Exploring a new model for science engagement through documentary video production

A thesis submitted in fulfilment of the requirements for the degree of
Master of Arts Degree in Journalism and Media Studies

RHODES UNIVERSITY

By

Nontokozo Mchunu

Supervisors: Dr Alette Schoon and Professor Janice Limson

February 2024

Acknowledgements

To my supervisors, Dr Alette Schoon and Professor Janice Limson, thank you for all the unwavering support throughout this research project. The journey has been an undoubtedly challenging one and there were moments where it was difficult to believe anything positive about it, but your support held me together. It encouraged me and made me believe that it is worth fighting. Your patience with me and the process has been one of the things that kept me going and believing that indeed, it is possible. Thank you. There is no way I could have done this without you.

To Dr Alette Schoon, thank you for encouraging me to do this research. I had no intention of coming back to school full time after being employed for a year, but your belief in me as a filmmaker and a person in general really encouraged me. I am grateful to have had the opportunity to work with you from my final undergraduate year to the end of this journey. Thank you for seeing me beyond my challenges with this particular research and still believing that I am capable of being an impactful filmmaker in the film and television industry.

To Professor Janice Limson, thank you for believing that I could do this with you.

To the SASRI extension officers, thank you for everything you supported Kyran and I with while we were in KwaZulu-Natal doing work on this research. Devlin Klusener, you welcomed us with such open and warm arms. You went out of your way to ensure that we get everything we need for this research. Thank you for seeing us as colleagues. Sis Bongiwe Chonco, Buhle Khomo and Sifiso, we would not have had such a great experience without you. Thank you.

To Dr Snyman at SASRI and all scientists, thank you for your time and effort to participate in this research. Thank you for your patience with us.

To Linda Pona, the scientists and science communicators at Rhodes University, thank you for agreeing to being a part of my film for this project and to every other individual I interviewed but did not make it to the film, I am grateful.

Dedications

This research is dedicated to the science communication and engagement industry in South Africa and to my family, my church and lost family members.

To all scientists and science communicators:

It has been an honour and an absolute privilege to have had the opportunity to have an input in the science field as a humanities scholar. I hope that this is the beginning of groundbreaking interactions and engagement with communities within your field. I hope that this encourages further collaboration between scientists and communicators. I pray and I hope that this research will not end up as a thesis digitally archived somewhere, but will actually contribute towards making a difference within the science field.

To my family:

I am so grateful to have parents like you. Mom and dad, thank you for your support. Mom, I know you cried on the day I gave you a call to say that I would be going back to school full time. I know that what you had envisioned for my life was a little bit different to where I am at the moment because of this thesis, but you held it all together and supported me nonetheless. I am ever so grateful for your unwavering support, maNgubane. Angazi ngingakubonga ngani. Ngikhulekela ukuthi uNkulunkulu angigcinele wena ukuze uzobona ukuthi isinqumo engasithatha mayelana nalolucwaningo kwakuyisinqumo esihle futhi esikhethwe nguNkulunkulu. I cannot wait to make you happy and proud and for you to enjoy the fruits of your labour for my education and success in life.

God bless you, mother. God bless you, Captain Dad. I think you're the coolest father a girl could ever ask for!

To my Swift family:

Thank you for opening up your home to me and accepting me into your family as your very own. You have been such a strong support system throughout this journey. I could not have had it any other way because I now have parents in Makhanda that I will forever cherish and come back to.

To my River of Life Church Family:

I do not know where to begin. Thank you for your discipleship. My journey in Makhanda could never have been so fruitful and an absolute blessing to me if I had not found myself such a beautiful family.

I am grateful to God for all the fellowship enjoyed with you and all the prayers that kept me going. Pastor Innocent and Mama Milcah, the way you have dedicated your lives to serving students in this town is honourable. Thank you for being my other parents.

To my *Friendsmas* people:

Apelele, Bella and Tatenda: Thank you so much for opening your home to me so that I could write my thesis. Your support is highly appreciated.

You have been community in practice, like the church in Acts. Thank you!

To the Salt and Light tribe:

"You are the light of the world. A town built on a hill cannot be hidden. Neither do people light a lamp and put it under a bowl. Instead, they put it on its stand, and it gives light to everyone in the house. In the same way, let your light shine before others, that they may see your good deeds and glorify your Father in heaven," Matthew 5: 14.

You have been to me what this scripture says. You have given me light and it has carried me through this journey. It has lit up my path in ways I cannot describe.

To the UNEARTHED band:

The trips we made, taking Worship music to different cities encouraged me in ways you could never imagine. I am grateful.

To my late uncle Babay' Sanele:

It hurts that we lost you to suicide and it hurts that it was during the time of this thesis. I know it kept me distant from family and I never got the chance to be light for you during your battles. I love you.

To my late nephew, Mmeli, whom we lost about a week and a half ago from writing this:

We love you, son. We are so sorry for the tragic end to your life. I know I did not make it to your funeral. I wanted to, but I couldn't. I am praying for your brother's healing. I hope you are resting in eternal peace, my boy.

To my late aunt and friend:

Aunt Thobi kodwa. Waze wasishiya kabuhlungu. Losing you has to have been the worst part of this journey. Ngaze ngakukhumbula, Phakade omuhle. You were my friend, the best aunt I could have asked for, really. I had so many plans regarding you but I guess God had different ones after all. I love you so much. I miss you dearly.

To my partner in love:

Sir, you are an honourable man. Thank you for being the most present and most effective support system during the course of this journey. You took practical steps towards helping me finish. You stayed up at night to give me moral support, you read through my work a couple of times. But more than anything, you have loved me unconditionally since the day I met you. The best part of this journey was saying yes to us! Thank you, Mqoma.

All glory and honour belong to God, the maker of heaven and earth who has carried me to this point through Yeshua the Christ.

Abstract

This study presents a model for science engagement that incorporates journalistic approaches. This model emerges from a project that aimed to create engagement and communication around a genetically modified sugar cane variety, developed by the South African Sugarcane Research Institute (SASRI). In this project, we engaged with small scale growers in the North and South Coast region of KwaZulu-Natal. This study's methodology is based in action research and an iterative approach to science communication and engagement. It draws and reflects on an action research cycle captured through video documentary as a way to effectively and thoroughly collect, analyse and interpret data and produce through the case study. Based on this action research process a model for science engagement is proposed and reflected on and interrogated by scientists and science communicators through a focus group engagement (see model here as part of this thesis):

https://drive.google.com/file/d/14UD1qd4fPcqIZrkESq5v2wgJ1Y2Q7hON/view?usp=sharing

I reflect, using video, on this model and how it incorporates principles and techniques for public engagement drawn from different approaches to journalism and communication studies, I argue that science engagement can benefit from drawing from journalistic approaches to public engagement such as those emerging from development communication, public journalism and development journalism.

The submission of this thesis includes various other videos as part of the overall thesis.

Table of Contents

Chapter 1: Context of the Research

Introduction

This study stems from a funded project coordinated by the Centre for Biotechnology and Innovation. It aimed to incorporate engagement with growers into a scientific research process for a new scientific innovation by the South African Sugarcane Research Institute (SASRI), which forms part of the South African Sugar Association (SASA), an organisation that represents all sugar cane growers in South Africa. The new innovation is a genetically modified (GM) sugar cane crop variety. The research took place in the North and South Coast of KwaZulu-Natal, geographical areas that are prone to a pest called the *Eldana Saccharanna*. The *Eldana Saccharanna* is a pest that causes serious economic harm within the sugar cane industry and is the most serious as it causes a direct and indirect loss of over R1 billion per season if uncontrolled (SASRI, 2022). The GM sugar cane crop being developed through SASRI's integrated Pest Management approach to controlling pests and suppressing their levels, is a 10-year process.

In this study, I have worked in a research team to facilitate conversations between SASRI scientists, extension officers and sugar cane growers who will have the option to receive and grow this new sugar cane variety. Our aim was to develop a model for science communication that would use media to elicit engagement between the scientists and the sugar cane growers in order to empower the growers to know and understand more about this scientific innovation while at the same time also enabling them to share their questions and concerns with the scientists. While another researcher in the team was primarily responsible for developing the communication media products, I have been exploring, through video documentary, this new model for science engagement that incorporates approaches for public engagement from journalism and communication studies. The intended outcome of my research was to explore how a new model for science engagement involving ideas from journalism and communication studies could be situated within broader notions of science engagement in South Africa. My study aimed to particularly interrogate how video could enable science communicators to reflect on this new model for science engagement in South Africa.

In this chapter, I will define science communication and briefly discuss its history and highlight the development of science engagement as a recent development within science communication. I will then outline the history of science communication in South Africa and give context to the main principles of this particular field based on this history, I will also touch

briefly on the history of extension officers in agriculture and the different approaches to science engagement that have emerged.

It should be noted that understanding science engagement in South Africa requires a broader understanding of science communication that incorporated both the global development of the concept and the model for its implementation and then the specific understandings that developed in the South African context. The political history of South Africa has shaped the culture of what and who we South Africans are, including our specific approach to the field of science communication and engagement.

What is Science Communication?

According to Kessler et al., (2022) any communication that focuses on science, scientific work and its results, is science communication. The non-scientific lay public is recognized as part of the audience in external science communication (Davis and Horst, 2016). Scientific research institutions, public relations (PR) agencies, as well as academics are considered communicators. However, this is the broad understanding of science communication and has, over the years, evolved (Kessler, 2022).

A number of different science communication models have emerged based on this understanding of science communication (Kessler, 2022). These models include the *MidTwentieth Century* science communication model which critics have come to call the deficit model in the 1960s, (Bucchi, 2008) and then developed into the *Public Understanding of Science* (PUS) model for science communication in the 1980s and 1990s (Schafer et al, 2019).

What is Public Understanding of Science?

Public Understanding of Science (PUS) emerged in the 1980s, in response to both a concern about a perceived deficit of knowledge about science among the general public, and a concern about the public's attitude toward science (Bauer, 2009). Scientific institutions were particularly concerned with the fact that the public did not show sufficient support for science. They understood such lack of support for the sciences to be directly related to a lack of understanding of science.

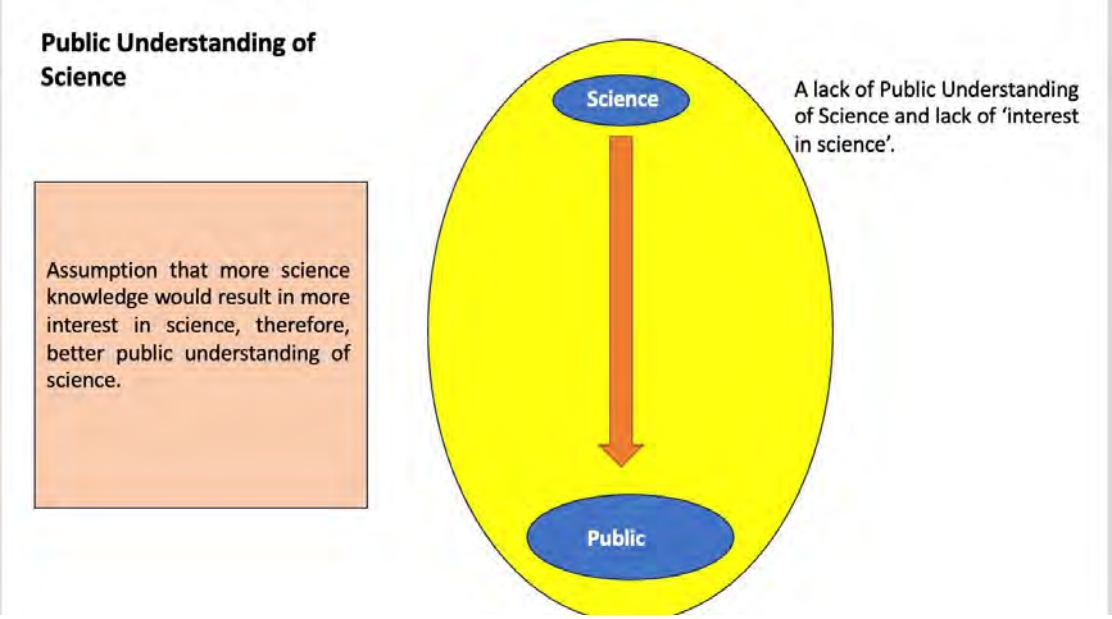
> Effective science is accompanied by an increase in lay knowledge about science and scientific literacy, which is inevitably supposed to lead to greater public support for science and to legitimation for its rarefied societal position (Kessler, 2022, p. 713).

As a result, scientists believed that the solution to the 'lack of interest in science' from the public was to simply share more knowledge as they believed that understanding of science would invariably result in favourable attitudes towards science (Rhodes and Sawyer, 2015). This resulted in various science communication initiatives such as museum exhibitions as strategies "intended to foster public understanding of science" (Mcdonald and Silverstone, 1990, p. 69). However, this expectation of improved attitudes towards science due to an increase in scientific knowledge is not assured because as is commonly acknowledged in social psychology (Bauer, 2009) knowledge is not necessarily a driver of attitude. Instead, knowledge is a quality index since attitudes -- whether positive or negative -- that are based on knowledge, tend to resist change because they are more strongly held.

> Well informed and less-informed citizens make up their minds differently, but do not necessarily come to a different conclusion (Bauer, 2009, p. 224).

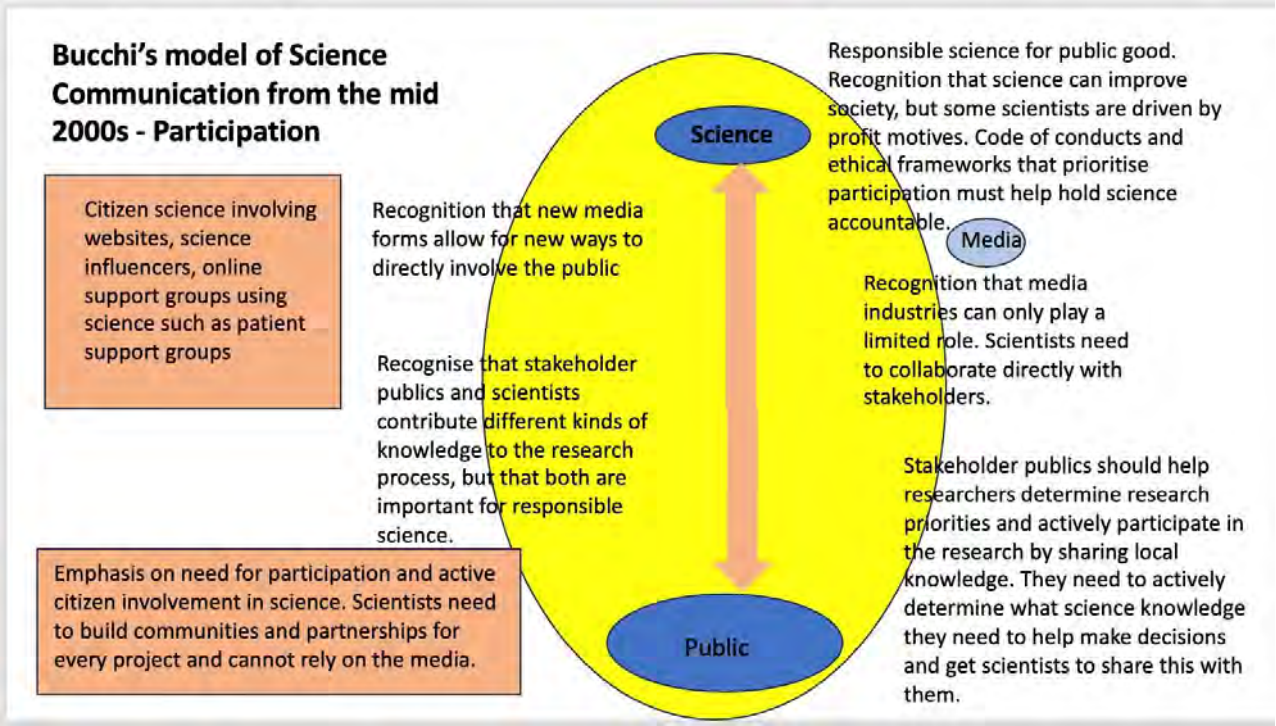
However, over a longer period of time some changes in the public's attention to science due to such knowledge interventions, were evident and consistently emerged across different contexts and different generations in different parts of the world (Bauer, 2009). The post-industrial model of PUS argues that the transition from an industrial to a post-industrial society, as well as the transition to a knowledge intensive economy, both provoked the emergence of different ways for people to relate to knowledge, and different interests and attitudes to science. A society's level of industrialization does not, however, determine attitudes to science. Different socio-economic contexts may promote different attitudes to science in populations with scientific knowledge. In more economically-developed countries, the knowledge of science among the public is generally more extensive than in less economically-developed countries, i.e. India (Bauer, 2009). In a country like India for example, the more knowledgeable the public is about science, the more positive their attitude becomes towards science. In Europe, however, the more scientific knowledge a person tends to have, the more sceptical they become of science (Shukla & Bauer, 2009). Therefore, "below a certain level knowledge drives positive attitudes, beyond that point knowledge drives sceptical attitudes toward science" (Bauer, 2009, p.224) although this argument is clearly contextual, given the Indian example above. The general attitude or perception of the public by scientists or science institutions is one of mistrust, in turn resulting in a mistrust of scientists by the public (Bauer, 2009).

This relationship between scientists and the public built on mutual mistrust "called for 'soul searching' among scientific actors" (Bauer, 2009, p. 225). Such introspection then led to the development of the concept of "Science in-and-of Society" that was founded upon the reversal of the notion of a deficit. The "Science in-and-of Society" model conceptualised this deficit not with the public but with the scientists and scientific institutions who have lost the trust of the public, thus having a deficit of public trust (Bauer, 2009). Due to increasing evidence of negative attitudes towards science during the "Mad Cow Disease" outbreak in the early 1990s and, debates over GM foods in the late 1990s social research detected a significant lack of confidence in scientists (Bauer, 2009). There was a need to repair the relationship between scientists and the public that had broken down due to mistrust. However, misguided ideas, such as that the public lacks knowledge or is scientifically illiterate, therefore, unscientific in its thinking, (Rhodes and Sawyer, 2015) by scientists even within the approach of science in-andof-society still alienate the public (Bauer, 2009). Efforts by Science-in-Society activists to improve science communication by changing science policy became a fruitless attempt as it ended up becoming a political consultancy advising how to rebuild public trust. This happened through science events such as science festivals, national debates, round table discussions, etc. (Bauer, 2009).



Defining science engagement

According to Bucchi (2008) theorists of science communication initially identified a model for the science communication practiced in the mid-twentieth century that focused exclusively on the level of the public's understanding of science and science literacy (Bucchi, 2008). This approach came to be known as the 'deficit model' by its critics. "This model characterized the public as having inadequate knowledge, and science as having all the required knowledge" (Burns et al., 2003). The Public Understanding of Science model is not too different to the mid twentieth century model as it also sees the public as lacking scientific knowledge. These deficit model approaches to science communication have limited their effectiveness since they are based on a paternalistic, top-down science-public relationship, and are no longer encouraged for science communication (Bucchi, 2008). Public engagement, which is the active process of engaging citizens involved in a scientific research process, is what is now encouraged in science communication and should be the approach scientists, science institutions and science communicators use as an approach to science communication instead of 'public awareness of science' signalling a shift from "'communication' to 'dialogue' and from 'science and society' to 'science in society'" (Bucchi, 2008).



Public engagement is the involvement of the public in technological and scientific innovations in a way that is responsible, inclusive of all beneficiaries in a dialogue, including those who might be disadvantaged, and ensuring that the development creates a better world (Skyes and Macnaghten in Owen and Heintz, no date). It is also the active opening up of dialogue and debate to members of the public as well as other stakeholders to what (Skyes and Macnagten in Owen and Heintz, no date) refer to as contentious issues, as a way to "explore ways to negotiate more equitable and considered impacts, more attuned to their seen and unforeseen effects" (Skyes and Macnagten in Owen and Heintz, no date, p. 86). Further, public engagement is the call to involve citizen participation in technological and scientific research as a way to ensure more accountability in the governance of science and technology (J. B. Owen & Heintz, n.d.). Democratic representation, input and engagement through fostering public debates is a crucial element of public engagement. It sees the public as an important group that will help make decisions and influence policy around science and technology as opposed to seeing the public as a group that needs to be taught about science (Skyes and Macnagten in Owen and Heintz, no date, p. 88). Public engagement calls for scientists to listen to the public and not "just talk at them" (Skyes and Macnagten in Owen and Heintz, no date, p. 88).

The necessity of transparent- open, inclusive and accountable- communication through public engagement has always been important and remains important for controversial topics such as GMOs, but it has not always been possible because of the limitations of how science communication has been conceptualized (Bucchi, 2008). Public turmoil around GMOs, such as those in the early 2000s, where debate in the media "had become extremely polarized" (Skyes and Macnagten in Owen and Heintz, no date, p. 91) through conflicting views about GMOs and American-based company, Monsanto, explicitly encouraging the use of GM products (Skyes and Macnagten in Owen and Heintz, no date), indicated the need for a new era/approach to science engagement because of the evidence of "mistrust, misinformation, corporate interest, as well as conspiracy theories over the past two decades" (Weingart et al., 2019, p. 22). This undoubtedly placed the field of biotechnology at the center for revised approaches to public engagement internationally (Weingart et al., 2019).

The need for an improved approach to science engagement is informed by strategies such as the European Union's Responsible Research and Innovation strategy (Joubert, 2001). In this approach the public is considered an active partner who can offer valuable insights around local knowledge, indigenous and traditional knowledge and concerns on ethical issues and sharing their sense of the viability of new technology that will help shape such research (Joubert, 2001).

The RRI, according to (von Schomberg, 2013, p. 1) "should be understood as a strategy of stakeholders to become mutual responsive to each other and anticipate research and innovation outcomes underpinning the "grand challenges" of our time for which they share responsibility."

Historical Development of the RRI:

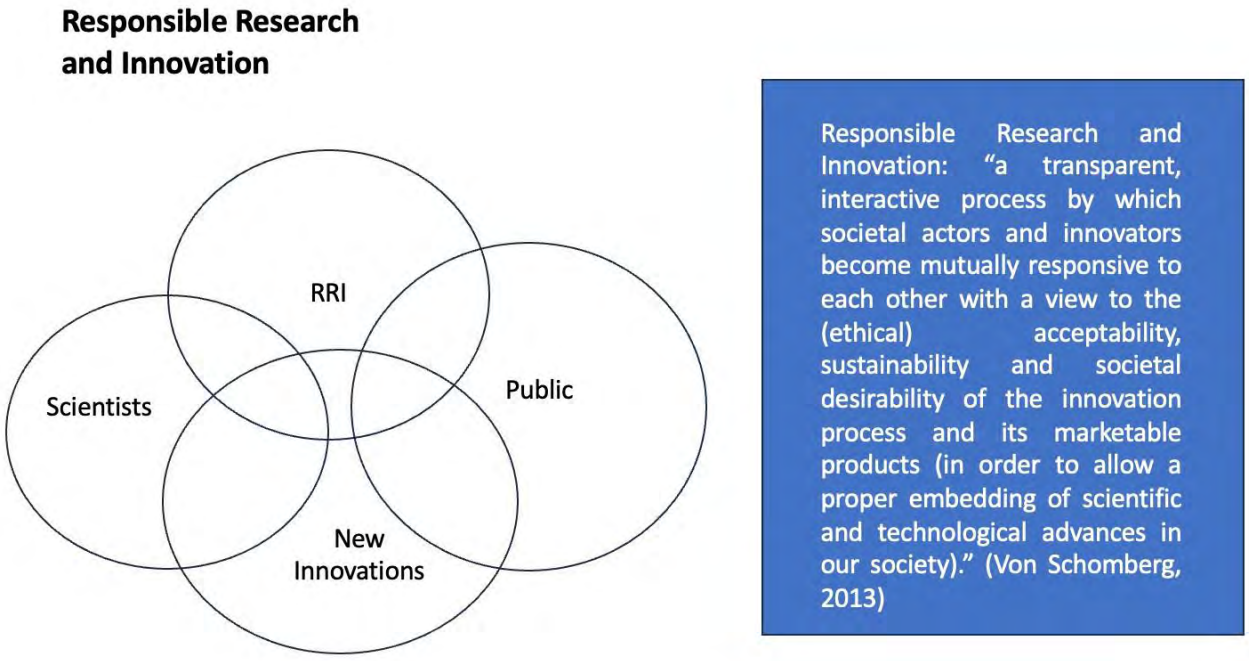
Debates, dialogue and sometimes near warfare is inevitable where there is technological developments and revolutions (Owen et al., 2013). Luddites is a term that has now become derogatory but was used in the early 18th century to refer to people who were considered antitechnology or anti-progress (Owen et al., 2013). In Britain, such groups flourished in their opposition of the Industrial Revolution (Owen et al., 2013). However, their opposition of technological advancement was not without reason. Most of these people feared losing their jobs to machines, "and the prospect of greater exploitation and greater class division" (Owen et al., 2013, p. 85). However, the British government then, responded to this by criminalising 'machine breaking' as a capital crime, which would result in a death sentence (Owen et al., 2013).

Furthermore, although the death sentence for opposing technological advancement by 'machine breaking' and other actions was lifted, arrests of protestors who were anti-genetic modification were made in Britain when protestors ripped up fields of GM crops (Owen et al., 2013). The need for a mature and responsible consideration of new technologies became necessary in order to ensure that "the impact of new technology creates a better world based on shared values, rather than just giving more power and money to the already powerful" (Owen et al., 2013, p. 86).

Responsible Research and Innovation is, then, driven by co-production, shared responsibility for innovation trajectories. (von Schomberg, 2013) propose the following definition for Responsible Research and Innovation: "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)."

RRI is described by different scholars in different ways that work towards a common goal. It is described by (Owen et al., 2012) as a framework which calls for research that isn't only for society but one that is responsive to society through the direct involvement of the public and is done with society. The RRI framework's ultimate goal is to contribute to research that is responsible and innovative through advocating for the involvement of the public from early stages of the research (Limson, 2018). The Commission, (2019, n.p.) describes responsible research and innovation as "an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation."

Science engagement is thus the active involvement of the public, by scientists, in science related activities and research as a way to improve the public understanding of science and scientific literacy (Bucchi, 2008). It also enables dialogue between scientists and the public, allowing mutual learning, transparent communication and democratic representation (Weingart et al., 2019). Some of the characteristics suggested by the RRI of science engagement include holding scientists accountable for their research in order to create a relationship of trust and responsibility between the scientists and the public. Weingart, Joubert and Falade, (2019, p. 47) argue that "scientists can no longer leave it to others to consider social ethical and political issues. It is clear that in an increasingly global context scientists and citizens need to work together" (Weingart et al., 2019, p. 47). The application of RRI in science engagement enables the public to ask questions about the risks and benefits of scientific research as it requires "a transparent and interactive process by which societal actors and innovators become mutually responsive to each other" (von Schomberg, 2013, p. 19).



Some of the New Approaches to Doing Engaged Science Communication

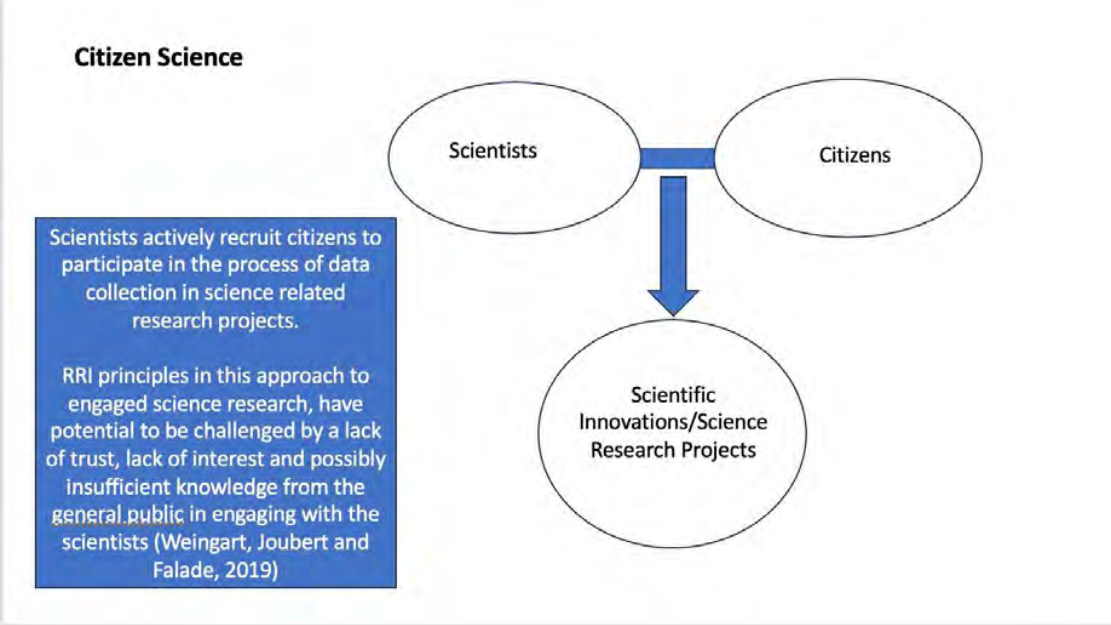
There are new approaches to doing engaged science communication that have emerged, some of these include, Citizen Science, Co-Creation, Community Based Participatory Research and Extension Officers within agriculture. I will briefly outline these.

Citizen Science

Citizen science is the active involvement and engagement through recruitment of some members of the public to help collect and analyse scientific data in research projects. Haklay *et el* (2021, p.1) broadly define Citizen science as "the active engagement of the general public in scientific research tasks. Citizen science is a growing practice in which scientists and citizens collaborate to produce new knowledge for science and society" (Haklay *et al.*, 2021, p. 1).

According to Eitzel *et al*, (2017) the degree to which participation of different stakeholders happens matters in how we describe citizen science. However, they further explain that citizen science can be categorized by many researchers as a tool, method, or form of research. Scholars such as (Bonney et al., 2009; Follett & Strezov, 2015; Wiggins et al., 2011, 2011) often

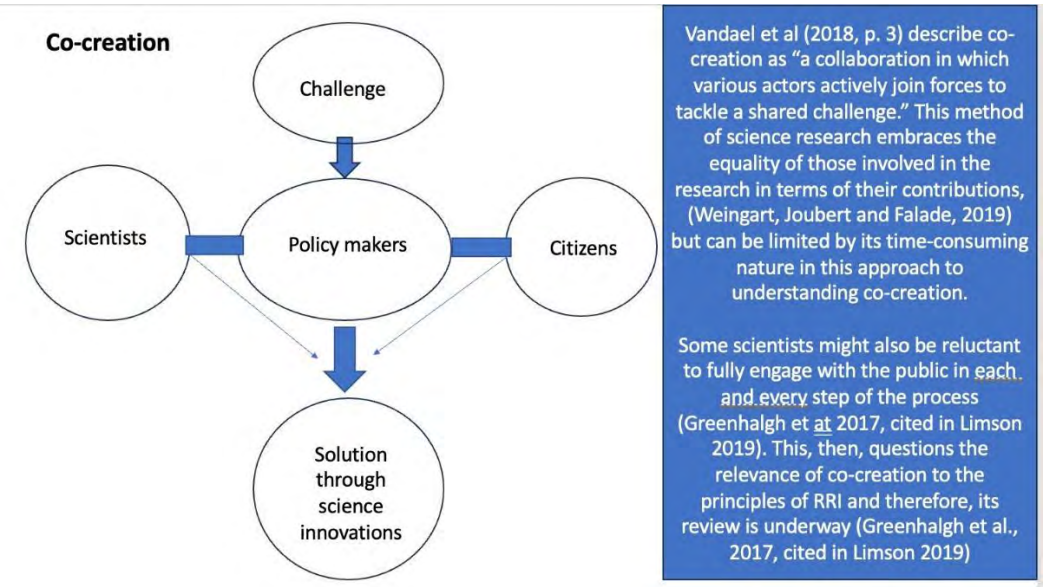
contextualize citizen science "within traditional, hierarchical science and policy-making processes," (Eitzel et al, 2017, p. 8). While those who advocate for a more instrumental view on citizen science, traditional research practices reach larger scales, (e.g., geographically, sample size) than it has ever been possible for many fields. Cohn (2008) on the other hand explains that the conception of citizen science tends to largely center the citizen in the role of data-gathering for different big projects. These can involve varying topics. Weingart, Joubert and Falade, (2019) state that it is an undeniable fact that citizen science can be a tool to science engagement with the public, to teach through science/ learn from science and encourage involvement in science. RRI principles in this approach to engaged science research, have potential to be challenged by a lack of trust, lack of interest and possibly insufficient knowledge from the general public in engaging with the scientists (Weingart et al., 2019).



Co-Creation

Vandael *et al* (2018, p. 3) describe co-creation as "a collaboration in which various actors actively join forces to tackle a shared challenge." Here, setting goals and priorities is part of the process of co-creation (Weingart et al., 2019). This method of science research embraces the equality of those involved in the research in terms of their contributions, (Weingart et al., 2019) but can be limited by its time-consuming nature in this approach to understanding cocreation. Efforts to rapidly translate research from universities into innovative products that patients can

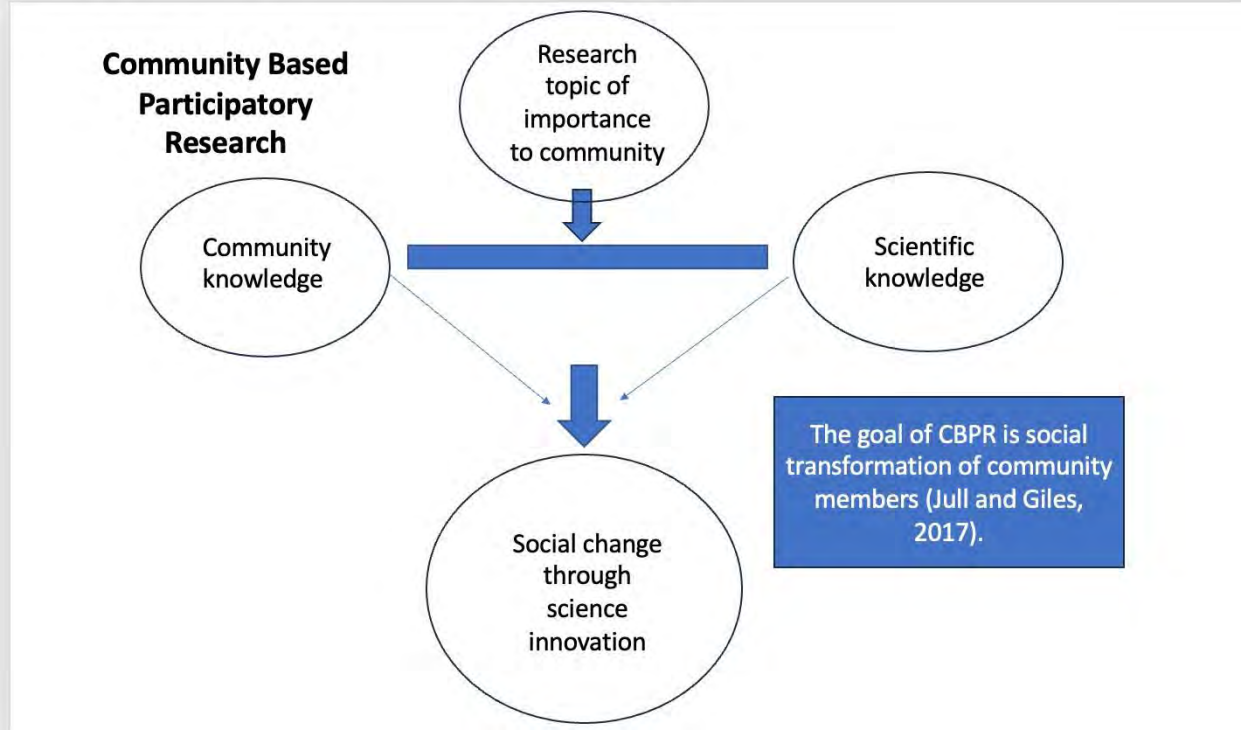
benefit from are made by the UK's National Institute for Health research (NIHR) through funding partnerships that allow for this to happen (Limson, 2019 in Greenhalgh et al, 2017). Limson (2019, p25) explains how Greenhalgh et al (2017) evaluated this collaboration between a British university and health research unit. "This initiative provides a real example of a 'value co-creation' model which seeks to involve patients in the design, delivery and dissemination of research needs" (Weingart et al., 2019, p. 25). However, because of the nature of biomedical research innovation and product development, this may, according to Greenhalgh et al (2017, cited in Limson 2019), cause a neglect of the priority setting of patients. Some scientists might also be reluctant to fully engage with the public in each and every step of the process (Greenhalgh et at 2017, cited in Limson 2019). This, then, questions the relevance of co-creation to the principles of RRI and therefore, its review is underway (Greenhalgh *et al.*, 2017, cited in Limson 2019).



Community Based Participatory Research

Limson, (2019); in Weingart, Joubert and Falade, (2019) draws from (Jull and Giles', 2017, p.

3) description of community based participatory research (CBPR) which is a "collaborative approach to research that equitably involves all partners in the research process and recognizes the unique strengths that each brings. CBPR begins with a research topic of importance to the community, has the aim of combining knowledge with action and achieving social change to improve health outcomes and eliminate health disparities." Through the community based participatory research, RRI principles and processes are pro-poor and dedicated to a collaboration with 'marginalised communities' as a strategy of dealing with or addressing the community's challenges. Here, members of the community "hold expertise to help shape the research" (Weingart et al., 2019). The goal of CBPR is social transformation of community members (Jull & Giles, 2017).



Extension officers

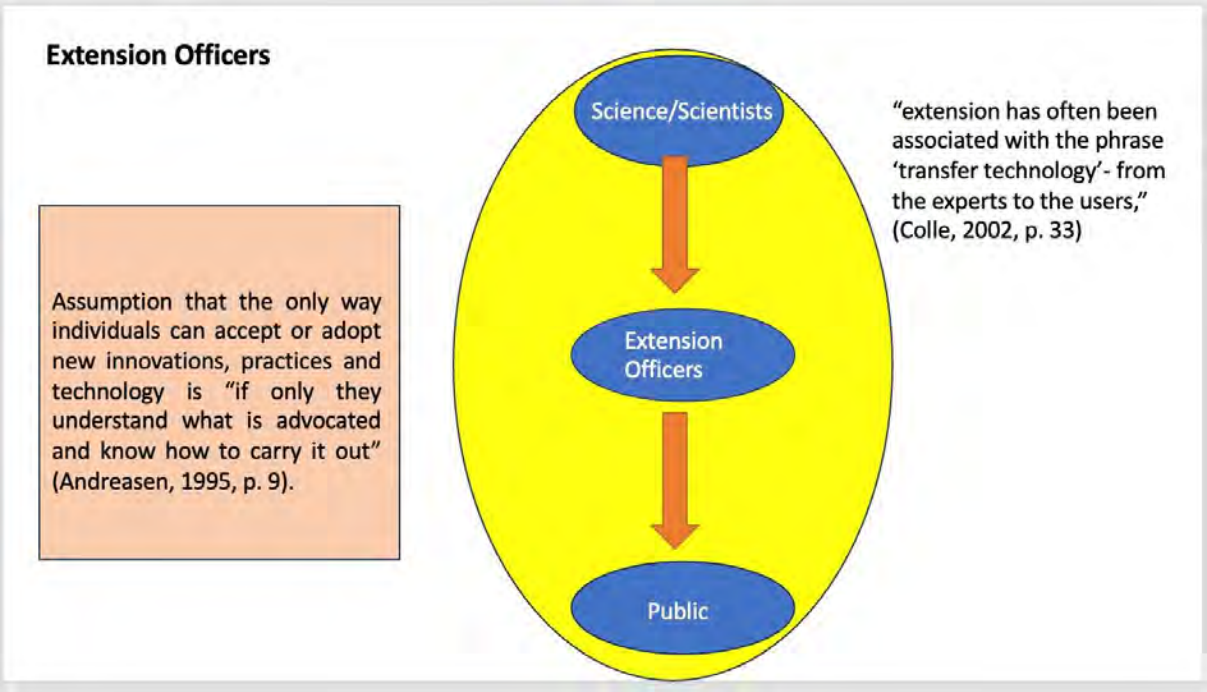
According to Colle, (2002, p. 3) "Extension refers to the process of linking researchers (or other producers of innovations) with potential users of research results". It is an approach to science communication that appeared prominently in the United States Land-Grant University, but not exclusively as a lot of other countries around the globe have adopted it (Colle, 2002). The approach places a lot of emphasis on elongating research-based recommendations and skills to

rural families with the hope that they would adopt the new practices as well as new technology (Colle, 2002). Therefore, "extension has often been associated with the phrase 'transfer technology'- from the experts to the users," (Colle, 2002, p. 33) implying a deficit in knowledge of the users. An example of this would be that scientific researchers develop a new technology innovation for a particular community or public and through the use of extension, train the community in appropriate ways to use that technology so that they adopt the technology. The assumption in this approach has been that the only way individuals can accept or adopt new innovations, practices and technology is "if only they understand what is advocated and know how to carry it out" (Andreasen, 1995, p. 9).

However, there has been a growing shift away from the traditional extension approach to the transfer of new innovations and technology as it is a top-down approach to the sharing and flow of information as well as technology. This shift is described as the 'researchers to farmers and families' approach. Therefore, the re-examination of the traditional approach and the reconceptualizing of the relationship between change agents included questions and considerations referred to by Chambers (1997) in (Colle, 2002) such as; "Are the farmers' perceptions of their needs the same as those presumed by the researcher? (2) Are the researcher's results appropriate for the farmers' needs? (3) Does the farmer have knowledge that would be useful to the researcher? (4) How should researchers' and farmers' agendas be set? And whose reality counts?" (Colle, 2002, p. 35).

Some of the concerns about the extension approach to science communication included the fact that the "top-down" direction of information flow supplied from scientists and officials to the farmers, (bottom) there is not much "feed-forward" for feedback as Colle (2002, p. 36) terms it. Further, the information is not always relevant to the farmers in question because the scientists or the researchers do not always respond to the needs of the farmers. It is assumed, in this approach, that relevant technical knowledge, for example, is available (Colle, 2002). The methods used to reach farmers is often face-to-face contact, however, there is little attempt to include communication media as well as distance learning into this process of interacting with the farmers (Colle, 2002).

Although extension systems have been, according to Colle, (2002) adjusting to some of these criticisms, although not all of them have been mentioned here, there is still a need for the science communication gap to be narrowed through new models of extension (Colle, 2002).



Information and Communication Technologies in Extension Officer Models

Information and Communication Technologies (ICTs) such as; cell phones, internet, computers, video, film, magazines, leaflets, etc. enable users to access, store, retrieve, transfer, and manipulate information in a digital form and they are referred to as information and communication technologies (FAO, 2023). ICTs can be used as a tool to address large audiences through television programmes, for example. In the field of agriculture and extension, agricultural advisory services and rural communication, ICTs have always been used (Lie & Witteveen, 2013). ICTs can play a critical role in learning in the field of agriculture and communication. Lie and Witteveen (2013, cited in Servaes 2002) distinguish different approaches to learning and communication and how ICTs contribute to such learning and communication processes. Some of these approaches to learning include "social learning, experiential learning, collaborative learning and transformative learning" (Lie & Witteveen, 2013, p. 876).

Although communication and learning has always been a critical component in the field of agricultural extension, advisory services and rural communication, it is only in recent years that learning has been given explicit and increased attention (Pretty & Chambers, 1993). In the 1960s, the approach to learning in the agricultural field was always top-down in its model, the Training and Visit model (T&V) as it focused primarily on regular output from the research

system, which resulted in blueprint extension messages. This approach to learning within the field of agriculture was challenged by scholars such as Roling, (1988, 1989) and Chambers, (1993) with a call for a new "learning paradigm" (Pretty & Chambers, 1993, p. 182). In this approach, questions such as "how do people learn?" and "how can we best cater to the different learning styles of people?" foreground the learning process and these questions pushed the field forward (Lie & Witteveen, 2013).

A more participatory approach to learning enabled capacity of the farmers to analytically experiment on more locally appropriate solutions for their contexts. This approach came to be known as the Farmer Field Schools (FFSs) (Lie & Witteveen, 2013). While the T&V approach emphasized the transfer of knowledge, making it top-down, the FFSs emphasize the interaction and co-creation of knowledge. Furthermore, Roling and Wagemakers (1998) played a critical role in emphasizing the importance of facilitating learning through approaches that are participatory as well as appropriate institutional support and policy structure (Roling & Wagemakers, 1998).

General ICT and mobile possibilities expanded exponentially while "all kinds of ICTs also became part and parcel of the pallet of agricultural advisory services" (Lie & Witterveen, 2013, p. 876). This expansion of ICTs within agricultural advisory services enabled new ways of communication and learning (Lie & Witterveen, 2013).

Understanding the history of science communication in South Africa

Science communication in South Africa has been considered by scholars such as (du Plessis, 2017) as non-comprehensive because of its undemocratic political legacy that excluded the majority of South Africans. The inhumane, racist systems of British Colonial rule and Apartheid that have caused deep social divides in South Africa are to partly blame for this (du Plessis, 2017). Although South Africa is now under majority rule and was democratized in 1994, it still carries the legacy of marginalization of indigenous knowledge systems. During the apartheid era Science interests in South Africa were not inspired by the majority's needs or expectations of research, but were driven by the interests of a small 'elite' within the academic space (du Plessis, 2017).

The period 1795- 1910 was a long period of British colonial rule, which was deeply entrenched in racial and ethnical segregation (du Plessis, 2017). Through this system, the colonisers

succeeded in conquering all aspects of the country, including land, property and knowledge systems. The epistemological practices of people were also conquered and old systems of learning fell away while the majority of the population (black people) remained uneducated in Western knowledge systems (du Plessis, 2017). The establishment of the Roman-Dutch law in South Africa exacerbated the 'othering' of local indigenous knowledge systems (du Plessis, 2017). Public debate and opinion regarding science knowledge and ideas was limited. What little room was given to public discussion about science in South Africa before 1948, was only for the intellectual, social and political elite, which would have been the minority of white people by invite only (Dubow, 2006). The reporting of such events, in the Cape Monthly Magazine established in the 1850's, would only focus on matters that promoted and supported white "intelligentsia" (Dubow, 2006).

During 1948-1994, Afrikaners promoted a crude racist notion of modernity and pitted scientific rationality against local 'primitivism' (du Plessis, 2017). This racist ideology revealed itself through structures and systems of belief that races are different in all aspects and that the intellectually superior race to other races is the white race (du Plessis, 2017). Science research disregarded indigenous epistemologies and science was seen and promoted as the "epitome of (western) rationality" (du Plessis, 2017, p. 7). Museums, professional associations, botanical gardens, etc. became a pivotal part of intellectual substructures of the Afrikaner identity (du Plessis, 2017). This approach to science knowledge was also seen through racist education policies that explicitly enforced different levels of education for learners depending on their official racial classification (McKeever, 2017). Black Africans were less likely to have taken math and science as subjects at school due to such policies (McKeever, 2017). The talent and potential of the non-White population in science and technology was thus wasted by the apartheid education system (Macrae, 1997). It, therefore, caused a severe knowledge gap crisis in science-based disciplines (Khan, 1992). Further, due to the separate and unequal development of education based on a difference in race, a majority (86%) of the non-White population in South Africa still underperforms in subjects such as mathematics (Macrae, 1997). "The legacy of apartheid for mathematical education includes the subordination of ethnocentric considerations to Eurocentric traditions and the exclusion of the majority if the population from access to and participation in the mathematics-related professions" (Macrae, 1997, n.p).

The high social inequality gap in South Africa can be attributed to the differences in education received by different racial groups in apartheid South Africa (McKeever, 2017). Further,

although these racist policies were developed pre-1994, the "minority White population is consistently able to achieve both more and better education" (McKeever, 2017, p. 115) while the majority of the population's quality of education differed, depending on parental background (McKeever, 2017).

Following the process of socio-political restitution post 1994, finding a demographically fair and critical approach to science education and communication was to be an uphill battle because of the gap in skills and literacy. The ANC government's efforts to narrow this gap included an introduction of a radical alteration and improvement of science communication through South Africa's Green Paper on Science and Technology, published in 1996 (Dubow, 2006). The main objective for this paper was to encourage the new democratic government to "…formulate, implement, and evaluate policy for the advancement of S&T in pursuit of an improved and sustainable quality of life for all South Africans, with the following objective: to promote the Public Understanding of S&T, especially in areas of implementation of the Research and Development Programme (RDP)" (Blake, 1996, p. 38). Public Understanding of Science surveys that try to measure the public's scientific understanding were conducted to try and rectify the position of science communication through communication efforts to the democratic public (du Plessis, 2017). After much critique of surveys of Public Understanding of Science that led to Johann Mouton's (2006) critical questions: "whose research demands are being addressed and to what purpose? How are these research demands articulated and represented and lastly, what modes of research production dominate institutions and do they support a transformative agenda in service of the poor, the marginalized and the illiterate?" (du Plessis, 2017, p. 10). According to du Plessis (2017) the realisation that South Africa's assessment of the public's relationship with science is not systematic, comprehensive and representative enough, meant that the approach to science communication had to be reassessed.

This new approach to science communication highlighted a need for engaging the public-science engagement. It meant all scientific research would now involve a component where scientists would not only communicate the science behind their research but would also consult the public as stakeholders as a way to eliminate the perceptions of race that has no fair demographical representation as well as to eliminate the idea of public perception existing only in theory.

It would involve the public as active partners in scientific research (du Plessis, 2017). "Public engagement with biotechnology in the South African setting sought to address scientific

misinformation on several issues through several science communication initiatives (Weingart et al., 2019, p. 23). Deficit models fuelled by the lack of access to education and information were the focus of science communication. However, with biotechnology viewed as a necessary and important tool to spiral hope for "addressing some of the most pressing global challenges of our time" a new approach to science engagement in this field is necessary (Weingart et al., 2019, p. 23).

The search for a model for Science Engagement at Rhodes University

Professor Janice Limson, the SARChI chair in Science Communication at Rhodes University has done extensive work particularly in the field of biotechnology. Acknowledging that traditionally, the role of the public in scientific research, technological products and knowledge, has always been that of a passive recipient, Limson (2018) argues for new models and approaches to the way in which scientists are trained and taught in higher education institutions.

Limson (2018) notes that concepts and notions of directly involving and engaging the public are faced with the challenge of "its 'in principle' adoption and uptake by scientists" (Limson, 2018, p. 20). Although, Limson (2018) does not go into great detail about this point, she argues that taking into consideration that most scientific research happens in universities, it becomes a particular challenge to integrate direct public engagement into research that is already existing, future research as well as teaching programmes at universities (Limson, 2018). Therefore, more innovative ways of teaching and learning are required for this approach to science engagement.

Rhodes University's Biotechnology department has embarked on a number of projects that involve the public through participatory research. Students at the Rhodes University's Biotechnology Centre for Innovation (RUBIC) have explored different models for science engagement by following different approaches. Some of the different approaches that are explored by science students in research projects that embed the RRI principles are; Citizen science, co-creation as a method of citizen science and participatory research. These approaches to research have not been deeply explored and therefore, there is a limited number of real-life examples where scientists have taken the initiative to explore such approaches to scientific research (Limson, (2019); in Weingart, Joubert and Falade, (2019).

Teaching different approaches to science engagement to students has become a key feature of the curriculum at RUBIC. The Centre aims to "provide an experimental, trans-disciplinary training space for postgraduate biotechnology students" (Limson, (2019); in Weingart, Joubert and Falade, 2019, p. 27). The integration of biotechnology research and teaching with courses that encourage entrepreneurship within the field as well as science engagement is the department's goal. To incorporate science engagement into the postgraduate programme training of biotechnology students, different projects were attempted. The following are some of these projects:

1. "Direct engagement between scientists and the public at a science fair;
2. Engage the public actively in laboratory-based research;
3. Engage the public about their views on new products; and
4. Engage specific publics regarding their perspectives on current and future research" (Limson, 2019; in Weingart, Joubert and Falade, 2019, p. 29).

Some factors had to be taken into consideration such as that, a number of students entering the biotechnology programme at postgraduate level had had no prior experience within science engagement, which lead to their discomfort in directly engaging the public about their research without a form of training, while very specialised research with a clear public in mind worked as an advantage (Limson, 2019; in Weingart, Joubert and Falade, 2019). Training scientists (post-graduate students) to develop the skill of engaging publics proved to be particularly difficult because of a lack of experience with engaging communities. Some limitations to these approaches to engaging the public presented themselves. These include issues of trust as well as relationship-building between the scientists and public. One of the main limitations was that there has been a lack of training in tools and the necessary skills for scientists to participate in societal engagement (Limson, 2019; in Weingart, Joubert and Falade, 2019).

Therefore, the RUBIC has taken the necessary step towards partnerships with socially trained stakeholders to participate in the engagement of the public in science related research projects with the aim of supporting relationship building. In order to address this gap, the RUBIC has collaborated with the School of Journalism and Media Studies around several projects. This has incorporated the involvement of journalism lecturers and students attempting to share these engagement and relationship-building skills with biotechnology students. Some of these involve Mr Shepi Mati, Mr Steven Lang and Mr Rod Amner, who have trained students through

several workshops to develop writing and audio skills, including personal communication with Professor Janice Limson. More recently, they have experimented with getting journalism students to produce media from interactions with science students. One example includes an animated video developed by a student to explain how aptamers are made. The success of these projects has prompted an interest in further research into how scientist students can work alongside journalism students to promote public engagement.

This particular study is centered around describing how such a new model for science engagement might be developed that incorporates communications professionals into the process of science engagement. This new model is, however, different to models such as the Public Understanding of Science or Science Journalism, where a scientist tells a journalist what the public needs to know about science and then they report on it. However, it is an engaged and participatory model because by incorporating a researcher like myself who has been trained in the field of journalism and media studies into the development of this model, there is great opportunity for deeper engagement with knowledge and methods around public engagement from the field of journalism and communications. Through this deeper engagement, the public is involved as partners in the research right from the beginning and they are the ones that define what is relevant to their circumstances in the context of this research. It is an example of some of the diverse traditions in the field that address debates around how to optimally enable public engagement, they include; development communication, development journalism, and elements from public journalism also known as civic journalism, such as; framing, civic and structural civic mapping.

Predating the debates in science communication by several decades, the fields of journalism and communication have similarly been through a process of self-examination and critique.

They have been questioning some of the positivist's assumptions of objective journalism tradition where journalists might consider themselves as serving the public interest, but would see themselves, not the public, as the gatekeepers of news and as setting the agenda. The next chapter will set out various debates where this assumption has been challenged and have engaged in explorations on engaging publics to be part of the process of defining what is relevant to their circumstances and should be the topic of public conversation.

Chapter 2: Theoretical Framework

Introduction

This study aims to answer the following research questions:

- How can a new model for science engagement incorporating concepts and methods from journalism and communication studies be used to deepen and expand notions of science engagement in South Africa?

- How can a documentary video enable science communicators to reflect on a new model for science engagement in South Africa?

Public engagement is key to this research because, as I have shown in the previous chapter, approaching science communication from a deficit point of view is problematic. Such models do not consider the public as active partners in scientific research. In this chapter, I will be examining different understandings of public engagement emerging from different approaches to journalism and communication, and discuss this in relation to some of the ideas about science engagement highlighted in the previous chapter. These understandings of public engagement have been intensely debated in the fields of development communication, (Colle, 2002) development journalism (Banda, 2007) and public or civic journalism (Haas, 2012). I will begin by unpacking notions of public engagement in development communication, then how public engagement is understood in both development journalism and development communication. These two fields particularly deal with public engagement in the context of the Global South, therefore, may hold particular lessons for science engagement in the African context. Next, I will outline public engagement as a central concept in the formation of public journalism and explain how this included new journalistic practices such as civic mapping and framing stories to specifically enable public engagement (Haas, 2012).

In developing an African model for science communication and engagement we can learn from all of these approaches to public engagement. These journalism and communication approaches to the concept of public engagement and its purpose vary in the degree to which they conceptualise an active public, but they all see a role for mediation by a journalist or communication professional in the process, which a lot of the approaches mentioned in chapter 1 do not necessarily focus on mediation, except, to a limited level, the extension officer model approach. Responsible Research and Innovation focuses on scientists talking directly to the

public, which is particularly challenging for scientists as we would have seen previously in examples about Rhodes University students who found it difficult to adopt communication skills. Therefore, journalism students and staff were engaged to assist the process of science engagement the Rhodes University students were involved in. Thus, mediation within the science engagement model has been a part of the debate but has not received sufficient attention.

Development Communication.

The United Nations unit called the Development Support Communications Service (DSCS), operating under the control of the United Nations Development Programme (UNDP), was among the earliest pioneers in the field of development communication. The key person leading the UNDP was Erskine Childers, who was one of the contributors to the peculiar new approach to communication as part of development interventions (Colle, 2002). He focuses on the importance of communication to enable the agency of the stakeholders. Such agency includes the agency to make decisions related to choosing the type of development that is relevant and beneficial to them. It also includes enabling agency to sustain development by being able to communicate with planners and each other to keep the project accountable once the foreign development workers have left.

> If you want development to be rooted in the human beings who have to become the agents of it as well as the beneficiaries, who will alone decide on the kind of development they can sustain after the foreign aid has gone away, then you have got to communicate with them, you have got to enable them to communicate with each other and back to the planners in the capital city. You have got to communicate the techniques that they need in order that they will decide on their own development. If you do not do that you will continue to have weak or failing development programmes. It's as simple as that.
>
> Erskine Childers cited in (Colle, 2002, p. 4)

Development Communication is "the planned and systematic use of communication through interpersonal channels, and audio-visual and mass media" (Thompson, 2002, n.p.) to gather and trade information among all relevant stakeholders involved in planning a development initiative. Development communication has been characterised by debates between different

role players within the development field about its defining characteristics. These alternate positions about the relationship between development and communication are called “development support communication", "communication and development" and "researchers to farmers and families extension" approaches (Colle, 2002).

Development support communication was a term that emerged in the early history of development communication. The term suggested that “the communication function was a subcomponent of various sectors” and that communication was not as important as the resulting development (Colle, 2002, p. 1). However, communication has been argued to be an integral component of development and cannot be considered as something that is added on to development as an afterthought. Development communication professionals from across the world, including the UN Specialized Agencies and academics who met at a roundtable discussion, debated whether the term development support communication was appropriate to describe their field and concluded that “its domain is best described by the phrase ‘communication-and-development’” (Colle, 2002, p. 2). Colle (2002) incorporates this notion of communication-and-development into their definition of development communication, which is how I too understand development communication to mean in this thesis.

In development communication, public engagement involves providing opportunities for the public to “identify non-technical factors relevant to evaluating a scientific project and/or to contribute otherwise neglected but valuable local and practitioner knowledge” (Salmon et al, 2015, p. 53). The various processes that are built into development communication to help the public define and share these ideas can also be characterised as the co-production of knowledge. This co-production of knowledge and opportunity for public participants to identify such factors implies that engaging the public in science research enables agency of the public in such research processes. However, development communication’s extensive focus on helping communities identify all relevant factors when evaluating a project to contributing to their local knowledge can make a great contribution to strengthening and widening the scope of public engagement within science communication and engagement.

According to (Colle, 2002) development communication is interpersonal communication and is different from mass communication because it foregrounds techniques for how communities could most productively talk to each other and talk to powerful decision makers. Different professionals within the development sector may have different understandings of what the characteristics of development communication are (Colle, 2002). Morris, (2003) argues that

two conceptual models make up development communication. These are; the diffusion and participation models. They have different characteristics in their program design and goals (Morris, 2003). The diffusion model approach to development communication focuses on behavioural change. Its goal is to persuade "individuals to change their behaviour by providing them new ideas and information as the purpose of communication campaigns" (Morris, 2003, p. 226). Knowledge, attitudes and practice are the basis of this approach to development communication. Information is given as a means to provide knowledge that leads to a change in people's attitudes and therefore, people's behaviour or practice (Morris, 2003). While this approach is seen as a top-down approach to development communication, the participatory model approach was developed to bridge the gap of "underlying assumptions to the diffusion model" approach (Morris, 2003, p. 226). The participatory approach to development communication sees communication as a non-vertical process of transferring information from those who have more knowledge to those with less knowledge about a particular thing. Furthermore, it sees communication as a horizontal process of interactions, exchange and engagement. It foregrounds dialogue as a tool to empower communities. The goal is to empower communities "to have greater control over decisions that affect them and, in this way, to foster social equity and democratic practices" (Morris, 2003, p. 226).

Similar concerns of agency in debates about public engagement are seen in strategies such as the RRI. In this strategy, the public is considered active partners who can offer valuable insights around local knowledge, indigenous and traditional knowledge and concerns on ethical issues and sharing their sense of the viability of new technology that will help shape such research (Joubert, 2001). This speaks to the kind of agency advocated for through development communication as argued by Erskine Childers in (Colle, 2002). The argument that RRI "should be understood as a strategy of stakeholders to become mutual responsive to each other and anticipate research and innovation outcomes underpinning the "grand challenges" of our time for which they share responsibility" (von Schomberg, 2013, p. 1) supports (Colle, 2002)'s argument about communication enabling the agency of stakeholders to make decisions related to choosing the type of development that is relevant and beneficial to them.

The concept of participatory development communication "rests on the premise that successful rural development calls for the conscious and active participation of the intended beneficiaries at every stage of the development process…" (FAO, 1989, p.1).

Development Communication and Science Engagement

Some of the functions of development communication include ensuring that the way in which the execution plan of a development project is designed, considers what the attitudes of the people which it is designed for or which it is trying to help are, as well as their perceived needs and capacities (FAO, 1989). This way, failed projects like abandoned irrigation schemes, settlement programs, broken down equipment, etc. because of assumptions immaturely made about the community's willingness and capacity to accept such new technology and development can be avoided (FAO, 1989). Science engagement can learn from this approach to communication by ensuring that no assumptions are made about the public's willingness to accept new scientific innovations. "Development communication helps to identify attitudes, felt needs, capacities, and constraints to the adoption of change" (F.A.O., 1989, p. 2).

Further, because of Development Communication's dialogue and consultation element, it automatically allows the community or intended beneficiary of development action to participate in the process, which is what this study proposes as a new model and approach to science engagement- dialogue with the relevant public. Development communication also allows an open dialogue among all stakeholder in a development project. This also helps with the spreading of information about the successes of any development project, encouraging other community members to participate in the process (F.A.O., 1989).

Colle, (2002) asserts that the FAO's approach to Development Communication compels community participation to be a part of Development Communication, which is also part of what RRI does. However, the organization is not the first nor the only one that has contributed towards promoting the participation of local people in development communication activities (Colle, 2002). Puerto Rico's Division of Community Education also played a crucial and very significant role in applying the concept of community participation systematically to development programs in the late 1940s (Colle, 2002). Further, Paulo Freire actively contributed in suggesting new approaches to the development communication in the 1960s through his "Pedagogy of the Oppressed" manuscript of 1968. It placed a lot of emphasis on community participation, including a bottom-up scenario for development. Freire used literacy to identify issues of concern among marginalised adults and then worked with them to develop materials that enabled sophisticated dialogues around these issues while also teaching literacy skills, (Colle, 2002). He foregrounded the importance of dialogue and caring in communication for social change. Later, in the mid-1990s, a policy of building participation into appropriate

programs was established by the World Bank (World, 1994). With much progress and effort, participation as an operational principle slowly spread through different major development initiatives (Colle, 2002). It is in the 21st century that the Rockefeller Foundation published a report called "Making Waves, Stories of Participatory Communication for Social Change" that introduced, through 50 experiments that empowered people to take charge of their own lives by changing their circumstances of poverty, discrimination and exclusion was Communication for Social Change introduced (Colle, 2002).

Furthermore, development communication (or participatory development communication) can contribute significantly to the field of science engagement because of its active involvement of the public in development projects. Science engagement calls for an active involvement of the public, by scientists, in science related activities and enables dialogue between scientists and the public, allowing mutual learning, transparent communication and democratic representation of all stakeholders who will potentially be impacted by a science and technology innovation (Bucchi, 2008; Weingart et al., 2021). Furthermore, the emphasis in development communication in helping people to develop the agency to communicate in ways that will enable consensus decision-making and to negotiate with people in power, development communication goes beyond what is understood by science engagement. Therefore, it can make a significant contribution to the field of science engagement.

Development Journalism

Development journalism is not conceptually distant from development communication as it is greatly informed by theories of development communication (Banda, 2007). It also encourages public engagement, and therefore, plays a significant role in providing relevant content that speaks to ordinary people about technological innovations and new infrastructures. However, development journalism has been contested by scholars such as (Odhiambo, 1991). I will begin by defining development journalism, unpack what it is and how it has been contested, then conclude with Banda's (2007) proposal of development journalism and how it can be undemonized.

According to Kunczik (cited in Banda, 2007, p. 158) development journalism

> "is an intellectual enterprise in which the journalists should form a kind of free intelligence, and should critically examine the aims of national development and the applicable instruments in a rational discourse and solve them by reasonable criteria free of social constraints".

Therefore, the tasks development journalism has are to encourage audiences to actively cooperate in development; as well as "to defend the interests of those concerned" (Banda, 2007, p. 158).

Development communication "is about understanding the role played by information, communication and the media in the directed and non-directed social change" (Thomas, 1994, p. 7). Some of the different practical applications in development communication are based on "the mainstreaming of communication as 'process' and the leveraging of media technologies in social change" (Thomas, 1994, p. 7).

Development journalism has been critiqued as a top-down form of communication due to its historical baggage as a mouthpiece for various developing states (Banda, 2007). Here the journalist is engaging in the top-down dissemination of development information to the reader without any public input (Shah, 1996). Further, development journalism has been association with advocacy from government officials "who wish to deflect press from engaging in the kind of watchdog reporting that challenges the political or economic status quo, or that uncovers government incompetence, corruption and malfeasance" (Banda, 2007, p. 18).

However, scholars such as Banda, (2007) propose a new conceptualisation of development journalism that builds on its strengths. He argues that in order to wrest useful principles out of the concept of development journalism, it is important to cast out all the demons that have been associated with it, particularly the demon of the "post-colonial state's blatant interference in the practising of journalism" (Banda, 2007, p. 154). Here he is referencing a metaphor coined by Shah, (1996) who argues that we should undemonise the concept of development journalism because its demonisation was birthed through the lens of Western notions of press freedom.

Banda (2007) believes development journalism's clear and careful commitment to democratising civic and political participation can play an important role in participatory democracy and peace among other humanistic values, and thus become cleansed from its unsavoury reputation (Banda, 2007).

Besides the critiques of development journalism as state propaganda, another critique is that it is embedded in modernist Western notions of development. The history of development journalism is embedded in the theory of development (Banda, 2007). Rogers (1962) and Lerner (1958) conceptualise development as a predictable and uniform evolution from traditional to modern society modelled on Western industrialisation. This approach assumes that traditional lifestyles in the Global South need to be destroyed to enable people to adopt modernised values and ways of being, such as Western industrialisation, political and economic behaviour as well as attitudes towards technology and innovation (Melkote, 1991). This modernist notion of development as evolutionary and the antithesis of tradition is also central to the diffusion of innovation approach (Rogers, 1962) which I have discussed above. Such patronising notions of development were championed by apologists like Shramm (1964) who saw development as an institutional tool of modernising institutions in 'third world' countries that operate as 'watchdogs', 'policymakers', and teachers for change and 'modernisation'.

The dependency-dissociation paradigm approach to development communication upholds and respects the diverse pathways towards development of the Global South. This paradigm supports the aspirations of "the newly independent nations… for political, economic and cultural self-determination and an ideological distancing from Western forms of modernisation" (Banda, 2007, p. 156). Despite the widespread criticism of colluding with state authorities, development journalism was indeed associated with independent journalism in the early 1960s (Shah, 1996). During that period, it was an approach that birthed and allowed a way of constructive criticism of governments and their agencies. It also went as far as informing readers "how the development process was affecting them, and highlighted local self-help projects" (Shah, 1996, p. 143).

This work of undemonising or reconceptualising development journalism allows one to then associate the concept with what Shah, (1996) describes as emancipatory journalism. Emancipatory journalism is a model of communication that foregrounds the importance of ground-up communication, and one that asserts democratisation and participation at all levels. Just like development communication, emancipatory journalism could encourage reform by keeping the problems related to development on the agenda of policy makers so that they may be forced to take action leading to emancipatory social change" (Shah, 1996, p. 156).

Essentially, this concept of development journalism is people oriented (Shah, 1996). Gunaratne, (1996, p.7-8) provides guidelines for development journalists that illustrates how they should mediate engagement:

> • "Whenever there is a reference to development, development journalists should try to make it concrete in terms of human beings. They should report on people as subjects, actors and agents rather than as objects or victims with needs deficit.
>
> • Development journalism should focus on the totality of concrete life situations – the rich, the middle class, the working class, the poor, the dirt poor, etc. In other words, human life is rarely captured in black and white; there are always shades of gray.
>
> • Development journalism should sometimes engage in 'constructive' criticism highlighting success stories, where necessary.
>
> • Development journalism should allow people to talk. A useful approach is for journalists to sit down with people from high to low, discussing the meaning of development, thereby generating an enormous range of visions as well as how-to insights…"
>
> (Gunaratne, 1996, p. 7-8).

Thus, development journalism also encourages the journalist to be socially engaged and active in the construction and deconstruction of reality. It values the voices of the minority and ensures that they are heard fairly. In its entirety, it is concerned and driven by the intention of the development of societies, wholly. (Banda, 2007). It is "distant from the influence of the market and the state" (Banda, 2007, p. 165).

"Through the broadly democratic dialogic and bottom-up nature of emancipatory journalism, local communities can develop a set of concepts and theories that provide the basis not only for understanding the contradictions of modernization but also for critiquing them and proposing alternatives" (Shah, 1996, p. 157). Emancipatory journalism is a localizing power that empowers people to take control of their immediate social conditions (Shah, 1996).

Wimmer & Wolf, (2005) describe development journalism as an intellectual enterprise. The expectation of the journalist is to form a kind of free intelligence. One ought therefore to be critical in examining national development aims as well as those instruments that apply in a critical as well as rational discourse. The journalist should interrogate them using reasonable criteria that are independent and free from any social constraints (Wimmer & Wolf, 2005).

Banda, (2007) cites Shah's, (1996) argument that this emancipatory journalism

> "offers a 'completer and more complex' perspective on the relationship between mass media and society in the context of the Third World. It is more complete because it

> provides a theoretical link between citizens' access to mass media and social change, and because it articulates a specific mechanism through which journalists can participate in social change. It is more complex because it incorporates principles of diversity and fluidity in the process of building cultural identities and communities, and because it challenges journalistic practice by abandoning the idea of objectivity" (Banda, 2007, p. 158).

A holistic approach to development journalism should also focus on

> "the extent to which 'freedom' (of conscience, expression, assembly, media, etc.) is actualised in the lives of citizens. This will clearly be a departure from the kind of development journalism envisaged by post-colonial political elites in the Third World. But it is a fuller expression of development journalism" (Banda, 2007, p. 160).

In conclusion it is important to recognise the similarities and differences between development journalism and science journalism as both introduce the public to new technological innovations that will directly touch their lives. Science journalism advocates writing scientific stories that inform the public about new technological innovations (Angler, 2017). In the science literacy model of science journalism, journalists are considered translators of scientific information while in the contextual approach to science journalism, stories written by journalists focus on tying scientific information to particular contexts for particular communities (Secko et al., 2013). However, it is worth noting that within the lay-expertise and public participation approaches to science journalism, journalists are encouraged to write stories that seek to acknowledge the limitations of science and that values knowledge outside of science and "seeks to view science as embedded in society" (Secko et al., 2013, p. 67).

While some development journalism approaches simply glorified such technology and the governments that introduced them, other types of development journalism have existed in the past and have inspired theorists such as Banda (2007) to reimagine what development journalism could be. This more critical definition of development journalism involves journalists who operate according to a set of guidelines, as listed above in reference to the work of Banda (2007), to engage marginalised publics. This kind of development journalism foregrounds the stories of ordinary people and also allows for a critical voice, which I believe engaged science communication can benefit from by foregrounding the stories of the public and critiquing the relevancy of science and technology innovations. Scientists can learn from development journalists by sitting down with people from different sectors of society and engaging all from high to low, discussing the meaning of development, thereby generating an

enormous range of visions as well as how-to insights related to their research that involves these people.

Furthermore, just like development journalism should focus on the totality of concrete life situations – the rich, the middle class, the working class, the poor, the dirt poor, etc. and should view human life as rarely captured, not in black and white; but with different shades of gray (Banda, 2007) - so arguably, science engagement should also not assume anything about the public it is trying to engage, but should focus on the particular context of each community.

The Idea of Public Journalism

Public or Civic Journalism emerged in response to a disaffection with mass media political discourse in the USA (Haas & Steiner, 2006). It resisted sensationalist commercialism of the media and insisted that the public should be considered 'citizens' as opposed to 'audiences' (Haas & Steiner, 2006). This was a means to enhance civic participation and commitment (Haas & Steiner, 2006).

In the United States, the Mass Media are central to election campaigns (Esser & D'Angelo, 2006). Journalists tend to eagerly frame election news by covering the campaigns as a 'game" focused on polling numbers, not civic issues (Patterson, 1993) and so degrade "the information environment because covering the press and publicity process pulls them away from attending to candidates' policy issues" (Esser & D'Angelo, 2006, p. 45).

In public journalism, journalists engage the public by reimagining who they are talking to through advocating for public listening in their newsgathering, reimagining their relationship with government and focusing on what people could do to participate in public debate (Dzur, 2002). In America, for example, the *Charlotte Observer* interviewed residents of a certain neighbourhood that was famous for its very high crime rate as a way to understand the crime problem from the point of view of the residents. The intention was to seek solutions as well as to follow up with the relevant people who make decisions on change (Dzur, 2002). Science communication often involves science festivals and expos that display scientific research in an entertaining manner (although generally not in a sensationalist manner), which could potentially be seen as a form of considering the public as 'audiences' instead of 'citizens', something public journalism discourages. However, science communication can learn from

public journalism and the public could be considered as ‘citizens’ who could participate in the process of scientific research through science engagement.

According to public journalism advocates, the concept of public journalism is based, fundamentally, on the idea that journalism and democracy cannot be separated. The two are so intrinsically linked that they can be described as mutually dependent (Haas, 2012). A democracy that is genuine in its practice depends upon a form of journalism that is, according to Haas, (2012) committed to promoting and encouraging citizens’ active participation in democratic processes.

The lack of commitment to civic processes in mainstream journalism in the USA contributed to the extensive withdrawal by citizens from democratic processes in the early 2000s. This was measured by the disdained voter participation in political elections as well as the reduced public interest in journalistically mediated political information, witnessed by the disdained newspaper readership (Haas, 2012).

Public journalism argues that the widening gaps that split society into two, namely; “between citizens and government and between news organizations and their audiences,” can only be narrowed if journalists see, which they should, themselves as having the responsibility of stimulating increased civic commitment to, as well as stimulating increased, active citizens participation in democratic processes (Haas, 2012, p. 3). According to Glasser and Lee (2002, p. 30) “public journalism rests on the simple but apparently controversial premise that the purpose of the press is to promote and indeed improve, and not merely report on and complain about, the quality of public or civic life.” Further to this, (1998, p. 54) also argues that journalists are responsible to “help form as well as inform the public.” Public journalism therefore frames its journalism in relation to citizenship and the improvement of civic life.

Framing is a concept that describes how an issue in question can be viewed from different perspectives. “Framing refers to the process by which people develop a particular conceptualization of an issue or reorient their thinking about an issue” (Chong & Druckman, 2007, p. 104). The attitude people have towards a particular issue is dependent on a number of evaluative beliefs about that particular issue. So, for example, the current Eskom issue frame presented by the press in South Africa at the moment is a mismanagement of funds frame, whereas someone else could believe something different about the crisis, such as, an economic policy issue, which would require voters to vote for a political party that foregrounds economic

policy solutions for load shedding that will benefit citizens. Both of these attitudes towards/ beliefs about the issue are dependent on the frame casted on the issue.

Tuchman's (1978) ethnographic analysis and field work was the beginning of the systematic study of journalistic framing in the United States. She conducted her field work from the late 1960's to mid-1970's.

Journalistic frames are forged in newsrooms. In other words, they are influenced by newsrooms and their "operating rules, professional procedures, and ethical guidelines for selecting which topics to cover and how to cover them" (Chong & Druckman, 2007, p. 104). These newsrooms are what determine a journalist's approach to how they make sense of their own observations and the information they find or research independently as well as their sources' issue frames. Issue frames involve how a particular issue or story is framed and for what purposes it is framed (Thomas et al., 2011). For example, in the famous Thabo Bester and Dr Nandipha Magudumana case in South Africa currently, where most of the news articles suggest that Dr Magudumana is guilty of intentionally assisting the Facebook rapist to escape from prison, the issue frame would not be the detail of the story nor the opinions reflected, rather, it would be the broader assumptions underlying the way in which the story is told. In this example, the framing would be the sensationalist framing of the "femme fatale", a stereotype of a woman who uses her powerful sexuality for evil. The purpose of this framing would be to entice readers through the salacious details of a story that has sex and violence at its core. However, a civic framing of this story on the other hand would be, the framing of how the victims of the Facebook rapist are affected by his escape from prison and how the rest of the community feel unsafe. The purpose of this framing would be to foreground the concerns of the citizens in how justice is served. When journalists cover certain topics for long enough, eventually, the kinds of stories they produce will not only convey issue frames, but they will also wield frames influenced by the spaces they occupy, such as, interpretive communities, or professional environments (Chong and Druckman, 2007).

Framing is growing rapidly in the area of communication studies as a conceptual tool for analysis (D'Angelo and Kuypers, 2010). It is a tool used by news professionals to communicate their preferred meanings of events and issues. Sources also frame issue topics when giving stories to journalists. In most instances, journalists tend to use the frame received through a source to report on that issue, even though they might also impose, to a certain extent, their own frame to that issue (D'Angelo and Kuypers, 2010).

In science engagement, framing can be used as a way to ensure that scientists frame their scientific research by ensuring that whatever scientific or technological innovation in question is relevant to the needs of the public. Framing can play a critical role in enhancing science engagement through the use of issue frames that are influenced by the public that the innovation is for as opposed to what the scientists think the public needs.

The purpose of public journalism is not to join with or substitute itself for government. However, its primary purpose is to elicit effective citizen participation as well as effective contact with the governing process, (Merritt, 1998) a very critical component of this study's model to science communication and engagement, encouraging effective citizen participation in science research as well as effective contact with all stakeholders involved in the research, including the scientists who develop new scientific innovations.

Civic mapping became the key tool of Public Journalism to facilitate public engagement. Civic mapping is a tool used in journalism to map out the community in which one is to do research as a way to know and understand the people in the community, (Haas, 2008). It is a tool used to identify the catalysts and the connectors to find ways to involve them in the research or newsgathering. It ensured that communities helped define the meaning of what was newsworthy based on their participation in newsgathering (Haas, 2008). Journalists would visit citizens' homes and conduct interviews in their living rooms or personal spaces as a way to understand their lives (Haas, 2008).

Civic mapping has two approaches; (1) Cognitive civic mapping (2) Structural civic mapping.

Cognitive civic mapping developed in 1996 as a means to construct and develop a method that would enable news organisations to better engage and report on the concerns of local constituencies (Haas, 2008).

Harwood (2000) attributes the failure of journalists to capture the real, deep concerns of their local constituencies to the truth that they focus too much time and attention on two particular "layers" of local civic life. Harwood, (2000) describes these as the "official" layer and the "private" layer. The official layer of local governmental institutions would be "when journalists report on the deliberations and actions of City Council" (Haas, 2008, p. 2). The "private" layer of local residents refers to journalists reporting on "the reactions of ordinary citizens to given news stories or otherwise refers to human-interest stories on individual triumphs and tragedies (Haas, 2008, p. 2, Harwood, 2000).

Harwood, (2000) organises civic/community life into five different categories/layers. This layered approach to understanding a community provides a more complex understanding of the community and so enables deeper engagement. These layers are known as; "the 'official' layer of local government institutions, the 'quasi-official' layer of local municipal committees, civic organisations and NGOs; 'third places' such as community halls, churches, also known as places of worship, taverns, 'incidental' encounters on places like food vendors, stalls, sidewalks as well as the 'private' spaces of people's homes (Louw, 2015). It is through these approaches or tools, that journalists have been able to broaden their range of news source (Haas, 2008). It is through these methods that journalists are able to identify the different civic players/actors such as official leaders that include local leaders, School Governing Bodies, etc; civic leaders- these can include religious leaders, possibly chiefs, ward committee members and those we would consider as wise historians who have knowledge on historical perspectives about particular issues and geographical areas. Connectors are also included. These are the people who move from one organisation to another, "like pollinating bees spreading ideas and social norms" (Louw, 2015, p. 106).

Other ways in which journalists and news organisations have broadened their range is through the active involvement of attending community socials, keeping a close ear to the conversations that happen around them in different public spaces as well as going as far as visiting citizens in the privacy of their homes (Haas, 2008). This involves a lot of face-to-face interaction and a lot of quality time in local communities and spaces.

According to Harwood (2000) it is important for journalists to distinguish between "third places", "incidental" encounters, and "private" spaces in order to be able to tap into the prevailing and truest citizen concerns as opposed to assumed concerns based on deliberations that take place within local government institutions. Furthermore, Harwood (2000) asserts that the three layers of local civic life mentioned above place journalists in more likely positions of encountering conversations that wouldn't otherwise happen in more organised spheres typically represented by the "official" and "quasi-official" layers (Harwood, 2000).

"A concern that bubbles up from [below] will sound quite different from one that is discussed at a [formal] public meeting" (Harwood, 2000, p. 4). Going beyond the official and quasiofficial layers in a community allows citizens to voice out different concerns (Hass, 2008). These concerns can appear as the kinds of differences that actually divide/separate a community as opposed to unite it as journalists would have previously assumed (Campbell, 2004). Spaces that

are controlled by rules and regulations limit the majority of citizens' ability to feel comfortable in speaking about their real concerns. Thus, limits the journalists' understanding of the citizens' concerns (Haas, 2008). Citizens are, contrary to popular belief, interested and engaged in conversations about political issues but only in their own private spaces like their homes. However, they tend to not participate much and remain silent in formal public spaces or speak in "hushed tone" (Eliasoph, 1998, p. 16).

Harwood (2000) argues that it is important for journalists to change the way they have approached citizens in the past if they want to capture the kinds of conversations that happen in private spaces amongst citizens. Haas, (2008) says that Harwood (2000, p. 23) further suggests that journalists should avoid knocking at people's doors to ask interview questions, but rather engage citizens in "civic conversations" by sitting down "in their living rooms to understand their lives." Furthermore, he says "The goal should not be to find the quote [but rather] to discover patterns in what people are saying, to probe to uncover meaning and figure out how people's thinking unfolds as they talk" (Harwood, 2000, p. 23). This way of interviewing people is a form of public engagement.

"Civic conversations", as opposed to other approaches to engaging citizens, would allow them to elaborate, at length, on their concerns, using their own words and through interacting with others. Civic conversations take place amongst citizens who are already used to one another instead of focus group discussions. This happens within their daily life contexts (Haas, 2008). This approach is more likely to provide journalists a better understanding of the citizens and their concerns or thoughts, and one that is nuanced as opposed to public polls and focus group discussions (Haas, 2008). This, then, might help journalists reduce the gap between their news organisations and their audiences as this would mean that citizens see their real concerns being reported on in newspapers and they feel that newspapers are relevant to them and their circumstances (Haas, 2008). However, critics of the cognitive approach to civic mapping claimed it "conceives citizens exclusively as news sources on given issues and does not also conceive citizens as active participants who are willing and capable of addressing those issues" (Haas, 2008).

Structural Civic Mapping

Structural Civic Mapping supplements the cognitive approach to civic mapping. It inspires citizens to participate more actively in democratic processes (Campbell, 2002, 2004). Public

journalism's structural approach to civic mapping complements the cognitive approach in that it strengthens it through covering its blind spots, such as concentrating on enhancing journalists' understanding of citizens' issues and not necessarily aiming to involve citizens in solving their own issues (Haas, 2008).

Campbell, (2002) argues that the cognitive approach to civic mapping should be complemented by the structural approach so as to enable citizens to participate in their life decisions and choices. The structural approach encourages citizens to be more effective in how they participate in issues concerning them. This way, citizens' problem-solving capacity is enhanced (Campbell, 2002).

Through the structural approach, journalists work in collaboration with the citizens in mapping out problem solving ideas and tools. They also evaluate whether the existing tools and structures are adequate as a way to improve what might need to be improved and new ways to enhance those efforts (Haas, 2008). So, structural civic mapping focuses more on what the issues are in a community, while cognitive civic mapping is more focused on the different kinds of sources you can find in a community. Some of the other things to be considered by journalists through the structural civic mapping approach is whether or not certain issues within the community can be addressed by the citizens themselves, and if so, can they can do so adequately or do they require "more deep-seated, political intervention by government institutions" (Haas, 2008, p. 7) and whether they require a broader non-local scope. It is undeniable that certain issues can be adequately addressed by local or non-local citizen groups, however, there are some issues they do need intervention that is more adequate by government institutions (Haas, 2008).

This kind of approach to the civic-mapping tool is one that citizens are more likely to find inspiring to them and therefore, are more likely to participate in more democratic processes.

"Indeed, by encouraging citizens to participate more actively in problem-solving efforts, either through involvement in organised citizen groups or in collaboration with governmental institutions, journalists are not only likely to inspire more citizen participation in the public affairs of the localities in which they reside, but may also prompt citizens to participate more actively in political elections. Importantly, such a structural approach to civic mapping is also likely to enhance audience interest in journalistically-mediated political information" (Haas, 2008, p. 8).

Public Journalism, Civic Mapping and Science Engagement

Science engagement encourages active involvement of the public, by scientists, in science related activities and research as a way to improve the public understanding of science literacy, (Bucchi, 2008) therefore, to some extent, science engagement can learn from concepts of public journalism and its civic mapping tool that encourages active involvement with the public in their own spaces. Instead of scientists or researchers conducting interviews or administering questionnaires without thorough civic engagement, they could use the civic mapping tool to learn to engage the public through civic conversations about who they are and what it is they care about. This could enhance the science engagement model to be thoroughly and more meaningfully involved with public engagement.

Responsible Research and Innovation advocates for the active involvement of all stakeholders in a scientific research project (Joubert, 2001) and can be seen as a similar approach to public journalism because of its civic engagement characteristic.

Framing in Journalism and How it Can be Applied in Science Communication

In science engagement, framing can be used as a way to ensure that scientists frame their scientific research by ensuring that whatever scientific or technological innovation in question is relevant to the needs of the public. Framing can play a critical role in enhancing science engagement through the use of issue frames that are influenced by the public that the innovation is for as opposed to what the scientists think the public needs.

Engagement and collaborative learning

There are a variety of different approaches to learning and communication (Lie and Witterveen, 2013) which speak to some of the debates in science communication. Social learning theory was discovered by Bandura in the 1960s and 1970s (Bandura, 1963). Social learning depends very much on the importance of social, collective context for learning. It takes place under the influence of the environment in which the learning takes place (Lie and Witterveen, 2013). Learning happens through the observation of the actions of others, listening to stories of others and in some instances through role-plays, where aspiring behaviour is constructed as a way to

influence one's cognition and behaviour. In social learning, double loop learning is recognised (Argyris & Schön, 1978). This way of learning addresses the "how" by focusing on the reason things are done a certain way and why they are done in that way. It addresses what is unknown while also discovering and creating new knowledge and behaviour.

In the social learning theory, ICTs, in particular film (video) and television, play a critical role. "Moving images can portray the behaviour of socially desired models, for instance through soap operas" (Lie & Witterveen, 2013). However, modelling behaviour is not the only thing film and television can do. They can also be used to bring people together, which is an important part of social learning. Video can be strategically used in such gatherings to reflect on key concepts in the process of learning as well as give feedback. It can be used for the portrayal of knowledge, actions or relation, (Lie & Witterveen, 2013)

Experiential learning is primarily based on experience (Kolb, 1984). In this theory, learning takes place in the form of continuous interaction between observation and interpretation (Lie & Witterveen, 2013). There are four different stages in a cycle of learning. These are; (1) a concrete learning experience, (2) reflective observation, (3) abstract conceptualisation and (4) active experimentation (Kolb, 1984). "Experiential learning builds heavily on social learning" (Lie & Witterveen, 2013, p. 879).

Collaborative learning, seems especially relevant to the concept of science engagement, as it emphasizes the importance of the group in processes of learning (Lie & Witterveen, 2013). In this approach a group is recognised as having the ability to accomplish far greater than an individual could ever accomplish. This learning theory shares "the basic idea that the old paradigm of 'teacher/expert vs. student/layman' needed revision," (Lie & Witterveen, 2013, p. 880) echoing the criticism of deficit approaches to science communication. All stakeholders involved in the process of learning, whether with different roles or similar ones, are seen as valuable contributors to the learning process. Meaning gets constructed in social interaction in this approach to learning. In Lie & Witterveen, 2013, p. 880) "collaborative learning is defined by (Laal & Laal, 2011) as 'an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product.'"

Reflexivity is a very crucial component of collaborative learning theory. "Reflexivity relates to rethinking, taking a step back, overlooking the situation, and deciding about how to continue" (Lie & Witterveen, 2013, p. 880).

Conclusion

In this chapter I have examined different understandings of public engagement emerging from different approaches to journalism and communication. These understandings of public engagement are; development communication, development journalism, pubic or civic journalism, civic and structural civic mapping. I have unpacked and briefly explained these different understandings of public engagement and how science communication and engagement can learn from all of these approaches to public engagement. I have also unpacked the idea of engagement and collaborative learning. In the following chapter, I will apply these different approaches to the concept of public engagement and examine how they all see a role for mediation by a journalist or communication professional in the process of this particular case study.

Development Communication	
Essential Practices	Lessons for science engagement
• Co-production of knowledge with the public. • Enables agency of the public in innovation and development. • Communication as a horizontal process of interactions, exchange and engagement. • Foregrounds dialogue as a tool to empower communities.	• Ensure that no assumptions are made about the public's willingness to accept new scientific innovations. • Allow the community or intended beneficiary of development action to participate in the process, as a new model and approach to science engagement- dialogue with the relevant public.

Development Journalism	
Essential Practices	Lessons for Science Engagement
• It is people oriented • Journalists report on people as subjects, actors and agents rather than as objects or victims with needs deficit. • should focus on the totality of concrete life situations – the rich, the middle class, the working class, the poor, the dirt poor, etc. • Journalists sit down with people from high to low, discussing the meaning of development, thereby generating an enormous range of visions as well as how-to insight. • Encourages the journalist to be socially engaged and active in the construction and deconstruction of reality. • It is concerned and driven by the intention of the development of societies, wholly. • It values the voices of the minority and ensures that they are heard fairly.	• Engage marginalised publics. • Foreground the stories of the public by critiquing the relevancy of science and technology innovations. • Scientists should sit down with people from high to low sectors of society, discussing the meaning of development, thereby generating an enormous range of visions as well as how-to insights related to their research that involves these people. • No assumptions should be made about the public scientists are trying to engage, but the engagement should focus on the particular context of each community.

Public Journalism	
Essential Practices	Lessons for Science Engagement
• The public as 'citizens' as opposed to 'audiences' • Journalists reimagine the public through advocating for public listening in their newsgathering, reimagining their relationship with government and focusing on what people could do to participate in public debate. • Community participation in newsgathering. • Identifies the catalysts and the connectors to find ways to involve them in the research or newsgathering. • Face-to-face interaction and a lot of quality time in local communities and spaces.	• The public should be considered as 'citizens' who should participate in the process of scientific research through science engagement. • Commit to promoting and encouraging citizens' active participation in democratic processes. • Encourage effective citizen participation in science research as well as effective contact with all stakeholders involved in the research, including the scientists who develop new scientific innovations. • Use the civic mapping tool as a way to engage the public through civic conversations about who they are and what it is they care about.

Chapter 3: Research Methodology and Methods

Introduction

This study used video to explore and interrogate a model for science engagement (what I have called the mediation model) that incorporates journalism and communication knowledge traditions. This model was developed through a case study of doing science engagement and communication around a sugarcane GMO product with growers in KwaZulu-Natal. The sugarcane product was developed by the South African Sugarcane Research Institute. In this research, I worked with a team that included a colleague who primarily focused on understanding effective media production for science engagement. The two of us went out together into the field, engaging with sugarcane growers, while he tested different types of media as science engagement tools, my focus was more conceptual and the aim was to develop an overall documentation and analysis of the science engagement model used in the study.

My study aims to answer the following questions:

- How can a new model for science engagement incorporating concepts and methods from journalism and communication studies be used to deepen and expand notions of science engagement in South Africa?
- How can a documentary video enable science communicators to reflect on a new model for science engagement in South Africa?

The action research methodology and its focus on cycles of action and reflection underpin the documentary video method I have used to undertake this research. Action research is the use of different research techniques aimed at facilitating change, as well as generating discussions and reflections that generate both data and findings. I used action research as a methodology for this study because it aims to change people's practices and the situations in which they practise (Kemmis, 2010). Further, it aims to change the conditions for their practice in order to change their understandings of their practices, (Kemmis, 2010) something central to my research because I developed a new model for doing science engagement. This methodology is based in

a process of collaboration as it involves local stakeholders as full partners in knowledge development (Greenwood & Levin, 2006). Such collaborative knowledge production is central to my project, because there were people with particular knowledge, such as scientists, science communicators, farmers and extension officers, that could help with addressing my research question, where insights were generated through several cycles of action and reflection, an iterative process which is the basis of action research. Action research begins with an inquisitive approach and attitude of inquiry to collaboratively construct a preliminary understanding of the issues involved and then engages in the necessary action that will magnify the participants' insights into the issues investigated (Stringer, 2007).

Aims of the Research

Research Setting

This research study was set in the North and South Coast of the province of KwaZulu-Natal, South Africa. It took place in the Amatikulu (NC) region as well as Sezela and Umzimkhulu region, in the South Coast, referred to as Port Shepstone in the documentary video because it is a name generally used by people who live in that area to make it easier for those who do not live there to have an idea of their geographical location.

Although the research study was undertaken with three different types of growers, namely large scale, small scale and land reform beneficiary growers, it eventually focused mainly on small scale growers. The focus on small-scale growers was a result of conversations that happened through interactions with scientists from the South African Sugar Research Institute. The scientists expressed that they did not know enough about the small-scale growers and therefore, preferred to focus on them for the purposes of this study so that they could get a better understanding of who they were and how best to engage with them.

The different types of growers were defined by their sugar cane delivery tonnage to the sugar mills. Growers who produce or deliver +1600 tons of sugar cane in a year were defined as large scale/ commercial growers. Whereas growers who produce or deliver -1600 tons of sugar cane in a year were defined as small scale growers.

Incorporating Qualitative Methods into Action Research

Qualitative research is underpinned by many different forms of data collection methods such as in-depth structured interviews, groups discussions, participant and non-participant observational studies as well as "analysis of textual and narrative sources such as reports, diaries, letters and film or television" (Bowling & Ebrahim, 2005, p. 215). All of these approaches can be made sense of in multiple ways (Bowling & Ebrahim, 2005). Qualitative research can be defined as the opposite of quantitative research. The difference between these two is that quantitative research uses numeric data collection methods, whereas qualitative research uses narrative and/non-numeric data collection methods (Bowling & Ebrahim, 2005). "In other words, qualitative research attempts to gain access to the insider's view of his or her own social world without, at the stage when data is being collected, making any value judgements" (Bowling & Ebrahim, 200, p. 215). Qualitative research at its best aims to use ethnographic and ethnomethodological approaches so as to connect social theory to everyday life (Bowling & Ebrahim, 2005). It is immersed in the emergence of a new social theory or the development of an existing social theory (Bowling & Ebrahim, 2005). The nature of qualitative research is that it is iterative and allows multiple perspectives as it follows processes (Bowling & Ebrahim, 2005).

Sampling

There are two different techniques to sampling. These are; probability or random sampling as well as non-probability or non-random sampling (Lumpur, 2016). Probability sampling means that "every item in the population has an equal chance of being included in sample" (Lumpur, 2016, p. 20). It is a technique that allows the researcher to avoid bias as much as possible (Zikmund, 2002). Non-probability sampling is the most common sampling technique in case study research and qualitative research (Lumpur, 2016). Usually, case studies work with small samples and survey real life phenomenon particularly focused or directed to that group (Yin, 2003). In non-probability sampling, there are four different techniques a researcher can choose from. These include, quota sampling, which is a non-random technique where the participants are chosen based on particular reasons and characteristics that were predetermined for the purposes of distributing the same characteristics of the total sample (Davis, 2005). The second non-probability technique is snowball sampling. Snowball sampling is a sampling method that

is not random and uses certain cases as a way to probe or encourage others to become participants of the study. This is a technique mostly used in small populations that are generally difficult to access for different reasons (Brewton & Millward, 2001). The third non-probability technique is convenience sampling. Convenience sampling is a technique that allows the researcher to select participants based on their easy availability for the study and readiness to participate. This technique is one that is typically used due to its inexpensive nature and less complicated compared to other sampling techniques (Ackoff, 1953).

Convenience sampling is the technique used in this study. It is a technique that makes the research process smoother and more convenient because it helps overcome a lot of the limitations that come with doing research (Lumpur, 2016). In this study, extension officers were engaged to help us find the readily and easily available sugar cane growers. The extension officers work closely with the sugar cane growers. In the North Coast of KZN in the Amatikulu region, two extension officers were engaged to help us locate/select both small scale and largescale sugar cane growers. Each extension officer represented a certain group of growers; small-scale or large-scale group of growers as both groups have assigned extension officers that they work with. The same approach was used in South Coast of KZN, in Sezela and uMzimkhulu. We chose these two regions specifically because as much as they are both susceptible to the *Eldana* Pest, it was also much easier and more convenient to work with these two regions for the purposes of this research.

We worked primarily with small scale growers in that region as it had been decided during the process of the research that we focus more on small scale growers after engagement with the South African Sugarcane Research Institute (SASRI) scientists that revealed that they were keen to develop strategies to better engage these growers. We also realised early in the research process that we would need to adopt very different approaches to engage different types of growers, and addressing all of the growers to the same degree would not fit in the scope of the study because of their different circumstances regarding sugar cane farming. This, then, is what we call purposive or judgmental sampling, a type of non-probability sampling (Maxwell, 1996). In purposive sampling, the researcher includes cases or participants in the study based on the researcher's belief that these particular participants warrant inclusion (Lumpur, 2002). "Particular settings, persons or events are selected deliberately in order to provide important information that cannot be obtained from other choices" (Lumpur, 2002, p. 23). Our deliberate selection and focus on small scale growers in the South Coast, after having worked heavily with large scale growers in the North Coast, was based on the fact that the purposes of this

research study is to elicit engagement and narrow the engagement deficit gap between scientists and the public. Therefore, based on the reflections that took part in this research study that lends itself to a continuously iterative and reflective process, it was crucial to involve small scale growers the way that we have in this study as they warrant inclusion.

Data Collection Methods

The next step after sampling had been established was to collect data (Lumpur, 2002). There are different data collection methods researchers can use in their study. Below I will outline the data collection methods used in this case study.

Video as research method

This research study used video documentary as a research tool to collect, analyse and interpret data and disperse findings that reflect on the process of science engagement through the case study. Harris (2016) demonstrates that video is an established method emerging from a long and rich history of visual anthropology. She emphasises the 'poetry' of video and how it enables creators to think more critically about the purpose of what they see and make. Video methods have enabled researchers to better understand cognition, sociology as well as aesthetic considerations and questions.

It is inspired by diverse traditions in social science, educational psychology and art-based research models (Harris, 2016). Its ability to capture and enable reflection on social interactions is more productive than methods that rely only on audio or written reflections of observations. Such video approaches have been used in our science engagement model to analyse various facets of the communication, showcasing video's ability to foreground processes such as the participants' cognitive processing (Harris, 2016). An example of this is the focus groups conducted with the scientists and the small-scale growers during cycle 3 of the action research process. What the video recording, which then became a documentary, did was enable me to foreground the small-scale growers' cognitive processes such as that of the access to land issue and how GM cane would affect that in their case. According to Rose (2016), video production compels the researcher to go through a series of reflective processes, which resonates with

Pearlman's (2012) argument on video editing incorporating the reflective processes of choosing a clip, naming a clip and being aware of how you react to the clip and deciding where to place it in the story. There was an opportunity to go back, through editing, and process this particular concern of the small-scale growers about land through re-cutting the sequence and then ensuring that I foreground the topic of land through choosing other clips that relate to the topic and cutting them in elsewhere in the rest of the video documentary. In particular, this issue of land is foregrounded in the short video documentary (Appendix 1) I created specifically for the scientists to watch. Furthermore, foregrounding the participants' (science communicators and scientists) cognitive processing, who watched the first cut of the overall documentary video (Appendix 5) that represents the process of the mediation model and the steps followed, is shown through my findings chapter as I unpack the reflections and feedback that took place at the end of the screening of the documentary.

Video allows for more vivid and direct communication (Harper 2012), and this was useful in the communication with scientists as participants in this research study. It allowed me to sit down, watch the video of the scientists responding to the challenges of the small-scale growers and process their responses to some of the challenges faced by these growers and their understanding of this particular community of small-scale sugar cane growers. An example of this is found in the overall video, where I ask scientists questions about the small-scale growers and watch their responses to these questions.

Pea, (1999) in Charlson, (2019) states that the rich, visually appealing and seductive nature of video-based data can convey a strong sense of direct experience with the phenomena studied.
In a study investigating pedagogy and children's learning, digital video was successfully used as a research tool (Pea, 1999). The developing equipment and technologies of digital video cameras, computer hardware, editing software, etc. make video a feasible option in research methodologies as well as new and developed ways of using, analysing and presenting video data (Walker, 2002).

In-depth interviews

In depth interviews are used by the researcher as a tool to collect or elicit information from a research participant through a structed encounter between the two. They are useful in offering practical, flexible and somewhat economical ways of gathering research data (Bowling & Ebrahim, 2005). This data collection method is advantageous in that it allows the participant to be directly involved through intervention in the research process, "allowing the researcher to

guide participants to talk about specific issues; and allowing the researcher to ask a number of participants the same broad questions on a particular theme" (Bowling & Ebrahim, 2005, p. 217). In this research study, I used in depth interviews by visiting the small-scale growers in their homes/fields and sitting down with them and asking questions about who they were beyond sugar cane farming, which is a civic mapping (Haas, 2008) strategy and draws from development journalism's emphasis on gathering the experiences of ordinary people with development technologies (Banda, 2007). This allowed me to understand what drives these growers and what they care about most. I was directly involved through intervention in that I was the one asking them questions but I did not lead them in their answers as I allowed us to have conversational interviews through the use of common language and cultural observations.

I also filmed this process of having in-depth interviews with the small-scale growers, which added an additional engagement dynamic to our interactions. It allowed me to repeatedly listen to the small-scale growers in the edit suite so that I could clearly understand what drives them and the kinds of challenges they face. I was also able to apply the concept of a citizen's agenda from public journalism in this process of interactive engagement, where growers defined their problems. As mentioned in chapter 2 of this study, in public journalism, journalists engage the public by reimagining who they are talking to through advocating for public listening in their newsgathering, reimagining their relationship with government and focusing on what people could do to participate in public debate (Dzur, 2002). What I did with the small scale growers by sitting down with them in their personal spaces, such as their sugar cane fields, was a form of public engagement through reimagining who I was talking to as a journalist and prioritising listening to the farmers in my data gathering by reimagining their relationship with the scientists and focusing on what the small scale growers could do to participate in the conversation about the new genetically modified sugar cane variety.

Focus-groups

Focus groups are a collective activity of discussions organised to explore a particular set of issues (Bowing & Ebrahim, 2005). This can happen through the watching of a film or examining a particular message. Its goal is not necessarily to gather accurate information or to influence opinions about a specific issue, thus they differ from group interviews (Bowling & Ebrahim, 2005). The goal of focus groups should be to "set up the conditions where interaction within the group can take place in order to explore both similarities and differences within a group and across a set of group sessions" (Bowling & Ebrahim, 2005, p. 221). The researcher

provides the topics to be discussed or unpacked in a focus group as they play the role of a moderator or facilitator (Bowling and Ebrahim, 2005).

In this research study, focus groups were conducted with small scale growers, commercial growers, scientists, extension officers as well as science communicators to reflect on the mediation model developed and followed in this study. According to civic-mapping approaches, civic conversations take place amongst citizens who are already used to one another instead of focus group discussions (Haas, 2008).

However, it is important to note that in this context, a mix of both in-depth interviews and focus groups were used. Further, most of the growers are a close community that is already used to one another. Although the approach in moderating the focus groups incorporated a group interview style in that there was a list of questions to ask the participants as a way to understand what their opinions about the communication media were, it was flexible and still provided an opportunity for the participants to lead the conversations. The focus group with science communicators took on a similar approach, except that they were sharing their opinions about our science engagement mediation model after watching the documentary film about the model.

The focus group method helps the researcher explore how people make sense of information (Bowling & Ebrahim, 2005). It can either be used as the main research method or as a complementary tool to questionnaires/survey data (Bowling & Ebrahim, 2005). In this research study, focus groups were not used as the main research method, but rather as a complementary tool to other data collection methods such as questionnaires, in-depth interviews and video methods. A focus group with the scientists at SASRI was conducted in order to introduce them to the small-scale growers they work with through the screening of a short video documentary (Appendix 1) created specifically for an audience of scientists.

This focus group aimed to get more information from the scientists about how some of the challenges faced by small-scale growers could be addressed by the GM sugar cane product. Through the interaction that takes place between participants in a focus group, the researcher is able to "explore the participants' attitudes and priorities in ways which may not be possible via traditional interviews" (Bowling & Ebrahim, 2005, p. 222). They also allow participants to express unexpected opinions that help generate unexpected findings and these can help give more insight into the research (Bowling & Ebrahim, 2005).

In this research, participants came up with interesting questions that provoked concerns about the new genetically modified sugar cane variety. It also allowed the growers to be able to ask the extension officers questions about this new product and this elicited a conversation about GM sugar cane amongst the growers. Further, a focus group with science communicators and scientists from Rhodes University was conducted through the screening of the video documentary that represents the mediation model (Appendix 4). This focus group was conducted as a reflective step in order to critically reflect on and evaluate the mediation model this study has come up with. The nature of focus groups can be empowering in that, some people get encouraged by others and become confident in expressing their critical opinions as opposed to how they would in academic research settings (Bowling & Ebrahim, 2005).

In the same breath, focus groups can be much more intimidating for other participants who do not feel confident enough to express critical opinions in front of others (Bowling & Ebrahim, 2005). Some participants in cases where sensitive topics are discussed, might not 'fit in' with group norms and dynamics (Bowling & Ebrahim, 2005). The advantage to this case study is that although the topic of genetically modified sugar cane can be a sensitive one because of its controversies which could provoke polarised discussions, (Bucchi, 2008) research has shown that in South Africa such polarisation is only common among the highly educated elite sector of society (Gastrow et al., 2018). Most ordinary South Africans consume GM maize on a daily basis, such technologies are generally acceptable (Gastrow et al., 2018). Moreover, it is something that all participants have in common as they are all sugar cane growers with similar interests and concerns.

Harris (2016, p. 56) explains that "the analysis of video must always include a consideration of data types" such as interviews, focus groups, etc. Therefore, it is important to acknowledge that video cannot work independently from other data collection methods, hence I started by outlining the first two data collection methods used in this study because what is captured by the camera in this study is the different steps of the data collection which takes form through in-depth interviews and focus groups.

It is important to explain that in this research project, I was actively assisting with various other levels of the project, which involved several other methods. Some of the questions of the broader research project were highly contextual to the specific concerns of communicating concepts for understanding GM crops. For this study, however, not all of those methods used were directly relevant as they did not all pertain to the broader more conceptual question of developing a new science engagement model for South Africa. While I accompanied and

assisted my colleague with some of his data gathering, I was also engaged in my own data gathering by constantly filming and documenting the process and then coming back and putting it together in the edit suite.

Ethical Considerations

Ethical considerations play a crucial role in the successful completion of a research study. As social scientists, we are likely to face challenges in how we conduct research because of the kinds of topics we explore (Cohen et al., 2002). Cohen (2002) argues that researchers should consider certain things when conducting research, such as, "informed consent, gaining access to and acceptance in the research setting, the nature of ethics in social research generally, sources of tension in the ethical debate..." (Cohen, 2007, p. 51).

In this study, the ethical considerations were; anonymity, informed consent, gaining access to and acceptance in the research setting. Our research proposal was approved and granted ethical clearance by the Rhodes University Ethics Committee (RU-HEC). In order to ensure anonymity, participants were given the freedom to not write down their names in the research consent forms, even though others chose to write their names. However, the challenges faced with this consideration is that a video documentary had to be shot on camera as well as audio. Participants were asked to sign a media release form as a way to indicate their comfort in participating in audio visuals for the purposes of this study.

We gained access to the participants through the South African Sugarcane Research Institute (SASRI) and their extension officers who work directly with SASRI as well as the farmers who are participants in this study. Each participant was asked to sign the invitation letter that included a consent letter to indicate their uncoerced willingness to participate in this study.

The study only involved adults from the age of 18+ to ensure that consent was directly from each individual. No children were interviewed or asked to participate in this study.

It was also important to consider each participant's health as this study took place after the COVID-19 national shutdown. We ensured to keep a social distance of 1.5m-2m between people. Most interviews were done outdoors to ensure ventilation and safety for each individual. However, some interviews took place indoors, but masks were strictly worn by all participants. In the case where individual interviews were recorded on camera, participants

were asked to take their masks off if they felt comfortable with it, but the researcher kept her mask on.

Limitations and Challenges

This research study took place during the COVID-19 pandemic. Therefore, fieldwork had to be rescheduled to the following year, 2021 February, after the National Lockdown restrictions had been lifted. This was a great challenge in the success of this research being completed on time as it was dependant on gaining access to the field and interviewing the sugar cane growers. Some interviews with the extension officers, which would be cycle 1 of this research had to happen virtually before the restrictions were lifted. Further, it was difficult to gain access to a big number of farmers to participate in this research project as we were limited to the number of people, we can have in a focus group at a time. This also meant that we were not able to do a representative study of all sugar cane growers. Moreover, we only focused on two geographical communities. This means that for a comprehensive study of science engagement in the sugar cane sector and all that needs to be considered in a comprehensive model, further research would be useful. However, I managed to develop several important notions in my analysis.

Engaged research requires that the researchers spend a lot of time with the participants in order to get to know them well and understand them better. It should be done through a long-term process (Heydenrych, 2001). COVID-19 limited us in the amount of time we were able to spend with all the participants of this research study, particularly the sugar cane growers.

Language proved to be somewhat of a barrier in the process of doing fieldwork. Although I am a native isiZulu speaker, I found it difficult to translate scientific terms for the isiZulu speakers, who were mostly small-scale growers. However, we were able to get assistance from a Zulu speaking small scale extension officer who was able to directly translate some of the scientific terms into isiZulu. I was able to quickly learn these terms.

On my second visit to the small-scale growers (cycle 2 of action research) I was accompanied by an extension officer who works for the government, under the Department of Agriculture and Environmental Affairs because the SASRI small-scale extension officer in the South Coast could not accompany me on this particular day. Upon arrival at one of the small-scale growers' homes, she introduced me by explaining what it is I was there to do. In her explanation in isZulu, she referred to genetically modified organisms as injected organisms, which is not

scientifically true. I was not able to correct her at this point as I had not yet learnt the Zulu scientific term for genetic modification.

Some of the limitations that came from cycle 4 of this research process included the challenge of starting this research once SASRI had already decided to go ahead with developing the GM sugar cane, meaning that the engagement process started later than I believe it should have started as it exposed, to a certain extent, the power dynamics between the different stakeholders. As mentioned in chapter 2, Responsible Research and Innovation is driven by coproduction, shared responsibility for innovation trajectories. Von Schomberg, (2013, p. 19) states that RRI is a transparent and interactive process. It is described by Owen & Heintz (n.d.) as a framework which calls for research that isn't only for society but one that is responsive to society through the direct involvement of the public and is done with society. The RRI framework's ultimate goal is to contribute to research that is responsible and innovative through advocating for the involvement of the public from early stages of the research (Limson, 2018), something we were not able to do as we did not start from the early stages of the process of the development of the GM sugar cane variety. Further, research expectations from SASRI had to be navigated because this project was funded as part of an external process, but it seemed as though the expectation was that we would be there to serve the organisation and not be independent and critical of their role in the engagement process. However, this did not hinder the research process from continuing as I explained what my role in this research is to the scientists at SASRI

In the findings chapter, as well as in the documentary, I discussed with the science communicators who watched the video documentary, the challenge of having had to start the engagement process several years after it had been decided that GM cane is a product SASRI would develop.

Concepts from action research underpinned the video documentary method I have used to undertake this research. As referred to earlier in this chapter, video production as a process mirrors the cycles of action and reflection of action research, particularly in the processes of the edit that actively encourage reflection as the editor sorts, classifies and structures video clips into a narrative (Harris 2016). In trying to define this model I used different research techniques aimed at enhancing change, as well as generating data. Action research is based on the process of collaboration as it involves local stakeholders as full partners in knowledge development (Greenwood & Levin, 2006) which was very central to my process of constant cycles of reflection in this study. Action research begins with an inquisitive approach and attitude of inquiry to collaboratively construct a preliminary understanding of the issues involved and then

taking the necessary action that will magnify the participants' insights into the issues investigated (Stringer & Aragon, 2021).

Action Research.

In action research, the researcher takes up the role of immediate involvement in the action process (Heydenrych, 2001). It is not research imposed on other people, but the research participants are considered autonomous responsible agents who are involved in shaping their own histories (Heydenrych, 2001). In this research project, the sugar cane growers were therefore considered active role players in shaping their own histories through participating in the process and decision making around the new genetically modified innovation that they would have the option of receiving in the future. Through the collective process of action-based research, growers were therefore engaged around a series of interactions.

Action research is an open-minded methodology (Heydenrych, 2001). As important as collecting data is, an open mindedness in the interpretation of the data is crucial. Kemmis, McTaggart & Nixon (2013) argue that action research is not simply about solving problems, but it is also about problematising practices that have been accepted and justified as 'normal' (Kemmis et al., 2013). What I have tried to do in this research is problematise the way in which science communication has always been done by reflecting on a new way to do scientific research through an iterative action research process that involved 4 cycles of action and reflection. These cycles provoke continuous understanding and change in developing this model. However, this does not mean that action research is a pattern of endless effort (Heydenrych, 2001). It is a methodology that is characterised by an up-ward movement of improvement and a long-term commitment (Heydenrych, 2001).

"Action research is a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social and educational practices, as well as their understanding of these practices and the situations in which these practices are carried out" (Henry & Kemmis, 1985, p. 1; Kemmis & McTaggart, 1988, p. 5).

1. Mapping the Field: Planning

The research was undertaken through four different stages or what Kemmis and McTaggart (1988, n.p) call "cycles" of action research. Planning, acting, observing and reflection are the pillars of action research cycles (Heydenrych, 2001). I have ordered and named these cycles as follows; (1) Mapping the Field, (2) Media Production and Piloting, (3) Collaboratively Implementing Feedback, and (4) Reflection/Interrogation. Each of these steps enabled me to further develop this new model for science engagement and also build in some insights about public engagement from journalism and communication studies. This, I was able to do by filming each process and then sitting in the edit suite, looking at the footage from each step and deciding how I would name each process while also drawing from journalism and communication literature. I also reflected on the video with my research colleague. The use of video particularly helped with the refinement of this model because we were able to keep going back and forth, pausing, and replaying certain parts while discussing out reflections of the interactions in the video.

As the first step of this research method is to collaboratively construct a preliminary understanding of the issues involved through careful planning, a questionnaire was administered to get to know who the farmers are and understand what their attitudes towards GM crops were and how they would prefer to receive their media. However, before the questionnaire was designed and administered, we used the civic mapping tool and started by hosting an online Zoom meeting with the SASRI extension officers as well as the SASRI scientists so that they could connect us to the right people (sugar cane growers) to engage for this research project (Harwood, 2000). Civic-mapping is a tool to facilitate public engagement. It recognizes citizens as active participants in news gathering. Journalists actively seek out for citizens' truest concerns as opposed to assumed concerns based on deliberation that takes place within local government institutions (Harwood, 2000). "A concern that bubbles up from [below] will sound quite different from one that is discussed at a [formal] public meeting" (Harwood, 2000, p. 4).

Hosting a Zoom meeting with the extension officers was a form of civic-mapping because we identified civic players within the community of sugar cane farming in the North and South Coast of KwaZulu-Natal. They are the ones who were able to point us out to the relevant sugar cane growers, therefore, play the role of being connectors in the community. It is through these approaches or tools, that journalists have been able to broaden their range of news source (Haas,

2008). It is through these methods (civic-mapping) that journalists were able to identify the different civic players/actors such as official leaders that include local leaders, School Governing Bodies, and civic leaders (Haas, 2008). This meeting helped us plan what questions to ask and what to consider as relevant and important information for the questionnaire. The questionnaire was constructed with the aim of understanding certain things about the sugar cane growers that would potentially matter in how they perceive GM crops. Some of these included language, religious affiliation, race, gender, age and educational background. I did not film this meeting, but it was recorded so that I could use it to reflect later.

From connecting with the extension officers, who are the people directly linked to both the SASRI scientists as well as the sugar cane growers, through a Zoom meeting, we were then able to identify the growers we wanted to engage for the purposes of this research project. These included both commercial sugar cane growers and small-scale sugar cane growers. Upon arrival in KZN, we were able to connect to the extension officers again who helped direct us to the sugar cane growers we had designed the questionnaire for. This is when we were able to administer the questionnaire by sitting down with the sugar cane growers and asking them questions that would help us understand them more and also identify their perceptions of GM crops and their biotechnology background. The questionnaire also helped us know what kind of communication tools are preferred by the different growers. Understanding this was crucial for the purposes of the media production for science communication.

Further to administering the questionnaire, I filmed the process and the reactions to the questionnaire so that I could go back to the footage throughout the journey of this study as a means to help me understand the sugar cane growers and also to keep a record of their responses and attitudes towards certain questions and information in the questionnaire. The filming of this step was also to enable me to look back on the footage and reflect on this step of the process and to contemplate the role of civic mapping in the model. This would help inform me of the needs of the sugar cane growers and help me know how to cooperate with them. “Action research methodology should be such that it addresses the bottom-up identification of needs and action, and that the spirit of cooperation between all participants within the context is of utmost importance” (Heyndrych, 2001, p. 41).

Each step of this research project was a full action research cycle because each step required both action and reflection from my part as the researcher. After administering the questionnaire and filming this process, I was able to go back to the video footage and reflect on it while I was editing it. This is how I noticed that this questionnaire did not work quite the same way for the

small-scale growers as it did for the commercial growers because we were not able to get sufficient engagement from the small-scale growers through the questionnaire because they had much more to express to us than the questionnaire allowed them to. For example, the small-scale growers expressed that they had challenges related to access to land, but the questionnaire did not cater to capture such information, therefore, I had to find an alternative way to engage them.

Action is an important component of action research, involving carefully considered deliberate planning of interventions into the research situation (Burns, 2009). According to Heydenrych (2001, p. 40) action research "is based on continuous dialogue with participants and stakeholders, rather than on the observation or experimental manipulation of people." After my reflections and observing that the questionnaire did not work too well for the small-scale growers, I took action by discussing this with SASRI scientists who told us that they did not know much about the small-scale growers and that is what led to the decision to go back into the field to do an in-depth civic mapping process of sitting down with the small-scale growers in their own private spaces to get to know them beyond the information received from the survey. In Haas, (2008) Harwood, (2000) suggests that journalists should avoid knocking at people's doors to ask interview questions, but rather engage citizens in "civic conversations" by sitting down "in their living rooms to understand their lives" and "the goal should not be to find the quote [but rather] to discover patterns in what people are saying, to probe to uncover meaning and figure out how people's thinking unfolds as they talk" (Harwood, 2000, p. 23). Through this visit to their homes and their own sugar cane fields, I was able to get to know the small-scale farmers and their most pressing concerns. I also got to know the broader contexts of their lives beyond sugar cane farming.

Following action in action research is systematically observing the effects of the action, as well as documenting the context, actions and opinions of the stakeholders (Burns, 2009). Here, I observed that the action to spend more time with the small-scale growers worked to develop rapport and sharing of knowledge because they were willing to engage further and beyond their sugar cane farming life. I was able to get to know them better and understand the contexts of their lives and some of the challenges they face as small-scale sugar cane growers.

The final step of action research involves reflection and evaluation, and I used Philips et al's, (2019) model of cognitive, affective, social, behavioural, and motivational dimensions for assessing science engagement through conducting interviews with the stakeholders. In this final step of the first cycle, I was able to reflect on our actions through the process of video editing,

during which I repeatedly watched the footage of the in-depth interviews with smallscale growers and structured these into a narrative about our science engagement. This brought me to the realisation that the challenges faced by small-scale growers were different to those faced by commercial growers. I was then able to capture my reflections in a video that would allow me to communicate some of these ideas to the scientists to allow them to get to know the small scale growers better through the short story narratives I created about some of these growers.

2. Media Production and Piloting

At this point, we have concluded the first cycle of this action research- mapping the field. The second cycle is; Media Production and Piloting.

In this stage, we start planning the creation of the communication media as per the sugar cane growers' preferences based on the survey results. During the reflection on the survey results, we discovered that most sugar cane growers would prefer to receive communication about the genetically modified sugar cane variety through a short video and/or booklet they can keep in their car cabin holes.

After the process of planning in this cycle, my research partner was able to design and develop, informed by the concept of information and communication technologies in development communication, a cartoon character that resembles a typical sugar cane grower and to use this cartoon to narrate relevant information about genetically modified sugar cane through a short video. He also designed a booklet with more detailed information incorporating images of sugar cane and the *Eldana Saccharina* pest to explain complex concepts such as the purpose of refugia. I produced another video in which the questions that the growers, particularly the commercial growers, wanted to ask the scientists about GM cane were assembled, so that we could share this with the scientists and film their replies.

Upon completion of the science communication media products and the video documentary about the small-scale growers, I went back into the field to show the SASRI scientists this video documentary to introduce the scientists to the small-scale sugar cane growers with whom they were working, to enable them to have a clearer picture of the priorities that drive members of their grower community. I then recorded the scientists' responses as part of the iterative research process. According to Bravett (1996, pp. 4–6) "action research is a deliberate, systematic, critical, emancipatory process carried out in collaboration with others sharing a common concern." In this research project, the common concern we share with the sugar cane

growers, scientists and extension officers, is the need for a participatory communication process. It is also to ensure that the science behind the new innovation (GM cane) is communicated well and inclusively to the sugar cane growers, a process of development communication. Some of the functions of development communication include ensuring that the way in which the execution plan of a development project is designed, considers what the attitudes of the people which it is designed for or which it is trying to help are, as well as their perceived needs and capacities (FAO, 1989).

This way, failed projects like abandoned irrigation schemes, settlement programs, broken down equipment, etc. because of assumptions immaturely made about the community's willingness and capacity to accept such new technology and development can be avoided (FAO, 1989). It is important that SASRI does not design a new innovation like the GM cane when they have not engaged with the sugar cane growers to understand their attitudes towards this scientific innovation, lest it becomes an abandoned innovation that is not relevant and accepted by the people it is designed for. "Action research aims at empowering the participants to take control of the environment and to become critical of practice and systems" (Heyndrych, 2001, p. 38). This step of the action research cycle included the crucial step of my research colleague presenting his communication media to the growers as well as the scientists for their evaluation. The communication media presented by my colleague included a booklet that had all the information about the GM sugar cane variety, as well as a cartoon character explainer video that helped the sugar cane growers understand how to plant and maintain the GM sugar cane crop.

The third step in an action research cycle is systematically observing the effects of the action, as well as documenting the context, actions and opinions of the stakeholders (Burns, 2009). Here, I observed the responses of the SASRI scientists to the video documentary I had created for them about the small-scale growers. I also filmed their responses and my observations.

I would argue that this step draws on insights from development journalism and its focus on involving the community/public. Development journalism can be associated with what Shah (1996) describes as emancipatory journalism. Emancipatory journalism is a model of communication that foregrounds the importance of ground-up communication and asserts that democratisation and participation should be central at all levels of communication and story production. This kind of journalism is action driven through the provision of information to the people so that they can be aware of services, opportunities and problems that need attention

(Shah, 1996). This focus on people's needs allows readers to then make immediate decisions independently and personally that are relevant to their needs (Shah, 1996). It is people oriented (Shah, 1992). However, this process was a difficult because I needed to confront issues of power and the scientists as SASRI did not expect that I would be asking them challenging questions based on some of the ideas that emerged from the video about small-scale growers and their concerns, particularly the concerns of land and the relevance of the GM cane to small scale growers,

During the demonstrations of the media products, I filmed the growers' engagement with the media so that we were able to later watch the footage to assess the effectiveness of this media and consider to what degree it was able to elicit engagement from growers, scientists and extension officers. Afterwards I was able to edit the video material and juxtapose the reflections of the scientists with each other and intercut these with my own reflections and the material from the field to create different layers of reflection, abstraction and debate.

After we showed the media products to the scientists and the growers, I went back to the editing suite to edit some of the footage I filmed of this process and this allowed me to reflect on the reactions the scientists had on the video documentary about the small-scale growers as well as the growers' responses to the communication media products. Through this reflective step, my colleague and I were able to understand the changes he needed to make to the media products in order for them to be more accessible to the growers and to incorporate some of their inputs. I filmed our process of reflection and we discussed some of the activities I filmed.

3. Collaboratively Implementing Feedback

At this stage, we have completed two cycles of action research. The third cycle I call; "collaboratively implementing feedback."

After watching the footage and reflecting on the previous cycle process, we were then able to plan the next step by ensuring that all comments, inputs, objections and suggestions about the media products made by the sugar cane growers were taken into consideration where possible and necessary for future planning. My colleague was also able to plan how these would be applied in the final communication media products while I planned how I would edit these reflections into the overall film.

The action taken here was to critically and constructively apply the inputs from the different stakeholders into the media products where relevant. It was important for us to take this action of considering the opinions and voices of the growers. My colleague made the necessary changes as per the feedback received from our previous trip, however, this was done with deep consideration for design elements for the booklet, for example, and for video storytelling techniques for the cartoon. I, on the other hand, filmed this process of applying feedback over a long period of time as well as continued editing the footage of responses into the bigger video documentary film that outlines the mediation model for science communication and engagement.

At this point of the process, I had managed to create a representation of our new mediation model for science engagement.

4. Interrogation

I then planned to show this video about our mediation model for science communication and engagement, to a focus group of scientists and science communicators to get their input on this new science engagement model.

I showed the final video to a group of scientists and science communicators at Rhodes University in a focus group screening where I asked them questions about their response to our model and their assessment of its effectiveness. I also filmed this engagement process to later edit into the film.

Once the scientists and science communicators had given me their input and feedback on this new engagement model, I then went back into the edit suite to watch the footage of their discussion of our model and integrate some of this discussion into a new edit in which I intercut these responses to our model with footage documenting the various steps of the model in the field. This allowed me to incorporate some of the ideas shared by these science communicators and scientists into my analysis of our model and its strengths and weaknesses.

The reflection process with the science communicators was also recorded on video and has formed part of the overall documentary process. Through the interactive mode of documentary representation (Nichols, 1991) I used narration to coherently connect the film which I initially screened to intercut it with comments by the science communicators to enrich the film with more complex debates in the field. This way, the film continues to add layers of voices to the

various layers it already incorporates. “Action research constitutes a positive, supportive, and proactive resource for change” (Heyndrych, 2001, p. 42). Action research is based on continuous dialogue with stakeholders and it requires direct cooperation between the sugar cane growers, scientists, extension officers as well as us, the researchers (Heyndrych, 2001). At this point, the overall process is complete and the documentary film is intended to be shown at Science Communication conferences to provoke further debate among scientists, and to add more voices and further dialogue to the process.

Chapter 4: Findings

Introduction

This chapter considers the findings emerging from two questions; (1) How can a new model for science engagement incorporating concepts and methods from journalism and communication studies be used to deepen and expand notions of science engagement in South Africa? (2) How can a documentary video enable science communicators to reflect on a new model for science engagement in South Africa?

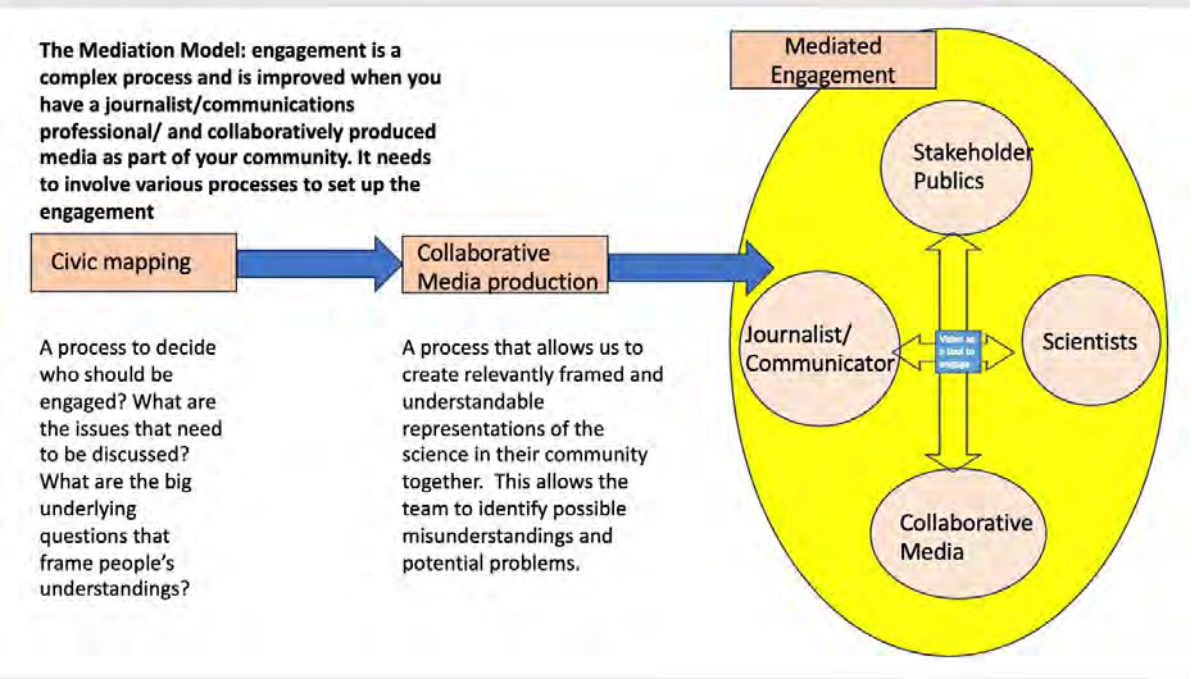
The Model

In this research, I developed a new model for science engagement, which I will explain shortly, that incorporated concepts and methods from journalism and communication studies as a way to deepen and expand notions of science engagement in South Africa. I also used video documentary as a way to reflect on this model.

The New Model for Science Engagement

The new model for science engagement I have developed is the Mediation Model. I have called it the Mediation Model because it involves journalists/communication specialists in the process. In developing this model, I was a part of a team of researchers that introduced a number of new roles and processes into the standard ways of doing science engagement. In the Mediation Model, journalists, as communication professionals, play the role of mediating engagements between the scientists and the public. However, they do not play an intermediator or gatekeeping of messages role, instead, everyone can communicate with everyone, but the job of the journalist or media professional is to enhance or facilitate such communication. One of my colleagues in this study played the role of creating engaged communication media products for a genetically modified sugar cane variety. Firstly, as journalists/ communication professionals, we found out through engagements with the sugar cane growers, what they would like to know about the new genetically modified sugar cane and allowed them to ask questions, through video, to the scientists about this sugar cane variety.

We then engaged the growers through an iterative process about what kind of communication media they would prefer and then allowing them to participate in the process of developing the media by giving feedback and making suggestions about the media products that were created by my colleague. From our deep well of knowledge about communication and public engagement, such as, civic mapping, public journalism, development communication and development journalism, we facilitated conversations with the sugar cane growers about the challenges they face as small-scale growers. This process was filmed and the video used to facilitate further engagements with the scientists based on the growers' concerns about the GM cane, challenges they face and questions they had. Video played a critical role in shifting scientists towards a place of engagement.

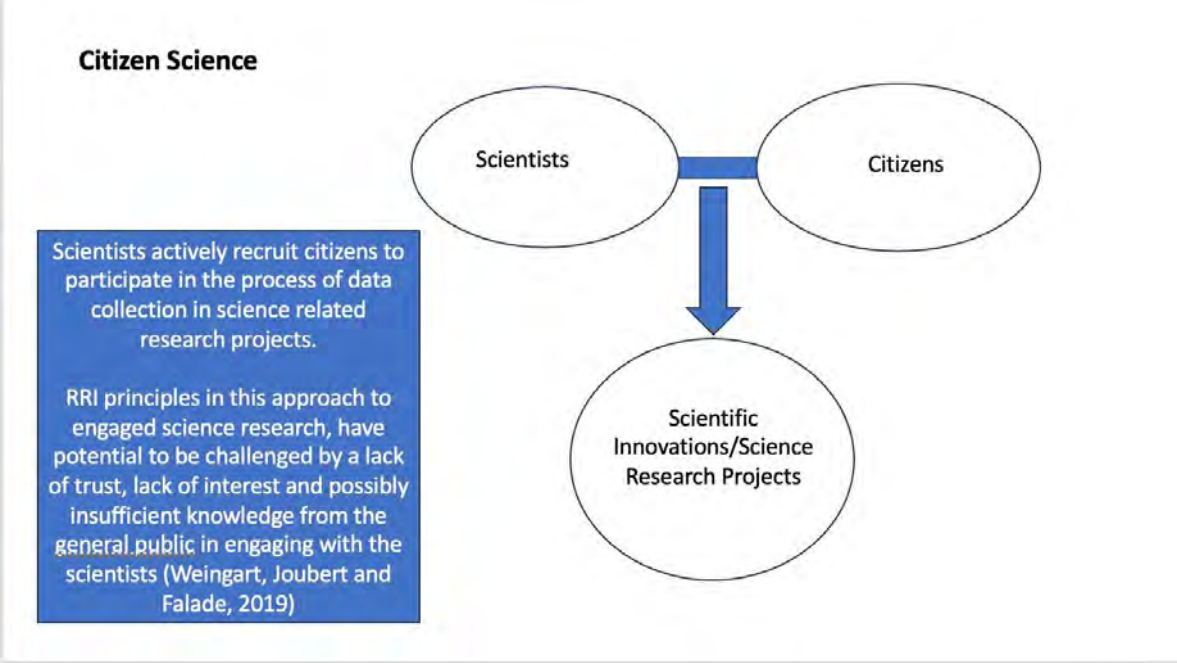


Difference Between the Mediation Model and other Models

In the first chapter of this thesis, I spoke about the different engagement models that have emerged as a result of RRI. These are Citizen Science, Co-Creation, Community Based Participatory Research and Extension Officers within agriculture.

Citizen Science

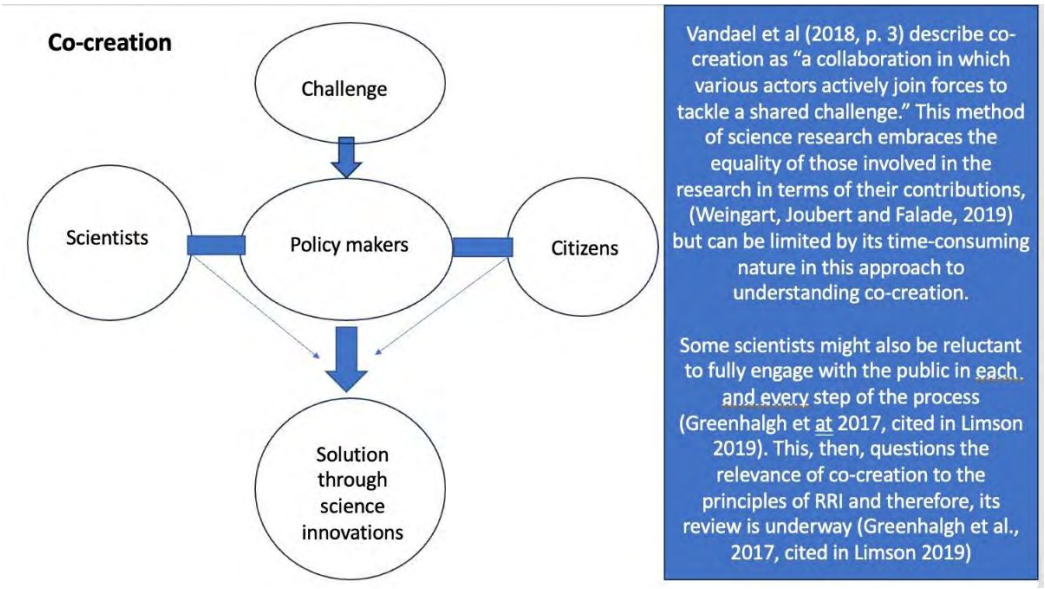
Citizen science is the active involvement and engagement through recruitment of some members of the public to help collect and analyse scientific data in research projects. Haklay *et el* (2021, p.1) broadly define Citizen science as "the active engagement of the general public in scientific research tasks. Citizen science is a growing practice in which scientists and citizens collaborate to produce new knowledge for science and society" (Haklay *et al.*, 2021, p. 1).



Although Citizen Science can be a tool to science engagement with the public, the approach does not focus on public engagement as a complex field that needs strategic attention like the Mediation Model does. RRI principles in the Citizen Science approach to engaged science research have potential to be challenged by a lack of trust, lack of interest and possibly insufficient knowledge from the general public in engaging with the scientists (Weingart et al., 2019). However, the Mediation Model builds a sense of trust through using tools like civic mapping to have deep, meaningful conversations with the public in their personal spaces. This also allows the public to open up in asking questions they might have to the scientists about scientific innovations, fostering a safe environment for engagement.

Co-Creation

Vandael *et al* (2018, p. 3) describe co-creation as "a collaboration in which various actors actively join forces to tackle a shared challenge." Here, setting goals and priorities is part of the process of co-creation (Weingart et al., 2019). This method of science research embraces the equality of those involved in the research in terms of their contributions, (Weingart et al., 2019) but can be limited by its time-consuming nature in this approach to understanding cocreation.

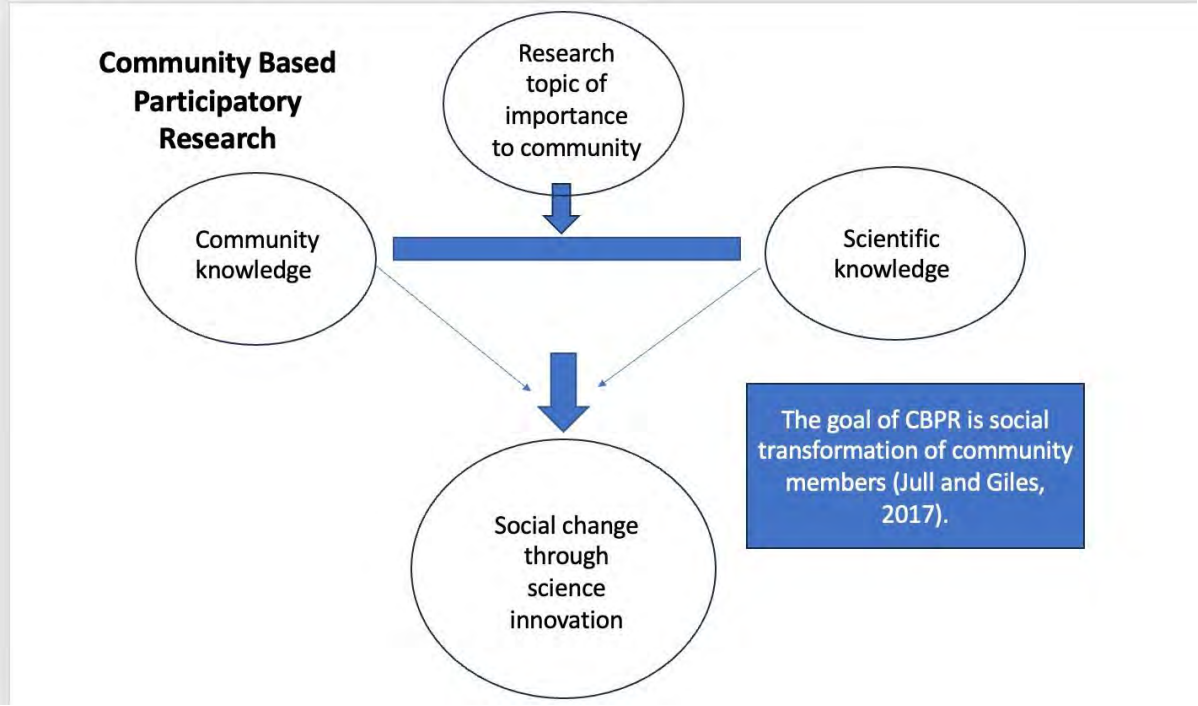


Some of the main differences with the Co-Creation approach and the Mediation Model are that because the approach requires collaboration with the public, it leaves room for some scientists to be reluctant to fully engage with the public in each and every step of the process, (Greenhalgh et at 2017, cited in Limson 2019) whereas, the Mediation Model actually involves communication professionals to take care of the collaboration aspect by using their communication skills to foster and encourage such spaces. Scientists are then immediately required to fully engage with the public in each and every step of the process because the communication professional is involved in each step as a person to encourage engagement.

Community Based Participatory Research

Limson, (2019); in Weingart, Joubert and Falade, (2019) draws from (Jull and Giles', 2017, p. 3) description of community based participatory research (CBPR) which is a "collaborative

approach to research that equitably involves all partners in the research process and recognizes the unique strengths that each brings. CBPR begins with a research topic of importance to the community, has the aim of combining knowledge with action and achieving social change to improve health outcomes and eliminate health disparities." Here, members of the community "hold expertise to help shape the research" (Weingart et al., 2019). The goal of CBPR is social transformation of community members (Jull & Giles, 2017).

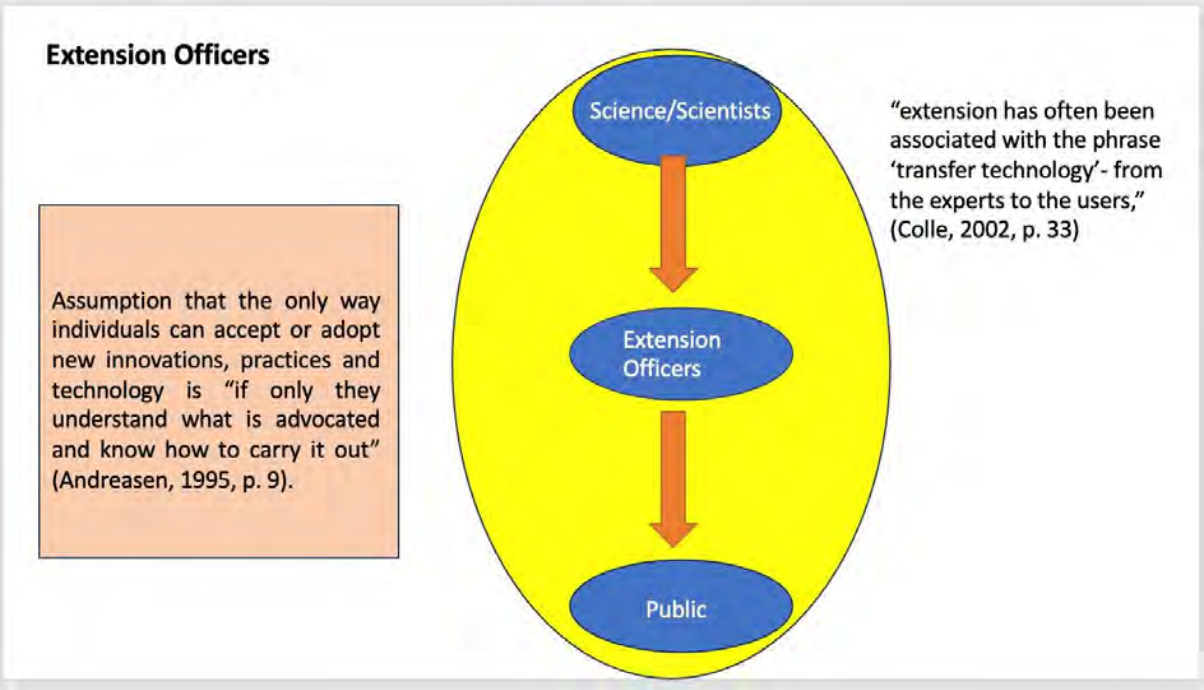


While the CBPR approach is very similar to the Mediation Model and shares some of the most important aspects of the model, its primary focus are marginalized communities. It is a distinctively pro-poor approach, whereas the Mediation Model is a model that sees all partners in the research as equal partners who can all contribute effectively to the process of the research.

Extension officers

According to Colle, (2002, p. 3) "Extension refers to the process of linking researchers (or other producers of innovations) with potential users of research results". This approach places a lot

of emphasis on elongating research-based recommendations and skills to rural families with the hope that they would adopt the new practices as well as new technology (Colle, 2002).



The main differences between this approach and the Mediation Model are that the Extension Approach is primarily top-down because it focuses on influencing rural families to adopt mew practices and new technology. The Mediation Model worked with extension officers as stakeholders/partners in the research. It sees a place for them in engaged science research but as partners who collaborate with the farmers. Extension officers are not particularly trained to be communication specialists, so their ability to engage the farmers collaboratively is limited. Furthermore, the methods used by extension officers to reach farmers is often face-to-face contact, however, there is little attempt to include communication media as well as distance learning into this process of interacting with the farmers (Colle, 2002). The Mediation Model uses communication media as an important tool in interacting with farmers.

Furthermore, the extension approach to science communication is a "top-down" direction of information flow supplied from scientists and officials to the farmers, (bottom) there is not much "feed-forward" for feedback as Colle (2002, p. 36) terms it, but the Mediation Model is based on an iterative process and 3 cycles of action research I will unpack shortly.

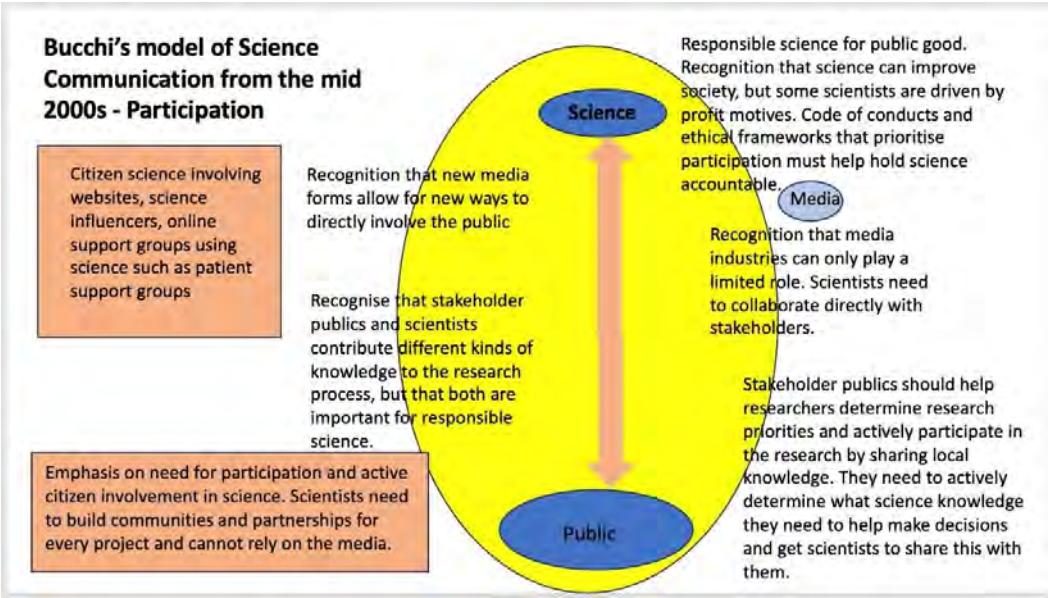
Copple and Others' Multiple Parallel Mediation Model

It is important to acknowledge Copple et al.'s (2020) mediation model which primarily focus on investigating the contribution of training to scientists' public engagement intentions by testing indirect relationships using parallel multiple mediation. In this model, the aim is "to provide a more granular understanding of how scientists' participation in formal communication training contributes to their willingness to partake in public engagement" (Copple et al., 2020, p. 509). Through building and testing a parallel mediation model, Copple et al., (2020) provide a comprehensive assessment on how training can impact engagement. The mediation model they build and test is based on insights from the theory of planned behaviour (Copple et al., 2020).

My Mediation Model differs from theirs in that its primary focus is enhancing public engagement in science research through the dialogic production of media based in principles emerging from journalism and communication approaches. I argue for the direct involvement of journalists/communication specialists in science communication processes as participants alongside scientists and engaged communities, without playing an intermediator or gatekeeping role, but to enhance and also facilitate such communication.

The Standard Science Engagement Model

The standard model of Science Engagement from the mid-2000s onwards recognises the need for participation among different stakeholders (Bucchi, 2008). It also recognises that scientists and the public are both important for responsible science, even though they contribute different kinds of knowledge (Bucchi, 2008).



However, the model does not draw from a deep well of communication and public engagement knowledge like the Mediation Model. Both the Science Engagement model illustrated above and the Mediation Model recognises the need for engaged science communication. However, the main differences between these models are that, while the standard Science Engagement model generally only involves scientists and stakeholder publics and assumes that it will be relatively easy to create deep meaningful dialogues, the Mediation Model strategically uses journalists/communication professionals as mediators to facilitate engagement. The model sees engagement as a complex process and is improved when there is a journalist/communication professional. Collaboratively produced media with the community is a crucial part of the Mediation Model. Further, the Mediation Model recognises that meaningful engagement needs to involve various processes (such as an iterative going back and forth to engage different stakeholders through civic-mapping) to set up the engagement. Furthermore, the standard Science Engagement model does not have a clear sense of how it proposes that conversations are set up, while the Mediation Model is clear in its 3 cycles of action research listed below.

The Mediation Model consisted of 3 cycles of action research. These were; (1) Mapping the Field, (2) Media Production and Piloting and (3) Collaboratively Implementing Feedback.

Cycle 4 of this research process answers the second question; How can a documentary video enable science communicators to reflect on a new model for science engagement in South Africa? This cycle is called; Reflection/Interrogation.

Mapping the Field

In this cycle of the research process, the use of the civic mapping tool allowed us to connect with the extension officers, who are the people directly linked to both the SASRI scientists as well as the sugar cane growers, through a Zoom meeting. This helped us know and understand that there are three types of sugar cane growers in KwaZulu-Natal, particularly in the areas we worked in. These growers are; commercial sugar cane growers, land reform sugar cane growers as well as small-scale sugar cane growers. Through the use of the civic mapping tool, we were able to facilitate a space where the extension officers taught us the difference between the different growers, which then helped us identify commercial growers and small-scale growers as the ones we would like to work with.

The extension officers also told us about the different individual growers that were involved in sugar cane farming. One of these growers was Participant A, someone we were interested in working with for the purposes of this study because of the passion he has for sugar cane growers, described by the extension officers. Participant A sounded like someone who would add a lot of input and information knowledge about sugar cane farming. On the other hand, we learnt that Participant B, a commercial sugar cane grower, would be an interesting partner to engage in this research because of his extensive experience with sugar cane farming. According to the extension officers, Participant B was one of the eldest sugar cane growers they had worked with who was also multi-lingual- a white man who spoke many of the Nguni languages- and so we identified him as a relevant and interesting person to engage.

This process of using connectors in the community allowed us to have a better and clearer view of the different dynamics within the sugar can farming industry and the different people involved in sugar cane farming.

Furthermore, the use of civic mapping as a tool enabled us to plan what questions to ask and what to consider as relevant and important information for the questionnaire. The questionnaire was constructed with the aim of understanding certain things about the sugar cane growers that would potentially matter in how they perceive GM crops. Some of these included language, religious affiliation, race, gender, age and educational background. In this cycle, we also administered the questionnaire to the sugar cane growers, and it helped us learn and know what kind of communication tools are preferred by the different growers. Understanding this was crucial for the purposes of the media production for science communication, something enabled by the civic mapping tool we used.

A very important element to this step was the use of video, I filmed this process of using civic mapping to identify connectors and the different sugar cane growers, but I also filmed this process to allow me to play back the footage in the edit suite and reflect on it. This is how I noticed that this questionnaire did not work quite the same way for the small-scale growers as it did for the commercial growers because we were not able to get sufficient engagement from the small-scale growers through the questionnaire because they had much more to express to us than the questionnaire allowed them to. For example, the small-scale growers expressed that they had challenges related to access to land but the questionnaire did not cater for that kind of question.

This helped me realise that perhaps we had not quite used the civic mapping tool effectively enough here. Part of the tool is to help journalists avoid knocking at people's doors to ask interview questions, something we did with the questionnaire, but rather engage citizens in "civic conversations" by sitting down "in their living rooms to understand their lives" and "the goal should not be to find the quote [but rather] to discover patterns in what people are saying, to probe to uncover meaning and figure out how people's thinking unfolds as they talk" (Harwood, 2000, p. 23). It is at this point then, that I had to sit down with the small-scale growers in their own paces to listen to them and engage them, a very crucial component of this research. Through this visit to their homes and their own sugar cane fields, I was able to get to know the small-scale farmers and their most pressing concerns, such as their need for land. The use of the civic mapping tool allowed me to know and understand that small-scale growers face challenges beyond the *Eldana Saccharina* pest manifestation. Part of public engagement involves providing opportunities for the public to "identify non-technical factors relevant to evaluating a scientific project and/or to contribute otherwise neglected but valuable local and practitioner knowledge" (Salmon et al, 2015, p. 53) such processes can also be characterised as the co-production of knowledge. This co-production of knowledge and opportunity for public participants to identify such factors implies that engaging the public in science research enables agency of the public in such research processes. Through the use of the civic mapping tool for public engagement, I also observed that the action to spend more time with the small scale growers worked to develop rapport and sharing of knowledge because they were willing to engage further and beyond their sugar cane farming life, something encouraged by RRI, a sharing of knowledge and involvement of all stakeholders in a scientific research process.

Through in-depth interviews/conversations with the small-scale growers in their own homes, I found that they are more open to engagement and telling their story about who they are beyond

sugar cane farming. Initially, before this step, I had assumed that most small-scale growers wouldn't be educated to the level of a tertiary qualification because I was under the impression that most of them are old. However, I was surprised to meet a couple of small-scale growers who are educated to the level of a tertiary qualification. One of them expressed that she does wish for an opportunity to be included by SASRI in what they do for them.

What this small-scale grower said is important and relates to Harwood's (2000) description that refers to civic mapping in journalism- the importance of identifying the catalysts and the connectors and to find ways to involve them in communication. This is done through engaging citizens in civic conversations. This also implies the right to participation in the planning and production of whatever communication that needs to happen. This refers back to development communication, the idea that the communication must be the point of departure when communication or research is happening. This implies the right to participation in the planning and production of whatever communication that needs to happen.

Furthermore, what the process of this cycle allowed me to do was to reflect on our actions through the process of video editing, during which I repeatedly watched the footage of the indepth interviews with small-scale growers and structured these into a narrative about our science engagement. I was also able to capture my reflections in a video that would allow me to communicate some of these ideas to the scientists to allow them to get to know the smallscale growers better through the short story narratives I created about some of these growers.

Something that enabled public engagement through the use of the civic mapping tool.

Media Production and Piloting

In this stage of the mediation model, we started planning the creation of the communication media as per the sugar cane growers' preferences based on the survey results. During the reflection on the survey results, we discovered that most sugar cane growers would prefer to receive communication about the genetically modified sugar cane variety through a short video and/or booklet they can keep in their car cabin holes. Through the use and application of some of the principles of development communication in this process, my colleague was able to design and develop a cartoon character that resembles a typical sugar cane grower and to use this cartoon to narrate relevant information about genetically modified sugar cane through a short video. This allowed us to use a planned and systematic approach of communication

through interpersonal channels, and audio-visual and mass media to gather and trade information among all relevant stakeholders involved in planning a development initiative, (FAO, 1989) an application of development communication to add another layer of public engagement to the process of science engagement that enabled mutual learning, transparent communication and democratic representation of the sugar cane growers who will potentially be impacted by a science innovation, (Bucchi, 2008; Weignart et al, 2021) which would be the genetically modified sugar cane variety in this case.

What the use of the development communication strategy in this process of the model through allowing the sugar cane growers to have an input on the media production. This aligns with the framework of the RRI (Khan, 1992) as it calls for research that isn't only for society but one that is responsive to society through the direct involvement of the public and is done with society. RRI advocates for the involvement of the public from early stages of the research, through communication, and considers this as an integral part of scientific research (Limson, 2018). Further, I produced another video in which the questions that the growers, particularly the commercial growers, wanted to ask the scientists about GM cane were assembled, so that we could share this with the scientists and film their replies, another way of engaging the public and enabling the framework of the RRI that calls for responsive research done with society and engages society. This process also ensured that the science behind the new innovation (GM cane) was communicated well and inclusively to the sugar cane growers, a process of development communication. Some of the functions of development communication include ensuring that the way in which the execution plan of a development project is designed, considers what the attitudes of the people which it is designed for or which it is trying to help are, as well as their perceived needs and capacities (FAO, 1989). This way, failed projects like abandoned irrigation schemes, settlement programs, broken down equipment, etc. because of assumptions immaturely made about the community's willingness and capacity to accept such new technology and development can be avoided (FAO, 1989). It was important for SASRI to not design a new innovation like the GM cane when they have not engaged with the sugar cane growers to understand their attitudes towards the scientific innovation, this way, they were able to avoid abandoned innovation that is not relevant and accepted by the growers it was designed for.

In this cycle of the mediation model, I also showed the scientists the video documentary I had created for them about the small-scale growers. This step drew from insights of development journalism, a model of communication that foregrounded the importance of ground-up

communication by asserting central participation at all levels of communication. The use of this kind of journalism in this process provided information to the scientists about small-scale growers so that they could be aware of the kinds of challenges they face and perhaps, where possible, provide opportunities to help solve some of the problems faced by these growers. It also allowed the scientists to be aware of the kinds of problems that needed attention. This process allowed us to focus on the growers' needs.

Furthermore, the piloting of the media and engagement with the sugar cane growers allowed us to foster a space where the growers could engage with us about the communication media that is designed for their consumption. It also helped my colleague to understand the changes he needed to make to the media products in order for them to be more accessible to the growers and to incorporate some of their inputs, a form of public engagement.

Collaboratively Implementing Feedback

In this stage of the mediation model, a public journalism notion of engagement based on the "town hall" was used to listen to the growers' opinions and actually taking them into consideration. Public journalism enhances civic participation (Haas and Steiner, 2006) through encouraging journalists to engage the public by reimagining who they are talking to. This process happens through public listening in their newsgathering, where they reimage their relationship with government and focus on what people could do to participate in public debate (Dzur, 2002). My research partner and I made it a point to ensure that we focused on what the growers could do to participate in the development of the media communication products as well as to raise issues that needed to be communicated to the scientists. This enabled a space for listening to the growers.

As mentioned in previous chapters, public journalism argues that the widening gaps that split society into two, namely; "between citizens and government and between news organizations and their audiences," can only be narrowed if journalists see, which they should, themselves as having the responsibility of stimulating increased civic commitment to, as well as stimulating increased, active citizens participation in democratic processes (Haas, 2012, p. 3). In this process, we saw ourselves, journalists, as having the responsibility to stimulate increased civic commitment among the sugar cane growers by bringing them into a space where they could participate in conversations about a new innovation and its communication that would be designed for them.

We have also stimulated increased civic participation of the small-scale growers by enabling them to have opinions and feedback on the communication of this new scientific innovation as well as enabling them communicate any concerns to the scientists. Although having the scientists present during this process could have enhanced a sense of connection and relationship between them and the growers, it also helped to not have them present as it allowed the growers to discuss their issues and concerns more freely. We have elicited effective citizen participation as well as effective contact with the governing process, (Merritt, 1998) a very critical component of this study's model to science communication and engagement, encouraging effective citizen participation in science research as well as effective contact with all stakeholders involved in the research, including the scientists who develop new scientific innovations.

Interrogation

Reflections on the Model by Scientists and Science Communicators

This cycle answers the second question of this research study; How can video enable science communicators to reflect on a new model for science engagement in South Africa?

Upon completion of the mediation model for science communication and engagement, I showed this video to the scientists and science communicators to get their input on this new science engagement model as a way to add different layers of reflection and debate into this model.

I have used this video documentary to analyse the nature of the engagement we followed. The reflection process with the science communicators was recorded on video and formed part of the overall documentary process. I used narration to coherently connect the film which I screened with science communicators so they are exposed to more complex debates in the field. This way, the film continues to add layers of voices to the various layers it already incorporates.

What video has allowed us to do through this process of reflecting, with scientists and the science communicators, is to critically analyse the mediation model we came up with in this study. One of the questions that came up from this step was the question of when the engagement took place. One of the people present in the room was a Post-doctoral fellow 1, a social scientist who has done intensive research in science communication, who alluded to the

limitation of our engagement model as she noted that the fact that the engagement only took place once SASRI had decided to go ahead with developing this genetically modified sugar cane, is in some ways, a top-down approach of engagement as we did not start with them right from the beginning, before they decided on going ahead with developing this genetically modified sugar cane.

Post-doctoral fellow 1's point is supported by the argument that RRI "should be understood as a strategy of stakeholders to become mutual responsive to each other and anticipate research and innovation outcomes underpinning the "grand challenges" of our time for which they share responsibility" (von Schomberg, 2013, p. 1) and it supports (Colle, 2002)'s argument about communication enabling the agency of stakeholders to make decisions related to choosing the type of development that is relevant and beneficial to them. However, it is important to note that SASRI did ensure the growers that they are not forced to accept this new innovation as it will be a choice, they need to make for themselves.

Furthermore, through video analysis, we were able to note that the science communicators in the room felt that the mediation model is on the right track, as we played the role of attempting to bridge the gap between the farmers and the scientists, however, what came out from one of the participants in the room was the fact that there needs to be a relationship of trust between the farmers and the scientists. This meant that it was a good thing that the engagement took part over several steps of engagement.

> *What you are doing is very important. That is the first step. To know the gaps and the challenges and then you should come with what you can offer to the farmers. They may be having lots of challenges, but this is what we can offer. So, it is a long-term investment, not just one visit or one interview* (Appendix 5).

Professor Janice Limson, the project leader, was also present in the screening. She echoed the sentiments of the participant who said that there needs to be a long-term relationship of trust built through such an intervention and stressed the importance of interdisciplinary cooperation:

> *The key thing that has come out of this is; as scientists we are challenged by certain types of engagement necessary for our research and for me as the SARChI Chair in science communication, this is really important for us to explore how we use or engage journalists or the field of journalism in mediating these discussions and I think this project has done that exceptionally well and I'll say again, it really does break new ground in how we engage communities* (Appendix 5).

A critical reflection that came out of the discussion after the screening from one of the participants was the difference between journalists and communication specialists. His opinion of the work I have done through this research process is that perhaps I should be referring to myself and my role in this study as a communication specialist as opposed to a journalist. This is because journalists are defined by their institutional role for a particular news organisation.

> *It struck me that one of the things that came out is around politics- political economy and that at the heart of this are a whole complex of dynamics, constraints that are outside of the ambit of science in a sense. So that was quite profound. It's kind of alerted me to the idea that in fact that there, journalism could play quite an interesting role, because if the political economy of sugar cane farming, especially for small-scale farmers, is hobbled by the lack of land reform, hobbled by the lack of fundamental shift in access to land in KZN- there is a role there for a particular kind of journalism. To put that on the public agenda and maybe some sort of investigative journalism or public policy type journalism, which would have to go to sort of a National Press to start putting pressure on policy makers around those kinds of issues, or even provincially, with the provincial Press. There I can see journalistic interventions being quite powerful and important. But I think the work you were doing, frankly, I think you know, as you put it, communication for development and social change maybe development support communication is more what you were doing rather than journalism* (Appendix 5).

However, it is important to note that this research project was done using journalistic strategies and tools from communication studies and therefore, referring to myself as a journalist in this process is merely a 'technical term' matter more than it is a matter of the work we have done.

Furthermore, the institutional definition of journalism no longer applies in an environment where journalism institutions are becoming weaker and new forms of independent journalism like citizen journalism are recognised (Motylska, n.d.). What is important is a sense of independence and a commitment to the public good and to holding the powerful accountable (Motylska, n.d). The participant goes on to explain that the word "journalist" implies that I am working for a particular news organisation. Therefore, this critique does not mean the work I have done is incorrect insofar as journalism and communication studies tools and strategies have been applied.

> *I think what you guys have proved is that there is almost like a spectrum here of different kinds of communication work and it really depends on where you're locating yourselves…* (Appendix 5).

What is undeniable about the mediation model based on this research is that, the role of journalists as mediators is indeed effective and inevitably exposes some of the crucial challenges communities could be facing over and above the ones scientists could potentially assume as more pressing. One of the participants reflected, critically, on the output of the struggle with land for the small-scale farmers by saying:

> *Just coming back to the question regarding the land and politics, etc. because I realise that, also, who takes responsibility of that input because as we saw in the video the scientist that was doing the discussion saying "it is what it is" meaning we can't really hold this. So, I guess it goes back to, without being a journalist myself, but I am feeling that part of the journalistic work is to actually carry out that input because the community is putting themselves out there, saying this is a concern for us, then as a mediator in that space and has initiated that space, you need to take care of that input. Do something with it. Because otherwise, next time someone comes and they bring out again and no one is interested or they say "oh that's too bad" then you're undermining that kind of engagement, you need to show that it is carried, however you can. I think journalists have the potential. Bring it in in discussions, you're not supposed to solve it but carry it somehow* (Appendix 5).

In the video I created for the scientists (Appendix 1), I ask them questions regarding this particular land and refugia challenge for the small-scale farmers. I ask whether there are ways in which we could have a discussion around GM cane framed around land and whether it is possible for GM crops to help put bread on the table while there is a struggle for land? In Journalism studies, we use framing to frame stories so that they can respond to people's broader concerns in order to create more inclusive conversations. One of the questions I ask the scientists (appendix 1) is "can we include economic models for GM cane for growers that include small yields and profits?"

Furthermore, some of the scientists present in the room expressed that they liked the mediation model as they are also trying to learn from what we have done as they are trying to involve communities as partners in research projects, they are busy with. However, they expressed the

importance of having more stakeholders involved within the mediation model in order for challenges faced by communities be addressed by the relevant stakeholders for solutions. This would create confidence in the small-scale growers to know that their challenges will be addressed.

One of the science communicators said that he sees the potential in this Mediation Model approach but one of the things he would want to explore is the idea of mediating with the community as opposed to mediating for them in order for him to feel like he has a strong, grounded approach.

My Reflections on the Overall Process

What the last cycle of the research has done, is foster a space for the Mediation Model to be reflected on in a critical and constructive manner by contributors to the field of science and science communication. It has added more voices and layers to the debate of public engagement in science communication and engagement through the mediation model.

It reflected on, using video, the new science engagement model through a screening of the video documentary with scientists and science communicators. It drew and reflected on an action research cycle captured through the video documentary as a way to effectively and thoroughly collect, analyse and interpret data and produce findings that reflect on the process of science engagement through the case study.

Through this Mediation Model that encompassed development journalism, development communication, public journalism and civic mapping, I believe I was able to break new ground within the science communication and engagement field by using video to analyse a new model within this field and by using media production as an important part of engagement. Sugar cane farmers were engaged from the bottom up and involved as partners within the research process. I was able to use civic mapping to visit the farmers in their own homes in order to have conversations about who they are beyond sugar cane farming. I was also able to use framing to encourage scientists to frame the GM sugar cane product in such a way that it is suitable and relevant for small-scale growers.

This model was able to give an opportunity to the small-scale growers to be heard by the scientists who create new innovations for them. They were able to express themselves and their needs and it encouraged dialogue through the use of video. For the first time, the SASRI

scientists got a better understanding of who the small-scale growers are and what drives them. As mentioned in chapter 3 of this study, video allows for more vivid and direct communication according to Harper (2012), and this was useful in the communication with scientists as participants in this research study as it allowed me to sit down and process their responses to some of the challenges faced by the small-scale growers and their understanding of this particular community of small-scale sugar cane growers.

Through video, they were able to understand at a deeper level, the challenges faced by these growers. Furthermore, through this model, I was able to take some questions that growers had about the genetically modified sugar cane to the scientists so that they could answer them.

Through our video reflections, we were able to create media products that sugar cane growers can relate to as well as find easy to access and understand. We were able to give the growers a voice by involving them in having an opinion about their communication material and then critically reflect on this process by going through the video footage. The model also allowed us to strategically suggest a practical way to create engagement/dialogue in science engagement research. Through an intense, iterative and reflective process, the Mediation Model was critically analysed by scientists and science communicators in the field. The 'poetry' of video, ass emphasised by Harris, (2016) enables creators to think more critically about the purpose of what they see and make. Video methods have enabled researchers to better understand cognition, sociology as well as aesthetic considerations and questions. It is inspired by diverse traditions in social science, educational psychology and art-based research models (Harris, 2016). The use of video as a research method in this study was very useful as it allowed for an opportunity to critically reflect on all stages of this new engagement model.

Chapter 5: Summary, Conclusion and Recommendations

This research reflected, using video, on a process where the principles and techniques drawn from different approaches to journalism, were applied to enhance the communication and engagement between scientists and sugar cane growers. It also sought to present a new model for science engagement by drawing from techniques and strategies from different approaches to journalism and communication studies to enhance the communication of a genetically modified sugar cane variety, developed by the South African Sugarcane Research Institute (SASRI), for small scale growers in the South and North Coast region of KwaZulu-Natal. These journalistic approaches included elements from, development communication, development journalism, public journalism and civic mapping. It sought to answer two questions:

1. How can a new model for science engagement incorporating concepts and methods from journalism and communication studies be used to deepen and expand notions of science engagement in South Africa?

   I used development communication, development journalism, public journalism and civic mapping as tools and strategies to apply in the different stages of the mediation model in order to deepen and enhance understandings of public engagement in science engagement.

2. How can video enable science communicators to reflect on a new model for science engagement in South Africa?

Through the use of video, scientists and science communicators were engaged to reflect on the mediation model and add more layers and voices to the debates within the field.

Chapter 1 of this thesis gave the contextual background of this research by first defining science communication as it relates to science engagement. It then outlined the history of science communication in South Africa and gave context to the main principles of this particular field based on the history. The chapter also touched briefly on the history of extension officers in agriculture and the different approaches to science engagement that have emerged.

Chapter 2 examined different understandings of public engagement that emerged from different approaches to journalism and communication. These understandings of public engagement were; development communication, development journalism, pubic or civic journalism, civic

and structural civic mapping. It then unpacked and briefly explained these different understandings of public engagement and how science communication and engagement can learn from all of these approaches to public engagement. This chapter also applied these different approaches to the concept of public engagement and examined how they all see a role for mediation by a journalist or communication professional in the process of this particular case study.

In chapter 3, the research methods and methodology of this study were outlined and how these were applied to this research. Concepts from action research underpinned the documentary video method I used to undertake this research.

Chapter 4 outlined the findings that emerged from this research study and how they add different layers and voices to the field of public engagement through the mediation model for science communication and engagement. Recommendations that can be made for further research studies within this field were also noted.

Recommendations

Narrowing the deficit gap to science communication and engagement is not something that can be achieved by one study. I believe that we can all have an influence towards achieving a nondeficit approach to science communication and engagement. The study I have done was able to achieve this in many ways, but there are recommendations for even better approaches to science communication and engagement.

Some of the recommendations that came from this study through video reflections with scientists and science communicators include the idea of involving scientists in all aspects and all steps of the mediation model. This means that scientists should probably be on the field with journalists as they engage the communities in order for them to understand the communities better. It was also clear that policy makers should be involved as stakeholders in the research process right from the beginning as people who influence the creation of new scientific innovations. It is also important to consider for further research what impact the new innovation being created by scientists for communities would bring. It is also important to consider the possibility of not only mediating for the communities but mediating with the communities in order to immerse them fully in the process of engagement.

Some of the scientists and science communicators said that they would consider the mediation model in their research, but perhaps with the above considerations applied.

I end with the same words I ended the video documentary created for this study; I look forward to an improved science engagement model in future.

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Appendices

Appendix 1- Video for Scientists about Small-Scale Growers

https://drive.google.com/file/d/10imXoa8OhcDSxGaw2bPImqWVnDkD7RUL/view?usp=drive_link

Appendix 2- Video for Scientists about Small-Scale Growers Transcript

00:00:23:22 - 00:00:49:22 Speaker 1

According to Jacob Coppola and others, the shifting expectations of scientists to communicate and engage with their public necessitates changes for scientists because public communication efforts have typically been reactive and ad hoc as a communication mediator have made this video with the aim of changing this narrative by helping the scientists accessory to get to know and understand the small-scale farmers they are working with better.

00:00:51:04 - 00:01:06:16 Speaker 1

I went back to KwaZulu-Natal to meet a few small-scale growers after we had spent a lot of time with commercial growers in our first trip and met for small scale goes to from the north end to from the south. The first one I met was a young black female farmer.

00:01:07:11 - 00:01:27:06 Speaker 2

My name is [redacted]. I'm born and bred from Maphumulo. I grew up in around the areas of my family or went to a couple of high school at the university in Ukzn Westville. I did Environmental science and Geology, so now I went to the space of farming.

00:01:27:13 - 00:01:48:17 Speaker 1

Because of our first trip. I found it very interesting that [redacted] was educated to the level of a geology degree. As I had the idea that most small-scale growers are old and possibly not educated to the level of a tertiary qualification. This made me realize that it is easy for scientists to also make the same kind of assumptions about the people they work with.

00:01:49:03 - 00:02:04:12 Speaker 1

There are quite a few small-scale growers who are educated and they could play such a huge role in taking up leadership positions in science communication. What I also picked up is that Silondiwe does wish for an opportunity to be involved more in what SASRI does for them.

00:02:04:22 - 00:02:33:07

Speaker 2

So definitely GMOs and but not just that particular thing. I think in anything that they are working on or they're trying to make better. I would like a communication or even in involving us within their process not to be in the labs or to question them because there's information that we definitely wouldn't have. But whatever seed that should develop, that's going to be maybe drought resistant, flood resistant wind resistant.

00:02:33:15 - 00:02:59:08 Speaker 2

It definitely has to be tested back within the farmers. So I'd definitely love to be involved within the actual process. From inception of the product to the the, the, they're quarantined and those parts so that they see if they work. But it's always good to come and taste it in even different species. I'm not going to just say I as a farmer volunteer within my space to come and actually do the test.

00:02:59:08 - 00:03:42:23 Speaker 2

But I think farmers in Mpumalanga, farmers down south coast, you know, farmers everywhere that are planting sugarcane would definitely love to be involved with accessory. With other

associations, you have the South African Sugarcane Association, you have the South African Farmers Development Association, every association under the umbrella of sugar cane would definitely be would love to be involved in all the farm, because I think involving the associations would make it easier even for communication to filter through to everyone that okay, this is a video and video form in letter forms.

00:03:43:20 - 00:03:59:00 Speaker 2

This is a tutorial, come to our farms see that something works not only in the current scene or controlled space. They see if it works here where it rains every other day.

00:03:59:00 - 00:04:25:06 Speaker 1

What [redacted] says is very important and relates to what Harwood and other researchers call civic mapping in journalism, the importance of identifying the catalysts and the connectors, and to find ways to involve them in communication. This is done through engaging citizens in civic conversations. This also implies the rights to participation in the planning and production of whatever communication that needs to happen.

00:04:25:11 - 00:04:57:00 Speaker 1

This is an important point with regards to development communication, for example, the idea that the community must be the point of departure when communication or research is happening. This implies the right to participation in the planning and production of whatever communication that needs to happen. Something else that is important to note is the idea of public journalism knowing and understanding that the community can be the best people to connect researchers to other relevant people.

00:04:57:05 - 00:05:28:17 Speaker 1

I think it's important for SASRI to know more about these small-scale girls because if they are able to identify these people, it would really improve their science engagement. Some questions for scientists “How can we identify new small-scale farmers with science education to help with science communication?” One of the reasons we use civic mapping as a tool in engaging the public as journalists is so that we move away from not identifying the public's real concerns and rather what we think is important to them.

00:05:29:00 - 00:05:56:08 Speaker 1

Part of engagement is listening as well, and it is important that a new science innovation being introduced to the community or public is one that is relevant to that community. For GM sugar cane that is resistant to Eldana. This would mean understanding whether the stakeholders have a note on a problem. I discovered that the small bloggers who spoke to don't necessarily struggle with the tiny manifestations at the moment.

00:05:56:17 - 00:06:11:01 Speaker 3

We don’t have a lot of the Eldana pest here in Ogwini. But years ago, in the 90s we did have it but it wasn’t too bad.

00:06:11:13 - 00:06:31:06 Speaker 1

What is very surprising is that although the small-scale growers do not suffer from Eldana pest manifestations at the moment they are still open to planting. I asked [redacted] if she would be open to planting GM cane and whether she had heard about it and she immediately mentioned her extension officer.

00:06:31:06 - 00:06:50:17 Speaker 3

[redacted], (extension officer) has told me about it but I haven’t seen it yet. I had the desire to see it so that one day I could see it in my fields and what its benefits are.

00:06:51:09 00:07:18:17 Speaker 1

[redacted]s' positive attitude towards GM cane probably has a lot to do with a positive relationship with her extension officer, illustrating how important these relationships are for science communication. It is also important to note that as much as they are open to science and GM small, small girls still have a lot of questions they want answered and don't want to simply accept what they hear of without understanding its thinking.

00:07:18:17 - 00:07:40:12 Speaker 4

Yes, I would plant it but only once I have understood what it's all about and whether it is suitable for our fields and how long it takes to grow. Is it not the kind of cane I would have to replant after two years for example?

00:07:41:14 - 00:08:02:08 Speaker 1

I heard such long-term thinking from several of the is they thought GM came might offer protection from a future health and a pest manifestation even though they had no l than a problem at the moment. I thought it might be very useful for statutes involved the growers and keeping track of potential problems in the region to help predict future invasions.

00:08:02:16 - 00:08:21:04 Speaker 1

But scientists also need to respond to this question Is it worthwhile planting the GM cane way? There's currently no danger to protect the cane from them in the future. Does planting GM cane where there is no Eldana issues how protect the cane from possible Eldana infestation in future?

00:08:22:01 - 00:08:50:14 Small-Scale grower 2

The challenges we face are mostly financial. Because of our small fields, it is very difficult to make profit. One ends up not being able to maintain their cane appropriately like buying fertilizer, herbicides, etc. The biggest challenge with sugar cane is maintaining it. Herbicides are very expensive. The labour is also very expensive. At some point the RV price dropped drastically and that really hit us as small-scale farmers because our cane died during that time since it is not maintained well enough for it to give us decent profits.

00:10:01:13 - 00:10:22:15 Speaker 1

[redacted] is not the only one unable to afford herbicides. It seemed a common problem of small-scale farmers. I wondered if Sastry would be open to consider stewardship contracts with

small scale goes that did not prescribe imazypr use. This would mean they would only be using the Eldana resistant parts of the GM product on a bigger scale,

00:10:22:20 - 00:10:47:07 Speaker

1 it would also mean that Sastry could not be labelled as forcing farmers to use herbicides. This criticism is coming from the anti GM lobby instead. The choice would depend on the farmer.

Some questions for the scientists "what strategies can we implement to listen to our growers to understand whether our antenna resistant and emissive tolerant GM sugarcane is relevant to their circumstance?"

00:10:47:07 - 00:11:15:06

Speaker 1

What can we do to make our stewardship arrangements work for small scale growers? One of the most important principles for these communicates is being able to identify the community's needs as opposed to what you think they need. When I ask small scale farmers what they need, the topic always turn to land.

00:11:15:15 - 00:11:17:01 Speaker 5

Our fields are very small. If it were for me, we'd have land allocated to us for specifically farming cane because as much sugar cane is a great crop to grow, it takes too long to make profit. Whereas, if we had access to a bigger plot of land, we could plant other crops there so we can sell them to make money so that by the time the sugar cane makes profit, you've put food on the table. It is a big struggle because I really like farming, not just cane, but other crops too. It's a bit impossible because my land is small. I have about 2 hectares of sugar cane but I wish I had at least 10.

00:11:19:16 - 00:12:12:06 Speaker 3

There are too many expenses and we only plant small fields. Sometimes when the cane you planted does not belong to you, then you don't make profit because you have to pay up the profit.

00:12:46:11 00:13:11:17 Speaker 1

I wonder if there are ways SASA or SASRI you could help these small-scale growers put bread on the table by setting up a structure to help them get more land. Is it possible discussing GM crops and people feel that other issues like the land issue is more pressing? Is there a way we could in the meantime include GM crops in this discussion and frame it in terms of land?

00:13:12:01 - 00:13:46:08 Speaker 1

So, can GM crops help put more bread on the table while we struggle for more land? Framing is a concept that comes from journalism studies and by framing stories so they respond to people's broader concerns. Science engagement can create more inclusive conversations. Questions for the scientists. Should we frame our engagement around GM cane, around land? Can we create economic models about GM cane for growers that include small field yields and profits?

00:13:46:08 - 00:13:54:16 Speaker 1

Finally, it was also very important for me to find out how the small-scale growers would like to receive any information about GM cane.

00:13:54:23 - 00:14:15:23 Speaker 4

E-mails would be great but it would be very useful to have someone we can ask questions and get answers from them right then.

00:14:17:09 - 00:14:27:07 Speaker 3

And have grower days where they can explain to us about this sugar cane. How to plant, what to know and why this cane was made, etc.

00:14:27:18 - 00:15:03:02 Speaker 1

Most small-scale growers seem to have a very good relationship with the extension officers. It is very important for society to know this. It means any communication strategy needs to center face to face communication with the extension. Officer says you should continue encouraging and investing in this relationship. This also means making sure that extension officers are empowered to give the right advice and not simply promote a product because it is new, but because it is relevant and visible for the small-scale growers.

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00:15:03:02 00:15:29:13 Speaker 1

Some more questions for the scientists. How can we send to extension offices in all our science communication, such as our media products? How do we ensure extension offices prioritize the needs of the growers in sharing the science? While we think about these questions, I think it is important to bear in mind that science engagement is a process of listening, thinking, talking and more listening.

00:15:30:23 - 00:15:49:06 Speaker 1

A project by the school of Journalism and Media Studies and the Department of Science and Innovation in RF Research Chair in Biotechnology, Innovation and Engagement at Rhodes University, funded by the Technology Innovation Agency, Department of Science and Innovation Biosafety South Africa.

Appendix 3 Commercial Grower Questions Transcript

Questions for the Scientists from Commercial Growers

00;00;00;00 - 00;00;40;06 Nontokozo

In our first trip to KwaZulu-Natal, we spent a lot of time with commercial growers and we discovered that most of them had similar questions about GM cane. This video is a short summary of the questions they had and the answers we got from the scientists.

00;00;40;09 - 00;01;10;06 Research colleague

If there was a SASRI scientist at the moment who's working on the frontlines of developing genetically modified sugar games, what questions would you ask them about GM sugar cane? Well, so what has been put into it to change it? Where it come from? Is it safe? It. Is it the same product that's going to be produced? And will it be enough marketing done to ensure that the consumer is happy with it?

00;01;10;08 - 00;01;44;21 Scientist

Okay. So, I'm going to start with the table sugar first. So, table sugar is 99.993% sucrose. Right? And it's very highly processed. So that sugar cane plant, whether it's grown down the south, whether it's grown in the north, whether it's cultivar in 12, whether it's cultivar in 73, the final product is sugar, and it's exactly the same. And in fact, in the northern hemisphere, they grow something called sugar beet.

00;01;44;24 - 00;02;12;21 Scientist

And that crystal that comes out of that processed juice is table sugar. And you can tell the difference. The shape of the crystal is a bit different, but it's its sugar. So, we are not changing that at all. So, the product is the same. Just remember that when sugar cane gets sent to the mill, it gets crushed, the juice gets heated and boiled and centrifuged and it's really highly processed.

00;02;12;21 - 00;02;52;09 Scientist

So, there is nothing of the original plant left in there. But when we actually think about the plant and the field, we know that we are part of what we do accessory. Even without genetic modification, is we always try to deliver new, improved cane varieties to our growers because yield is important. That's why they in business, that's why we here, because we get funded by

them to release new varieties that grow better, that use less water, that are resistant to pests and diseases, you know, that grow under all sorts of conditions.

00;02;52;09 - 00;03;23;27 Scientist

And that's what we do. That's our mandate. With genetic modification, we have an opportunity to really target what it is that we want to change in the plant. And in this particular instance we are introducing a protein from a soil bacterium into the plant which targets Aldana, which is a big paste in our industry. So, it's a very specific kind of breeding that we're doing and it's very targeted.

00;03;23;29 - 00;03;55;07 Scientist

So, nothing else is going to change in the plant except for that new protein that is going to be produced and that acts on Eldana. So that's kind of the context that we're looking at. Obviously, the safety around it is always a big thing.

Sugar cane grower

For the consumer, at the end of the day, what is the role of the GM interference, what possible down causes down the line or issues, could it cause it?

00;03;55;10 - 00;04;34;24 Scientist

That's always the biggest concern. And yeah, safety. Okay. So, in South Africa, we have the most amazing historical record to go back to because we have been eating GM maize for 20 years. And so, and there's been no associated health effects. So, maize is an interesting crop in America. They and in Europe it's mainly used to feed livestock.

00;04;34;26 - 00;05;04;10 Scientist

Okay. In South Africa, we love our mealie meal and we eat white maize and some of the yellow maize, but you know, mainly the white maize. And so, we've been consuming it for the last 20 years and there've been no negative effects associated with it. But before any of these genetically modified crops are released, you have to go through very strict regulations.

00;05;04;13 - 00;05;37;05 Scientist

And so, these are crafted by the Department of Agriculture, the Department of Health. And so, the Department of Agriculture, while they are the custodians of the GM regulations. So, for

example, at SASRI, this lab where all of our GM work is done, has to be registered. So, the facility has to be registered with the Department of Agriculture. If you want to take a little GM plant and do a field trial, you have to get a permit from the Department of Agriculture.

00;05;37;07 - 00;06;20;07 Scientist

So, that means that you have to know what it is that you're dealing with and you have to be able to communicate that with the people in the area. Fellow scientists, they the newspaper publications that are associated with any of these releases. So, it's very well regulated from a legal point of view, from a health point of view, if you want to sell a main seed that's genetically modified, you have to prove that its substance is naturally equivalent to the normal maize, which means that it must not have other than the single gene that you have inserted into that crop.

00;06;20;09 - 00;06;48;28 Scientist

It must be the same. That's what substantive equivalence is about. And that's the whole premise for GM technology. You are just wanting to modify one or two characteristics and you do not want to interfere with anything else. Otherwise, it can't be called the same thing. It can't be called maize. So those are very strictly looked at and tested and have taken big companies many, many years to sort out.

00;06;49;01 - 00;07;26;05 Scientist

So, all of that is very well taken care of by our government. We also have a scientific panel that advise the government and they look at all of those applications. And in the days before we used to get PDFs, I promised you I would receive a mountain of paper this big to look at all the health studies. So, they tested obviously you're not allowed to test that on humans because that's not ethical, but they do various genetic alignments to look for allergens, to look for toxins, and then they will also look at wholesomeness of the food.

00;07;26;05 - 00;07;54;09 Scientist

So, they will feed maize to broiler chickens and then they will look at the size of the chicken and they will look at the composition of the meat and the effects on the bird and then make a call. Is it substantially equivalent for that chicken to eat normal maize versus GMOs? And if there's no difference, then that is scientific evidence that there's nothing in there that's substantially different.

00;07;54;12 - 00;08;32;16 Farmer

Now, that's a bit of a difficult question to answer in a way. If we are a pure sugar cane farming operation, I would have I'd be very happy to accept genetically modified sugar cane, which would combat those issues, resistance to certain types of herbicides, which you would then be able to use more effectively for weed control and shall we say, a gene which might control insect borers and that kind of thing.

00;08;32;18 - 00;09;02;12 Farmer

On the other hand, we are also avocado farmers. Every year we have to have what's called a global gap audit gap, standing for good agricultural practice. And one of the questions which we are asked every year, and this is an annual audit which we have to go through every year, we are asked. Do you produce any genetically modified organisms on your farm?

00;09;02;14 - 00;09;46;04 Farmer

And obviously happen to know the answer has been no, but how that would fit in with the Global Gap audit on avocado production. If we said yes, we are producing a genetically modified sugar cane, that's a question which still has to be answered.

Nontokozo

We are still in the process of finding the answer to this question.

A project by the School of Journalism and Media Studies and the Department of Science and Innovation in our research chair in Biotechnology, Innovation and Engagement at Rhodes University, funded by the Technology Innovation Agency, Department of Science and Innovation Biosafety South Africa.

Appendix 4- Reflection on the Mediation Model with Science Communicators Video

https://drive.google.com/file/d/1xdr88lQki_K3r03xAzbx2Q28CaaiWts_/view?usp=sharing

Appendix 5- Appendix 5 The Mediation Model Documentary

https://drive.google.com/file/d/14UD1qd4fPcqIZrkESq5v2wgJ1Y2Q7hON/view?usp=sharing

Appendix 6- Reflection on the Mediation Model with Science Communicators Transcript

00:00:00:01 - 00:00:07:17
Nontokozo
To hear your thoughts on the on the process. Would you like to go first?

00:00:10:01 - 00:00:13:07
Speaker 2
So the question is, would you use this kind of approach? Do you consider.

00:00:14:00 - 00:00:16:27
Nontokozo
In your research as a scientist?

00:00:18:03 - 00:00:21:10
Speaker 2
I think it should be in multiple different types.

00:00:21:12 - 00:00:26:11
Post-doctoral fellow 1
Of research that we do. And sure, we can find.

00:00:26:11 - 00:00:27:21
Speaker 2
Some form of engagement.

00:00:27:28 - 00:00:35:06

Post-doctoral fellow 1

With communities to move us to do the type of research and management and to resolve of you.

00:00:35:39 - 00:01:01:28

Speaker 2

And so, you know, I think certainly with your research, it might be somewhat for engagement. And and but this is really, you know, what types of research will require that. And do you think we need to be involved with this kind of approach would be the best one?

00:01:01:36 - 00:01:11:13

Post-doctoral fellow 1

Things like environmental impact incentives and make decisions.

00:01:18:33 - 00:01:20:13

Nontokozo

Should thank you and.

00:01:21:10 - 00:01:44:03

Post-doctoral fellow 2

Yeah. So the engagement is very important. I come from a farming background. So extension is important in terms of agriculture, technology, and just trying to serve to benefit the farmers. But the farmers must also trust the scientists. So there should be a relationship of trust. No gap in the communication. I see a lot of gaps happening.

00:01:53:45 - 00:02:22:37

Post-doctoral fellow 2

So collaboration between the scientists and the farmers is vital. So active communication with the farmer with collaboration like to engage them like if you can set up field trials, the small scale field trials as you move forward.

00:02:22:37 - 00:02:23:30

Post-doctoral fellow 2

In your research, you know, and you come up with that for that. So, are you going to engage some of these small-scale farmers which you interview? Are they willing to collaborate with you to set up the small-scale field trials to see the output? So that kind of, you know engagement will be required to realise the success of this project. Yes, and then if so, they will know how much they are going to benefit. And how they are going to benefit.

If you can think of different trials on their own land. And so that could be they can develop some confidence in that approach. So, I would say to people in different parts or different communities you know, it would be beneficial to build the confidence.

00:03:23:17 - 00:03:33:25
Nontokozo
Okay. So you mentioned that you think that a collaboration between the scientists and farmers is is important so that they can also gain some trust.

00:03:33:36 - 00:03:40:25
Post-doctoral fellow 2
For the extension so they know what is happening and what you are saying.

00:03:40:44 - 00:03:42:16
Post-doctoral fellow 2
Can be delivered, you know?

00:03:42:25 - 00:03:49:40
Nontokozo
Yes. Would you say in your opinion, would you say that we achieved that in this process?

00:03:51:07 - 00:04:19:31
Post-doctoral fellow 2
So you are somewhere in the middle? I would say that you are trying to build a bridge between the scientists and the farmers. You are trying to understand what their concerns are. So you are on the way. I think you're on the right track. But to be successful, you have to under your confidence. I mean, they should be willing to.

00:04:20:05 - 00:04:21:03
Post-doctoral fellow 2 You
know, trust.

00:04:21:36 - 00:04:57:27
Post-doctoral fellow 2
In what you can support. Yes, I have one acre of land. And if you come to me and you say that you have a project and you have a plan, so you have to convince me that I should, you know, be involved and I must be benefited. I should not lose something. So, in that sense, if you sort of, you know, if you can bring them on the table and they do sign up for something, then they will they will provide you their land

for small scale field trials and you maybe ten different, you know, in one hand the 20 different, you know, farmers. And do a small-scale trial whenever you come up a product and you show them the benefits, you know, it must be there, you know, economic output. So, let's so that is that is something very important. So that's how the farmers will start putting their trust

00:05:30:13 - 00:05:53:09
Post-doctoral fellow 2
Yeah. So what we are doing is very important to know the gaps, the problems, the challenges that they have and then you can say this is what we can offer. They may be having a lot of challenges, but this is what we can offer and this is what we can collaborate and move forward.

00:05:53:23 - 00:05:58:46
Post-doctoral fellow 2
So, this is a long term engagement. Not just one visit or one interview.

00:06:02:39 - 00:06:15:13 Nontokozo
For clarity's sake. When you say we can show them that this is what we can offer, are you referring to us as journalists who are mediating this process of engagement for.

00:06:15:47 - 00:06:26:35

Post-doctoral fellow 2
So, the collaboration between the scientists and journalists and the farmers. Not just one aspect. This is a comprehensive package that, you know, if you go to the farmer, they want to know how they are going to get better.

00:06:29:32 - 00:06:30:34
Nontokozo Yes, OK.

00:06:31:07 - 00:06:37:20
Post-doctoral fellow 2
Continue reform with whatever they. So, yeah, this has to be
a comprehensive package.

00:06:38:09 - 00:06:47:03 Nontokozo
Sure, thank you. Prof, did you have something to say there?

00:06:47:41 - 00:07:07:34
Prof Limson
I think it's just what he says about trust, you know and the nature of engagement between scientists and communities and the long-term approach. So, and that trust is only going to come about through longer term engagements. But I think that, you know, the key thing that's come out of this is that as scientists we are challenged. By certain types of engagement necessary for our research. And for me, as such the SARCHi Chair in Science communication, this is really important for us to explore how we...
Use or engage journalists or the field of journalism in mediating
these discussions. And I think that this project has done that exceptionally well.
And I say again, it really breaks new ground in you just break new ground in how we engage communities.

00:07:38:18 - 00:07:42:09
Nontokozo
Sure, thank you. [redacted] you had your hand up.

00:07:43:13 - 00:07:51:03

Speaker 3
Yeah thanks. Yeah. Well, I'm going to be speaking more from the perspective of sort of journalism and media studies, rather than science. Is that OK?

00:07:51:04 - 00:07:55:04
Nontokozo
Sure, of course, yes.

00:07:55:04 - 00:08:42:17
Speaker 3
I think yeah, I mean, it struck me that, you know, one of the things that came up was around politics, political economy. In fact the heart of this is are a whole complex of dynamics, constraints that are outside of the ambit of science in a sense. And so, you know, that was quite profound. And it kind of alerted me to the idea that, in fact, their journalism could play quite an interesting role because if, you know, if the political economy of sugar cane farming, especially for small scale farmers, is, you know, is hobbled by the lack of land reform, the lack of, you know, a fundamental shift in access to land in KZN, then there is a role there

for a particular kind of journalism, you know, to put that on the public agenda, maybe some sort of investigative journalism or public policy type journalism which would have to go to, you know, a sort of a national press, in a sense, to start putting pressure on policymakers around these kinds of issues where you can provision to the provincial press. There I can see journalistic interventions being being quite powerful and important, but I think the work you were doing, frankly, I think, you know, as you put it, you know, communication for development and social change, maybe development support communication is more what you were doing rather than journalism because, you know, it wasn't really you weren't paying attention to how did these

messages scale up to mass audiences? How do we work with community radio stations or community media or even provincial media in starting to get those conversations that you unearthed in those hyperlocal locations from these small-scale producers? How does that then, you know, how do those issues and messages start to diffuse outwards into the wider population?

And when they actually start using the GMO, you know, maybe the then there's a kind of on one hand, a sort of diffusion of innovation type of approach within communication for social change kind of framework, but there's also potentially a whole of journalistic work that could be done there as well. So,I think that there was a kind of role confusion a little bit, I think, in this.

Are you guys journalists or are you communication for social change or development social change or development support communications? In fact there are even gradations there. So I think the terminology maybe could be clarified from time to time because you asserting that you're journalists but in fact I think what you did there was more in the role of development communication. I don't know if you would agree with that?

00:10:43:37 - 00:11:02:33 Nontokozo
I mean, I hear I hear what you're saying, but I think we're journalists using tools and strategies from communication studies to to elicit these conversations and to lead these conversations.

00:11:02:33 - 00:11:41:39
Speaker 3
But why are you journalists rather than communicators? You see what I'm saying so it's sort of what camp is your foot most firmly planted in when you approach something like this and maybe it doesn't matter too much because I think ultimately it is about the methodologies you use and I think you did that really effectively and but I think those mediation sort of roles were more limited to sort of, to you know, sort of a communication for developments and social change paradigm rather than a journalistic one.

00:11:42:16 - 00:12:07:38
Nontokozo
I think also another thing is, you know, journalists, one of the probably reasons why I would go for the term of journalists is because we are playing an independent role as well. So my I mean, I stand to be, you know, corrected on this one but my take would be that if we move towards calling ourselves communication specialists, then we're probably doing a communication strategy for SASRI.

00:12:09:03 - 00:12:40:17

Speaker 3
No, not if not if you're a communication for social change, or development for social change practitioner. So, you can be, in fact, should be independent because you know that that Jan Savaes quote that you used, you know that that's very much about independent practitioners. So, you're not you're not a strategic communicator for the organization, for research organization. You you're precisely in fact, you're locating yourself in communities.

First and foremost, as your kind of primary anchor and then mediation, which, you know, would come from that. But I don't think it's the same as strategic communication.

00:12:51:10 - 00:12:51:34
Nontokozo Sure.

00:12:51:34 - 00:13:14:37
Post-doctoral fellow 3
It’s communication for social change. Yeah. And I think that is a different political different positionality and it is more aligned with journalism in the sense that you correctly point out that it is about independence, but there is in fact a kind of a bias towards communities there. Seeing it from the perspective of communities rather than as a strategic communicator for an organisation

00:13:14:39 - 00:13:36:48 Speaker 2
trying to sort of get GMO technology to be accepted by, you know, communities and but it's very messy. I appreciate it. It's very messy. And I don't I don't think it really has a big impact on what you're saying. And the methodology that you came up with, I think that’s all, you know, feel with the caveat that there needs to be more work in a sense, further down the line.

00:13:37:20 - 00:13:39:41
Nontokozo
Yeah, yeah, yeah.

00:13:40:07 - 00:13:41:42
Speaker 2
So it's more terminology

00:13:41:48 - 00:13:47:21 Nontokozo

Sure. Thank you for that. It's very useful. Very. Thank you. Yeah, sure.

00:13:47:39 - 00:13:48:14

Prof Limson

[redacted], do you see this as potentially opening up new spaces and roles for journalists in mediating these discussions, especially from, you know, contentious issues such as GM?

00:14:03:03 - 00:14:29:00

Speaker 2

So, it' s quite difficult this word journalism implies that you're associated with a journalistic institution of some kind. So, I think that's where the difficulty comes in in my head. So, are you working for a community media organization, in which case your positionality could be quite different to a commercial journalist or public broadcaster? The SABC, for example.

00:14:29:00 - 00:14:56:31

Speaker 2

So, when you say journalism and ones one uses that term, you know, it's a bit tricky because there are different political economies for different kinds of journalists. So, it's possible that journalists could play a role in all of this. And should and particularly, as I say, around the politics of it, because you're talking about influence on policy and that's about science policy, but it's also about political economy issues around land and so on.

00:14:56:33 - 00:15:23:11

Speaker 2

So that's quite a complex and then the question, As a journalist, are you doing the journalism for a hyperlocal community? That's a very different kind of journalism, or you're doing provincial or national journalism or writing for the New Internationalist and looking at journalism, land politics globally, you know what I'm saying? So, it's all these levels. But I think what you guys proved is that there's almost like a spectrum of different kinds of communication work.

And it really depends on the way you're locating yourselves. And you could make an argument for your word journalists to some extent, but you were also communication for social change people. And I think the the the problem in the journ School is that we've always framed things as journalism and we've done less, well we do things like strat comms,

like a PR person who works for governments or NGO's or whatever as a strategic communications person trying to advance the interests of, say, working for the research organization, for example. But what we don't do is we don't teach students how to be independent communication for social change people, which is a different orientation and it's divorced from a specific interest group, it's there to kind of help communicate, discover their own interests and communicate and find a way to communicate themselves.

So there's a lot more sort of it would be almost participatory from work where they would help collaborate on making a film, maybe once they're actually using the GMO, they would actually be in a participatory filmmaking relationship with you in making those media productions. So that moves much more into a more developmental terrain. It's also about building developmental capacity in those communities.

But this I mean, there's just a lot of confusion, confusion over layers of multiple, you know, fields of practice. And I don't think it matters too much in this regard, but it might be worthwhile getting into those distinctions later on as more of these sorts of projects come as well over time.
00:17:01:27 - 00:17:03:38

Nontokozo
Sure, yes Alette?

00:17:03:39 - 00:17:34:26
Dr Alette Schoon
And I think what's interesting to me in this talk about increasingly because of the crisis in journalism, in terms of jobs, etc. that what we are producing are students with a journalistic mindset and that mindset is about independence and it's also about awareness of and siding with the public and being aware of public debates. So, I think that's one of the things that a Nontokozo and her research was putting forward.

00:17:34:26 - 00:18:04:19
Dr Alette Schoon
So she became aware that a lot of the debates around GM were about, you know, whether glyphosates were safe or not. And she also became aware that the small-scale growers couldn't afford, you know, herbicides anyway. So that's why she asked the scientists in the past, because these GM's were associated with big corporations and also sell those glyphosates, you know, that was something that they did.

00:18:04:19 - 00:18:40:22
Dr Alette Schoon
But now that the patent has expired and a very, you know, a communal organization like the Sugar Cane Association, can actually, you know, set the rules to some extent. Could they allow these small scale growers to grow these GM crops without using glyphosate and just, you know, and weeding like they would normally do? So for me, I mean, that was, you know, an interesting example of that, you know, publicly minded, independent sense of the kind of journalistic orientation.

00:18:40:22 - 00:19:07:08
Speaker 3
Yeah, thank you so much. It's a very interesting topic and a lot of thoughts about it. But I just come back to this question that was brought up regarding the land and politics of the because of the, I realise, also where who takes the responsibility of that, because as we saw on the video, the scientist that was in the discussion said, okay, it is what it is.

Meaning we can't really solve this. So I guess it's very much like for without being a journalist myself, I'm feeling that there is some kind of half of the journalistic work is to actually carry that, that input because the community is putting themselves out there saying this is a concern for us. Then as a mediator in that space and who has initiated the space, you need to take care of that input, do something with it, because otherwise next time someone comes up, you bring it up again and no one doesn't do anything else with it and say, Oh, that's too bad.
That is like you're undermining that kind of engagement. You need to show that it is carried however you can. And I think journalist has the potential as was brought up, bring it into a wider discussion, something you're not supposed to solve it, but... So that was somehow carry

that thing and I think that's the responsibility of engaging people in these kinds of processes whose lives are just a reflection.

I was just curious about this. It was brought up around the benefit or the value, you could say. Like, what are some of the communities engaged? I think that's it is how much did this project engage in what why were the small-scale farmers willing, if we focus on them, to engage. Was it that they saw potential to benefit beyond like further benefit or mostly thought business as usual is not working? Are they driven to engage by it by saying this is unsustainable?

The situation we have or is that they're calling this situation sustainable but they see a potential of further benefit? So that's quite different motivations of what kind of need are we talking about? So I think that's very much different in how why people engage and how and I think, that also comes to this question of value through this kind of process because it can be that the benefit can be an economical course the new development in terms of getting new contacts so you can have the potential values of knowledge, of the like, you know, the information channels and some who realize about you, maybe new practices came out of it.

So, I think when we talk about benefit, and value, I think we need to pay further attention to what that means. You can actually create nuances.

00:21:56:38 - 00:22:20:38
Nontokozo
I think with regards to the first point you made about realizing that this I mean, there's a need for carrying that input of the concerns that the farmers brought up about land. I think it's something I've been I've been thinking a lot about throughout the process because to me it feels pointless if there's nothing we can do about it, because then why do we even engage them?

00:22:21:09 - 00:22:29:11
Nontokozo
So I don't know, maybe there's opportunity. The approach to further some research, I don't know in that in that area.

00:22:29:35 - 00:22:58:35
Dr Alette Schoon

Maybe something that wasn't really in the video which is quite important is that as well, I think about a quarter of the actual yield of sugar cane in South Africa is lost because they have to harvest the cane early or else these insects that live inside the cane- the Eldana insects, kind of lava, eat it from the inside. So we lose a huge amount of revenue in South Africa because we can't spray since they live inside the cane.

00:22:58:35 - 00:23:23:48
Dr Alette Schoon
They live inside the cane. So that has no effect. And what's happening now is with climate change, these insects are moving into the areas where the small-scale growers are actually planting. And they are they predicting that they're going to be a huge threat. And that's part of the reason why SASRI saw the importance of engaging.

00:23:24:15 - 00:23:36:49
Post-doctoral fellow 1
In these things. And I think it's fascinating process of just discussing things in the most. I

was just thinking through the when engagement took place, so maybe I need some clarification on what or whether SASRI was able to come to the community in advance said to To ensure that they actually needed.

the GM sugar cane or was the engagement happening as a result of the funding and then let's go to the community because I learnt in the video that they' re not actually comfortable with the GMO approach and was almost yeah.

00:24:09:03 - 00:24:30:21
Nontokozo
So one of the things that's not in the video I said to the scientist when he had that conversation after watching the video was, I wish we started this process before that the technology was approved by whoever approves it, because then it would have been more, you know, more effective for us to do the engagement, because if people are uncomfortable, then why we continue with it?

00:24:30:43 - 00:24:49:17

Nontokozo
So they are really doing they are really developing it and they probably it's over ten years. It's going to take ten years to develop the GM cane. So they've started already really. And I stand to be corrected and it's is it about seven years left now because we've been into this. It's this is the third year we've been doing it.

00:24:50:09 - 00:25:00:33
Nontokozo
So they've already started the process of of developing the GM cane. It's it's going to happen anyway. So we kind of feels like we jumped on the wagon.

00:25:00:48 - 00:25:03:28
Alette Schoon
What they said is it's going to be a choice thing.

00:25:04:07 - 00:25:05:20 Nontokozo Of
course, it is a choice.

00:25:12:36 - 00:25:17:23
Post-doctoral fellow 1
Raised with the mention of the communities are full on. That's always like sort of critiquing that. It came from the top and it was like SASRI was like we are developing this.

Communities, this is the product and then the engagement happened as a result of a predetermined thing?

And then so I'm also interested in the issues around power to be able to make the stakeholders the more national key stakeholders to consult. And I was just, you know, using the video as a way to see it's like, you know, like use my mother over in my European Union excluded from starting to solicit from the utility. I don't know how you're able to make miracles symbol wasn't these ancestors of these boxes so not so much the people that are really doing this want to use that option do you just have to like what would they need to get out of the program and then maybe those elsewhere just a modest presentation.

00:26:32:08 - 00:27:03:36
Nontokozo
People that so I appreciate that comment. We saw how the mapping process happened is we we engaged with the extension offices and then they directed us to the relevant people. But they were in sugar cane farmers. There is particularly one young person who is in one of the videos I show to the farmers. So she's not in this final documentary.

She's a small-scale farmer and she is interested in these kinds of interactions. Her name is you and she she's also got a degree in geology and all of that. So she says in in that I guess I'll see first part of the video, the documentary which is directed signs is that she once wishes for these kind of opportunities to happen more often.

And it says you can also involve them in the process of developing any technology and from right from the beginning. So she's one of the few young people who or she's the number to remember the figures, but she's a small representation of young people within the farming and space sugarcane farming so yeah so there aren't many she can farmers and obviously our civic backing was done through sesame extension offices.

00:28:07:46 - 00:28:38:10
Speaker 2
And not just empty bearings, you know, scientists. The next bit of what you find is and this is a key sentence, I'm just wondering in general that is outsourcing these activities, whereas I see but I also see like the scientist division just watching this video and I wish it was the game and you know what you seen, see the scientist.

00:28:38:32 - 00:28:44:44
Speaker 2
So, you know, also part of what you're doing, this is just the other way around.

00:28:45:01 - 00:28:47:14
Nontokozo
I get it so well.

00:28:47:14 - 00:29:20:16

Post-doctoral fellow 3
The reason is mainly that we can change the mediation to reduce that. You know yes there's this whole theme of the scientists are to reason with become more in tune with the science is is while they are still busy. I don't know maybe you guys can comment that so it's not just you mediated by transferring the information that can be translated in a way that we can help to make.

00:29:20:16 - 00:29:46:29
Nontokozo
And there's a question there. Is it related to your one? Okay. I was well, I don't know. I also wonder because I when I had a conversation with the scientists, I they they said they particularly said that they they don't they are not involved directly with farmers. It's the extension officers who are directly involved and that's why they it.

00:29:47:36 - 00:30:22:11
Nontokozo
And so they also explain that they they get told what to do. And so their research is lab based based on, I guess CSA in this instance. So maybe then the conversation should be around. Is it possible for policymakers maybe like within CSA to, to, to actually put involve themselves directly with communities because they're the ones then who kind of give the scientists what to do.

00:30:22:11 - 00:30:32:26
Post-doctoral fellow 3
Yeah, it's more than participatory. It's like the multistakeholder approach process throughout course. This is the process.

For reasons because this is where most of this piece is. I'm just thinking about it.

00:30:42:24 - 00:30:45:08
Nontokozo
Yeah. Yeah, I hear you.

00:30:45:08 - 00:31:11:08

Post-doctoral fellow 1
You put it all in one piece. That's right. Part of my previous master's and research development agency. Things around social activism and. And nobody else. But maybe do that for you.

00:31:11:45 - 00:31:15:38
Speaker 4
Oh, well, I. My experience was a bit different, but I just would just be.

00:31:16:09 - 00:31:36:43
Speaker 4
The first people. So, here's what usually happens and we try to scoop on that because that's what you study and that'll also come back to solve the problem and realize that this information, which has been.

00:33:34:32 - 00:34:15:45
Post-doctoral fellow 3
You know, something will come up and end up talking about when you woke up like this kind of amusement, that big improvement point here is where is engagement taking place, for example, in that case, I could imagine there's also a big difference between engaging communities in a community center or a like figuring segregated group away from their practices versus actually, if you like, is working with practitioners in the field, for example around the Eastern Cape and farmers is it helps a lot to get into a deep conversation.

If you interview with the farmer then they can talk about what they are doing and it's also going back to the power that it is very different because you're suddenly in your home field. It's there, they know this, you're doing you're the forum and that's not just from coming from outside of it, but in that space they are very comfortable that because they are there every day.

So you're there doing things with them and you talk about their concerns because it's also that you get such a more mainstream, a deeper understanding of what these kind of needs are. The challenges are because you can you can see how it's been grown within their practice, rather bending, having to explain to you and often in a maybe not often the language, which is not their first language, you know, kind of.

So we're not. But I think that links also into this kind of mediator role is that you're trying to bring scientists into a room where they are not using, they are maybe using in the lab you bring them that you did community to the same group but neither of the people you are engaging or mediating from these and the home field.

00:35:59:09 - 00:36:32:34
Nontokozo
And I guess that's also what we're trying to achieve as well through this process. And, you know, hence, you would have seen us in their homes and in their fields and having this in their own spaces. Yeah, I think you've kind of touched on that in most of the questions. I was going to ask one question particularly I'd like to ask is would any of you guys use this this model as a as a model for your research as yes, right.

00:36:32:48 - 00:36:44:03
Post-doctoral fellow 3
Can I ask the question? So, I mean, I think the it's clear that society has made the decision to develop the chain.

00:36:44:20 - 00:36:44:42 Nontokozo
Yes.

00:36:44:44 - 00:37:33:40
Post-doctoral fellow 2
And then at some point stop and then the process sort of of mediation unfolding. But can I ask, I mean, would it be possible, you know, is it in the bounds of possibility that science could take its cue from the communication for social change process? In other words, if you were to work with a community, the farming community, for a length of period in a sort of prairie sense of developing community capacity in that community, getting that to find for itself a range of issues from its own perspective really map the problems of politics, access to land, access to markets, access to credit, access to technologies, access to you know, there's so many things that

the farmers actually need to, you know, to develop their agendas, if you like. And, you know, once that work is being done, then, you know, it feels like it needs to be a cross-sectoral approach. So, what can scientists do? What can you do? What can you do? What can you know? There's so many and that's what government is trying to work out.

How do we get out of our silos? How do we collaborate across these different sectors and have a holistic response to the complex situation that those bodies find themselves in? So that I mean, scientists are aware of all of those other deep conceptual contextual issues that those farmers are facing. They know that it's not just about the science is no magic bullet science solution to their problems because this problem with the economics of markets, you know, marketing and, you know, and land reform and, you know, they understand that more holistic decision.

Scientists become aware of the holistic context within which they're working and they take their cue from that. So whatever innovation says, you know, anyone at any other scientific institution wants to take up their starting points is really understanding the community's needs and interests right from the beginning before they come up with a general solution. There is far deeper way of who that community.

00:38:58:37 - 00:39:00:49
Nontokozo
So what is your question to me?

00:39:00:49 - 00:39:01:35
Post-doctoral fellow 3
My question is;

Would it have made a difference to you if if instead of sort of saying says he wants us to do this work and they got this GMO solution out of the immediate community, would it not have made better sense for you in a sense to help them to understand all of that stuff that you retroactively uncovered?

00:39:21:06 - 00:39:21:19 Nontokozo
Yeah. 00:39:21:36 - 00:39:22:13

Post-doctoral fellow 3 If
you were going to.

00:39:22:13 - 00:39:42:09
Nontokozo
Say most definitely, I would have mentioned it to Dr. Snyman when we had the conversation that I personally feel like it's it's a process that we should have started right at the beginning before they made the decision on whether or not they're going to go with this new innovation.

So, yes, I definitely do think it would have made a huge difference for me as well as a person.

00:39:43:32 - 00:40:03:13
Nontokozo
And also these are the kind of things I reflect on as we go in the process. And I don't know, I don't I'm not sure how I'm going to deal with them or handle them in the process of completing the writing and all of that. And maybe it's an opportunity to continue with the process of the research. I don't know yet.

00:40:03:13 - 00:40:04:28
Nontokozo
What did you have a comment?

00:40:04:47 - 00:40:33:25
Speaker 5
Oh, yeah. Just just to say I did love the push that you used and I think that's also what you're trying to do now, is that you produce that value just because of you also learning from what you have done through the auto pilot testing 2013, trying to get into the communities just to go through and find out what are the issues and know what to plate and then try to to in that and independent feedback.

00:40:33:37 - 00:41:04:49
Speaker 5
But I just wanted also to commend you for coming in terms of the engagements that led some years, but said engagements that happen at the local level are those that I've been involved in.

Then those engagements that you look at admission of public. So it's very difficult sometimes to to have this vision for quality development, to have these local communities being involved in having a say in the project.

00:41:05:39 - 00:41:34:22
Speaker 5
And that's why sometimes you end up having these small scale farmers really, or solutions that just come to dense top down and bottom up. And also maybe the challenges are different, but the community may be a community that's growing, which is a community. Some kids don't have really the same challenges as the one in the city. And so they have to them to be different strategies by which those problems can be solved.

00:41:34:40 - 00:42:01:14
Speaker 5
But one other thing that I wanted to say is, apart from the scientist community and in journalism engagement, they're also other stakeholders that need to be engaged and especially. What do you look up to when it comes to the land issue? Because those people, those people have to come to the fold to also then provide a solution on how they can then deal with that particular land that's been involved.

00:42:01:14 - 00:42:37:31
Speaker 5
The polity politicians are also really very important key stakeholders as far as these things that you're concerned. So I don't know if journalists when you planning now that you have issues that are coming from the community or are you planning then to look for would you engage is what is within the linkages consent is what is how then can you build confidence that if this plan is to come to farmers, can we have confidence that because one thing that's very difficult is change for them to change from the normal which they had done for all that period of time.

00:42:37:31 - 00:42:54:40
Speaker 5
And they have something that they've got to do that if they do this this year, they're going to get so much out of it and begin to kill 1 to 3 things. Not if a new thing comes in. They might

see it as a risk that they might actually lose everything. And they don't they don't have confidence that there will be something out of it.

00:42:55:04 - 00:43:23:05
Speaker 5
S, my point is to have confidence in this promise, we need to have more stakeholders like the scientist being back in the ground to help them see this. It will be up to you. What are you still going to take if you decide to take on this? Because we have proven that this is going to wait and they knew that you can expect if you do use this technology moving forward.

00:43:23:14 - 00:43:56:39
Speaker 5
But also the other factors like what are the what is the impact that particular to mitigation is going to be? Because I think it's about the end of the day. What is the impact it's going to bring to the community, whether is news wise, whether it's economic, whether it's in terms of the environment, how severe the environment can be or even in terms of the expenditure being cut down, because now they no longer need to spend on these pesticides and now they're using biogas, which are also environmentally friendly.

00:43:57:00 - 00:44:14:01
Speaker 5
And all those other things that need to be explained. But I think the same needs to also in a better position to explain that. So instead of you taking the information from the scientist and bringing Donne back to the people, maybe she also helps the company to actually solve that problem.

00:44:14:26 - 00:44:32:18
Nontokozo
So thank you. Thank you for this. In the market for shaded. Okay. I think I think we've covered most of these patients without actually asking them O numbers. The only actually answered whether he would use this research and you've got.

00:44:32:30 - 00:44:57:15

Post-doctoral fellow 3
Yeah, yeah I think you can let me use that to how we understand to this is going to be the mediating approach. But so what that one mediating is because I see here there's a number of steps. So the first thing I would do if I try to use it is to really delve into what we need to do.

I see mediation is happening in the actual media programs. That kind of video, you have an animated character that's part of the mediating tool, but he's also mediating practices in the process that mediate between groups. But then I think what I would delve into really try to understand in order to use if the mediating experience that we can offer is all we can offer people in terms of meetings, of understandings.

But we also need to think about what kind of who can make up and can't really control that and how do we create kind of an experience with people who need to mediate themselves is also important. So we are not maybe mediating for people, but mediating with. So I think that's I see a huge potential in this approach because I would need to delve into those kind of concepts to to feel like I have a strong conceptual foundation, methodological work on these about how do I like you could think about it doesn't fear objection what is happening here what do you expect from how is the topic of this instead of just offering and then

you end up with like a clouded box or something? We'll have that hopefully. I want to understand those thoughts at least also so. So that's when we'll be like.

00:46:30:34 - 00:46:37:45
Nontokozo
Okay, okay. Thank you.

00:46:37:45 - 00:46:41:47
Post-doctoral fellow 1
Everyone is connected. And what do you say.

Appendix 7- The Mediation Model Documentary Transcript

The Mediation Model Transcript

00:00:12:21 - 00:00:44:19
Speaker 1
Hi, my name is Nontokozo, your host with the most. Okay, maybe not so much, but here's what I really am. I'm a science and gaming researcher who's interested in taking you on a science engagement journey. So come join me.

00:00:44:21 - 00:01:33:23
Speaker 1
Almost a year after COVID 19 and months of being restricted by the lockdown, we finally got to travel to KZN after some restrictions were lifted. It was exciting to finally get into the field and do this research to find out what role journalists can play in mediating engagement and scientific research.

00:01:34:00 - 00:01:36:13
Speaker 2
Hanging on to pleasure.

00:01:36:15 - 00:01:41:14
Unknown
You tweeted and just like this.

00:01:41:16 - 00:02:09:02
Speaker 4
And I think at the moment I can think of the research we did. I think just three would be interesting. But yeah, so this.

00:02:09:04 - 00:02:30:16
Speaker 1

I can only imagine how difficult it must be for scientists to communicate science because it is such a fascinatingly complex field. Well, that's why I'm here. I can't promise that I will make it any easier. But what I am going to do is take you through a new approach to science, communication and engagement that I'm hoping you will get to engage with at the end of this video.

00:02:30:18 - 00:02:39:06
Speaker 1
So sit back and relax as they embark on this journey together.

00:02:39:08 - 00:03:41:19
Speaker 1
This research takes part through an iterative, reflective and responsive process. It involves commercial and small scale sugarcane farmers in the northern and southern parts of KZN. The purpose of this approach to science communication is to foster engagement between the different stakeholders the scientists, farmers and extension officers. Ten nine Science communication originated in the science fairs of the 19th century, but it came a big industry from the mid-twentieth century onwards in the efforts to involve the public through engagement and a nonpartizan holistic top down a science public relationship.

00:03:41:21 - 00:04:23:01
Speaker 1
Scientists got involved in festivals like Safest Africa. However, although a progressive approach from a top down a science public relationship to science engagement critiques still recognized this as a deficit model. As there is an opportunity for a more engaged approach to science communication, one that involves the public as active partners in the early stages of the research. For example, the South African Science Engagement Strategy, as well as the European Union's Responsible Research and Innovation Strategy, aims to develop a critical public.

00:04:23:06 - 00:04:24:04
Speaker 4
That actively.

00:04:24:04 - 00:04:33:07
Speaker 1
Engages and participates in scientific research. It sees the public as partners who can offer valuable indigenous and.

00:04:33:07 - 00:04:34:24
Speaker 4
Local knowledge through the.

00:04:34:24 - 00:05:00:20
Speaker 1
Testing when they do the testing. We also discuss around ways of cleaning the water if they find that there's contamination in the water and it has changed. The public can also practice active citizenship by raising concerns about ethical issues or the potential harm or benefits of a new technology. All of this kind of feedback helps scientists to shape their research.

00:05:00:22 - 00:05:39:19
Speaker 1
Professor Janice Lamson says that involving the public from the early stages of the research is what enables science engagement to produce research that is both responsible and innovative. Science Engagement is the active involvement of the public by scientists in science related activities and research as a way to improve the public understanding of science and scientific literacy. It also enables dialog between scientists and the public, allowing mutual learning, transparent communication and democratic representation.

00:05:39:21 - 00:06:18:12
Speaker 1
The necessity of transparent communication through public engagement has always been important, but it has not always been possible because of the limitations of how science engagement has been conceptualized. So can you tell the difference? Instead of scientists simply lecturing the public. Our eye allows the public to speak back and engage the scientists. It is conversational and interactive. In the field of biotechnology.

00:06:18:17 - 00:06:48:16

Speaker 1
Controversy around genetic modified organisms catalyzed a broad mistrust of science communication. The public turmoil around GMOs was colored by misinformation, conspiracy theories, as well as real concerns about corporate interest in science. It highlighted the need for a new era or approach to science communication. This is exactly what placed the field of biotechnology at the center for calls for a new approach.

00:06:48:18 - 00:07:23:02
Speaker 1
Science engagement. Under-reported science Communication was minimal. And black South Africans were deprived of science education in the New Democratic South African context. Science communication was driven by deficit models for a long time to address the racial imbalance in science education. The South African government has realized the importance of making science and technology more answerable to citizens through policies and stresses that allow for this to happen.

00:07:23:04 - 00:08:00:14
Speaker 1
However, what is not quite clear is the how. And so what I have done with this research is implement my idea of the how I've been involved in the science engagement project around GMO crops. And with this project we are testing out a model for science engagement.

00:08:00:16 - 00:08:25:21
Speaker 1
So what we have done in this new model of science engagements, which I call the mediation model, is we've involved journalists like myself to be a part of these interactive conversations. We don't replace the scientists, but we try to facilitate and enhance the conversations. And to help us understand science engagements. We draw from a deep well of ideas, from journalism and communication studies.

00:08:25:23 - 00:08:51:24
Speaker 1
But how to engage communities. We came up with this new model for science engagement as part of a GM sugarcane research project run by the South African Sugar Research Institute. We used it

to create discussions between scientists and sugar cane growers, using media to create a deeper engagement.

00:08:52:01 - 00:09:15:15
Speaker 1
The first step of the mediation model was civic mapping, which is a tool used in the field of journalism that I will unpack in more detail later. This we did by interviewing sugarcane extension specialists who could point us to commercial and small scale sugar cane growers. The sugar cane industry in KZN takes place over a vast geographical area.

00:09:15:17 - 00:09:33:18
Speaker 1
And so we worked with Sastry to identify two typical geographical spaces. These were the northern and southern parts of KwaZulu Natal. If you happen to know KZN, you might have heard of dengue in Louisville and protested. Yep, that's where we were.

00:09:33:20 - 00:09:53:20
Speaker 5
In the sugarcane per annum and that is classed as a commercial grower. So the growers that we'll be interviewing tomorrow are all right up there in terms of high tonnage. So they will deliver anything from sort of 15 to 30000 tons of cane per annum, which is quite a big operation.

00:09:53:22 - 00:10:33:21
Speaker 1
From these interviews with the extension specialists, we developed a survey to help with the mapping process. It focused on things like their demographic representation, their understanding of biotechnology and GMOs, their communication preferences and their relationship with farming, sugar cane. As part of our process, we did not wait until the end of the study to reflect on things. In fact, every step along the way involved us doing something and then reflecting on it, changing our approach if needed, and then carrying out the next step of the research.

00:10:33:23 - 00:10:35:16
Speaker 1

This kind of research is called.

00:10:35:22 - 00:10:37:06
Speaker 2
Action Research.

00:10:37:08 - 00:11:04:09
Speaker 1
And is known for having cycles of action and reflection. So based on what we got in the questionnaire, we could decide if our science engagement was working and this issue changed, tech or not. What we find from some of the questions, the answers is that most sugar cane growers knew very little about biotechnology. Most had heard something about GMOs, but didn't really know enough to tell a friend about them.

00:11:04:11 - 00:11:28:24
Speaker 5
How knowledgeable are you about biotechnology? On a scale of 1 to 10 of one device? Yeah, I'd say probably four. Not not to to queued up on that sort of thing. So I know the basics of DNA, but are not yet fully three or four out of five. Very little, except that I'm a great believer in science. I'm a great believer in progress.

00:11:29:01 - 00:11:58:00
Speaker 5
And I believe we had a setback in agriculture or in any kind of sphere, whether it's machines or industry, and set out with what we had in 1600 and expected just to develop quite along those lines. We wouldn't be near where we are today. And I believe that science and its knowledge applied to not only farming but everywhere is vital for the improvement of the development of our country.

00:11:58:02 - 00:12:24:14
Speaker 1
We realized that this step worked really well for the commercial growers, but somehow not precisely the same way for the small scale growers based on the results from the survey. We figured that it would make more sense to spend some time with the small scale growers. Doing

some in-depth civic mapping through video. Video would help us see the different challenges those growers faced and visually put us in the environment.

00:12:24:16 - 00:12:51:10
Speaker 1
See, they are not called small scale growers for no reason. Access to farming land in order to make profitable returns when farming sugar cane is a significant barrier for the small scale growers. But we wouldn't have known this if we did not sit down with them and chatted about deeper issues than just those of farming sugar cane.

00:12:51:12 - 00:13:27:07
Speaker 1
If they haven't got already, what I've just done is explain cevik mapping in more depth, using a practical example. We use this tool to identify the catalysts and connectors to find ways to involve them in the research. It also implies the right to participation and the planning of any communication that needs to happen. Part of the reasons why we use civic mapping as a tool in engaging the public as journalists is so that we move away from not identifying the public's real concerns and rather what we think is important to them.

00:13:27:09 - 00:14:04:12
Speaker 1
Part of engagement is listening as well, and it is important that a new science innovation is one that is relevant to that community. Now that we have all the information we need, operational scale grows and we've gone through a reflection process. The next thing to do is develop the communication media, but just take a moment to listen to how we incorporate development journalism into this parts of the mediation model into opportunities for social development journalism is the idea that the community must be the point of departure when communication or research is happening.

00:14:04:14 - 00:14:33:07
Speaker 1
This implies the right to participation in the planning and the production of whatever communication that needs to happen. Development journalism forces journalists to clearly explain how a new development or technology works and how it could impact a community.

While some critics have dismissed it as sunshine journalism, others have argued that development journalism will work best if it foregrounds the voices of ordinary people.

00:14:33:12 - 00:15:26:12
Speaker 1
In examining a new development or innovation in the mediation model, small scale and commercial growers were engaged from the beginning through spending time with them and asking questions about their understanding of biotechnology and their communication preferences. We started creating the media for communication with the growers, so the next step of our science engagement model was producing media. Such media products would not only help the growers to understand the science, but would also help the scientists understand the growers.

00:15:26:14 - 00:15:52:02
Speaker 1
Although not an end to itself. Communication, media and information communication technologies are important tools in achieving social change. Creating a video narrative that helps the scientists get to know the small scale growers is one way in which we can use communication, media and technology. We picked up, based on engagement with the scientists that they do not know the small scale growers very well.

00:15:52:04 - 00:16:26:20
Speaker 1
Therefore, the creation of the video help scientists better understand the people they are creating. This GMO product for. Creating these media interventions also allows us as communication mediators to challenge scientists to consider identifying and using scientifically literate, small scale goals to help with science communication. So we have moved beyond the civic mapping process. We are using information from the civic mapping to enable the two groups to engage better with each other.

00:16:26:22 - 00:16:42:10
Speaker 1

We were able to question scientists and the strategies they implement to listen to their growers to ensure the Aldana resistant and the Mesopotamian sugar cane they are developing is relevant to their circumstances.

00:16:42:12 - 00:17:07:18
Speaker 4
Some questions for the scientists. What strategies can be intended to listen to our brains? To understand whether our obtaining resistance and Mesopotamian gene shooting is relevant to their circumstances? What can we do to make our stewardship arrangements work for small scale groups?

00:17:07:20 - 00:17:12:04
Speaker 4
One of the most important principles for these communities is being.

00:17:12:04 - 00:17:13:14
Speaker 1
Able to identify the.

00:17:13:14 - 00:17:23:12
Speaker 4
Community's needs as opposed to what you think they need. On a small scale, funding is what they need. And tucked in all these tend to lend normally.

00:17:23:12 - 00:18:09:22
Speaker 2
No money. And I'm wondering why we see them winning awards. I know that it's not only if you know a lot more than one of us just can't where it might continue on. But anyone who read more study this to you all day to day. You guys, we would have saved more money. And more importantly. So who will be willing to give you the point of your time?

00:18:10:01 - 00:18:28:09
Speaker 2

I do not know the time. I was maybe like this week or two people knowledgeable. And so to get us. And now I'm going to tell you how we know that some time no one even died.

00:18:28:11 - 00:18:46:14
Speaker 4
September 14. This mean that was the time. This means that to move to the next level and protect. But that's what I'm the choice is tied to the same emotion which I think I can support my people.

00:18:46:14 - 00:18:53:14
Unknown
In my community. Last week.

00:18:53:16 - 00:19:20:21
Speaker 4
I wondered how we sensory processing can help listening to the various ingredients by taking out the structure to help them in the. Is it possible? And the discussion of our team constantly that other issues like the land issue is more pressing? Is there a way we could in the meantime intrigue and concerns, discussions and free means in terms of land so tension drops?

00:19:21:02 - 00:19:51:20
Speaker 4
How could move really table while we struggle for more land saving is a concept that comes from Jainism states and by framing stories, soothing responds opinions. But it concerns science, engagement and creates more interesting conversations. Questions from the scientists Should we spring from engagements about hygiene came from land tenure creates economic models sometimes in came from theories that include small field yields and profits.

00:19:51:22 - 00:19:52:17
Speaker 4
Basically, all.

00:19:52:17 - 00:19:54:09
Speaker 1

I want to talk about is.

00:19:54:14 - 00:19:59:18
Speaker 4
Those possibilities. Is it possible for that kind of.

00:19:59:20 - 00:20:00:17
Speaker 2
You know.

00:20:00:19 - 00:20:01:09
Speaker 1
Conversation.

00:20:01:09 - 00:20:24:08
Speaker 4
To happen? Can you talk about thinking in such a way that we actually bring in an event so that it's relevant as well and you guys don't just make the sugar cane, the gin cane, and then it's like a no. So I think one thing to remember is that we like ostensibly and we are not allowed to do anything we have been told to do.

00:20:24:12 - 00:20:25:03 Speaker
4 Yeah.

00:20:25:05 - 00:20:44:23
Speaker 6
So, so so there is an engagement process where this must go, goes on cue and the law school grows. So they all we have a meeting every year and the brothers come to us and they say these are problems. Yes. And then as scientists we say, well, this is not something we can address or yes, this is something we can address.

00:20:45:00 - 00:21:08:18
Speaker 6

Some some projects are addressed in different ways. So not all projects of science lab based. So they are communication based projects of community based projects. And and there is a recognition that maybe we should be doing more participative stuff. So we are already trying to do that. But but the bottom line is that there's nothing that we can do about land.

00:21:08:20 - 00:21:26:01
Speaker 6
Yeah, I mean, so for them, I get the point completely that GM is actually not their biggest issue. Yeah. You know and so that's that is just that is one of those. So having GM cane is not probably going to make a big difference in my life. I think that.

00:21:26:03 - 00:21:52:00
Speaker 1
So if you are listening carefully at the start of our journey, you will remember that I told you why science engagement is important, right? But I stressed how especially important it is in the field of GM OEs, in case you have forgotten, it is because GMOs are a controversial topic and they have been contested for years as independent journalists raising some of the issues and critiques around GMOs.

00:21:52:02 - 00:22:21:22
Speaker 1
In the video we created for the scientists was very important. For example, we noted that critics of GM crops focused on the use of glyphosate based herbicides. Most of us small scale farmers could not afford herbicides anyway, so we emphasize this way the growers could be allowed to plant the GM crop without using glyphosate. Science engagement then plays the role of transparency and clarification here because so much miscommunication can happen.

00:22:21:24 - 00:22:53:10
Speaker 1
Don't worry, we didn't just focus on educating the scientists about the growers who spent a very long time making sure that we could communicate the science clearly and in a non intimidating way to the growers. We developed a designed animated character who looked just like a typical small scale sugar cane grower. When 99 then we created an animated explainer video with this

character explaining the science to growers in clear, relatable language. 00:22:53:12 - 00:23:25:13

Speaker 1
The growers specifically asked us to spell out exactly what they needed to do if they wanted to plant the GM sugar cane. We responded by making another animated explainer video focusing on all the steps they would need to follow. Creating media based on popular formats of entertainment like iTunes is one of the techniques of communication for development. This technique to engage publics is the basis of edutainment and is a valuable tool for science.

00:23:25:13 - 00:23:55:01
Speaker 1
Engagement. Communication for development, I believe, is using any tools with its message or social media to communicate and more importantly, to help communities develop. And I think that would go with community journalism where we try to not only bring the news out to the people, but also get the people to engage in the news about the community, for the community, and more importantly, by the community.

00:23:55:03 - 00:24:27:07
Speaker 1
I do understand, for example, there was a project I think was the mapping project, which Brett Davidson did many years ago, where he mapped the community and looked at how radio could develop. So I do believe that journalists have used communication for development in order to get the news out there to the people. So I think journalists have used communication for development in, you know, to reach the community.

00:24:27:09 - 00:24:28:17
Speaker 4
You know, scholar.

00:24:28:19 - 00:25:03:07
Speaker 1
Surveys would say that communication for development, open quotes is the nurturing of the knowledge aimed at creating a consensus for action that considers the interests, needs and capacities of all concerned. Post quotes. Therefore, it is a social process, and its ultimate goal is sustainable

development at distinct levels of society. The character used is featured in his video that explains to the sugar cane growers what genetically modified sugar cane is and why it has been developed for them.

00:25:03:09 - 00:25:13:10
Speaker 1
The contents of the video was based on the sugar cane growers communication preferences, which is why there is also a booklet to accompany this video.

00:25:13:12 - 00:25:28:20
Speaker 5
Product to help South African farmers. This product was developed by researchers at the South African Sugarcane Research Institute, the research unit of the South African Sugar Association. This first of its kind.

00:25:28:22 - 00:26:07:23
Speaker 1
So we've done civic mapping and produce media to catalyze engagement. The next step is piloting the media products to see if they are able to produce engagement. Now we are going back to Wesleyan Daily to show this media to the sugar cane growers extension specialists and the scientists. This is important because part of engagement is involving the different stakeholders in all the steps that take place and to have them input on what it is they want to see in the media products that are produced to bring them closer together in terms of understanding the signs and the community who will be implementing it.

00:26:08:00 - 00:26:35:23
Speaker 4
This opens and I'm going to lose the signal. If we do see it. Really, it could cause a mob and basically environmentalists winning wouldn't even move this now, as this is very much available in Maryland. And this is something we all watching in civilian life because the game will only leave Canadian fishermen to succeed Jim and William or sit to see what you do when they need it.

00:26:36:00 - 00:27:20:04

Speaker 4
So it's the same solar movement and legacy left, but simultaneously as elated as has seen music, animals and as Canadian as news impending is that Tesla forces within maneuver section don't have to move she Jackson. I said like this and I'm like I didn't want it and then Netherlands it would seem okay and wouldn't have let us and he year I wouldn't allow my who would mean underneath my dingy because I know it's a losing is the same thing they were like yeah she was me and maybe we'll see a see it's this economy now you will see a Indonesian tens of thousands into wasn't food and a little cuisine that will never move to

00:27:20:05 - 00:27:34:15 Speaker
4 medical services concert in it. I'm not committed to the Canadian civil and the law prohibits business resources of the Netherlands. SIEGEL Is this the Canadian music if I'm sitting here?

00:27:34:17 - 00:27:38:19
Speaker 1
O'CONNOR Urban Democrats, as the Keating is, it is a liberal.

00:27:38:22 - 00:27:39:20 Speaker
2 Force.

00:27:39:22 - 00:28:26:18
Speaker 1
Or to or law. So Saliency womanizer awards the Isaac Israel forces Olympics here as Israeli Mazda is is a numbers game it is Islamic and it in a band Leslie Aziz also Geller Ortega is all globe is it I'm love says I see coke wins and win Portugal and another economy booze or Niamh gallon mobile Coca-Cola unable foods also signs must sesame hunger time that always combined symbol would see also say in zimbabwe peninsula continues or now a lot more but not Coolamon the millionaire Google for less than a nicer or sooner grower day Lapo win and not buying Berlin is a Google sign a nice and in also say and see how we wanna

00:28:26:18 - 00:28:29:16
Speaker 1
Abbasid beans and Gallo more by Opel great will new.

00:28:29:16 - 00:28:31:03
Speaker 2
Boy for so.

00:28:31:05 - 00:28:37:06
Speaker 1
After watching this video the small school girls awesome important questions.

00:28:37:08 - 00:28:39:08
Speaker 4 Came up.

00:28:39:10 - 00:28:52:00
Speaker 2
With a good I want to make it clear but or which you know go China or whatever you may or may have company so what I'm going to NSW of course.

00:28:52:02 - 00:29:30:18
Speaker 4
So it will be a word highlighting the reasoning when continue with this Suzie Suzie Global content slim build I I get selenium called the game team says you also was a team president led me in in being me to ensure they take what they know what she would say more and more that you will see your name so willingly that we've been delays military said it because then I guess was in the name of a woman I became concerned in being to to which is useful for us and God will be dealt with this issue what would.

00:29:30:20 - 00:29:34:18
Speaker 2
You would normal prodromal level or even in.

00:29:34:20 - 00:30:02:05
Speaker 4
Your because you would know what normal woman are by each of them, let's say? Yeah, fine. Sunday most of all, one or more. That what we do is Tom was the most old time of pain that

what we told because this thing wasn't Muslim being for new more Muslim of the soldier or the they would target every Leunig and they obviously are the number of self memory quote.

00:30:02:07 - 00:30:03:00
Speaker 2
Also, it wasn't.

00:30:03:00 - 00:30:04:15
Speaker 4
That it would take.

00:30:04:21 - 00:30:08:15
Speaker 2
No would you know someone in the military which.

00:30:08:17 - 00:30:18:09
Speaker 4
Must look for gay. This was part of the graffiti of my 16 year old because I wanted to them a monkey that's obviously does the same thing the whole thing because we need to.

00:30:18:09 - 00:30:20:11
Speaker 2
Study report and a little more Joe.

00:30:20:11 - 00:30:22:14
Speaker 4
Negative or it might have been such we did one of.

00:30:22:14 - 00:30:26:01
Speaker 2
The most lovely.

00:30:26:03 - 00:30:42:19
Speaker 1

What is important to note from this exercise is how the process has allowed growers to ask questions and have an input on their concerns and how to possibly solve them. They also have a lot of knowledge to add and the possible benefits of this new innovation.

00:30:42:21 - 00:30:51:00
Speaker 4
When it was these were going to live because I think many new ideas in the country would be.

00:30:51:02 - 00:31:19:08
Speaker 2
Built, you know, something that would go away digitally, meaning away from the economy, which enabled them to value excessive, unneeded or seasonal things. And the whole general idea to sell more of their privacy to protect their businesses. And so that when I look forward and then the bulk of the rest of this is much of what you saw in the community did not live in the environment.

00:31:19:08 - 00:31:55:17
Speaker 2
I can identify, but that looks like about a year ago that was a white male on the Internet. We know that this. But when you go put that out there, you have there's a lot of debate on me about it. You was a of alarming just in the water. There are a lot of women in Denver that were fully aware no matter what your child and what it is, not what you.

00:31:55:19 - 00:32:28:06
Speaker 2
Yeah you know we are simply not keen to associate the among on you a my here whatever you want to call it. We really much more in the in the internet the ones we hear and I think it went on Google and became so much of a novelty but my name is I mean I may need to watch but we, I need one of women up.

00:32:28:08 - 00:32:46:13
Speaker 2
We might have done a video shot. Yeah. Yeah, we know you. We said 19 out of 20. Golly, I don't know. My head is allowing them to ahead of fire that we might be able to survive.

00:32:46:15 - 00:33:09:01
Speaker 4
He pointed it at me within a moment. See us are put is a look at this in our society say in my mind you know every moment in a woman and it's and then finally, you know Google GoDaddy this is your cousin. The numbers suggests some of the users are pretty disappointed to see the silly one. It is it.

00:33:09:03 - 00:33:33:22
Speaker 1
Do you see what just happened there? Through this interactive partnership, we have tried to mediate. The small scale growers raise a concern that is crucial for this new technology, which is the refugia that needs to be planted as small scale growers. They do not have big enough land for this. So what is the way forward? Is this technology even relevant for them then?

00:33:33:24 - 00:34:01:18
Speaker 1
This is the conversation we had with scientists and it is an important issue. They need to engage and find a possible way forward. What is undeniable about this media piloting step in the process is that it is interestingly interactive and engaging, which is exactly what we said we aim to do through this mediation model. It is exciting to see all stakeholders participate in this process as they have the final step in.

00:34:01:18 - 00:34:28:12
Speaker 1
Our model of the mediation science engagement model is going back to implement some of the feedback we have received. This means drawing up guidelines for how these sciences anchors can based participates in meaningful and productive science engagement. It is in this stage of the process that we journalists have done our job bringing the scientists and the affected communities together in kind of a session on an issue.

00:34:28:14 - 00:35:02:05
Speaker 1

So to summarize, the mediation model is both around cycles of action and reflection, hence the mapping, the survey, the making of the media, going back to pilot the media, the interactions and feedback from the growers and scientists. This makes it an action research project because action research scholars Greenwood and Levin would say is based on the process of collaboration as it involves local stakeholders, as full partners and knowledge development.

00:35:02:07 - 00:35:26:02
Speaker 1
But the most important difference of our science engagement model is the role journalists can play in it. We believe that journalists, with their strong sense of independence and their commitment to the public interest and engaging the public can be a real asset to science engagement. They can help bring about mutual understanding between scientists and growers and kick start the conversation.

00:35:26:03 - 00:35:48:18
Speaker 1
And journalists are trained in using ideas from journalism and communication studies that have deep understanding of different approaches for engaging the public. So now that we have come to the end of our journey, I want to ask you a few questions. Firstly, what were your thoughts as a scientist on this model? Is this the kind of model you would use to approach your research in future?

00:35:48:20 - 00:36:29:21
Speaker 1
Why would you invite a journalist to be a part of your science engagement project? Let's chat a project by the School of Journalism and Media Studies and the Department of Science and Innovation in our Research Chair in Biotechnology, Innovation and Engagement, Edwards University, funded by the Technology Innovation Agency, Department of Science and Innovation in Biosafety, South Africa.

Appendix 8- Scientists Focus Group Transcript

Scientists Focus Group Transcript

Good morning, everyone, as [redacted] has said I am Kyran Blaauw. I am a MA student in JMS at RU. I am quite excited and fortunate enough to work with SASRI and Biosafety on developing communication material about the sugar cane. So, all of the material you will see here today comes from on our initial survey that Nontokozo and I administered back in Feb/March with some sugar cane growers; commercial, small and land reform growers to get their understanding of what GM cane is and how it will work and also what their responsibilities will be in terms of, should they decide to grow GM cane. So, this material is not developed to tell growers that they must grow GM cane but rather to inform them what GM cane is and responsibilities, etc. etc. so the reason why I am sharing this material is for me to get your scientific inputs on what you think of the material, what should be changed about it, what should be changed about it, what should be clarified about it. So, thank you so much again for coming through so I can get your inputs in it. So, I've spoken to extensions and growers and I thought it would be really important for me to speak to scientists as well. Uhm, so there are two videos. Both videos are animation videos, it's what are your responsibilities of GM cane and what is this new SA GM cane. And then most of the material that is in the two videos has also been elaborated briefly in the print material that I am hoping once everything is approved to be circulated amongst cane growers. So, I'll show the first two videos then we'll have a brief discussion about them, then we'll come back, then I'll hand over to Nontokozo who also has a video she would like to show you then she will also have a discussion around that. On your tables you will see there are packs of documents, in the packs there's an invitation that outlines what the study is about. If anything, you feel uncomfortable with you are more than welcome to email either myself or Nontokozo, our details are at the back, or Prof Janice Limson or Dr Alette Schoon on the details provided. Then there is a media release form because we are recording some of the material on camera and also probably we'll be taking some photographs; you can read through that. I will give you 5 minutes to read through that and there's also some questions that Nontokozo has put on the table. So, I think we'll start at 10 past. So, the people who have already signed the documents, you've spoken to Nontokozo or myself before, you don't have to sign it. If this is your first encounter with us, please read through it, sign it or if you have any questions about it, please ask either myself or Nontokozo.

Scientist: So, just for the SASRI people, we have signed, SASRI has signed an agreement with Rhodes University to say that it is fine.

Other scientist: We don't need to sign this?

Scientist: You must sign, but just an overarching agreement, SASRI has agreed to, that our staff can participate in it, so its not that no one knows about it.

Scientist: So, Kyran, can I just quickly check? So, can we just make some note? So while your video is on we can make notes, if we pick up on any scientific inaccuracy do you want us to say that or what do you..?

Kyran: Scientific or any other comments, so after that I will just ask for comments so please do make notes for comments.

Scientist: And can you tell us what the response has been so far from the growers or do you want to wait until afterwards?

Kyran: I'll wait until later but there were so many questions about the refugia

Scientist: Ahhh, my gosh. OK, that's for the entomologists.

Watching of video

Scientists: Yeeay.

Kyran: The floor is now open for comments, critiques and questions.

Scientist: It's really great. I am so impressed with these Journalism students and all this complicated scientific terminology, so well done for synthesising it. I just have one small comment; I really love the moths, but in the slide where you say the Eldana gets killed by the plant or something like that, it's actually the Laval stage that gets killed. So, if you think about the life cycle of the insect, it starts off with the two moths, male, female; lay eggs, the eggs hatch into lava. And it's the larval stage of the life cycle that munch into the sugar cane. So it you can create some, like, little worms instead of the moths on the sugar cane- that's the damaging part. So that's the only sort of incorrect…

Kyran: so, I just want to go back to it.

Scientist: There, so it's actually the anti-insect protein affects the larval stage of the life cycle for when it actually munches on the cane, so if you can tweak that and just have a lava instead of a moth, I think that would be perfect.

Scientist 2: While we're on that slide, I was just wondering why you chose to use just that bit of the plant.
I realised you used that icon of the plant throughout, but is it worth putting anymore in?

Scientist: I think it's fine. I think the message for me gets across. Why, do you want to see more of the stalk or what?

Scientist : Ya, I think I would quite like to but it's really not a must, I don't think.

Kyran: So if I am understanding correctly, so maybe just dropping these…

Other white female: Maybe one leaf

Kyran: OK, one leaf and then the stalk of the lava inside the muncher.

Scientist: Ya, ya. That would be amazing. Even your t-shirt, it's so brilliant. We want t-shirts like that.

Scientist: So even if you use that little logo with the lava on the outside…

Scientist: Coz they bore in, they make little holes and go in… So, I also love your presentation and I do lectures to people who do junior certificate courses and I would love to show your video.

Kyran: Uhm, I don't know about the logistics about that.

Scientist: OK, of course

Nontokozo: I think once we have gone back and developed the media then you can but for now it's still a process

Scientist 2: It's such a valuable tool because you have really synthesised it really well. It's really nice. Well done, Kyran.

Kyran: The other comment is; because people tend to view science as more realistic but now I've animated this, does it make science behind GM cane illegitimate or does it still make it factual?

Scientists: no, it's perfectly factual. It's fine. I don't think it takes anything away from the science. If anything it makes it more appealing

Kyran: What about the language use, was it too simplified, complex?

White lady: No

Scientist1 : I think it's fine, just one thing that I noted, there is a nice break down of the background of the BT protein and everything but I missed the part about how then it equals to herbicide tolerance because I could see you spoke about the insect and the plant producing its own insecticide but then there was herbicide tolerance that was thrown in so I think it could be interpreted as insect tolerance is also equal to herbicide tolerance.

Scientist 2: Yes, you're right, [redacted]. There wasn't like of an intro of how the herbicide tolerance got in.

Scientist: So Kyran what happens, is that for the BT, so you show that soil bacterium perfectly, so you took the gene from that and put that into sugar cane but the imazypar tolerance is a separate, it comes from a… it's actually a mutation of a plant enzyme but that sounds scary. I don't want to freak anyone out.

Scientist 2: Let's not use that word

Scientist: We can help with the wording a little bit. I think [redacted] got a great point. Let's just ensure that the audience doesn't think that the herbicide tolerance also comes from that root because in a way it's a little bit different so you could just say another genetic modification involves the creation of herbicide tolerance in the same plant using a different mechanism. You can even use those words. In a way it doesn't really matter what the mechanism is.

Scientist 1: Yes, it doesn't.

Scientist 3: In the beginning you mentioned insect resistant and then imazypr that's what the hell? What's imazypr? If you're going to say insect resistance then just say herbicide resistance.

Kyran: We had that conflict as well, and was like should it be imazypr is it herbicide resistance. So, which one would probably work best?

Scientist 3: At the beginning, herbicide but at some point you need to mention a specific herbicide

Scientist: And that's the imazypr

Scientist 4: People will immediately think glyphosate

Scientist: Which I did pick up on before, remember?

Kyran: Yes

Scientist 1: Just to ask one question, if we know whether the growers know the herbicide as arsenal or imazypr

Scientist: You're right, [redacted]

Scientist : We can't really mention arsenal otherwise there will be more frustrations…

Scientist 1 : Oh, OK

Scientist 2: Is there another name under which it's known better?

Scientists: No, not really.

Scientist 2: So it's just imazypr

Scientist: So imazypr is the active ingredient, the same as glyphosate is the active ingredient of round up and all the other springbok or I don't know whatever they're called. So it is correct, but yes, uhm…

Scientist 3: Even as imazypr, they're…

Scientist: They might not know it. There's nothing you can do about it

Scientist 2: But if you have said herbicide at the beginning, they'll know it's a herbicide

Scientist: Yes, correct.

Kyran: So if you had the video, for example one of the specialists asks you that I've shown the video to my scientists, they want to know more, how would you feel about having this video shown and making this video being a starting point to having a discussion with the growers. Would you be able to engage with them and what are some of the questions you think would come up?

Scientist 4: Uhm, one thing that I picked, so when you say is that it won't affect humans, it will affect eldana but it won't affect humans- they will probably ask how? If it's killing insects, why won't it kill me, what is different about me? Would it be too scientific to go down to explaining?

Scientist: So, no, I think in a post video engagement, that would be the level that you would say the protein binds to certain receptors and mid gutter insects but we don't have the same mid gutter as the insect so the protein doesn't affect us.

Scientist 3: probably the simplest way to say it is that the bacterium is an insect disease and people just can't get it like insects can't get a disease from us.

Scientist: Then they'll say but look at what happened with the coronavirus.

Scientist 3: It's not the same thing…

Scientist: I think that is a good question but I don't think that you need to address in the video. So I think this is perfect and then we would be happy to go out to a grower day or whatever form of engagement extensions feel would be beneficial and any one of us can probably answer most of the questions.

Scientist 5: OK, ya, one other thing I was saying just to follow up on your question of saying what happens after this. Because looking at the GM that has already been developed for the other three crops that you spoke about, one of the biggest problems that used to come up; I've worked with GM cotton for about 16 years, so what the biggest problem that needs to be clarified, not on here but in the after thing, there's also that perception among the farmers that BT increases the yield, thinking that if you use a GM crop, it's going to increase the yield. That's one of the things that need a very clear explanation to say because of the reduction of the pest that affects the yield, eventually the yield goes up but not to because BT acts as sort of a catalyst to increase the yield.

Kyran: That exact same question came up in the testing with commercial growers who asked will it mean that my yield will increase

Scientist: Oh really? It's great to have a heads up

Appendix 9- Commercial Grower Questions Video

https://drive.google.com/file/d/1EiWv1XEurD3m5JCngCtHiEYz1ETsHn9i/view?usp=sharing

Appendix 10- Questions for Science Communicators

Interview Questions for Science Communicators

1. Please critically reflect on this process followed on the mediation model. What were your thoughts?
2. What do you understand science engagement to be?
3. Do you consider the idea of science engagement as a viable approach to scientific research?
4. Would you consider including a journalist in your research? Why?
5. Is there any step in particular that was not clear to you?
6. What are some of the things you would consider in using the mediation model?
7. Are there any limitations to the mediation model you picked up?

Appendix 11- Interview Questions for Scientists Focus Group

Questions for Scientists Focus Group

1. How can we identify and use small-scale farmers with science education to help with science communication?
2. What strategies can we implement to listen to our growers to understand whether our Eldana resistant and imazapyr tolerant sugar cane is relevant to their circumstances?
3. What can we do to make out stewardship arrangements work for small-scale growers?
4. Should we frame our engagement around GM cane around land?
5. Can we create economic models about GM cane for growers that include small field yields and profits?
6. How can we center extension officers in all our science communication such as our media products?
7. How do we ensure extension officers prioritize the needs of the growers in sharing the science?