“Investigation into the use of WhatsApp group chats to transfer knowledge to beef farmers in Ireland”

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DECLARATION

I declare that this thesis has not previously been submitted as an exercise for a degree at the National University of Ireland, or any other university, and I further declare that the work embodied in it is my own.

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THESIS ABSTRACT

The purpose of this study was to investigate the potential use of social media for enabling extension workers to share information, knowledge, and advice to farmers or farm workers. The social media tool examined was WhatsApp, the leading social message site in Ireland.

The research design was based on an action research approach. A mixed method sampling approach was used, using WhatsApp group chat. Then a paper-based questionnaire of the farmers in the group chat was used to analyse the farmer characteristics. The level of participation was measured using the WhatsApp Score model, modified from Galvin (2012) index system for Facebook pages.

The key findings for this study identified that the majority of the farmers had all positive experiences when using the WhatsApp group chat, both as a communication tool for connecting them with the other members of the group chat and also accessing agricultural information. In the study, 92 % of the farmers had a WhatsApp account, with 77 % using WhatsApp daily to access agricultural information. The farmers identified the most popular days to use the WhatsApp group chat were Friday, Saturday, and Sunday (weekend) and the most popular time of day was 8 pm to midnight. The farmers who accessed the internet most frequently had the highest WhatsApp group chat usage. The single respondents who had no dependents had the highest WhatsApp group chat usage. Education did not have a major effect on the usage of the WhatsApp group chat. Part-time farmers had a much higher usage of the WhatsApp group chat compared to the farmers farming full-time.

WhatsApp has huge potential for advisors and farmers to keep in contact, share, and transfer knowledge. Farmers are not solely relying on the advisor to answer questions in the group chat but the interaction and peer to peer learning from other members of the group is far more important.

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LIST OF ABBREVIATIONS

AKIS	Agricultural Knowledge Innovation System
CSO	Central Statistics Office
DSL	Digital Subscriber Line
FOMO	Fear of Missing Out
FTTP	Fibre to Premises
ICBF	Irish Cattle Breeding Federation
ICT	Information Communication Technology
IP	Internet Protocal
IT	Information Technology
Mbps	Megabits per second
NBP	National Broadband Plan
SMS	Social Messaging Sites
SNS	Social Networking Sites
SPSS	Statistical Package for Social Science
VDSL	Very High bit rate Digital Subscriber Line

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CHAPTER 1 INTRODUCTION

The purpose of this study is to investigate the potential use of social media for enabling any extension workers or agencies to share information, knowledge, and advice to farmers or farm workers. This research is intended to help understand the characteristics that affect the usage of social media in particularly WhatsApp. WhatsApp is a social networking site developed in 2009 allowing people to stay in touch all over the world with over 1 billion users in 180 difference counties (WhatsApp, 2018). This research is to identify the role WhatsApp has to play in agricultural extension. Agricultural extension is a service that provides technical advice to farmers. As a result of the increasing extra workload due to farm sizes increasing, does social media hold the potential to help farmers improve efficiency with the help of spreading knowledgeable information. Chowdury & Odame (2013) shows that information is more freely available with the use of social media. However, there is no evidence available to show the role social media has played on building knowledge to help solve problems and innovation's regarding agriculture and rural development.

Extension agents can be known as "change agents", with technical and social skills which help them connect and build a relationship with a number of farmers. Change agents work within the organisation also known as the change agency (ie. Teagasc). Through training "change agents" with the appropriate knowledge, skills and tools this allows for effective planning and management of change (Markham, et al., 2014).

Teagasc has a unique innovation system based on three pillars; research, education, and advisory, all together known as the Agriculture Knowledge Innovation System (AKIS). For these to be tied in together, ways of transferring new research and technologies to farmers and students need to be continually improved. Some of the methods used currently for agricultural extension are one to one consultations, discussion groups, education, training, newsletters, and public events. Teagasc advisory has a considerable role to play in agricultural extension; the advisors are in contact with about 80,000 farmers each year, of these farmers, 45,000 avail of Teagasc intensive farm consultancy services all within 12 advisory regions (Teagasc, 2017).

1.1 Background to the study

The background of this study shows the purpose of the exchange agents/ organisations, explains the essential link between exchange agents and farmers needed for solving problems, and the potential of the changing communication channels. Agricultural extension organisations interact with clients and farmers in a number of different methods. These include one to one contact, discussion groups, farm walks, national walks, conferences etc.

To be effective as a competent extension agent, the agent is required to be well trained (Ogunlade, et al., 2011), with skills, knowledge and behaviour competencies to be able to meet client demands (Suvedi & Ghimire, 2015). These core competencies are affected by the training and education extension workers receive. A study carried out by Bager & Proost (1997) shows how facilitators assist farmers in learning and development as they bring farmers together helping to empower and encourage change. Methods of interaction vary depending on the relationship between the advisor and the client. This link is essential for solving problems (Cerf, et al., 2011). Decision making is aided with the social aspect of interaction as contact is made with a "web of influencers". The "web of influencers" includes agricultural support and other farmers. The relationship built allows farmers to gain an in-depth understanding of technologies and innovations which they may decide to use from related agricultural communities. The communities help with challenges and have the ability to access information from other farmers pulling on their expertise. The communities help farmers come together for louder voices in times of need (Orezczyn, et al., 2010).

The world of communication is constantly changing as the internet and ICT have evolved. Lasley *et al.* (2001) believed that extension service's use of ICT would modify or replace the traditional methods previously used. The use of ICT has been helped in recent years by the improved computer literacy skills and awareness of the new technologies available. Social media then became a popular method of communication and the fastest growing communication channel (Rigby, 2008). Social media allows the user to discuss, interact, and share information between people. It is facilitated by the use of digital technologies (Barau & Afrad, 2017). Users can share information in any form such as text, pictures, videos etc. (Saravanan, et al.,

2015). Accessibility of social media has led it to be used as a communication tool, with an increase in social media usage seen to follow in line with increased phone subscriptions. There are 2.08 billion active social media accounts of this 1.69 billion people access these via the mobile phone (Bhattacharjee & Raj, 2016). Stanley (2013) shows that social media gives the power of voice, with the ability to connect with farmers, industry and consumers no matter their geographical location.

1.2 Research Problems

With fewer advisors in the agricultural sector, it is essential to find a useful way in which farmer and advisors can keep a strong relationship through communication. Communication is used to effectively aid knowledge transfer, developing new ways of sharing information in the forms of pictures, videos, links, and technical information. Social media has the potential to spread the information freely, but it is not known if this has a role in building knowledge, keeping up to date with new research, technologies, innovations and helping solve problems leading to improve productivity and efficiency levels in agriculture and rural communities. Little research has been done in this area and has not previously looked at the farmer characteristics and how these affect their use of social media tools such as WhatsApp. This study has been designed to investigate the use of the WhatsApp group chat to transfer knowledge.

1.3 Research Questions

The following research questions need to be answered to investigate the use that the WhatsApp group chat has in transferring knowledge to beef farmers in Ireland:

- What are the opportunities and potential ways social media can be used by extension to target audiences to deliver key messages?
- What are the characteristics of the farmers using WhatsApp and how does this affect their interaction in the group chat?

1.4 Research Objectives

To carry out this study, the following research objectives need to be addressed:

1. **Develop and pilot** WhatsApp group chat suitable for farmers.
2. **Analyse** the characteristics of farmers who use WhatsApp and their type of interaction in the group chat.
3. **Identify** the role WhatsApp has to play in transferring knowledge.

1.5 Utility of Study

This research will be valid for agricultural extension worldwide and will help gain an understanding of how WhatsApp as part of social media can be used to communicate with farmers. It would specifically benefit any beef advisor dealing with a number of clients who interact in online discussion sites to keep the communication and relationship active and updated throughout a season of farming. It is more important as the ratio of advisors to farmers is constantly dropping. This study appears to be one of the only studies looking into the usage of WhatsApp group chat to transfer knowledge to beef farmers in Ireland.

CHAPTER 2 LITERATURE REVIEW

The purpose of this chapter is to review and present literature which will provide a suitable background, establishing the previous research completed in the area of transferring knowledge to beef farmers in Ireland practically with the use of social media. The chapter is broken into four sections, the first section focusing on methods of extension. The second section focuses on the development of the internet and how it has evolved. The third section reviews the development of social media, looking in detail about Ireland's usage and following on to farmers' usage. The fourth and final section discusses the factors which affect social media usage and determines the positive and negative effect social media has on society.

2.1 Methods of Extension

There have been many methods used for extension and communication with clients. Extension is the method used to help give information, which forms opinions and makes good decisions. Extension is needed for farmers to learn about the changes in our society and how farm efficiency is needed to cope with the changing environment (Van Den Ban & Hawkins, 1996). Today, depending on the message being transferred, different techniques are used, some more innovative than others. Telephone and letters are still a common way of communication. Information influences changes in practice, this can be from print (e.g. newsletters, papers etc.), electronic media (social media), experts, peers, or training days. All these combine to give the farmer a range of information to learn from and new techniques to manage their business (Ryan, 2004).

Farm advisors and extension agents have a massive role to play in agricultural extension as they help farmers to validate, reflect on, and reinforce technical learning. Agricultural advisors give farmers' confidence to put in place new practices (Watson, 2012). It is important for extension agents to bring change to farmers using the right teaching methods, this all helps to achieve a set of goals for the farmer by changing skills, knowledge and attitudes (Okunade, 2007). Promoting new technologies through the use of communication tools is very influential (Roger, 2003). Morrison (2012) stated the five primary methods used by an advisor to communicate

with clients were one to one, discussion group meeting, public agriculture events, agricultural publications, and general conversation. One to one allows for discussion of confidential issues. A discussion group helps deal with practical issues, learning from other experiences. Public events allow for learning from the best in the area or field demonstrating best practice. Agricultural publication spreads messages through print from newspapers, newsletters etc. A general conversation develops peer to peer learning through discussing day to day practices (Morrison, 2012). Mass communication is useful for the transfer of information to numerous people at one given time, to plant an idea, but for the transmission of specific information, other methods are more critical (Mgbakor, et al., 2013). Mass media plants the idea, from this farmer can decide to adopt the idea. Often more communication can be needed before the innovation is adopted depending on the individual's farmers, varying from individual one to one consultations to discussion groups or events (Santucci, 2005). This gives the farmers the extra confidence farmers need to take up new practices and to adopt new technologies (Botha & Coutts, 2006). Watson (2012) showed the interaction between the client and his/ her household is an extremely important relationship, where individual effective responses are a critical part of the role of an advisor to continue the learning process.

"Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1983). Rogers (2003) further categorised people into the rate they adopt an innovation; he broke this into five categories innovativeness, early majority, late majority, and laggards, known as the theory of innovations. This is presented in Figure1.

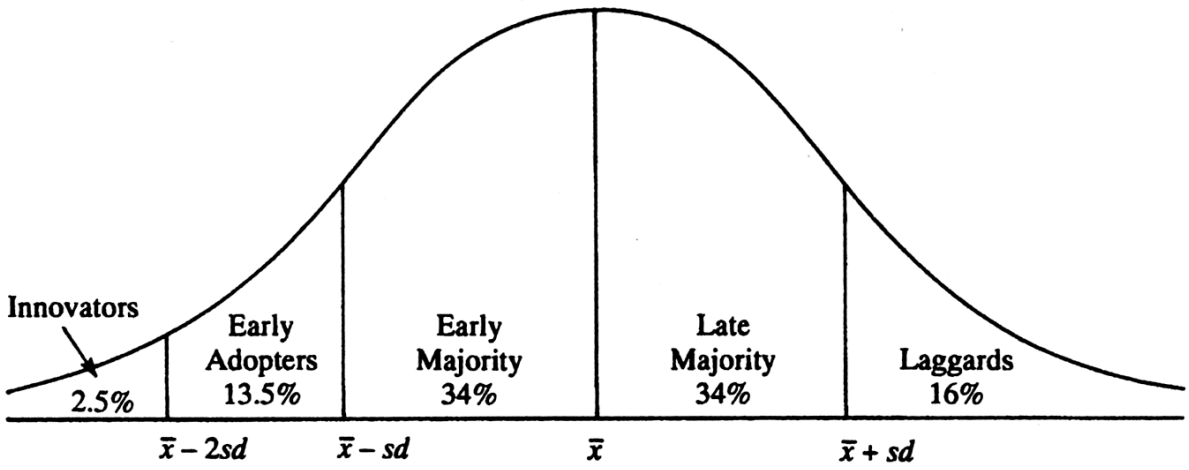

Figure 1: Bell-shaped curve **(Roger, 2003)**

These five types of innovators represent a bell shape curve; the bell represents the five different categories:

- **Innovators** - farmers willing to take risks wanting to discover innovations, and ideas (Roger, 2003). These are very social, young in age, a higher social class, with contact with scientific sources and interact with other innovators they are also known as “technology enthusiasts” (Dube & Gumbo, 2017).

- **Early Adaptors -** these are the earliest adopters after discovery, they are slightly more cautious. This category is most looked for to speed up the adoption process as they can be seen as opinion leaders when innovations are discovered (Roger, 2003). They are techno-savvy, educated, young in age, and high social status (Dube & Gumbo, 2017).

- **Early majority -** these are willing to take on new ideas but want to wait and see before adopting, they will not lead (Roger, 2003). These have strong expectations, taking longer to adopt the idea, and have an average amount of knowledge when dealing with technology (Dube & Gumbo, 2017).

- **Late majority** - these are the last ones to adopt new ideas, they are sceptical about ideas, but once the innovation is adopted, they soon realise the benefit.

- **Laggards -** these might never get around to adoption; they are set in their ways, bound by tradition and do not like change, these are the oldest of the

adopters (Roger, 2003). Santucci (2005) stated that the methods of communication used should be suitable for the reason intended and must be tailored to the needs of the individual to meet their goals.

Adoption is the process where an individual takes up a new idea or product, for this to happen, a number of stages must first occur from hearing about an idea to finally adopting it (Roger, 2003). Everett Rodgers set a five-step process, the innovation diffusion process, which outlines the process of the adoption of an innovation. The five-step process is broken down into knowledge, persuasion, decision, implementation, and confirmation.

- **Knowledge -** is where the idea is first introduced. Mass media and IT are the main ways of spreading the message from these farmers who want to find out more information about the idea.

- **Persuasion -** is when farmers have found out about the idea and are interested in the innovation. The message could be spread through field days, demonstrations, farm walks, and meetings.

- **Decision -** here the farmer decides if he will reject or accept the idea, weighing up the positives and the negatives. At this stage, farmers will determine if the innovation suits their system one to one consultation may be needed to help assess the innovation.

- **Implementation -** this stage occurs when the farmer is after trying the innovation and will reflect on the new practice. Within discussion groups, farmers have access to a number of important people to encourage progression such as specialists and consultants (Roger, 2003). Farmers also feel that a problem shared is a problem halved, they have a number of people they can talk to in the same situation (Owen, 2003).

- **Confirmation -** is when farmers start using the innovation to its full potential.

Diffusion in the process where innovation is communicated, relating to the bell shape curve, helping to categorise people into the rate of adoption. Understanding the bell shape curve and the individuals in each category help to determine the communication channels needed to connect with the individuals. As examined

previously the innovators and the early adoptions were also known as “technology enthusiast” and “technology savvy”. This is where forms of mass media such as the internet and social media have the potential to plant an idea. Adoption is the individual decision to adopt an idea. Here agricultural advisors have a considerable role to play in extension; advisors are needed to give farmers extra confidence to take up new practices, to adopt technologies and to help individuals through the five-stage process of adoption of innovation from knowledge down to confirmation. Methods of communication used are changed to meet the demands of the client and the message to be trailer messages. The Internet is used to develop conversation where peer to peer is possible from discussing day to day practices, all building up knowledge. WhatsApp has the potential to facilitate this conversation between a closed group of people. The development of the Internet will be discussed in the next section.

2.2 Development of the Internet

The face of communication has been changing since the development of the internet, with the ability of global broadcasting gradually replacing traditional mass media communication such as newspaper, television, videos, poster, leaflets, and radio (Osatuyi, 2013). The benefits of mass communication allow for rapid transfer of information at the same time, but it is only a one-way communication channel (Watson, 2012). The Internet can be used to interact and communicate with people and communities regardless of their location (Varner, 2012).

Effective communication is needed for increasing agricultural productivity by transferring new research findings and technology (Abubaker, et al., 2009). When it comes to managing a farm business, farmers use a wide range of information resources and learning processes. Most changes occur from the interaction between a number of different sources (Ryan, 2004). The World Wide Web used interlinked hypertext to access data from anywhere at any time. Tim Berners-Lee created web 1.0 in 1989 this was the first generation of the web. Web 1.0 was a “read-only web” allowing very little interaction, information was static (Patel, 2013). There were 45 million global users on 250,000 sites, in 1996 (Wright & Zdinak, 2009). A webmaster published the content by manually assigning hyperlinks to pages consisting of text,

images, menu, and navigation icons (Patel, 2013). Web 1.0 was deemed unsuccessful as it struggled to cope with a large number of web pages. As web 1.0 usage slowed down, it allowed the user to create and share content, but the facility was not available to change content (O'Reilly, 2005).

Web 2.0 was developed in 2004 in a conference brainstorming session between Media Live International and O'Reilly (O'Reilly, 2005). O'Reilly himself stated, "Web 2.0 is a set of social, economic and technology trends that collectively form the basis for the next generation of the internet – a more mature, distinct medium characterised by user participation, openness, and network effects" (Wright & Zdinak, 2009). The development allowed for a read/write web moving to where people could easily contribute, which had no hard boundaries. It did not take long for web 2.0 to take off and by 2006 there were over 1 billion users with 80,000,000 sites (Wright & Zdinak, 2009). Table 1 presents the comparisons between Web 1.0 and Web 2.0.

Table 1: Comparison between Web 1.0 and Web 2.0 users **(Wright & Zdinak, 2009)**

Web 1.0	Web 2.0
Passively read and search for content	Actively creating and sharing content online
Opinions are expressed by the content creator	Content presented can be changed, and your opinion can be expressed
Take the webpage as it is	Change and customise web pages
Main communication tool was email	Peer to peer programs are the main communication tool
Main assess point to the internet through the computer	Able to connect to numerous different devices
Internet was limited to time sessions	Internet readily available often connected the whole time

New communication behaviours were seen from the growth of the broadband internet connection, this allowed for change to occur at an extraordinary rate. This included better social interaction, active participation, personalisation and communication of information (Wright & Zdinak, 2009). Nelson and Trede (2004) believed the internet

would be useful for farmers in the future. However, to utilise this farmers would first have to improve their IT skills.

Morrow *et al.* (2003) stated that Teagasc believed that ICT had a real role to play in improving the efficiency of farm operations. However, the uptake of Irish farmers is very low and extra resources are needed to get farmers to understand the real benefits of ICT but also to focus on training needed to get competencies up to the level required.

Dhaker *et al.* (2013) stated that the agricultural industry is continually changing. ICT delivers information quickly, using this to provide knowledge and advice; this has now been recognised as an essential element for agricultural extension.

The internet started the use of mass communication to spread a one-way message with the use of Web 1.0. As Web 2.0 was developed, it allowed for read/ write information, allowing people to easily contribute with no boundaries, leading to new behaviour changes. This was aided with the growth of broadband internet, leading onto the development of social media which discussed further in the next section.

2.3 Development of Social Media

Social media is an Internet-based communication method with the power to connect millions of people, where users interact, create, share and exchange user-generated content through an online community (Morris & James, 2017). Social networking is the term used for how people interact on these social media sites such as Facebook, Twitter etc. The individual constructs a profile public or semi-public, becoming part of a community by connecting with other friends or likeminded people used to share information (Boyd & Ellison, 2008). Social messaging is the way of sending an instant message or chat such as Facebook messenger, snapchat or WhatsApp etc. As the users of social media grow, information gets more useful and valuable as people connect depending on their shared aims and interests in “real time” (Andres & Woodard, 2013).

The first recognised social media site was Six Degrees and developed in 1997 with peak usage of around one millions members. Over the years other social media sites

were developed with different purposes and categorised on how users interact with them (Osatuyi, 2013). In 2003 LinkedIn was founded and devoted to businesses. In 2004 Facebook was started with Harvard students, before it was expanded to everyone in 2008. Facebook users could not customise the design of the web page but allows for the posting of photos, videos and one can change the content available on their profile (Kinsey, 2010). In 2006 Twitter was launched, this only permitted tweets to be sent to followers with a capacity of 140 characters or less (Staff, 2009). In 2009 WhatsApp app was founded and developed by Brian Action and Jan Koum, allowing people to stay in touch all over the world. WhatsApp was changed to a paid service to avoid it growing too fast but in 2014 Facebook bought WhatsApp. In 2016 WhatsApp changed its business model to a free service. WhatsApp is used for both messaging and calling phones all over the world, with 1 billion people using the app currently in more than 180 different countries. WhatsApp also has a function which allows it to be synced with a desktop to allow for a conversation on whatever device is being used (WhatsApp, 2018)

As internet connections increased, this led to an increase in social media used for connecting more and more people. In a quarterly report carried out by ComReg at the end of March 2018, there were 1.71 million active subscriptions of broadband in Ireland.

Broadband is accessed in a number of different ways (Table 2) varying from DSL broadband- digital subscriber line, VDSL broadband- very high bit rate digital subscriber line, to FTTP broadband- fibre to premises, cable broadband and mobile broadband.

Social networking is ever-increasing starting out with a global use of 0.97 billion in 2010 and increasing to 2.46 billion in 2017 (statista, 2018). A study carried out by McGreevey related broadband speeds to be a major cause of the slow uptake of ICT in farming families. It showed Irish Premises with a broadband speed higher than 10 Mbps only accounted for 35 % of all premises. Irish homes with broadband speeds of 4 Mbps only accounted for 69 % of households.

Table 2: Active broadband subscriptions in Ireland March 2018 **(ComReg, 2018)**

Subscription Type	Q1 2018	Quarterly Growth Q4'17 – Q1'18	Year-on-Year Growth Q1'17 – Q1'18
DSL Broadband	340,350	-5.2%	-17.9%
VDSL Broadband	591,709	+2.9%	+12.5%
Cable Broadband	373,239	-0.6%	+1.5%
FTTP Broadband	50,091	+26.5%	+314.8%
Satellite Broadband	4,865	-2.4%	-6.8%
FWA Broadband	50,658	+6.8%	+7.0%
Total Fixed broadband	1,410,912	+0.7%	+2.8%
Mobile Broadband	297,223	+1.4%	-12.4%
Total Broadband	1,708,135	+0.8%	-0.2%

Social media allows an individual construct a profile which connects millions, from the interaction with others shares, and create content. Social media has come a long way from the first social media site in 1997 to currently Facebook the leading social networking and WhatsApp the leading social messaging site. The increase in internet connections due to more broadband subscriptions has led to more people using in social media. However there is still potential to increase further as the broadband penetration rate in Ireland was at 68.4 % for the start of 2018 (ComReg, 2018). The continued growth of social media is further discussed in the next section.

2.3.1 The growth of Social Media

The growth of social media was hugely aided by access to internet on smartphones. Usage further increased with the decrease in internet data charges (Jijina & Raju, 2016). The revolution of the internet from the 1990's offered a new view on the purpose of the internet as a useful tool and this in turn increased the adoption of social media (Durkin, et al., 2013).

The popularity of social media sites is not just because of the ability to connect people, family and friends but because of the vast potential it holds in rapid communication, in both a personal capacity and a business capacity and for educational purposes (Jijina & Raju, 2016) (Howe, 2014) (Aladwani, 2014) (Howe, 2014). Social media plays a huge role in a number of different areas, especially

marketing. Professionals use social media as a favourite method of marketing. It is highly cost-effective, reaches large numbers of people, discussions can be generated from members of a community and content can be accessed on mobile phones. It is also easy to measure the impact of posts by tracking the number of followers, and people visiting the page (Saravanan, et al., 2015) (Durkin, et al., 2013).

Social media marketing is used to build brand awareness and build a reputation, which will lead to generating sales (Öztamur & Karakadilar, 2014). Social media can build strong relationships by gaining trust and helps in enhancing and maintaining this, giving a platform for stakeholders to have more intimate network relationships (Durkin, et al., 2013). The information gathered and gained through social media can allow for informed decisions to be generated (Howe, 2014). As this area is changing so often, it can be hard to keep up to date with these new opportunities as they arise. It is essential to be open to new ideas and not to miss out. This has been seen to have caught many industries off guard in the past (Drury, 2008).

The key to successful marketing, stated by Maddy & Kealy (1998) is to create easy to remember messages and images, keeping language consistent throughout the posts and messages. As internet access and the ability to access the internet on the mobile phone improves, social media usage started to accelerate. Social media holds great potential in both business and personal capacity. Ireland's use of social media is discussed further in the next section.

2.3.2 Irelands use of Social Media

Ireland's use of social media is aided by the improvement of infrastructure and broadband speeds. With lower data rates it is now easier to access the internet on different devices. The current ownership of devices Ireland versus the UK is presented in Figure 2. Mobile data has increased dramatically since 2013 rising fivefold by 2017 according to the survey carried out Ipsos. This shows that 42 % of mobile phones are now accessing 4G internet (RTÉ, 2017).

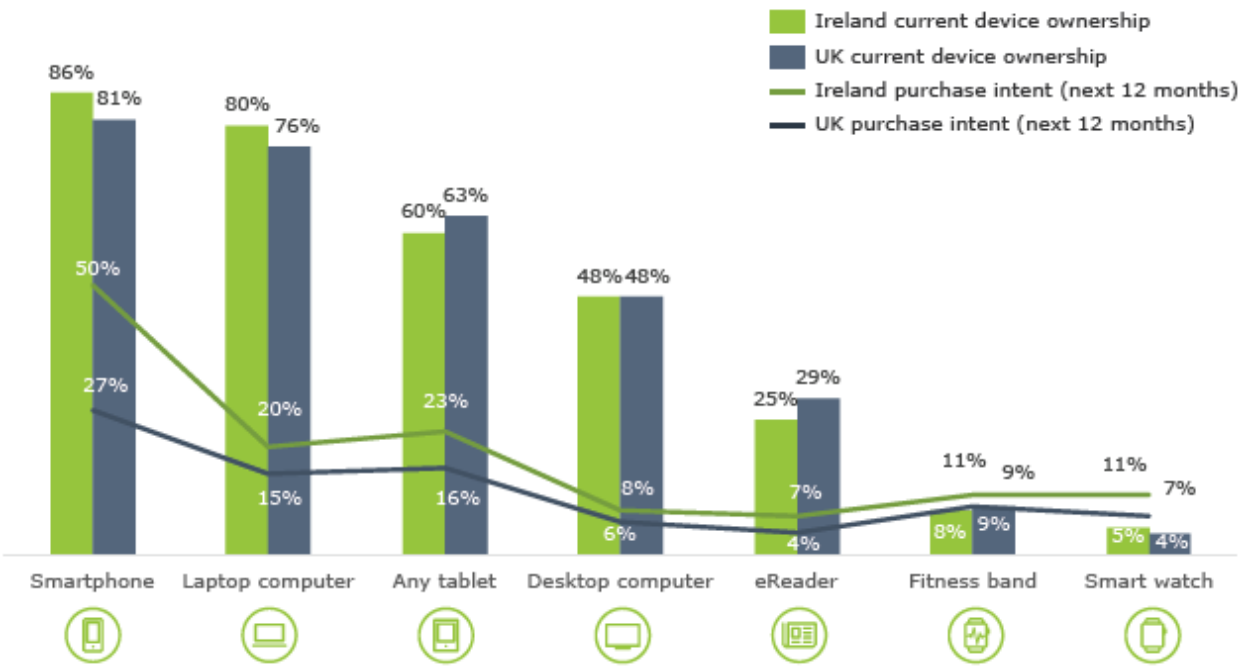

Figure 2: Device ownership in Ireland compared with the UK in a survey carried out by Deloitte Global Marketing **(Howard, et al., 2016)**

Facebook is currently the world leader, with 2.23 billion monthly active users in June 2018 and 1.47 billion daily active users (Facebook, 2018). Ipsos MRBI carried out surveys up to November 2017 which showed Facebook is the leading social networking site in Ireland with 65 % of adults over the age of 15 in the Republic of Ireland with an account, of these 69 % using it daily. WhatsApp is the leading social messaging app in Ireland with 61 % of adults holding an account (about 1.4 million people), this is the highest record to date and has been continuously increasing. A more recent survey in March 2018 showed the usage has risen to 64 %, with 69 % of adults using the app daily (Ipsos MRBI, 2018).

It is hard to determine Ireland's social media use. In 2017, when looking at businesses (classified as employing more than ten people) the social media usage was 69 % compared to the European average of 47 % (Table 3).

Other ways social media was used include social networks, enterprise blogs, multimedia, content sharing websites and wiki-based knowledge sharing tools. Irelands use is above the EU average in all of these areas with social media usage increasing in all areas since 2015 (CSO, 2017). For social media to be successful, it

needs to be an active account, and the followers need to be a committed group of followers (Rigby, 2008).

Table 3: Social media use in businesses 2015 – 2017 compared with EU averages **(CSO, 2017)**

						%
	Ireland 2015	Ireland 2016	Ireland 2017	EU-28 2015	EU-28 2016	EU-28 2017
Use of any social media	64	67	69	39	45	47
Use of social networks	62	65	67	36	42	45
Use of enterprise's blogs or microblogs	30	33	33	13	14	14
Use of multimedia content sharing websites	21	23	23	13	15	16
Use of wiki based knowledge sharing tools	8	8	7	5	5	5

Research has shown that farming families have a slower uptake of ICT. This is an infrastructure issue, affected by lower broadband speeds. As the speeds of broadband have increased, so has the uptake of ICT. Farmers use of social media is discussed in the following section.

2.3.3 Farmers use of Social Media

From looking at the economic benefits of ICT, the uptake is low. This attributed to poor infrastructure and low levels of education (Thysen, 2000) (McGreevey, 2015). Another study carried out, looking at the adoption and usage of technology in Ireland by Connolly (2010) showed that only 29 % of farmers rated themselves as having an experienced or advanced skill level for computer use. It could be seen that a farmer's age affected their attitude towards web-based technologies and this was also influenced by the level of educations the farmers had received (Connolly & Woods, 2010).

Social media has the advantage of connecting farmers from all areas around the world, but Stanley (2013) noted four key areas which show the main advantages from using social media: Farmer to farmer contact, Farmer to the agricultural industry, farmer/ industry to the consumer and crisis communication. The Farmer to farmer contact allows for networking via social media. This has been seen to reduce isolation in communities abroad and in Ireland. This connection allows for the ability

to meet and network with other farmers, business and consumers understand the changing world (Stanley, 2013).

There are a number of influences in which social media allows direct contact with, no matter where they are located. The range of sources available provides the environment for the transfer of ideas and wealth of knowledge. It also allows for the facilitation of online discussion on industry issues such as AgChat model (Stanley, 2013).

The use of the internet for social purposes has a huge role in agriculture as a way of reducing isolation and reducing the impact of rurality (Dillon, et al., 2017). The 2013 National Farm Survey showed that 59 % of farmers had internet access. Of this, the majority of farmers (61 %) used the internet to access social media such as Facebook and Skype to communicate with others. Age had the biggest bearing on internet usage with only 28 % of farmers over 60 having internet access and only 7 % using It for social purposes (Dillon, et al., 2017). In 2013 a survey carried out by The Linking Environment and farming stated that eight out of ten farmers are active on social media (Gough & Jarrett-Kerr, 2013)

Furthermore, in 2017 the National Farming Union surveyed farmers in Britain which showed 98% of farmers had a phone, of these 61 % owned a smartphone. The study also showed only 3 % did not use the internet, with 60 % owning a tablet (National Farmers Union, 2018). Farmers who have reached the point of succession and are in the age bracket of 35-44 years. Social media has the potential to play a significant and active role in decision making and drivers of technology adoption (Morris & James, 2017).

Social media is an Internet-based communication tool with the ability to connect millions no matter their geographical location. The adoption of social media was affected by internet access and rapidly accelerated with the access to the internet on a mobile phone. Farming families had a lower uptake with poorer infrastructure and low levels of education. Farmers rate themselves with low or poor rates of computer skill, further holding back adoption of social media.

Social media has huge potential and is continuing to grow in both a business and a personal capacity. Social media allows businesses to identify the impact of a post by

tracking the number of follows, visits to page etc., with memorable messages sticking in the mind making bigger impacts. Social network sites have developed and changed over the years, constantly trying to import and keep up to date. Currently, Facebook is the leading social networking site, with WhatsApp as the leading social messaging app. Both these sites allow for the transfer of a wealth of knowledge, ideas, with the ability for online discussion bringing people or communities together. This is where WhatsApp holds massive potential to allow peer to peer learning within a closed group forming online discussion on the topic. When dealing with online communities and social media, there is a number of different factors which affect social media usage which is discussed in the next chapter.

2.4 Factors affecting usage of Social Media

The Impact of social media all relates back to the participation of the users and the free flowing of information which occurs between members (Saravanan, et al., 2015). The free flowing of information was not possible until the introduction of Web 2.0 explained in previous chapters. This granted the users access to generate content, which allowed for commenting or sharing of information. This led to knowledge and information achieving much greater audiences in a short space of time (Bhattacharjee & Raj, 2016).

People get confused by inaccurate messages which lead to misbeliefs that can be hard to change. This relates back to influencing the group you are part of and how these people share information and the quality of the information available in the group. Understanding the group improves the way people share information and the truthfulness of the data shared. From this opinions are shared with suggestions and judgements leading to adoption by other members (Li & Sakamoto, 2014). Older adults aged 55 and over spent a lot less time on the internet than younger consumers, but are not as knowledgeable about internet fraud and this can lead to them being a lot more vulnerable to online information, privacy and security scam but also to have different attitudes towards computers (Chakraborty, et al., 2013).

A study carried out by Newbury & Humphreys *et al.* (2014) showed the main barriers to social media were money, the ability to access the internet, time and control. The

perceived barriers were seen as security, privacy both personal and professional and publicness of media (what happens to the information published). This is reinforced by Mandel and McQueen as they found owner characteristics and organisational efforts on social media such as the time involved and expectations which had a role to play in both adoption and barriers. Morris and James (2017) identified the barriers to adoption and why uptake of social media is low due to age, education, technology infrastructure (poor internet connection), and IT skills.

In agriculture, it can be seen that most producers are not making the most of technology. This can be due to personal characteristics, character, and education. This can in turn relate to the barriers they face as they are not able to utilise the information available to them, this being the most substantial barrier to ICT adoption.

Engagement in social media looks at the relationship needed for gaining information arising from political, consumer or social needs. Barriers affect how information is utilised and how content is engaged with (Morris & James, 2017). Continuing on from this section I have discussed the positive and negative effects of social media in the next subsection.

2.4.1 Positive and Negative Effects of Social Media on Society

Social media has many different effects, both positive and negative but a meta-analysis carried out by Boulianne (2015) shows that social media has a positive impact on the relationship between social media use and participation of 82 % of the 36 studies with 170 coefficients, with the remaining 18 % showing a negative relationship. However, only half the positive coefficients are statistically significant.

Battacharjee & Raj (2016) researched agricultural professions to explain the reasons they use social media. They show that 79 % use social media to find out news and events, exchange knowledge (62.9 %), share information (62.9 %), connect with friends and relatives (60.7 %), share professional activities (55.4 %) and use it to find interests (54 %).

Social media is used by organisations to gain and build relationships across platforms, to use this to its full potential a number of companies hire social media

communicators. The social media communicator uses a platform to engage with the target audience through posting information and engagement (Carpenter & Lertpratchya, 2016). As the relationships are built companies try to develop their sources as having sources of credible and valuable information (Lotan, et al., 2011).

Stanley (2013) shows the four key areas showing the value of social media, bring the farm to fork closer, making more transparency, building trust through engagement and authenticity.

- **Farmer to farmer contact:** the value of networking
- **Farmer to agricultural industry:** is a key area for marketing, using, or providing content with a value to the farming community. This can be used for lobbying gaining a collective voice with people of influence to try and bring about action and change. This allows for agricultural practices to be disseminated to wider audiences through extension and knowledge transfer.
- **Farmer/ Industry to the consumer:** As consumers, purchasing decisions are changing, it is important to use social media as a marketing tool to connect and engage. Consumers will talk about issues, but it is important to be a part of them to agree/ disagree with issues raised and understand the needs and viewpoints of all involved while helping to gain and build trust.
- **Crisis communication:** social media is a two-way communication tool this helps the agricultural industry to use communication strategies with authentic, efficient, and transparent voices.

Positives effect of social media comes from a connection with a number of peers and friends, to allow enjoyment and usefulness of the information posted, again for these results from men and women were analysed. The research found that women are more sensitive to new technology and opinions and are more susceptible to influence from SNS. Also the number of followers/ peers determined the effectiveness and usefulness of SNS. While with men, the number of members does not affect them and feel no need for large followings. They use new technologies to perform the tasks required.

When users posted information such as sharing links, photos, videos and weblogs this makes friends feel interested and allows for interaction and fun between peers (Powell, 2009). The pleasurable experiences associated with SNS strengthen the use of the site, increasing the connections between members with enjoyment, the most significant factor to affect the continued use of SNS (Lin & Lu, 2011). Companionship support, appraisal support and life satisfaction had a positive effect on SNS users (Oh, et al., 2014).

There is a number of drawbacks or negative effects of using social media. Bhattacharjee & Raj (2016) shows that faulty internet connection (35.2%) is the major drawback of social media, followed by unproductive use of time (33.9 %), control internet footprint (24.2 %), lack of experience using social media (20.7 %), Fear of Missing Out (FOMO) (10.6 %) and other (10.6 %). Certain infrastructure issues need to be dealt with by service providers such as internet connection. A number of the other issues can be eliminated through training and workshops to create better understanding and awareness of different personal and privacy concerns. Disadvantages were the lack of authenticity (48.8 %), confusing (45.9 %), the absence of professionals of higher age (43.2 %), location-specific nature of social media (32.4 %) and this was distracting to many (24.3 %). Poor citation leaves it impossible to trace, with a lack of control. Irrelevant posts, privacy concerns, conflicting perceptions and lack of capacity, all are negative effects seen by using social media (Fuess, 2011).

Social media still needs to be improved in the way it connects with research, with the lack of monitoring allowing for mistakes in scientific information and allowing for duplication, making it harder to show authentic sources. Still, to this day, there are limitations in the audience. There is a massive variation between developed and developing countries (Bhattacharjee & Raj, 2016). As social media usage has increased, so has the number of reports such as cyberbullying, privacy invasions, trolling, addictive use and fake news.

Kietzmann *et al.* (2011) developed seven social media building blocks to develop the honeycomb framework. The framework looked at the bright side of social media, describing features, user experiences and functionality under seven sections. The seven sections are; sharing, presence, conversations, identity, relationships, groups

and reputation. This was then modified to show the negatives effects of social media in each functional block seen in Figure 3 (Baccarella, et al., 2018).

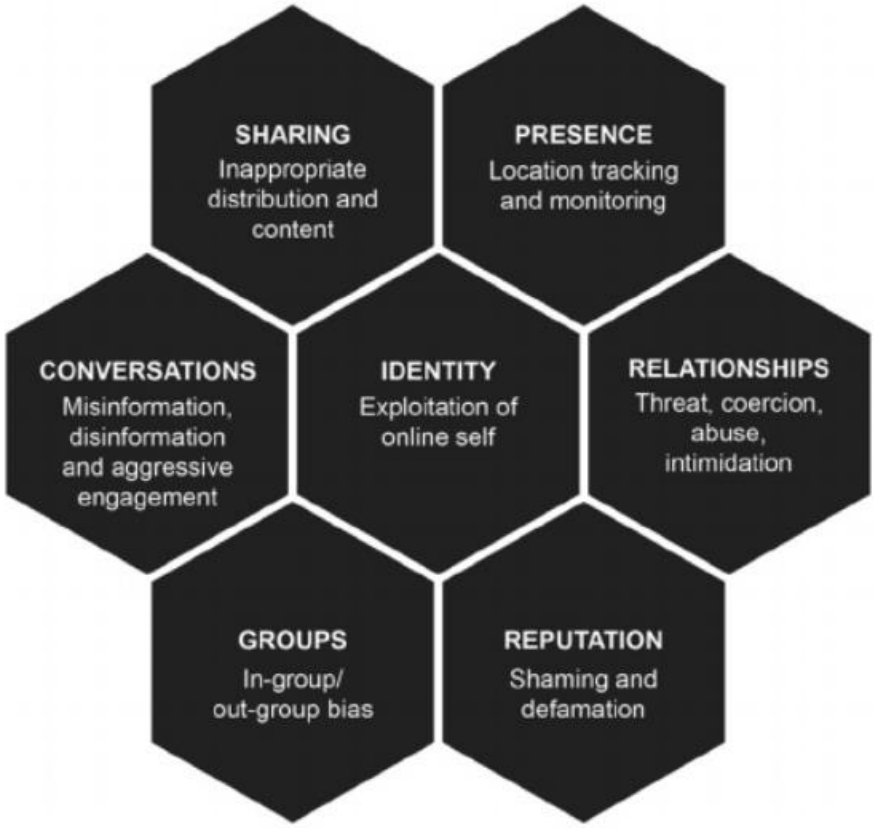

Figure 3: Building blocks which show the dark side of social media **(Baccarella, et al., 2018)**

The honeycomb framework seven building blocks are explained below:

- **Sharing -** can lead to cyberbullying, defined as "intentionally harming individuals" (Baccarella, et al., 2018). This in turn can lead to anxiety caused by the oversharing of information. Once content is uploaded it can be shared again without permission or any rights; there is a risk that inappropriate or undesirable content can easily be shared. Information shared can be of a violent nature or with pornographic content (Livingstones, et al., 2014). Fake news is also a major problem. This has been seen in the presidential election in 2016 (Allcott & Gentzkow, 2017). A study carried out by Pew Research (2016) shows only 39 % of American individuals feel they are very confident to recognise fake news with 45 % being somewhat confidence of identifying fake news (Barthel, et al., 2016).

- **Presence –** this can lead to individuals being tracked. Awarness and consent is not always given to allow this information to be used. Some social networking sites use internet protocal (IP) to allow them access to address information.

- **Conversations -** can lead to misinformation, which can lead to dark conversations; this can be seen to pollute conversations. Polluted conversations can lead to misleading advertisements or scams (Ferrara, et al., 2016).

- **Identity -** is a major problem, once you post personal information on the internet or social media sites, you are not in control of the information any more, this allows for safety risks and privacy issues. Trolls can fish for information, trying to get a rise where they can or lead to stalking (Baccarella, et al., 2018).

- **Relationships -** can lead to stalking, online harassment and cyberbullying, these can often be seen to occur from jealousy (Kowalski, et al., 2014).

- **Groups -** when people are part of a group with the same interest, this helps to amplify their own beliefs reinforced by the group (Brewers, 1999).

- **Reputations -** this can be destroyed easily with the posting of inappropriate content, whether it is considered to be true or false information, this can harm other peoples reputation. This information is looked at, on social media sites when businesses are hiring for a job, but also affect people with jobs, leading to resignations in certain instants and effecting promotions (Roulin, 2014).

This honeycomb framework helps identify the long-term cost of using social media. This gives customers and the workforce an idea of how to monitor and understand the effects of social media.

Other research has shown that the negative effects of social media through compulsive checking behaviours and excessive engagement in social media which lead to negative psychological consequences seen in teens and young adults. A lot of time spent on social media is seen to lower grades, with a higher depression rate, and lower self-esteem with the fear of missing out (FOMO). Another study focuses on

the effects of social media on gender difference in adolescence, with males showing no negative effects towards depression from FOMO or social networking sites SNS.

For females, it has demonstrated significant negative consequences showing psychopathological results (Oberst, et al., 2016). Users with low levels of life satisfaction tend to try and increase their well-being by increasing their use of SNS (LaRose, et al., 2010).

2.5 Conclusion

This chapter has revised literature to give the relevant information for the background to this research project. Agricultural extension is as important as ever to provide information, which helps farmers to form an opinion, which leads to decisions to help stay ahead with an ever-changing environment. The way information is communicated depends on a number of different factors; understanding how the message is spread and how individuals decide to adopt. Diffusion of an idea is how it is spread in the community and the different communication channels used to interact with the five categories of innovativeness set out by Rogers (2003).

There has been huge development in the internet over the past number of years and it is how it is used for both personal and business use daily. Since social media sites started it has evolved with Facebook, the most popular social networking site and WhatsApp, the leading social messaging site.

There is both a very bright and dark side to social media. The honeycomb framework under the seven categories; sharing, presence, conversation, identity, relationship, groups and reputation allows for monitoring and understanding the effects of social media. Used in the right way social media has huge benefits, enabling user-generated and share information, with the ability for discussion, allowing for learning, transferring of knowledge and extension. Social media helps all areas of the channels of distribution to stay connected from the farmer to industry to the consumer.

Used properly, social media holds great potential. The aim is to minimise the negative effects and maximise the positives effects. One way to do this is through a

closed group on WhatsApp. Here every member knows the identity of their fellow members, which means there is a positive atmosphere to post, interact and comment with the other members.

CHAPTER 3 METHODOLOGY

The research design was based on an action research approach, using both qualitative and quantitative sampling approach. This mixed method sampling was based on WhatsApp group chat developed and piloted and then a paper-based questionnaire on the farmers in the group to analyse the farmer characteristics. The WhatsApp group chat was set up with 26 participants on the 1st of February 2018. The WhatsApp group chat was monitored from the 1st of February to 1st of May 2018, measuring the participation using the WhatsApp score model of each group members, evaluating and analysing the information gathered using Statistical Package for Social Science (SPSS).

3.1 Sources of data

The sample of this study was the BETTER beef farmers of Phase 3 BETTER farm programme. The program was developed to improve the profitability of beef production by establishing a roadmap to improve technical efficiency within a farm. Teagasc / Irish Farmers Journal funds the programme and is supported by ABP, Dawn Meats, FBD, and Kepak. The program runs for a four year period; phase 3 started in February 2017 running to 2021 with the manager of the programme, Alan Dillon and two advisors Tommy Cox and John Greaney to work with the farmers to address the different challenges they face. 26 new farms entered into phase 3 of the program, one farm per county, two in Offaly, one of which is an organic farm. The program looks at focusing on social media and specific farm challenges, some mandatory and some optional. There are ten different challenges in total (Teagasc, 2017).

As a way of communication between the different BETTER farm participants, On 1st February 2018, the decision was made to develop a National BETTER farm group chat by the management team of the program. This group was a closed group with 26 farmer participants plus three advisors, one Walsh Fellow student and two members of the Irish Farmers Journal.

3.2 Collection of data

Quantitative is one of the most used methods of research in social science. There are a number of research principles which must be obtained when carrying out this research. Sarantakos (2005) states that the principles vary from precision in measurement, replication, validity, reliability, objectivity, ethics, representativeness, and generalisability. Questionnaires were chosen as the quantitative approach as these can measure knowledge, emotion, behaviour, attitudes, cognition, or intention (Rattray & Jones, 2005). The questionnaire was chosen to be administered as a self-completion given to each farmer in person. Using self-administered surveys allows for the reduction of potential bias, strengthening the results obtained (Bowling, 2005). The questionnaire contained mostly closed questions which are easy to answer and easy to follow, this helps to minimise the risk that the surveys will not be completed correctly. The survey is also a reasonable length to stop fatigue as respondents get tired of completing the survey they may throw it away rather than finish the questionnaire (Sarantakos, 2005).

There are a number of advantages to using questionnaire self-complete surveys. They are quick to administer, easily distributed in large quantities and the respondents find them more convenient, filling them in at their own pace. Respondents also like the idea that they are not interviewed, this avoids respondents feeling they will have to deal with difficult and unexpected questions. The structure of the questionnaire allows for much quicker analysing of the results and is very cost effective regarding the time required and money. Questionnaires allow for easy organisation of ideas and observations into different categories for analysis (Bryman, 2012).

The questionnaire is designed with structure in mind, helping the questions flow, starting with questions on internet access, access to agricultural information, WhatsApp group chat and experiences using the WhatsApp group chat and personal information. A number of drafts were developed before the questionnaire was piloted. The survey was piloted with eight farmers. A few small issues were discovered, a number of questions had to be rephrased for clarity to the farmers, and with one question deleted as it was unclear to the farmers and was not necessary for the study. Once fixed, the final draft of the questionnaire was then to be administered

(Appendix 1). In May and June 2018 the questionnaire was distributed to the 26 farmers in the WhatsApp group, hoping to determine their characteristic with a 100 % response rate.

3.3 WhatsApp Score Model

Galvin (2014) developed an index system in the study of Social Media as an Aid to Agricultural Extension and Education Services. The index system was designed to measure the contribution by each group member to a Facebook group page. The scale was developed with four different categories of non-technical (social), semi-educational, technical and highly technical. The scale also included seeing a post and liking a post. The cumulative score index for each comment ranged from 0 -10, with the total participation score calculated at the end of the three month period (Galvin, 2014). The score index model was modified from previous experience with the supervisor's interaction in using this scale model to allow it to be used for WhatsApp group chat. A number of the lower scale was only relevant to Facebook, so these were excluded such as seeing a post and liking a post. The next problem noted was transparency was needed between categories for future reference. To do this the categories needed to be made more defined, bringing the number of categories down to three, non-technical, semi-educational and technical using a score index range from 0-6 (Table 4).

Table 4: Index system used for measuring each group members contribution on WhatsApp group chat **(Galvin, 2014)**

Score	Type of Contribution
0	Does not comment
1	Comments on a post- not of technical use, e.g. social, thumbs up/down, motivation (e.g. excellent stock, nice job, good work), emoji's
2	Creates a post - not of technical use
3	Comments on a post- semi-educational, e.g. weather, slurry, snow, ground conditions, fertiliser prices, meal prices
4	Creates a post- semi-educational
5	Comments on a post- technical use, e.g. grass growth, weigh, tags, vaccinations, breeding, fertility results, the rate of fertiliser applied, fostering calves, vaccination
6	Creates a post- technical use

To clarify the differences between semi-educational and technical, I have a few examples from the group chat:

Semi-education	price of fertiliser per tonne "€350 for a tonne of urea and sulpha can €265"
Technical information	"fair drying and growth today. Closed silage ground today went with 3 bags of 18-6-12 and a bag of urea per acre."
Semi-education	"I use rotavec corona on the whole herd",
Technical information	"rotavec corona kicks in after 3 weeks and lasts for 10 weeks… starts wearing off then."

Semi- education	“thought the cow would have more milk….my silage very low in sugar and only ok in protein.”
Technical information	“give 1 kg of soya per day for 2 weeks before they calves, can make a big difference in terms of colostrum supple and quality.”
Semi-education	“calf had plastic lodged in his stomach [Picture]”
	“what were the symptoms.”
Technical	“Bloated first, treated him for twisted gut no signs of improvement, was very bad and nothing to lose so decided to operate. Totally different calf hour and a half later.”

3.3.1 Analysing of data

Data from the WhatsApp group chat was analysed for a three month period from when it was set up on the 1st February 2018 to 1st May 2018. The index score was used to determine a total score for each participant at the end of the control period. This varied depending on their usage of the WhatsApp group chat. All of the 26 participants in the WhatsApp group completed a questionnaire. The questionnaire helped provide information on the farmer’s personal information, internet access, access to agricultural information, and experiences with WhatsApp group chat. The results obtained formed the essential background needed for making recommendations to identify how WhatsApp group chat can be better used to communicate with farmers. All data gathered from questionnaires was coded and added to the SPSS to analyse data with the total index score for each farmer. SPSS was used to present the data findings by frequency, means tests and cross tabulation tests.

From analysing the data, it was hoped that it would be possible to identify the characteristics of the participants that affected their usage of the WhatsApp group chat.

CHAPTER 4 ANALYSIS OF RESULTS

Twenty-six farmers completed the questionnaire after a three month control period on the WhatsApp group chat. The results are presented in five sections: section one presents the personal characteristics of the respondents. Section two presents the farm characteristics of the respondents. Section three determines the social media usage patterns with the tools used to access agricultural information. Section four identifies the respondent's experiences using WhatsApp. Section five identifies how the farmer's characteristics affect the usage of WhatsApp.

4.1 Personal Characteristics of Respondents

All the farmers in this study were male beef farmers in Ireland and participating in the BETTER Beef Farm Challenge programme joining in February 2016. The split of part-time and full-time farmers was very even with 54 % of the respondents farming full time and 46 % farming part-time (N=26). This is in line with the National Farm Survey, where in 2016 49 % of farmers had other off-farm income and were part-time farming (Dillon, et al., 2017). The marital status of the farmers was 81 % of the respondents were married with dependents while the other 19 % were single with no dependents. According to the CSO single adults over the age of 15 accounts for 41.1 % of the population while 47.7 % of the population is married (CSO, 2017). The respondents were asked to identify who the dependents were, 100 % of the dependents were children (N=21). The farmers were then asked in the questionnaire the number of children they had, the results are illustrated in Figure 4.

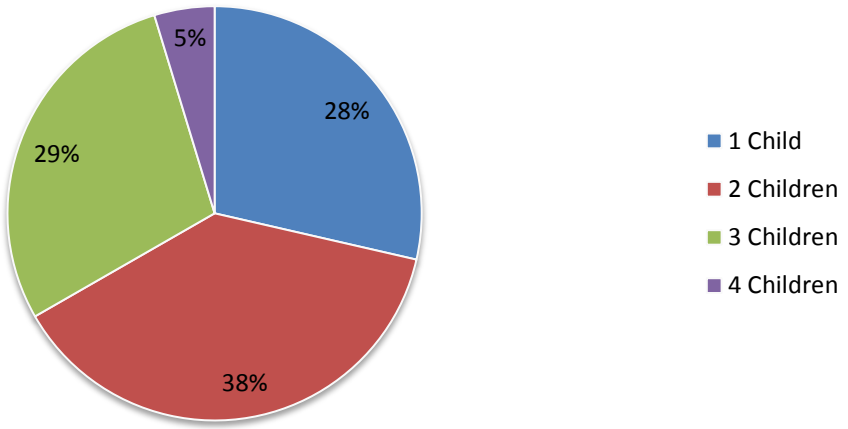

Figure 4: Distribution of respondents by the number of children per family (N=21)

The number of children per family varied from 1 to 4 children with a mean of 2.10. This was similar to the average family size in Ireland which in 2016 was 2.09 per married family (CSO, 2017). 84 % of the respondent's youngest child was aged 9 or under, this ranged from 6 months to 20 years old with the mean age of 5.72 years. 50 % of the respondent's oldest children were aged 9 years or younger this ranged from 1.5 years to 27 years old with the mean age of 10.75 years.

In the past 25 years, the number of educated people has continuously increased throughout Ireland. In the questionnaire, the respondents were asked to identify what was their highest level of education; the results are illustrated in Figure 5.

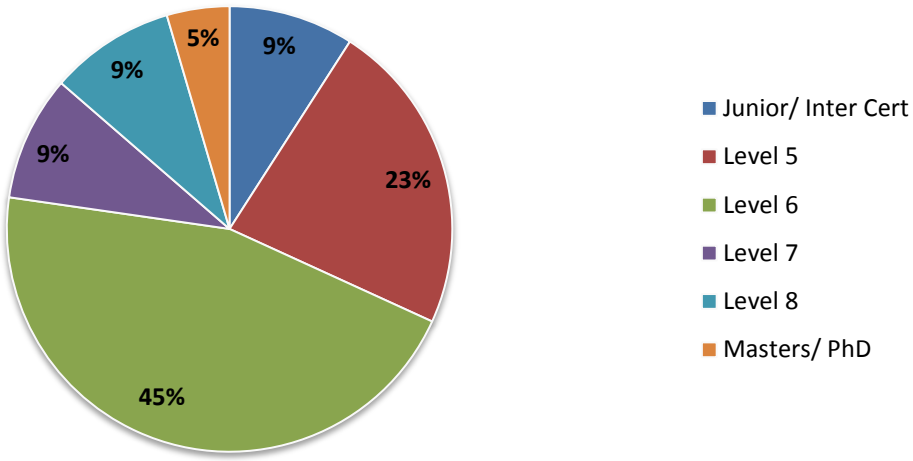

Figure 5: Distribution of respondents by Highest Level of Education (N=22)

Only one of the respondents did not have any education beyond his junior / inter certificate. This is the only respondent who does not obtain a formal agricultural education. All the other respondents had a level 5 or higher. This compares to CSO figures showing that 40.7 % of male adults have a third level qualification (CSO, 2017). To gain a better understanding of the type of agricultural education each respondent was asked to identify the highest agricultural education obtained. The respondents had the choice of seven responses varying from Level 5 Certificate in Agriculture to Level 9 Masters degree in Agricultural Science. The results are illustrated in Figure 6.

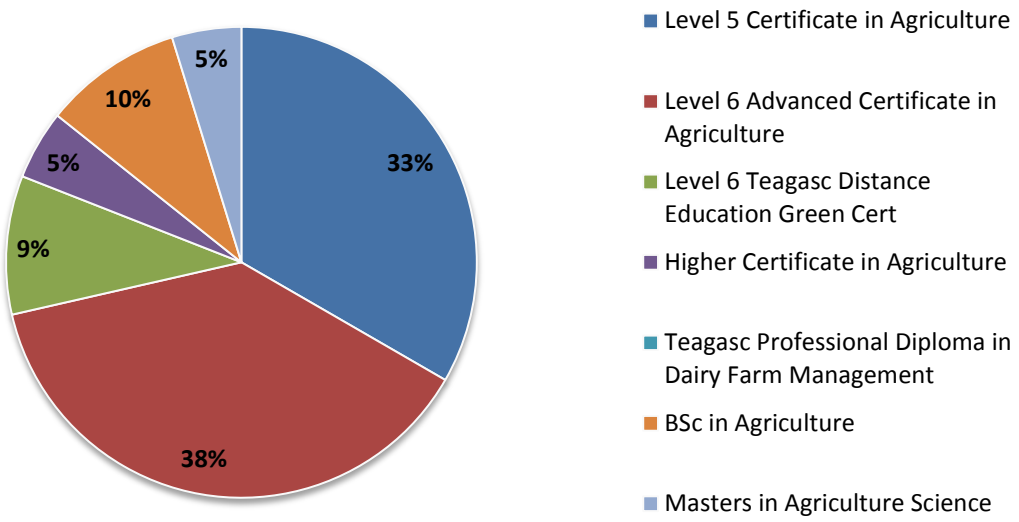

Figure 6: Distribution of respondents by the highest Level of Agricultural Education obtained (N=21)

The majority of the respondents highest agricultural education was either a Level 6 Advanced Certificate in Agriculture accounting for 38 % of respondents or a Level 5 Certificate in Agriculture accounting for 33 % of respondents. In 2010 the National Farm survey showed that agricultural education increased from 24 % in 2000 to 44 % in 2011. The research continues to show that farmers with an agricultural education have a higher family farm income and larger farm size (Heanue & O'Donoghue, 2014).

4.2 Farm Characteristics of Respondents

The farms of the respondents were not based in one geographical location but contained one farmer from each county in the Republic of Ireland and two farmers from Offaly. One of the farms in Offaly was an organic farm while the rest were conventional farms. The farming system varied between the farmers depending on their set up. Figure 7 illustrates the farming system of respondents in 2017; however, these may change throughout the programme.

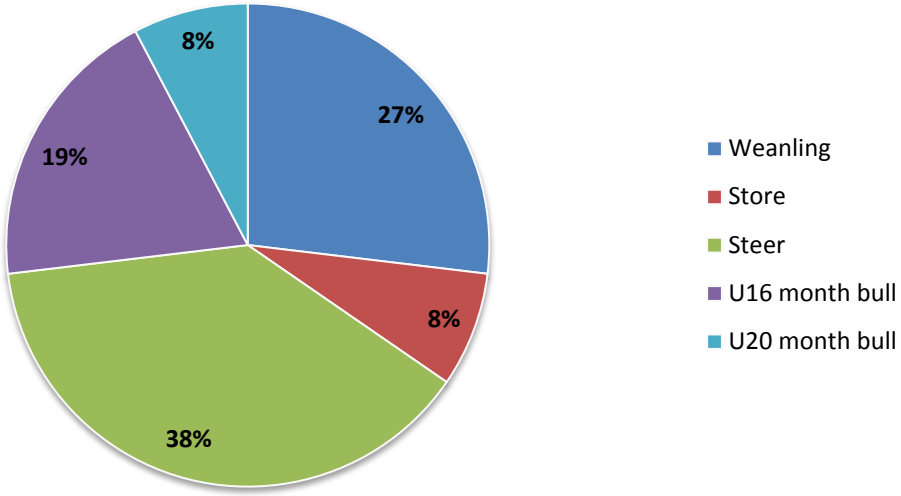

Figure 7: Distribution of respondents by a system of beef farming (N=26)

The largest portion of respondents was selling all the stock as steer accounting for 38 %. This was followed closely by weanling producing farms at 27 %. The calving pattern varied with 62 % having spring calving herd, 15 % autumn calving herd and the reminding 23 % operated a split calving system (N=26). The key farm characteristics of the respondents are outlined in Table 5.

Table 5: Distribution of the key farm characteristics of respondents participating in the WhatsApp group chat (N=26)

	Study Average
Farm size	54 hectares
Stocking Rate	2 LU/ha
Cow Numbers	54.33 cows
Gross Margin	€709/ha

The average farm size in the study was 54 hectares this is higher than the national average of 36 hectares (Dillon, et al., 2017). The stocking rate is often determined by the type of land the farm. Land type has been categorised into three categories of free draining, heavy and mixed. Heavy land accounted for 19 % of the farms, 31 % free draining and the reminder 50 % has a mixture of both land types.

4.3 Social Media Usage Patterns

For the respondents surveyed 100 % of the respondents owned a mobile phone however 8 % of the respondents did not own a smartphone. The respondents with smartphones, all respondents used mobile internet (3G or 4G). The majority of respondents owned a computer or laptop 86 % while 70 % owned a tablet. The internet was accessed through a number of different types of connection. The types of internet connection included mobile broadband (dongle), fibre optic cable, ADSL, broadband via satellite and broadband via wireless, the respondent's results are illustrated in Figure 8.

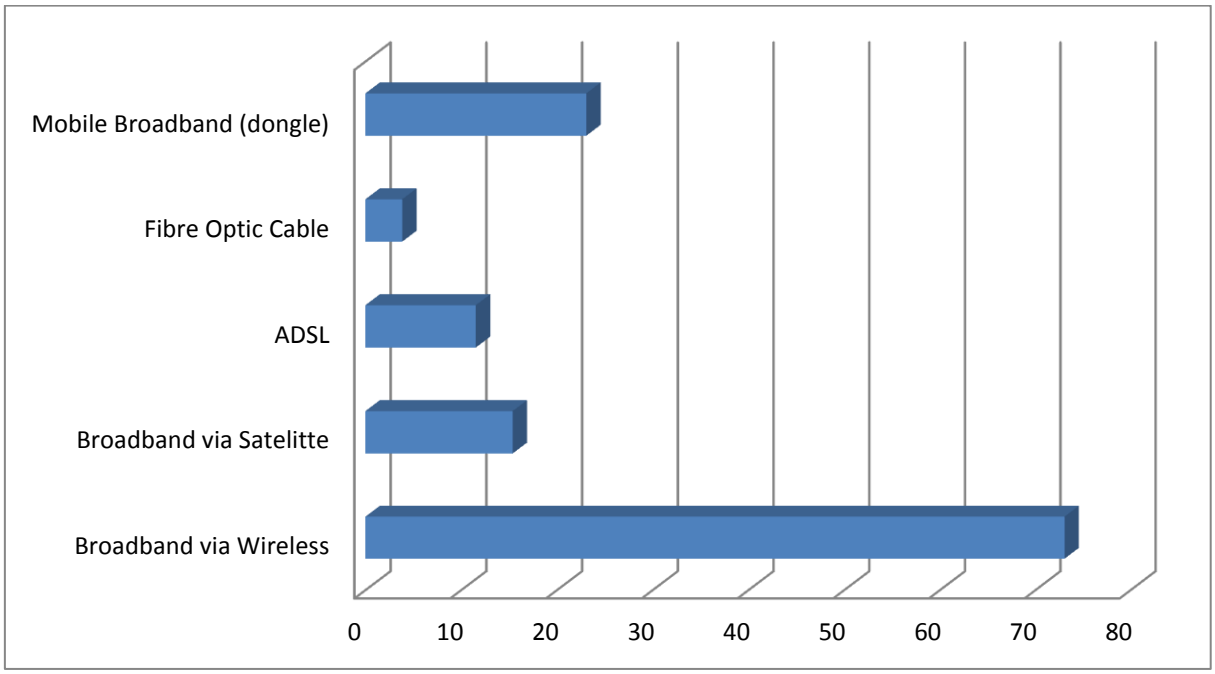

Figure 8: Distribution of respondents by the methods used to access the internet normally (N=26)

The highest amount of respondents accessed the internet through broadband via wireless at 73 % of respondents. However, the fewest respondents accessed the internet through fibre optic cable at 4 % of respondents.

The respondent's usage of the internet and how often it was accessed had a considerable variation from 2-3 times or more daily to only about once a month. 88.5 % of the respondents used the internet daily, while 3.8 % of respondents used the internet at least once a week. This accounts for 92.3 % of the respondents surveyed using the internet more than once a week. This compares with CSO figures show that 70 % of individuals used the internet at least daily while 10 % use it at least once a week (CSO, 2017). There was no statistically significant relationship found between how often the internet was accessed and part-time/ full-time farming, marital status, or number of dependent children.

Agricultural information can be accessed from a number of different areas on the internet from various social media tools. The respondents surveyed, 92 % obtained agricultural information from WhatsApp. This was from the BETTER farm National WhatsApp group chat. The second biggest source was Facebook at 60 % this was used to access information from the Irish Farmers Journal, AgriLand, ICBF, Teagasc, and Teagasc Farm Discussion Group. This was followed by YouTube at 36 %, Snapchat 32 %, Twitter 16 % and other 16 %, the other source for obtaining agricultural information were Google, Met Office, Accu weather and text. In the questionnaire the respondents were asked how often they used each social media tool to access agricultural information, this is illustrated in Figure 9.

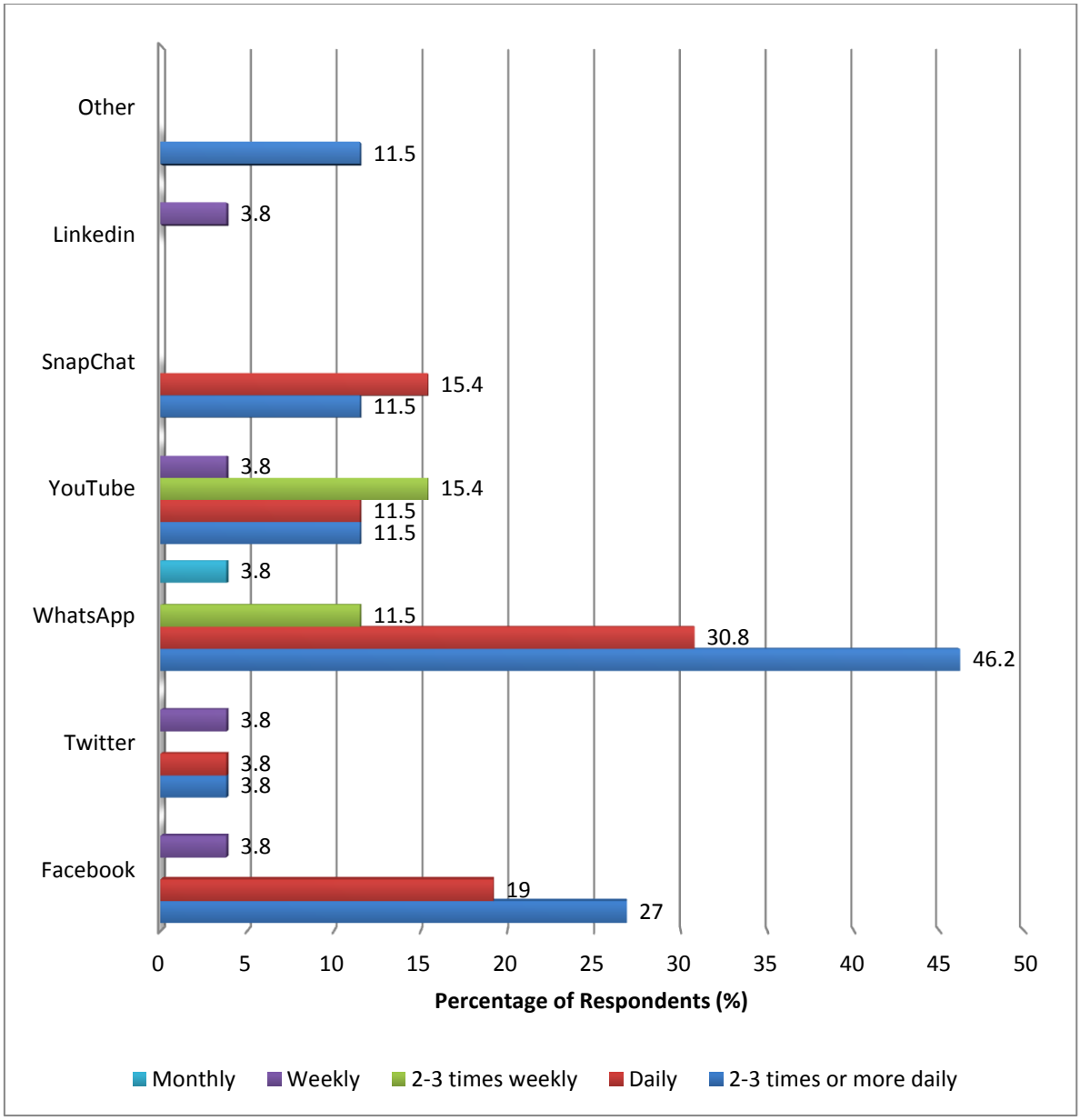

Figure 9: Distribution of respondents by how often each social media tool is used to access agricultural information (N=26)

WhatsApp was the social media tool used to access agricultural information the most frequently with 46.2 % of respondents using it 2-3 times daily and 30.8 % of respondents using it daily. Facebook was used daily or more to access agricultural information. However, YouTube was usually used 2 - 3 times weekly to access agricultural information. The respondents were asked in the questionnaire was there any challenges they encountered when using social media. The majority of respondents had no difficulties or challenges with obtaining agricultural information. The respondents identified the challenges that affected obtaining agricultural

information was they “did not have enough time” for using social media or being “too busy to discuss information properly”, and the fear of misleading information such as on “Facebook a lot of farmers are just messing with comments”. Two of the respondents felt they were “not up to date with social media” and had a “poor interest” in social media.

4.4 Experiences using WhatsApp

There are a number of different features which are available when in a WhatsApp group chat from the discussion, pictures/ videos uploaded, technical information available, ability to talk to other farmers in the group. The features the respondents enjoyed presented in Figure 10.

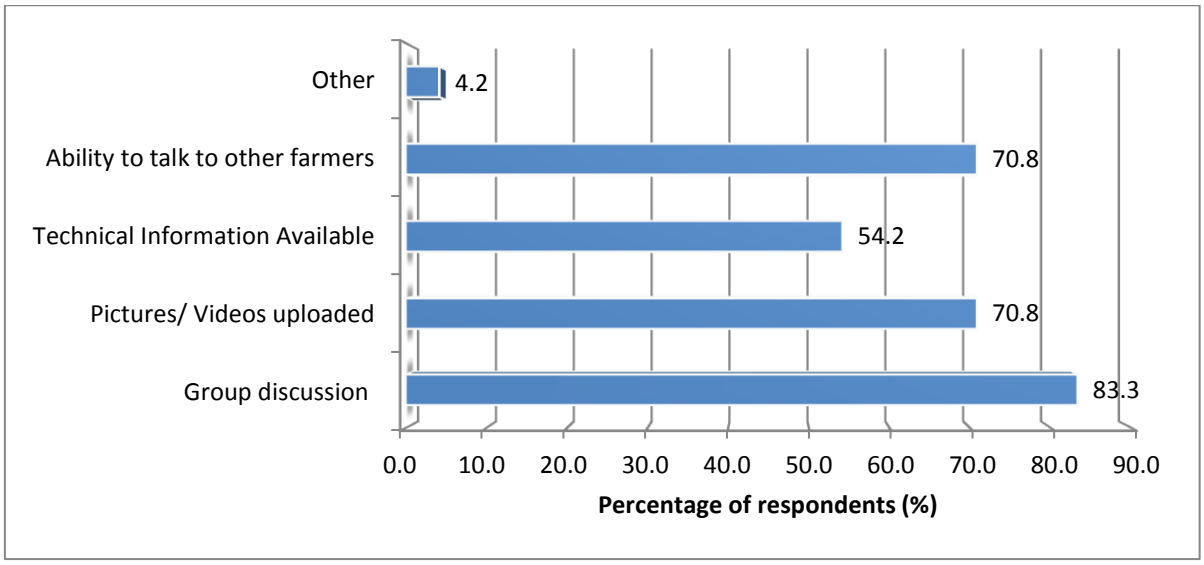

Figure 10: Distribution of respondents by the features of WhatsApp enjoyed (N=24)

There was no major variation in features respondents enjoyed while using WhatsApp. The respondents felt they enjoyed the group discussion the most at 83.3 %. However, respondents felt they least enjoyed the technical information available while using the WhatsApp with 54.2 % of respondents enjoying this feature. In the questionnaire, the respondents were asked to identify the time of the day and days of the week where most engaged in the WhatsApp group chat. The results are illustrated in Figure 11 & 12

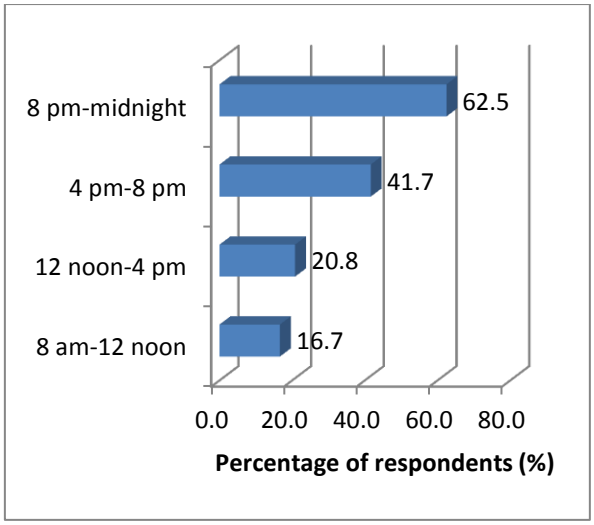

Figure 11: Distribution of respondents by the time of day they use WhatsApp (N=24)

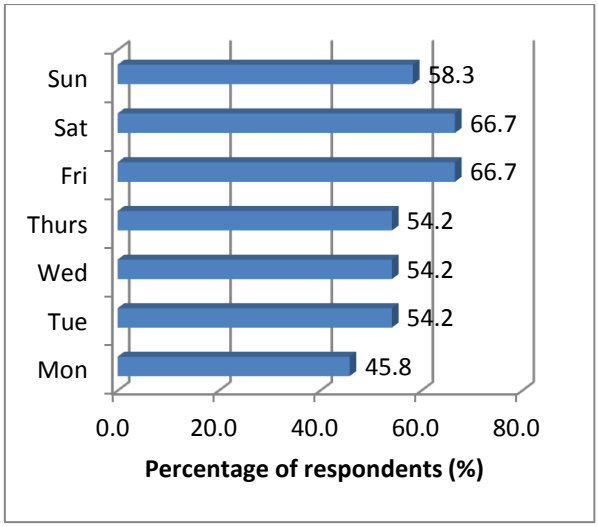

Figure 12: Distribution of the respondents by the days of the week they use WhatsApp (N=24)

When determining the time of the day, the respondents mainly used the WhatsApp group chat. The later in the day, the higher the usage of WhatsApp group chat. The lowest usage was seen between 8 am – 12 noon with the highest usage between 8 pm – midnight. There was no major difference between the days of the week the respondents used the WhatsApp group chat with the highest usage on Friday and Saturday. When respondents were asked to explain why there was higher usage at certain times and days, it was noted that the evening is a “quieter time”, “more time available” especially if farmers are working. Other full-time farmers stated “any time” suited them, “no certain time depending on what’s happening”. The respondents agreed (92 %) that WhatsApp was a good outlet to talk to farmers in peak times of stress such as the difficult spring this year 2018, outlining how “everyone is in the same position”, “all have the same problems”, “have a conversation share problems and solutions”, “quickly get answers/ responses”. Among the negative aspects of the WhatsApp group, some farmers found it “nuisance when busy” or “too many farmers they wouldn’t know”. The answers were similar when asked did they encounter any difficulties with WhatsApp group chat the majority had no problem with only two different problems coming out the “internet coverage” and “notifications can be annoying”.

4.5 Respondents usage of WhatsApp Group Chat

The level of usage varied hugely: three of the respondents had zero interaction in the group chat while the maximum score obtained was 563. The mean was 106.61 with the median of 52.5 and a standard deviation of 134.46. The level of interaction varied from the type of comments made by the participants, score 1: social comment, score 2: create social comment, score 3: semi-educational comment, score 4: create semi-educational comment and score 5: technical comment, score 6: create technical comment. This also included both pictures and videos posted in the group chat. The distribution of the farmer's grouped index score shows the average number of comments in each score index, when added together determined the total participation score, this was then categorised in the group index score to allow for analysis this information is presented in Table 6.

Table 6: Distribution of the farmer's grouped score index showing the average number of comments in each score index (N=26)

Grouped Index score	Number of Respondents	Index score 1	Index Score 2	Index Score 3	Index Score 4	Index Score 5	Index Score 6
0 - 100	15	1.87	0.47	2	0.87	1.13	0.53
101 - 200	8	13	2.5	17.63	4.38	6.63	2.75
201 - 400	3	34.67	6.33	45	12.00	20.67	4
401 - 600	1	44	17	63	23	24	14

In the three month control period, the number of messages per person varied from 0 to 185 messages posted in the group chat. When determining the type of comments which led to the total index score for each respondent, it can be clearly seen that the number of comments in each category all related to the grouped index score. The number of pictures and videos posted in the group chat over the period was 237 this varied from each participant from zero to forty-four with pictures more commonly posted than videos. The pictures and videos helped give farmers an insight into what was happening on each farm over the period from calving, weather, snow, floods, animals grazing, stock, breeding, articles and ideas/innovations on farms. For some analysis, the respondent's group index score was split into two categories or high and low usage, this is presented in Table 7.

Table 7: Distribution of the respondents by grouped index score (N=26)

Usage Level	Grouped Index Score	No. of Respondents	Percentage (%)
Low	< 45	13	50
High	> 46	13	50

The low usage group of respondents had an index score of less than 45 accounting for 50 % of respondents. The high usage group of respondents had an index score of over 46 accounting for 50 % of respondents.

A Compare Means test was completed against WhatsApp index score to give comparisons to indicate the average score for marital status, number of dependent children, education, years farming, farm size, part-time/full-time farming, system, land type, internet usage and device ownership. For each of the comparisons made, statistical significance and measure of association were analysed using an ANOVA table, to determine if there was a significant relationship between WhatsApp index score for each of the comparisons.

4.5.1 Relationship between personal characteristics and WhatsApp group chat

All the farmers were asked about their marital status; there were six possible answers single with or without dependents, married with or without dependents and other with or without dependents. All the respondents' marital status was either single with no dependents or married with dependents. This was used to determine the relationship between usage of WhatsApp group chat and the marital status of respondents. This is presented in Table 8.

Table 8: Relationship between the WhatsApp mean index score and the marital status of respondents (N=26)

Marital Status	No. of Respondents	Mean Index Score	Standard Deviation
Single no dependents	5	116.2	155.66
Married with dependents	21	104.33	133.13

F-value= 0.030 Df= 1 Significance= 0.863 ETA= 0.035

There was statistically no significant difference between the WhatsApp index score of the married and single respondents. Single respondents with no dependents had a mean index score of 116.2; these respondents were the younger farmers of the group and many farming with their fathers. Married respondents with dependents had a mean index score of 104.33 and accounted for the majority of respondents. Looking into more detail, the married respondents with dependents stated the number of children varied from one to four children. The relationship between the mean index score and the number of children in the family is illustrated in Figure 13, with the standard deviation on error bars on the graph.

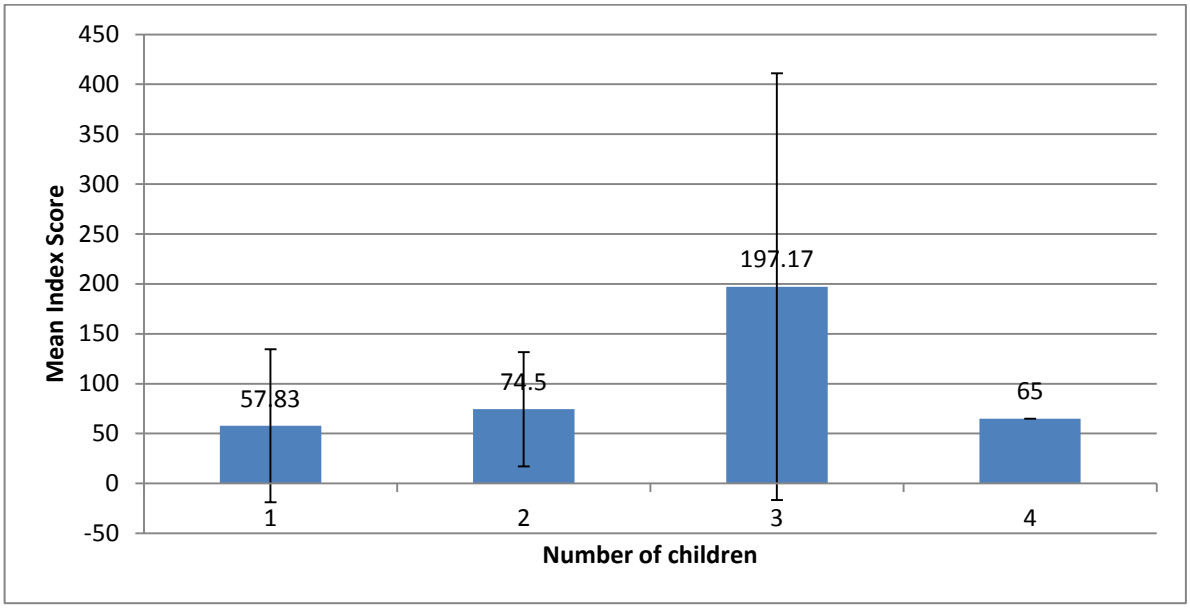

Figure 13: Relationship between the mean index score and number of children of the married respondents (N=21)

The respondents with three children had the highest mean index score of 197.17, followed by two children with a mean index score of 74.5, four children with a mean score of 65, with the lowest mean score with the respondents with only one child at 57.83. The results are statistically not significance at 0.256 (F-value= 1.48, Df= 3, ETA= 0.455).

The farmers were asked to identify the highest level of education on the questionnaire. This was to determine if there was a relationship between WhatsApp mean index score and education. The results are presented in Table 9.

Table 9: Relationship between the WhatsApp mean index score and the highest level of education of the respondents (N=22)

	No. of Respondents	Mean Index Score	Standard Deviation
Junior/ Inter Cert	1	37	
Level 5	4	98.75	84.14
Level 6	12	72.58	60.61
Level 7	2	10	14.14
Level 8	2	257.5	171.82
Masters	1	16	

F-value= 2.812 Df= 5 Significance= 0.052 ETA= 0.684

There is a huge variation in the mean index score in each of the education categories. The two respondents who have completed a level 7 degree have the lowest mean score of 10. This was followed by one respondent with a Master's degree who had a mean index score of 16; however, this respondent identified the group chat as not having relevant information for his enterprise. This was the major reason for poor interaction in this particular group chat but identified having a high interaction in other group chats and being extremely beneficial to him and transferring knowledge and exchanging ideas. The two respondents with the level 8 degrees obtained mean index score of 257.5; both of these farmers had only recently completed a level 8 degree in Agricultural Science in UCD and are only farming with a short number of years.

To understand if the level of agricultural information affected the usage of the WhatsApp group chat the farmers were asked to identify their highest level of education in the questionnaire. The relationship between the usage of WhatsApp group chat and the highest level of agricultural education is presented in Table 10.

Table 10: Relationship between the mean index score and the highest agricultural education of the respondents (N=21)

	No. of Respondents	Mean Index Score	Standard Deviation
Level 5 Certificate in Agriculture	7	75.71	74.17
Level 6 Advanced Certificate in Agriculture	8	63.13	67.65
Level 6 Teagasc Distance Education Green Certificate	2	115.5	12.02
Level 7 Higher Certificate in Agriculture	1	20	
Level 8 BSc in Agricultural Science	2	257.5	171.82
Level 9 Masters in Agriculture	1	16	

F-value= 2.367 Df= 5 Significance= 0.090 ETA= 0.664

The highest mean index score of 257.5 was obtained from the level 8 BSc in Agricultural Science. The majority of the respondents had completed Level 6 Advanced Certificate in Agriculture with a mean index score of 63.13 or Level 5 Certificate in Agriculture with a mean index score of 63.13. The results were not statistically significant different (at 5 % level) between the WhatsApp mean index score and the highest level of agricultural education.

The purpose of looking at the ownership of certain devices was to determine if they had any relationship with the usage of WhatsApp group chat. The results are presented in Table 11.

Table 11: Relationship between the WhatsApp mean index score and the ownership of smartphone, computer/laptop or tablet (N=26)

Device	Ownership	No. of Respondents	Mean Index Score	Standard Deviation	Significance 95% Level
Smartphone	Yes	24	115.5	136.32	
	No	2	0	0	
Computer/Laptop	Yes	23	118.91	138.32	
	No	1	0	0	
Tablet	Yes	18	118.8	156.94	0.773
	No	8	94.9	667.27	

There were twenty-six respondents in the study, all 100% of respondents owned a mobile phone, but two respondents did not have smartphones. The farmers who did not own smartphones both had ownership of tablets. There was no statistically significant difference (at 5% level) between ownership of any device and the mean index score of respondents. When examining the cross-tabulation of the relationship

between the mean index score and ownership of a tablet, it found that 55 % of the respondents with low WhatsApp participation owned a tablet compared to 37.5 % who did not. However if found that 62.5 % of the respondents with high participation in the WhatsApp group did not own a tablet compared to 44.4 % who did (DF= 1, Significance= 0.395).

The respondents were asked in the questionnaire how often they used the internet to determine the relationship with the usage of WhatsApp group chat. The results are presented in Table 12.

Table 12: Relationship between the mean index score and internet usage of respondents (N=26)

Internet usage	No. of Respondents	Mean Index Score	Standard Deviation
2-3 times daily or more	19	133.16	147.59
Daily	4	48.25	50.7
2-3 times a week	1	12	0
About once a week	1	0	0
About once a month	1	37	0

F-value= 0.685 Df= 4 Significance= 0.610 ETA= 0.340

When the data was examined, it emerged that there was not statistically significant difference between WhatsApp mean index score and the number of times they use the internet. The majority of the respondents (73 %) used the internet 2-3 times daily had the highest mean index score of 133.16, followed by the 15 % of respondents who access the internet daily with a mean index score of 48.25. The respondent who used the internet about “once a month” identified he does not use the internet regularly however his wife uses the internet for him whenever he needs anything done such as registering calves.

The respondents were asked in the questionnaire to identify the day(s) of the week they mostly engaged in WhatsApp group chat. This was then compared with the actual data obtained from the three month control period counting the number of messages sent each day of the week overall throughout the period to identify the percentage of messages sent each day. This is illustrated in Figure 14.

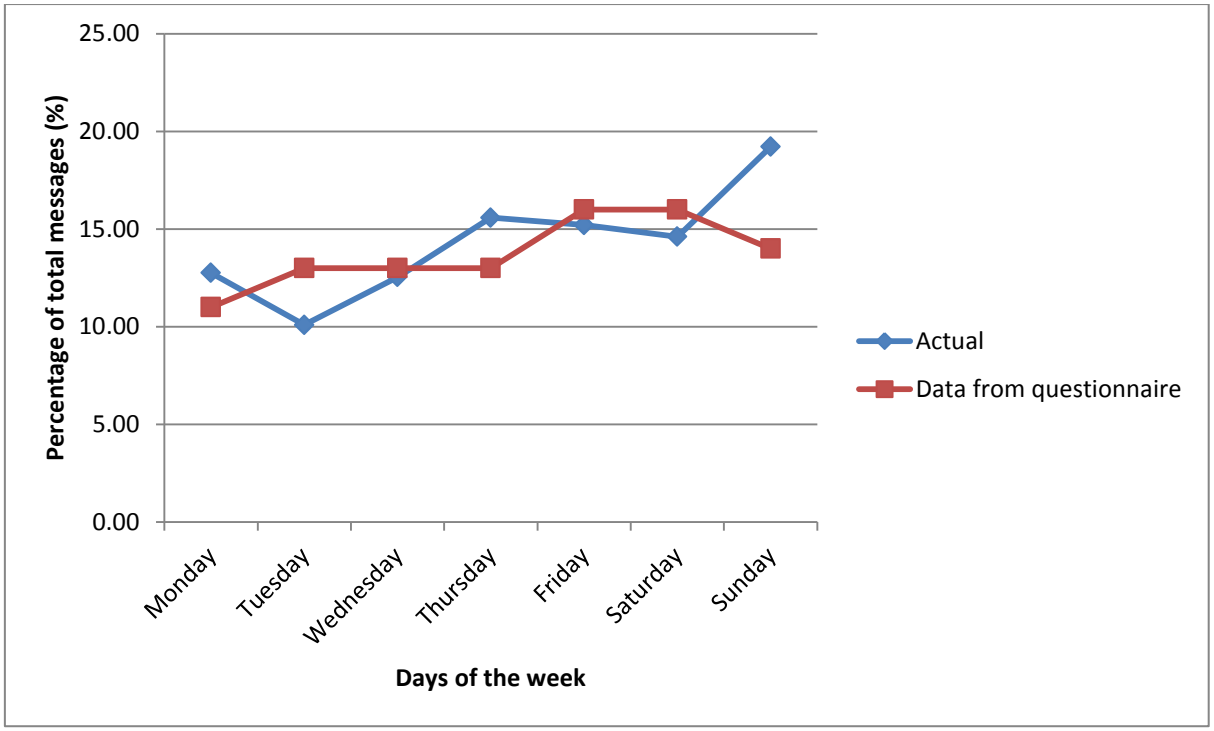

Figure 14: Relationship between the actual percentage of messages posted each day of the week in the WhatsApp group chat and the day/days of the week the respondents feel they mostly engage in the group chat (N=26)

From the questionnaire, the respondents felt that Friday (15 %) and Saturday (15 %) were the days they most engaged in WhatsApp usage follow by Sunday (14 %), with the lowest engagement expected on a Monday (11%). However when the WhatsApp data was analysed it showed Sunday was the day with the highest usage of 19.21 % of the overall messages sent, followed by Thursday at 15.58 %, Friday at 15.21 %, Saturday at 14.61 % and Monday at 12.76 % of the messages being sent. The lowest usage was on a Tuesday with only 10.09 % of the messages sent, followed by Wednesday with 12.54 %. Monday was not the day with the lowest engagement as the respondents thought.

The frequency WhatsApp was used depended on the individual farmer. The farmers were asked in the questionnaire to identify how often they used the group chat. This was then used to determine the relationship between WhatsApp group chat usage and how often they used it to access the internet. The results are presented in Table 13.

Table 13: Relationship between the WhatsApp mean index score and WhatsApp group chat usage of respondents (N=24)

WhatsApp group chat usage	No. of Respondents	Mean Index Score	Standard Deviation
2-3 times daily or more	12	168.25	170.55
Daily	8	59.25	52.93
2-3 times a week	3	80.67	98.08
About once a week	0	0	0
About once a month	1	37	0

F-value= 1.273 Df= 3 Significance= 0.311 ETA= 0.400

The mean index score was highest for the respondents who used WhatsApp group chat the most, 2-3 times daily or more at 168.25 accounting for the majority of respondents. There was a dip in the mean index score of the respondents using WhatsApp daily with a mean index score of 59.25. An increase was noted in the farmers who use WhatsApp 2-3 times a week with a mean index score of 80.67.

Not all farmers were working full time on the farm, 46 % of the farmers were part-time farmers and had another job outside of the farm. These jobs varied from working on a factory line to working for other farmers. The relationship between the WhatsApp usage and part-time/ full-time was examined to determine the difference in the mean index score. The results are presented in Table 14.

Table 14: Relationship between the WhatsApp mean index score and part-time/full-time farming of the respondents (N=26)

Part time / full time	No. of Respondents	Mean Index Score	Standard Deviation
Part time	12	134.17	117.65
Full time	14	83	147.49

F-value= 0.933 Df= 1 Significance= 0.344 ETA= 0.193

There was no statistically significant relationship between part-time/full-time farming statistics and the mean index score, however, there is a trend. Part-time farmers had a much higher mean index score at 134.17, and the full-time farmers had a lower index score of 83. The crosstab looks at determining was there a relationship between high and low usage of WhatsApp group chat and part or full-time farmers. The results are presented in Table 15.

Table 15: Relationship between the participation in the WhatsApp group chat and full-time or part-time farming (N=26)

	Part-time No. (%)	Full-time No. (%)	Total No. (%)
Low	4 (33.3)	9 (64.3)	13 (50)
High	8 (66.7)	5 (35.7)	13 (50)
	12 (100)	14 (100)	26 (100)

Chisq= 2.476 DF= 1 Significance= 0.116

The results show that the majority of the respondents that have low usage of WhatsApp are full-time farmers accounting for 64.3 %. Compared to the respondents with high usage, the majority of these were part-time farmers accounting for 66.7 %

4.5.2 Relationship between WhatsApp usage and Farm Characteristics

There were five different farming systems among the respondents weanling, store, steer, under 16-month bulls and under 20-month bulls. The majority of the respondents farmed using a steer system. These had the highest mean index score of 180. There were only two respondents who used a store system, and they had a mean index score of 152.5. Seven respondents are weanling producer and had a mean index score of 62.43. The respondent with under 16-month bull system had a mean index score of 43.6. The lowest mean index score of 3.5 was from the under 20-month bull system. There was statistically no significance at (5% level) of the mean index score and the system farmed by the respondents (F-value= 1.762, Df= 4, Significance= 0.174, ETA= 0.501).

Farm size was grouped into two categories under 40 hectares accounting for 50 % of respondents and over 41 hectares accounting for the other 50 % of respondents. The two farm size categories were compared against to mean index score, this was not statistically significant difference at 5 % level (F-value= 941, Df= 1, Significance= 0.342, ETA= 0.194). The mean index score of the respondents with the farm size under 40 hectares was 81. The mean index score for the respondents with farm size over 41 hectares of 132.23.

The number of years farming by respondents varied from a minimum of 3 years up to a maximum of 36 years farming. The mean years farming of respondents was 20.05 years. The years farming was split into two categories under 20 years accounting for 14 respondents and over 21 years accounting for eight respondents. When the relationship was examined, respondents farming under 20 years had a mean index score of 100.43. The respondents farming over 21 years had a mean score index of 56. The results were not statistically significant at 5 % level (F-value= 1.243, Df= 1, Significance= 0.278, ETA= 0.242).

On the questionnaire two statements were asked "I often post queries on WhatsApp" and "I contribute to discussion on WhatsApp". To answer this, there were five answers (strongly agree, agree, undecided, disagree and strongly disagree) circling the most appropriate answer to relate to their usage I used forming a correlation with the WhatsApp index scale. The results are presented in Table 16.

Table 16: The Correlation between the WhatsApp mean index scale and how farmers perceived themselves as post queries and contribute to discussion in the group chat

		I often post queries on WhatsApp	I contribute to the discussion on WhatsApp
WhatsApp Scale	Pearson Correlation	-0.673**	-0.642**
	Sig.	0	0.001
	N	24	24

**Correlation significant at 0.01 level

When the relationship between the statement "I often post queries on WhatsApp" and the WhatsApp index scale was examined the Pearson's r revealed a strong negative correlation of -0.673 at a significant level of 0.01. When the relationship between the statement "I contribute to discussion on WhatsApp" and the WhatsApp index scale was examined the Pearson's r revealed a strong negative of -0.642 correlation at significant level of 0.01.

4.6 Conclusion

This chapter presents the data from the research completed, the WhatsApp group chat was developed, and pilot and the questionnaire was administered. The group chat was set up with 26 participants on the 1st of February 2018. The WhatsApp

group chat was monitored from the 1st of February to 1st of May 2018, measuring the participation using the WhatsApp score model of each group members. The questionnaire was administered in May and June 2018 to determine the farmer characteristics. Once all the information was gathered, it was evaluated and analysed using SPSS. The level of usage varied hugely, three of the respondents had zero interaction in the group chat with a maximum score of 563. The mean was 106.61 with the median of 52.5 and a standard deviation of 134.46. The level of interaction varied from the type of comments- social, semi-educational and technical but also included both pictures and videos posted in the group chat. The index score of each participant was used to determine the relationship between the characteristics of the respondents.

The next chapter includes the summary of the findings from this research carried out, a discussion of the results from the information gathered in this research and literature review.

CHAPTER 5 SUMMARY OF FINDINGS AND CONCLUSION

This chapter includes three sections. The first section includes the summary of the research outlining, the research objectives of the study the methodology and the findings. The second section forms a discussion of the results, presented under the three research objectives. The third and final section concludes the study.

5.1 Summary of research

The aim of this research is to investigate the use of the WhatsApp group chats to transfer knowledge to beef farmers in Ireland. The research objectives included

1. **Develop and pilot** a WhatsApp group chat suitable for farmers.
2. **Analyse** the characteristics of the farmers who use WhatsApp and their type of interaction in the group chat.
3. **Identify** the role WhatsApp has to play in transferring knowledge.

5.1.1 Methodology

One BETTER Farm National group chat was set up on WhatsApp with twenty-six farmers, three advisors, two members of the Irish Farmers Journal and one Walsh Fellow Student. This group chat was used a method of communication for all group members. The level of usage of each participant was determined by using an index score system, a scale from 0-6 which was modified from previous research carried out into social media usage. The level of participation was measured for a three month control period with the total index score calculated at the end of the period. The farmers participating in the WhatsApp group chat were administered a questionnaire at the end of the WhatsApp control period.

5.1.2 Findings

The findings are presented under each of the three research objectives outlined for this study. The discussion is formed from the results of the study and relates back to the literature review

5.1.2.1 Objective 1: Develop and pilot WhatsApp group chat suitable for farmers

- The BETTER Farm National group chat was set up on the 1st February 2018 and twenty-six participants were added in.
- The WhatsApp group chat was piloted for a three month period from the 1st February to 1st May 2018, measuring the participation of each member in the WhatsApp group chat using the Score Model.
- Three of the farmers had 0 interaction in the WhatsApp group chat, while the maximum score obtained was 563.
- The mean index score was 106.61, with a median score of 52.5 and standard deviation of 134.46.
- The majority of the farmers (58 %) had a grouped index score of between 0 and 100.

5.1.2.2 Objective 2: Analyse the characteristics of farmers who use WhatsApp and their type of interaction in the group chat

- From the farmers in the study, 100 % owned mobile phones, but 93 % owned smartphones.
- From the farmers with smartphones, they all had access to the internet, either 3G or 4G connection.
- The farmers with ownership of a computer/ laptop accounted for 86 % of farmers.
- The respondents that owned a tablet (70 %) had a higher mean score index, than does who did not own a tablet.

- 46 % of the respondents were farming part-time. Part-time farmers had a much higher mean index score of 134.14 when compared to the full-time farmers with a mean index score of 83.
- The marital status of the respondents shows that 81 % are married with dependents.
- The single respondents with no dependents had a higher mean index score of 116.2 compared to the married respondents with a mean index score of 104.33.
- All the dependents from the married respondents are children, the number of dependents per family varies from one to four with a mean of 2.10. The highest mean index score of 197.17 was seen from the respondents with three children.
- Only one of the farmers had no education above inter / junior certificate.
- The majority of the farmers' (68 %) highest education was either a Level 5 or Level 6 education. When only looking at agricultural education, 80 % of the respondents had a Level 5 or Level 6.
- The highest mean index score was seen from the farmers with a Level 8 degree with a mean index score of 257.5, but the lowest level of education did not have the lowest mean index score.

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5.1.2.3 Objective 3: Identify the role WhatsApp has to play in transferring knowledge

- The percentage of farmers in the study to hold a WhatsApp account was 92 %.
- The WhatsApp group chat was used daily by 77 % of farmers.
- The most popular internet connection was broadband via wireless (73 %). Only 4 % of the respondents had a fibre optic cable.

- The internet usage varied from 2-3 times or more daily to about once a month. The farmers who accessed the internet the most at 2-3 times or more daily had the highest mean index score of 133.16.
- There was no statistically significant relationship found between how often the internet was accessed and part-time/ full-time farming, marital status, or the number of dependent children.
- The biggest source used for obtaining agricultural information was WhatsApp (92 %), followed by Facebook (60 %), YouTube (36 %), Snapchat (32 %), Twitter (16 %), and Other (16 %).
- The majority of the farmers encountered no problems when using social media. However, a few identified “not having enough time” and being “too busy to discuss information properly” as the biggest drawbacks to using social media.
- The two farmers with the lowest usage of social media identified the factors why they did not engage in social media as having “poor interest” and “not up to date with social media”.
- WhatsApp was a good outlet to talk to farmers in peak stress, agreed by 92 % of the farmers.
- In times of peak stress, farmers stated “everyone is in the same position” and “questions get answers/ responses” as some of the benefits of the WhatsApp group chat.
- The number of pictures and videos posted in the group chat dramatically increased during the snow in March 2018.
- The farmers mainly used WhatsApp group chat on the weekend. The highest number of messages was sent on a Sunday at 19.21 % of total messages.
- The most popular time of day was using WhatsApp group chat was 8 pm to midnight.
- At these times or days, farmers stated they were “quieter” and they had “more time” available.

- The experiences the respondents enjoyed from the WhatsApp group chat was: group discussion (83.3 %), followed by the pictures uploaded (70.8 %), ability to talk to other farmers (70.8 %) and the technical information (54.2 %).

5.2 Discussion

This section covers the discussion, which is derived from the results from this research and the literature review which are presented under the three objectives which were set at the beginning of this study.

5.2.1 Objective 1: Develop and pilot WhatsApp group chat suitable for farmers

The interaction in the group chat occurred from social, semi-educational, and technical content which was added by the contribution of pictures and videos. The way the farmers interacted was very successful. The farmers found the WhatsApp group chat extremely easy to use with very few difficulties. The difficulties came from poor internet coverage and infrastructure, all beyond the control of the farmers. WhatsApp made it quick and easy for the advisor or farmers to get opinions or information within the group chat. The farmers enjoyed the interaction with the other farmers in the group. The farmers identified it as being very beneficial to be a part of this group chat, which was an excellent idea to set up, with all members staying in the group chat over the control period.

5.2.2 Objective 2: Analyse the characteristics of farmers who use WhatsApp and their type of interaction in the group chat

The farmers' ownership of three devices, smartphone (92 %), computer/laptops (86 %), and tablets (70 %) was identified. This was compared with the survey carried out by Deloitte Global Marketing (2016), it showed ownership of smartphone (86 %), laptop computers (80 %), and Tablets (60 %). This shows the farmers in the study have higher ownership of devices than the average adult in Ireland (Howard, et al.,

2016)**.** There farmers could be seen as being more technologically enthusiastic. These technology enthusiasts are more likely to be categorised into innovators and early adopter's. The respondents who owned smartphones obtained higher mean index scores. This followed the same trend as identified by Galvin (2014), farmers who owned smartphones had a higher mean index score than farmers who did not own smartphones.

Part-time farmers had a much higher mean index score when compared to the full-time farmers. Mishra and Gillespie (2011) showed that the increase in cash flow on farms due to off-farm work allowed for the adoption of technology. Part-time farmers are more exposed to technology when working outside the farm; this would relate to them obtaining a higher mean index score.

The farmers who were single with no dependents had the highest mean index score. This is not in line with the CSO stating that the adults with dependent children use the internet more frequently than adults with no dependents (CSO, 2017). From the farmers who had between one to four dependents the highest mean index score was seen from the respondents with three children. This shows the more dependents the farmer had, the higher mean index score, this follows up to three children, and after this, it decreases again. As children are becoming more independent the farmer may have to use technology to keep in contact and are more likely to keep up to date through encouragement from their children.

The level of education did not play a major role in the usage of the WhatsApp group chat. The highest mean index score was seen from the farmer with a Level 8 degree. The results are the same than that of Galvin (2014), also showing that the lowest level of education did not have the lowest usage. Higher education helps the farmer to utilise the information available to them through social media or IT (Morris & James, 2017). From previous research, such as Morris and James (2017) this result was not expected. It reinforced that there was a barrier in the uptake of social media caused by a low level of education. Another study identified that level of education affected their attitude towards web-based technologies (Connolly & Woods, 2010), showing that farmers with a higher education were more likely to use social media.

5.2.3 Objective 3: Identify the role WhatsApp has to play in transferring knowledge

WhatsApp is now the leading social networking app in Ireland. The majority of farmers in this study already held a WhatsApp account (92 %), of which is much higher than that obtained in the results of a survey carried out by Ipsos. This shows that 61 % of Irish adults (over 16 years) hold an account (Ipsos MRBI, 2018). The farmers in this survey (77 %) used WhatsApp daily to access agricultural information while the Ipsos survey states 69 % use the app daily. This shows that farmers in this research are above the national average for holding a WhatsApp account and using the app daily. As these farmers are trying to access agricultural information daily using the app, they are committed to the group and want it to be successful (Rigby, 2008). The farmers are willing to interact, create, and share content (Morris & James, 2017). From this, conversations develop further down to discussing day to day practices, giving all members in the group the chance to learn from peer to peer learning (Morrison, 2012). Talking about practises or new innovations gives farmers the extra confidence they need to adopt new practises or technologies (Botha & Coutts, 2006). As you would expect, the mean index score was highest for the farmers who used WhatsApp more frequently.

The slow uptake of ICT in farming families has been caused by poor broadband speeds in rural areas in Ireland. In Irish homes' broadband speeds vary hugely, with only 69 % of household having connection speeds of 4 Mbps or over (McGreevey, 2015). The most popular internet connection in this study was broadband via wireless, with very few farmers with fibre broadband. Improvements need to be continually made in order to stop infrastructure and internet connections affecting the usage of social media. The current penetration rate of broadband in Ireland is 68.4 % showing Ireland has still some way to go to get broadband access to everyone (ComReg, 2018). The farmers with broadband in their home (satellite and/or wireless), accounts for 88 % of farmers in the study. This is similar to results obtained by Galvin (2014), showing 81.6 % of farmers with internet connections in the family home. Ireland's broadband connection is still lagging behind as Ireland is ranked 42nd in the world regarding fixed broadband speeds and only 72nd for mobile broadband speeds (Speedtest, 2018). The rollout of the National Broadband Plan (NBP) which aims to introduce broadband at high speeds no matter where you live,

with high speeds defined as 30 Mbps as minimum download speeds (Department of Communications, Energy and National Resources, 2012). However, this is still a long way off but as broadband and mobile internet connections increase, this allows for greater potential for social media and WhatsApp to be used by all farmers no matter their location. As the internet is improving with improved infrastructure (Thysen, 2000) and lower internet data rates, this allows for more frequent use of the internet (Howard, et al., 2016). This should lead to more opportunities for farmers to use WhatsApp.

According to the CSO, 81 % of the individuals used the internet in the last 3 months, of these 70 % use the internet daily and a further 9 % use the internet at least weekly (CSO, 2017). The majority of the farmers (88 %) in the study used the internet once a day or more. The number of farmers to use the internet daily is much higher in this study than the national average. The highest mean index score was seen from the farmers who accessed the internet daily or more, this is what you would expect. Farmers who access the internet more have more opportunities to contribute to discussions in the group chat. The more frequent use of internet in turn allows for higher adoption of social media (Durkin, et al., 2013), leading to a higher WhatsApp index score.

WhatsApp has huge potential for getting information out at short notice such as crisis communication. For example, this year 2018 with the difficult spring, with the fodder crisis and the snow. This reinforced what Stanley (2013) stated, that the importance of a two-way communication tool of social media in times of crisis, which was WhatsApp in this study. WhatsApp was a good outlet to talk to farmers in peak stress, agreed by 92 % of respondent's. In times of crisis, the farmers discuss day to day practices as everyone was in the same circumstances. The farmers believed a problem shared is a problem halved. The group chat helped farmers to get through the tough period by reinforcing the fact they were not on their own. In times like this, such as the heavy snow, the number of pictures and videos shared in the group chat dramatically increased, with each farmer showing what they had to deal with every day. Through the interaction between the farmers, this helped to identify different tips and knowledge to try to help a farmer solve problems. The conversations lead to peer to peer learning (Morrison, 2012), but sometimes this moral support is all farmers need to make them feel they are heading in the right direction, even if this is

only a comment saying “great stock” or “looks well”. Another advantage of the WhatsApp group chat is that the information does not become repetitive or stale, as farmers themselves choose the topics they want to discuss. This varies from the time of the year, what information is relevant, or just the problems that arise. This overcomes the problem Bogue (2013) stated about discussion group’s being hard to keep the farmers interested in the group as information can be repetitive. WhatsApp can be used at any moment in time rather than just challenged at a discussion group roughly once a month.

Once the relationship is built between the farmers in a group, it overcomes a lot of the negative factors associated with use of social media, improving the way information is shared. Once the relationship is built farmers trust the truthfulness of the data shared, helping farmers to open up and form a discussion. WhatsApp delivers content in a number of different ways from pictures, videos, or messages, which allow group discussion to form. The pleasurable experience from the chat encourages farmers to share information, photos, and links (Powell, 2009). The feature of WhatsApp which farmers in the study mostly enjoyed was the group discussion which takes place. From the information gained, gathered, and discussed the farmers can then make an informed decision (Howe, 2014). Farmers need to contribute to discussions within the chat (Durkin, et al., 2013), to get the chat to its full potential from posting queries. From the WhatsApp score model developed it shows the massive variation in the interaction between the different members of the group chat.

Understanding the time of day where farmers have the time to engage and interact has a major role to play in transferring knowledge. This affects gaining information to change practices (Ryan, 2004), by helping farmers to set goals to change skills, knowledge and attitudes (Okunade, 2007). Through the interaction of social media and peer to peer learning once a farmer gains the knowledge, they can be helped along the processes of adoption to the confirmation stage with the help and interaction with other farmers. Farmers need time to process and utilise information (Morris & James, 2017). The farmers mainly used the WhatsApp group chat on the weekend, with the highest number of messages being sent on a Sunday. The most popular time of day for using the WhatsApp group chat was 8 pm to midnight. At the weekends and evenings, farmers had more time for themselves to engage in the

conversation, post, and discuss information. This was seen especially for the part-time farmers as they were off in the evening and the weekends. At these times farmers enjoyed talking about farming.

5.3 Conclusion

Social media is an excellent communication tool for connecting millions of people no matter the geographical location. WhatsApp is a social networking app which is easy to work for farmers, with simple context that farmers understand. Farmers are added to a closed group. The idea of the closed group chat makes members feel comfortable to interact with one another.

The majority of farmers found the WhatsApp group chat extremely beneficial, some members using it more than others. As not all members commented the same amount, the farmers with the higher interaction in the group chat encouraged the other farmers to interact, comment, and express their opinion in the group chat. The farmers' own unique characteristics show all farmers are different, coming from different paths, having dealt with different challenges along the way, leading to a large pool of knowledge among a small group of farmers. Individual personalities and a good sense of humour are essential to keep a group chat interesting and interactive rather than just being a question and answer session found on other social media sites. The farmers are willing and comfortable members within the group which helps to share information and ideas with other farmers. For the WhatsApp group chat to work farmers need to be willing to discuss and contribute to discussions.

WhatsApp has huge potential for advisors and farmers to keep in contact, share, and transfer knowledge. Farmers are not solely relying on their advisor to answer questions in the group chat but interaction and peer to peer learning from other members of the group is far more important.

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APPENDIX 1

I (Marie Flynn) am currently completing a MAgrSc in Agricultural Extension and Innovation with the title of my research: **"Investigation into the use of WhatsApp group chats to transfer knowledge to beef farmers in Ireland".** This study is funded by the Teagasc/ Walsh Fellowship Programme, and I am under the supervision of Alan Dillon (Teagasc) and Dr Pádraig Wims (UCD). This research will help Teagasc to identify how WhatsApp group chats can be better used to communicate with farmers. All information gathered will be treated with confidentially. Take this chance to express your own views/ opinions and experiences.

NAME: _____

1) **Do you own any of the following?** (Tick **(√)** all that apply)

a- Mobile Phone [Yes] [No] is it a smart phone [Yes] [No]

b- Computer/ laptop [Yes] [No]

c- Tablet [Yes] [No]

INTERNET ACCESS

2) **What method do you use to access the internet normally?** (Tick **(√)** all that apply)

a- Broadband via Wireless [ ]
b- Broadband via Satellite [ ]
c- ADSL (through house phone line) [ ]
d- Fibre Optic Cable [ ]
e- Mobile broadband (dongle) [ ]
f- Mobile internet (3G or 4G) (on your mobile phone) [ ]

3) **What device do you mainly use to access the internet?** (Tick **(√)** all that apply)

a- Computer/ laptop [ ]
b- Tablet [ ]
c- Smart Phone [ ]

4) **How often do you access the internet?** (Tick **(√)** all that apply)

a- 2-3 times daily or more [ ]
b- About once a day [ ]
c- 2-3 times a week [ ]
d- About once a week [ ]
e- About once a month [ ]
f- Less than once a month [ ]

ACCESS TO AGRICULTURAL INFORMATION

5) **Which of the following social media tools do you use to obtain agricultural information?**
(Tick **(√)** all that apply and fill in relevant data)

a- Facebook [ ] From Who in particular? _____

b- Twitter [ ] From Who in particular? _____

c- WhatsApp [ ] From Who in particular? _____

d- YouTube [ ] From Who in particular? _____

e- Snapchat [ ] From Who in particular? _____

f- Linkedin [ ] From Who in particular? _____

g- Other (please specify) _____

_____

6) **How often do you use your social media to access <u>agricultural information</u>?**
(Tick **(√)** all that apply)

	2-3 times daily	**Daily**	**2-3 times a week**	**Weekly**	**Monthly**
Facebook					
Twitter					
WhatsApp					
YouTube					
Snapchat					
Linkedin					
Other					

7) **What challenges do you encounter when trying to obtain agricultural information from social media?**

_____

_____

_____

WHATSAPP GROUP CHAT

8) **I often post queries on WhatsApp?** (Circle the most appropriate)

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

9) **I contribute to discussion on WhatsApp?** (Circle the most appropriate)

Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

NOW I WOULD LIKE TO ASK YOU ABOUT YOUR EXPERIENCE IN USING THE WHATSAPP GROUP CHAT

10) **Please indicate the features of the WhatsApp group chat you enjoyed?** (Tick **(√)** all that apply)

a- Group discussion [ ]
b- Pictures/ videos uploaded [ ]
c- Technical information available [ ]
d- Ability to talk to other farmers in the group [ ]
e- Other (please specify)_____

11) **a- What time of the day did you mostly engage with WhatsApp group chat?** (Circle the most appropriate)

8 am – 12 noon	12 noon - 4pm	4pm – 8 pm	8 pm – 12 midnight

b- What day/days of the week did you mostly engage with WhatsApp group chat? (Circle the most appropriate)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

c- Why these times/ days? _____

_____

12) **Do you think WhatsApp is a good outlet to talk to other farmers in times of peak stress?** (Tick **(√)** one)

a- Yes [ ]
b- No [ ]

Please comment_____

_____

_____

13) **Are there any difficulties you encountered with using the WhatsApp group chat?**

_____

_____

_____

_____

PERSONAL INFORMATION

NOW I WOULD LIKE TO ASK YOU CERTAIN QUESTIONS ABOUT YOURSELF

14) **What is your Marital Status? (**Tick **(√)** one)

	No Dependents	**With Dependents**
Single		
Married		
Other		

Are the dependents your children? (Tick **(√)** one)

a- Yes [ ]
b- No [ ]

If yes how many children do you have and what age are they?

No. Children	**Youngest**	**Oldest**

15) **What is your highest level of <u>education</u> you have completed?** (Tick **(√)** one)

a- None [ ]
b- Junior/ Inter Certificate [ ]
c- Leaving Certificate [ ]
d- Level 5 [ ]
e- Level 6 [ ]
f- Level 7 [ ]
g- Level 8 [ ]
h- Masters/PhD [ ]

16) **Have you received formal agricultural education?** (Tick **(√)** one)

a- Yes [ ]
b- No [ ]

If yes please tick your highest level of <u>agricultural education</u>? (Tick **(√)** one)

a- Level 5 – Certificate in Agriculture [ ]
b- Level 6 – Advanced Certificate in Agriculture [ ]
c- Level 6 – Teagasc Distance Education Green Cert [ ]
d- Level 7 – Higher Certificate in Agriculture [ ]
e- Level 7 – Teagasc Professional Diploma in Dairy Farm Management [ ]
f- Level 8 – BSc in Agricultural Science [ ]
g- Level 9 – Masters in Agricultural Science [ ]

17) **How many years have you been farming?**

_____years

18) **Are you a member of any farming/ rural organisations?** (Tick **(√)** all that apply)

a- None [ ]
b- Macra [ ]
c- IFA [ ]
d- Breeding societies [ ]
e- ICSA [ ]
f- Other (please specify) _____

This questionnaire is now complete. Thank you for taking the time to participate in this study.