach and combines it with the situational crisis communication approach, which is one of the most influential theories for understanding crises and crisis response strategies [4–6]. Both approaches are based on organizational/business communication, and their main ideas are also applicable in agriculture, as crisis communication involves the collection, processing, and dissemination of information needed to manage a crisis situation [4] in order to enable sustainable communication [8]. The emerging sustainability communication approach combines two key elements (sustainability and communication) in two ways, namely, as communication about sustainability and as sustainable communication. The last element is particularly useful in a crisis situation, such as the COVID-19 pandemic. Indeed, regardless of the size of the company or farm, continuous communication is fundamental to success, not only in business terms but also in a broader sense, as it enables the sharing of information between people within and outside an organization (farm). When communication through established channels is interrupted during a crisis, it is necessary for the farmer to adapt by using appropriate communication channels [8,9]. Based on the situational crisis communication theory, we could indicate that the main adaptation strategy of farmers is based on gathering information by using appropriate communication channels to respond, within their available resources, to changes in the external farming environment—in our case, to drastic changes resulting from the COVID-19 pandemic.

The media richness theory is useful in identifying appropriate communication channels as complex matters should be communicated via a richer communication channel (e.g., face-to-face) because it can provide information, while routine issues should use a leaner channel (e.g., printed reports) [16]. An appropriate communication channel must be selected with respect to the complexity of the message in order to ensure successful transmission. The channel chosen for the transmission of a message has a certain richness that affects the perception of the communication and is, therefore, generally suitable for the transmission of a particular message. The richness of the medium depends on: (a) the ability to provide immediate feedback; (b) the number of communication signs used, such as non-verbal communication, tone of voice, and other verbal and non-verbal signs; (c) the ability to personalize messages; and (d) linguistic variety [16]. However, the media richness theory cannot explain the popularity of communication channels that are less rich than e-mail and SMS because it is assumed that communication channels are static and do not alter with use. According to the adaptive structuration theory, users may modify their use of informal communication elements (e.g., use of emotional cues and colloquial language) from richer communication channels in a particular communication context, and change their perceptions of a channel's richness [17].

Studies on the use of communication channels by farmers in recent years have come from less developed countries and show that radio has emerged as the most used and important medium that farmers rely on to receive agricultural information due to its good accessibility [18,19]. However, this does not apply to the developed Central/Eastern European agricultural situation, where the challenge is the adoption of digital channels as rural access to broadband is relatively good [20]. In particular, studies on farmers' potential ICT use show that the rapid development of ICT, represented by mobile phones and the internet, is enabling them to make greater use of the wealth of available agriculture-related information and knowledge. This facilitates information searches speeds up the flow of information, reduces the cost of information, and expands the channels for information

exchange, while improving farmers' access to information and social connections [21]. Moreover, digital channels can be used to improve agricultural production [22], overcome the information problem that prevents smallholder farmers from entering markets [19], increase market opportunities and self-sales [14], etc. In addition to internet searches, social networking sites or social media such as Facebook, Instagram, or Twitter had proven to be useful channels for seeking information, sharing knowledge, and facilitating interactive communication processes within agriculture even before the arrival of COVID-19 [23–25]. Due to the so-called 'forced digitalization' during the COVID-19 pandemic, online meeting or video conferencing applications such as Zoom, Skype, Google Meet, and Microsoft Teams have become popular [26,27]. Although online conferences were in use before the pandemic, they have become more widespread because they allow users in different locations to hold prominent meetings without having to relocate or meet directly in the same (live) location [26]. Nevertheless, the use of online conferences must be supported by applications and hardware devices, such as cameras, and additional digital skills, which could be introducing information asymmetry among farmers. The Slovenian population generally, and Slovenian farmers in particular, have been conservative with respect to adopting ICT [28], leading to the question of how Slovenian farmers have accepted digital communication channels during the COVID-19 pandemic.

Das [29] found that different communication channels, such as phone calls, text messages, TV news, e-resources, radio, and newspapers, were largely used by Indian farmers to obtain COVID-19 virus information, with phone calls, text messages, and television dominating. In terms of socio-demographic differences, studies on farmers' use of communication channels show that younger farmers and farmers with higher education levels, a higher income, and more cultivated land rely on digital channels more often to obtain agricultural information; men use digital channels more frequently than women [14,18,19]. The question arises as to whether the changing situation created by the pandemic has influenced the use of communication channels in terms of farmers' socio-demographic characteristics and, in particular, in farmers of different types of livestock, as no known study investigates this relationship.

The pandemic has changed the perception of using communication channels to facilitate work from home [30]. Regarding the disadvantages of using digital communication channels during the COVID-19 pandemic, studies on telework [30] show that the lack of face-to-face interaction with colleagues is the factor most frequently mentioned, followed by the lack of face-to-face interaction with one's manager. Moreover, distant communication has complicated access to work-related information and led to insufficient feedback and increasing uncertainty and worries about overlooking important information, also causing a significant information overload and time-consuming asynchronous communication. In contrast, the use of digital communication channels through teleworking during the pandemic has shown advantages such as reducing stress related to communication and time- and cost-savings as employees no longer need to travel to and from work [30]. Since no known study examines farmers' perceptions of the (dis)advantages of using communication channels, the question arises as to whether farmers have encountered similar advantages/disadvantages in using communication channels as employees in other sectors during the COVID-19 pandemic.

In the absence of any known study on the changing use of communication channels by farmers during the pandemic, the question arises as to how farmers in Central and Eastern Europe have changed their use of communication channels in relation to socio-demographic characteristics and the main (dis)advantages of relying on these communication channels in this time period. These findings may help policymakers and agricultural information sources to ensure that they employ the appropriate communication channels to provide agricultural information to farmers in Central and Eastern Europe during the mentioned pandemic and beyond given that the radical changes seen in communication patterns are likely to be lasting [31].

## 2. Materials and Methods

An online, self-administered questionnaire was used to establish how different livestock farmers have altered their use of communication channels. An invitation with a link to the online survey was sent by e-mail on 30 December 2020 to key livestock associations and groups of different livestock farmers (more than 1000 e-mail addresses) and via social networking sites (Facebook) to various groups of livestock farmers in Slovenia (cattle, pig, sheep, and goat farmers, horse farmers, and laying hen farmers). The survey was active for approximately 1 month and potential respondents were invited to participate several times.

The survey was completed by 502 respondents (Table 1), of which 46.8% kept cattle, 26.1% sheep and goats, 18.1% pigs, and 9.0% horses. In terms of gender, 25.3% of the respondents were female (74.7% male). Their ages ranged from 22 to 70 years (mean 41.4 years); the majority of respondents (25.5%; 6.38% female and 19.13% male) were between 26 and 35 years old, followed by those between 36 and 45 years (21.5%; 5.38% female and 16.13% male) and between 46 and 55 years (20.2%; 4.22% female and 15.88% male). Up to 43.9% (21.22% female and 22.68% male) of the respondents had completed secondary school, 33.1% (17.76% female and 15.34% male) had a university education, and 3.5% (1.05% female and 2.35% male) a master's and/or doctorate degree. The majority of farms (40.1%; 17.31% female and 22.79% male) cultivated between 21 ha and 50 ha of agricultural land with forest (Table 1). The sample was comparable to the national farmer characteristics.

**Table 1.** Respondents' characteristics and farm sizes ( $n = 502$ ) (%).

Attribute	Category	Share of Total Respondents (in %)
Gender	Male	74.7
	Female	25.3
Age	<25	14.3
	26–35	25.5
	36–45	21.5
	46–55	20.2
	56–65	16.2
	>66	2.5
Highest education level	Primary school	7.8
	Secondary school	43.9
	College degree	11.8
	University undergraduate	33.1
	Master's degree	2.9
	Doctoral degree	0.6
Land size (ha)	<10	17.9
	11–20	18.1
	21–50	40.1
	51–100	18.4
	>101	5.5

The online questionnaire was based on previous studies of communication channels [24–27,29] with application to the COVID-19 situation. In addition to the usual communication channels (face-to-face, phone calls, television, radio, newspapers, professional journals, internet, social networking sites, SMS, MMS/Viber/WhatsApp), online conferencing was included. In the first part, respondents were asked to indicate on a 5-point scale (from 1—Never to 5—Very frequently) the frequency of their use of communication channels, before the COVID-19 pandemic and during it, through which they received information important for their farm (necessary information for daily work on farm). In order to determine the respondents' personal opinion regarding the (dis)advantages of using communication channels during the pandemic, we included two open-ended questions where the respondents could write down positive or negative experiences about the situation arising from it. In the analysis, only answers related to the use of communication channels

were selected. The second part included questions on education level, age and gender, and land size in hectares. A pilot study was conducted with livestock experts and livestock farmers and the questionnaire was improved where their suggestions were relevant.

For the open-ended questions, each free-text response was manually coded with one or more categories. Only responses that addressed the topic of the (dis)advantages of using communication channels during the COVID-19 pandemic were included. In addition to basic descriptive analyses, one-way analyses of variance (ANOVA) were performed by applying a *t*-test, taking account of the use of communication channels, and gender, age, education level, land size, and farmers by livestock species. The relationships between variables ((dis)advantages, gender, age, education level, land size, and farmers by livestock species) were analyzed using the  $\chi^2$ -test for categorical variables. Data were coded and analyzed using SPSS 24.0 (IBM, Armonk, NY, USA).

### 3. Results

#### 3.1. Use of Communication Channels

The majority of respondents generally used phone calls, e-mail, and the internet before and during the COVID-19 pandemic to stay informed about agricultural news and obtain information that was important for their farms (Table 2). The *t*-test revealed a difference in the use of communication channels before and during the pandemic in all analyzed channels that were used by the respondents to acquire agricultural information. Respondents had substantially increased their use of online conferencing (+25.4%) and slightly increased their use of social networking sites (+5.5%), while the only form that saw a substantial decrease was the use of face-to-face communication—interpersonal communication, such as personal meetings (−32.5%), and group communication, such as group meetings and lectures/training (−29.4%).

**Table 2.** Use of communication channels by farmers before and during the COVID-19 pandemic ( $n = 502$ ) (in %) <sup>1</sup>.

Communication Channel	COVID-19 Pandemic	Never	Very Rarely	Occasionally	Frequently	Very Frequently	<i>p</i> -Value
Phone calls	Before	5.6	13.3	14.9	35.7	30.5	0.001
	During	5.6	10.6	14.1	34.3	35.5	
Television	Before	6.2	25.7	34.5	22.1	11.2	0.001
	During	5.7	27.3	29.5	24.5	12.9	
Radio	Before	13.1	29.5	31.9	18.1	7.4	0.001
	During	13.5	27.9	27.9	22.9	7.8	
Newspapers	Before	20.3	31.5	33.5	10.2	4.6	0.002
	During	23.5	31.5	26.7	12.0	6.4	
Professional journals	Before	10.0	17.3	28.1	31.9	12.7	0.001
	During	11.4	18.3	28.1	28.1	13.5	
E-mails	Before	7.2	16.3	21.1	33.9	21.5	0.001
	During	8.0	12.7	21.3	30.9	27.1	
Internet	Before	2.4	7.6	14.3	34.1	41.6	0.005
	During	3.0	7.8	13.1	31.5	44.6	
Social networking sites (e.g., Facebook, Instagram)	Before	25.7	15.5	15.3	23.1	20.3	0.001
	During	26.2	11.6	13.3	25.3	23.6	
SMS/MMS/Viber/WhatsApp	Before	23.9	25.5	21.3	18.3	11.0	0.012
	During	25.9	21.1	18.7	20.1	14.1	
Online conferences	Before	51.0	25.3	13.3	7.0	3.4	0.001
	During	23.9	20.5	19.7	20.9	14.9	
Interpersonal face-to-face communication (personal meetings)	Before	4.0	8.2	20.3	39.0	28.5	0.001
	During	10.0	8.7	21.3	20.9	14.1	
Group communication (e.g., group meetings, lectures)	Before	10.6	14.5	28.1	30.9	15.9	0.001
	During	41.2	25.1	16.3	11.6	5.8	

<sup>1</sup> *t*-test.

Table 3 reveals differences in the use of communication channels during the pandemic by gender with regard to the use of television, the Internet, social networking sites, and online conferences. More men (54.2%) than women (45.8%) used television and social networking sites (53.2% vs. 46.8%). The differences were even greater concerning the internet (64.8% men vs. 35.1% women) and online conferences (84.2% men vs. 15.8% women).

**Table 3.** Use of communication channels during the COVID-19 pandemic by respondents and farm characteristics ( $n = 502$ )<sup>1</sup>.

Communication Channel	Gender	Age	Highest Education Level	Farm Size	Farmers by Species
Phone calls	0.536	1.703	0.561	1.184	0.591
Television	9.135 **	1.134	1.280	0.933	2.786 *
Radio	0.017	2.434 *	0.405	1.175	3.093 *
Newspapers	1.291	3.379 **	2.166	1.057	4.765 **
Professional journals	0.560	2.893 **	1.974	1.130	3.903 **
E-mails	0.222	1.036	5.574 ***	1.017	0.455
Internet search	4.354 *	5.040 ***	6.159 ***	1.264	5.186 **
Social networking sites (e.g., Facebook, Instagram)	7.003 **	16.641 ***	4.158 ***	1.035	11.201 ***
SMS/MMS/Viber/WhatsApp	2.312	1.194	4.208 ***	1.111	1.892
Online conferences	6.168 *	3.367 **	18.101 ***	0.933	5.292 ***
Interpersonal face-to-face communication (personal meetings)	1.532	1.624	1.837	1.004	1.058
Group communication (e.g., group meetings, lectures)	3.530	2.874 *	3.383 **	1.064	0.753

<sup>1</sup> ANOVA; F-value; \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

There were differences in the use of communication channels during the COVID-19 pandemic by age in the case of radio, newspapers, professional journals, the internet, social networking sites, online conferences, and group communication. The use of communication channels varied by age. For example, the use of radio (41.2%) and newspapers (37.2%) occupied a leading position among farmers over 56 years of age. Respondents of the younger generation up to 35 years predominantly used internet searching (49.6%), social networking sites (53.7%), group communication (42.7%), and, together with the middle generation (farmers aged between 36 and 55 years), also online conferences (78.9%). Professional newspapers were mainly read by respondents of the middle generation (farmers aged between 36 and 55 years: 64.3%).

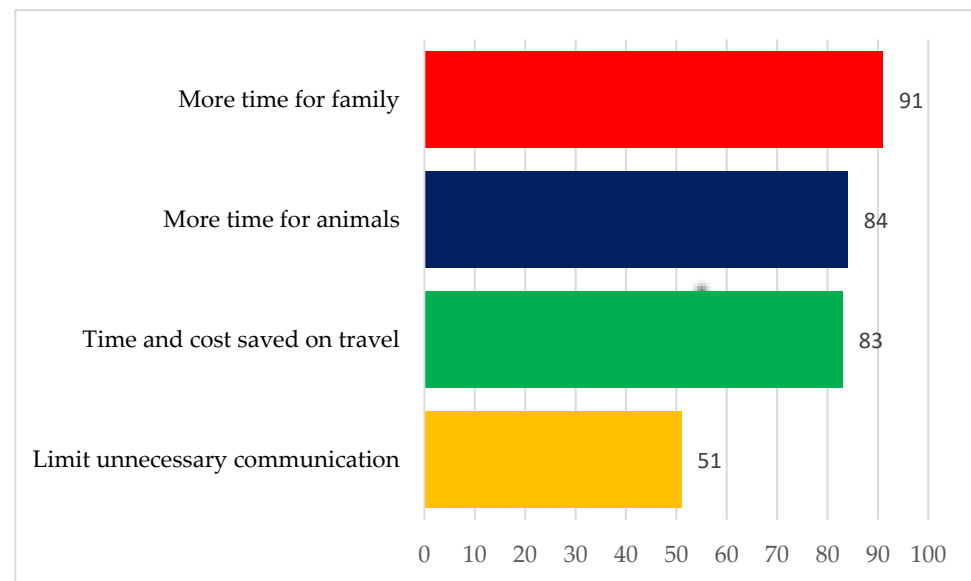
The use of communication channels during the pandemic also varied by education level. Digital communication channels were used by respondents with university degrees and above: e-mail (54.2%), social networking sites (62.9%), internet searching (65.1%), and online conferences (78.9%).

Differences in the use of communication channels were not detected by farm size, while differences in such use during the pandemic emerged between farmers keeping different species. The largest share of those watching television most often reared cattle (34.5%) and pigs (21.4%). Radio was listened to more frequently by cattle (28.6%), small ruminant (23.5%), and pig farmers (21.2%). Newspapers were most often read by cattle (36.4%) and pig (26.9%) farmers, while professional journals were read by cattle (29.5%), sheep and/or goat (21.9%) farmers, and horse farmers (21.4%). Internet searches were most frequently relied on by horse (32.9%) and cattle (31.3%) farmers. Similarly, social networking sites were most often used by cattle farmers (34.2%) and horse farmers (31.4%). Online conferences were by far the most used form by cattle farmers (61.5%).

### 3.2. (Dis)advantages of Communication

Regarding the advantages of using communication channels during the pandemic, Figure 1 shows that around one-fifth of the respondents ( $n = 112$ ) held a positive attitude towards the use of communication channels during the pandemic situation. In particular, 91 respondents stated that the key advantage was having more time available to spend with their families, and 84 respondents emphasized that they had more time for their

animals. A typical statement was: “Since everything is online, I have more time. I can spend more time taking care of the animals and my family”.



**Figure 1.** Advantages of communication during the COVID-19 pandemic ( $n = 112$ ; multiple answers).

As a consequence of the reduced face-to-face communication, 83 respondents pointed out the time and costs saved on travel. One respondent reported, “Because we have online meetings, I have more time available and lower travel expenses”. More than 50 respondents also expressed that they had greater control over their communication and could limit unnecessary communication. “Because it’s an online meeting, I have more control when to leave and I can do something else at the same time”, another respondent wrote.

A bivariate analysis of categorical variables and advantages showed that there was only one significant relationship between time and cost saved on travel and gender (Table 4). Farmers who reported time and cost saved on travel as an advantage of the COVID-19 pandemic were significantly more likely to be female than male respondents ( $\chi^2 = 14.23$ ,  $p = 0.050$ ). There was no significant association between other advantages and gender, age, education, farm size, or farmers by species.

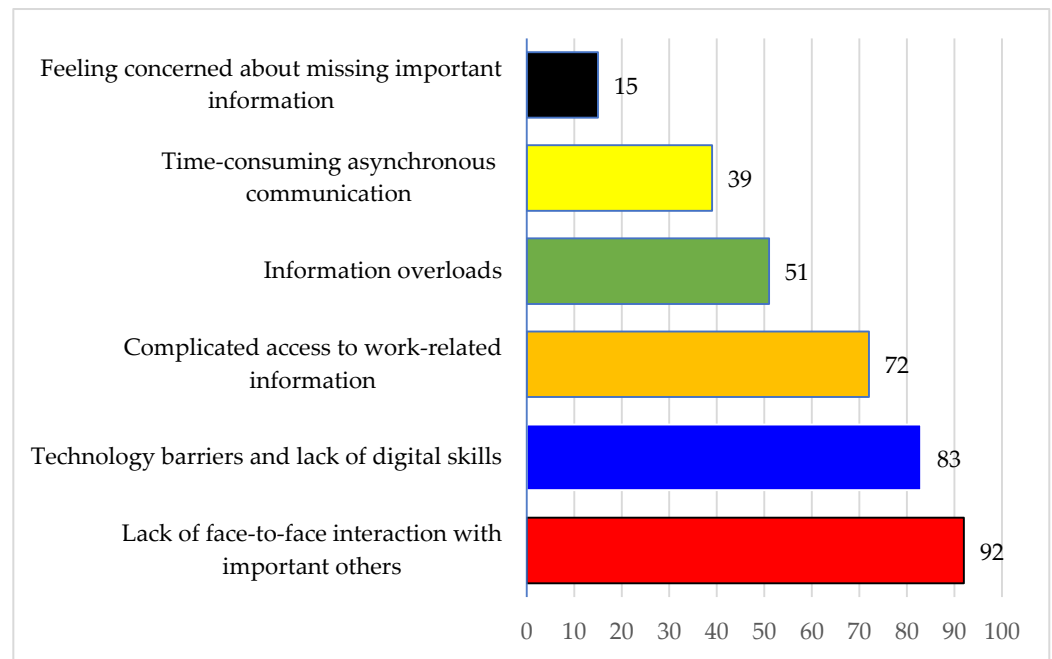
**Table 4.** Advantages of communication during the COVID-19 pandemic by respondents and farm characteristics ( $n = 112$ )<sup>1</sup>.

Advantage	Gender	Age	Education	Farm Size	Farmers by Species
More time for family	0.366	0.050	0.505	0.701	0.071
More time for animals	0.073	0.252	0.093	0.616	0.578
Time and cost saved on travel	0.050 *	0.786	0.071	0.059	0.614
Limit unnecessary communication	0.751	0.641	0.116	0.066	0.059

<sup>1</sup>  $\chi^2$ -test; \*  $p < 0.05$ .

More respondents ( $n = 154$ ) reported disadvantages than advantages (Figure 2) of using communication channels during the pandemic, in a variety of ways. The most frequently mentioned disadvantage ( $n = 92$ ) was the lack of face-to-face interaction with important others, such as other farmers, extension advisers, or veterinarians. A typical statement was, “I miss seeing my colleagues and talking with them seriously. It’s harder over Zoom because we’re not in the same room”. Many respondents ( $n = 83$ ) noted having experienced problems with the technology involved and not knowing how to use it. For example, “I have problems with technology. Every time on Zoom, I have a sound problem and I don’t know where to press to share the screen”. Respondents ( $n = 72$ ) also stated that

access to work-related information had become more complicated. A typical statement was “It bothers me that it’s harder to get information now”.



**Figure 2.** Disadvantages of communication during the COVID-19 pandemic ( $n = 154$ ; multiple answers).

The difference between these two factors is that the “problems with technology and lack of digital skills” factors focus on the problem on the farmer’s side, while the “complicated access to work-related information” factor relates to problems on the information channel’s side, such as an overloaded internet connection or poor performance resulting in a bad connection or not working at all. Over 50 respondents noted that they had too much information, with one interjecting that “everything is too much, too much information”. Around 40 respondents mentioned the time-consuming asynchronous communication as a major disadvantage: “I just have online meetings almost all day, it’s too much. I feel empty”. Some respondents ( $n = 15$ ) also pointed out that they were afraid of missing important information: “I don’t have a comprehensive overview of the information and I’m afraid of missing something”.

There were two significant relationships between disadvantages and age (Table 5). Farmers who reported experiencing problems accessing work-related information ( $\chi^2 = 11.21, p = 0.001$ ), technological barriers, and a lack of digital skills ( $\chi^2 = 9.22, p = 0.001$ ) were significantly more likely to be older than younger. There was no significant association between other disadvantages and gender, age, education, farm size, or farmers by species.

**Table 5.** Disadvantages of communication during the COVID-19 pandemic by respondents and farm characteristics ( $n = 154$ )<sup>1</sup>.

Disadvantage	Gender	Age	Education	Farm Size	Farmers by Species
Feeling concerned about missing important information	0.117	0.100	0.503	0.252	0.059
Time-consuming asynchronous communication	0.838	0.250	0.505	0.172	0.165
Information overload	0.177	0.145	0.106	0.177	0.491
Complicated access to work-related information	0.182	0.001 ***	0.830	0.172	0.531
Technology barriers and lack of digital skills	0.170	0.001 ***	0.144	0.255	0.844
Lack of face-to-face interaction with important others	0.404	0.052	0.182	0.580	0.991

<sup>1</sup>  $\chi^2$ -test;  $p$ -value; \*\*\*  $p < 0.001$ .



#### 4. Discussion

The use of appropriate communication channels is important for obtaining useful information for farmers' strategic decision-making. Based on the sustainability communication theory, situational crisis communication theory, and media richness theory, this study is the first to show changes in farmers' use of communication channels during the COVID-19 pandemic and adds to the understanding of communication channel use by farmers. The study shows the applicability of the emerging approach of sustainability communication, which until recently was common only in the field of business science [32,33], also in the field of agriculture. The results show that in crisis situations such as the COVID-19 pandemic, both farmers and other key stakeholders in agriculture need to establish and maintain long-term quality communication to maintain the farm. The study contributed to the development of a sustainability communication approach when it showed that although the sustainability communication approach equally combines communication about sustainability and sustainable communication, in crisis situations sustainable communication can be even more important than communication about sustainability, as communication is a key element for farm viability.

The study shows that, generally speaking, telephone calls, e-mails, and internet searches were most commonly relied on to obtain agricultural information before and during the pandemic. Farmers were found to differ from the general public in their use of communication channels during this time period. In contrast to the general public, where the dominant sources of information during the COVID-19 pandemic were television, social media, and the internet [14] because they could rapidly provide general information about the pandemic to all sectors, especially emergency announcements and official government information [34,35], farmers received agricultural information through interpersonal communication channels (telephone and e-mails) and internet searches. This may partly be explained by the fact that agricultural information is rarely provided in Slovenian traditional media, such as television, and farmers must search for agricultural information via digital sources. Although Slovenia is traditionally an agricultural country and agriculture is an integral part of everyday culture, it is marginalized in the media and the image of agriculture and farmers is relatively poor [36]. The second reason might also be the dominance of middle-aged and younger respondents in the study, who largely rely on digital channels [35,36].

This study shows differences in Slovenian farmers' use of communication channels to obtain agricultural information before and after the COVID-19 pandemic. A high percentage of respondents significantly increased their use of online conferences and slightly expanded their use of social networking sites, while a significant decrease was seen in the use of face-to-face communication—interpersonal and group communication. This may be explained by the fact that, since governments enacted regulations that restricted public life, farmers and agricultural organizations responded by quickly moving from physical and location-based interactions to virtual interactions, with online conferences largely replacing face-to-face meetings and lectures [37].

The study also found differences in the use of communication channels during the pandemic by gender. Men watched television, searched on the internet, used social networking sites, and attended online conferences more frequently than women. Although similar studies among farmers show that men rely on digital channels more than women [14,18,19], data for the general population show that women tend to use television and social networking sites more than men. However, data for the period between December 2020 and January 2021, when our survey took place, show that the use of these communication channels has changed considerably, with all major key social media being used equally (Instagram) or much less (Facebook and Twitter) by women than by men [38]. A possible explanation for these significant changes may lie in changes in work and responsibilities. The COVID-19 pandemic has exposed and exacerbated gender differences in the constraints that farmers face. Women were already disproportionately responsible for household and caregiving tasks compared to men before the pandemic. With the expectation that they take care of

their children outside of school, female farmers are more likely to be responsible for any additional housekeeping tasks [39]. Therefore, during the pandemic, women have had less time to use various communication channels due to work overload, especially online conferences, which tend to take a longer time [39].

The study also reveals differences in the use of communication channels during the pandemic by age with respect to radio, newspapers, professional journals, internet searching, social networking sites, online conferences, and group communication. The use of traditional communication channels is dominated by the older generation of respondents, while the use of digital channels is mainly led by the middle and younger generations, which is not surprising and is in line with other studies [14,21,22]. Only professional journals are predominantly read by middle-generation respondents, which may be explained by the fact that the younger generation chiefly uses digital channels to obtain agricultural information [14], while the older generation, which is less interested in adopting innovations in agriculture and also tends to save on media purchases [40,41], less frequently buys and reads professional journals.

The use of communication channels during the COVID-19 pandemic also varied by education level. Digital communication channels were typically used by respondents with at least a university degree, which is consistent with other studies [14,40] showing that more educated farmers use ICT because digital literacy is required.

Surprisingly, no differences were found in the use of communication channels by farm size. The reason for this may be that Slovenia does not have stratified farms in terms of size, and small farms dominate. In other words, Slovenia has a tradition of small family farms since, prior to 1991, the maximum land area was limited to 10 ha [14,21,22]. Due to tradition by inheritance, farms have been split into small plots and have become very fragmented. The process of consolidation and enlargement has been slow and successful only for a limited number of farms. Slovenia's farm structure is similar to the situation seen in Poland, Croatia, Bulgaria, Romania, and other Balkan countries.

According to farm size, it is expected that farmers from larger farms acquire their main income from the farm and are not employed outside of it. On the other hand, farmers from small farms are employed outside their farms. Regardless of farm size, almost all farmers have had to stay at home during the pandemic because most companies 'closed their doors' or work was arranged to take place from home. Consequently, almost all respondents reported as their main occupation working on the farm, irrespective of its size.

The study also showed that the use of communication channels during the pandemic differed among farmers that kept different species. Cattle and pig farmers dominated in the use of traditional media, i.e., television and newspapers, while digital channels, i.e., social media and the internet, were principally used by cattle and horse farmers. The vast majority of cattle farmers participated in online meetings, which can be explained by the fact that cattle farmers are organized in different breeding associations, which arranged many online meetings and webinars last winter and in early spring. Since cattle farming is the largest livestock sector in Slovenia, online meetings were attended substantially [38].

On the other hand, the pig breeding organization mainly consists of a small number (around 50 farms for hybrid pigs and 150 members for local breeds) of farms with nucleus and multiplier herds; the others are less organized and, thus, less often invited to different events. Given that the sector is smaller, there is also no specialist professional journal. To some extent, the breeding organization tries to compensate for the lack of professional articles by maintaining a website, but it is still not used by breeders outside of the two breeding organizations.

Respondents reported fewer advantages than disadvantages of using communication channels during the pandemic to obtain agricultural information. As advantages, they stated that they appreciated having more time to spend with their families and on animal care, the lower traveling time and expenses, and the ability to limit unnecessary communication. As digital channels have become the primary communication channel for many farmers, they have emerged as a social technology that has led to a new virtual together-

ness, shared and synchronous and asynchronous social activities and events, replacing the 'off-line' meetings or even events that otherwise could not have taken place due to the distance, cost, time, or other difficulties.

Studies on workers in other sectors working from home during the pandemic reported that they worked for a longer time than they would at their usual workplace, largely because the time spent commuting to work has been replaced by work activities. In contrast, farmers who mostly work on the farm and only leave the farm to perform additional activities were reported as saving time. While studies on telework found that workers missed small conversations and informal interaction [30], our study showed the opposite: farmers believed that the established digital channels limited unnecessary interactions and small talk during the pandemic. In other words, the culture of farmers is more work-oriented than social-oriented [42–44], meaning that small talk and other unnecessary conversations to maintain social relations are not very important for them.

As expected, women were significantly more satisfied than men with the use of communication channels during the COVID-19 pandemic, having saved time and travel costs during the COVID-19 pandemic. In Slovenia, women are typically responsible for shopping and other domestic chores, which takes up much of the time they have saved [12].

The respondents expressed considerable negativity with respect to the use of communication channels during the COVID-19 pandemic, showing that the 'forced digitalization' or unique rationale for and the speed and scale of the adoption of digital communication channels during this pandemic [38] have also brought many negative aspects. The most frequently mentioned disadvantage was the lack of face-to-face interaction with other farmers, advisors, or veterinarians. Respondents noted the technological barriers, lack of digital skills, and complicated access to work-related information. Finally, older farmers experience significantly more problems in accessing work-related information, as well as technological barriers and a lack of digital skills. In addition, they feel burdened by information overload, time-consuming asynchronous communication, and fear that they are missing some important information. In contrast to the results of teleworking studies, which show that the greatest disadvantages of using digital communication channels during the COVID-19 pandemic have been the lack of face-to-face interaction with colleagues and managers [30], the respondents have lost professional communication with other farmers and advisors rather than their colleagues and managers. The fact that most Slovenian farms are family farms means that farmers work alone or with the help of family members. This allows them greater social cohesion within the family and, at the same time, leads to isolation from others (farmers, extension workers, veterinarians, salespeople, etc.). It is possible that the lack of direct contact has been all the more negligible given the COVID-19 pandemic's major impact on the agri-food business [1–3]. Similar to other European countries, animal production (cattle, pigs, horses, and small ruminants) in Slovenia was in a precarious position as prices fell dramatically and fattening animals were difficult to sell in time, which further lowered the price as they were overgrown during the COVID-19 pandemic in 2020. The ratio between purchase and sale prices collapsed as certain categories of beef and pork were more than four times the purchase prices of farmers who could not cover production costs, and warehouses experienced an excess of meat [45–48]. This situation may be, at least in part, a result of reduced demand, the closure of restaurants, educational, tourism, and other institutions in some months in 2020/2021. During this period, unfair trade practices for fresh and perishable meat products increased, such as non-compliance and unilateral changes in contracts, price discounts, changes in delivery terms, and forced discounts [46].

Technology barriers and low digital skill levels also suggest that as access to and skills in using infrastructure and technology rise in importance, more efforts should be made to mitigate the digital divide by developing policies and carrying out measures to ensure that less digitally literate farmers (e.g., less educated and older farmers) are included in the use of technology.

In our study, a significant number of farmers had little experience in using digital channels such as online conferences and/or were not particularly proficient in technology prior to the COVID-19 pandemic. Since all of these farmers have needed to integrate these communication channels into their daily routines and operations, a collective learning process was established, including the awareness of the (dis)advantages of these channels.

The study findings emphasize that the use of digital channels is considered to be important by respondents, especially in the situation of the COVID-19 pandemic, thereby stressing the need to strengthen information technology and education in rural areas. Secondly, the findings also imply that for urgent responses to the changing situation in agriculture, it is necessary to ensure the communication of current information on regulation, policy, and other agricultural issues through digital channels such as the internet rather than focusing on other media. Accordingly, information providers, such as extension and government organizations, should use public information resources to develop, deliver, and disseminate agricultural and rural information through adequate communication channels. Thirdly, the less frequent use of mass media also suggests that the coverage of agricultural issues must be expanded through traditional channels, such as television, to make sure that different farmers (also those with less digital competencies) can find agricultural information through various communication channels.

## 5. Conclusions

The strength of our study is the introduction of the communicative sustainability approach to agriculture, combined with the situational crisis communication theory, and media richness theory, and the presentation of changes in farmers' use of communication channels during the COVID-19 pandemic. The study contributes to the understanding of the use of communication channels by farmers with the diversity of background in terms of different groups of livestock farmers in Slovenia (cattle, pig, sheep, goat, horse, and layer farmers), as studies are usually conducted in breeders of individual animals. Nevertheless, the study has several limitations. Since the survey is based on self-reporting, there may be differences in the actual use of communication channels by farmers. Due to the restrictive measures against the spread of COVID-19, we could not use methods and techniques, such as participant observation, to verify the validity of the results and, hence, we suggest that further studies introduce additional methods.

The study findings show that farmers have increasingly relied on online conferences and social networking sites during the pandemic. At the same time, younger farmers and farmers with a higher education level have used digital channels the most frequently, with men doing so more often than women. Digital channels have primarily been used by cattle and horse farmers, while cattle farmers have shown the greatest online conference participation. Respondents reported having more time to spend with their families and animals as an advantage and the lack of face-to-face interaction with other farmers and advisers as a disadvantage of such communication patterns. Therefore, there is a need for a new communication strategy among farmers in Central and Eastern Europe, one that includes a stronger focus of agricultural information sources on digital channels; better connections to digital media are needed in the countryside, as well as support for farmers to develop their technological and digital skills while also strengthening traditional media's coverage of agriculture.

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