## The Covidiots of the COVID -19 Infodemic: A Systems Perspective

Cecil Naphtaly Moro Ouma<sup>\*a,b</sup> Nancy Achieng Odhiambo<sup>b</sup> and Nixon Muganda Ochara<sup>c,</sup> <sup>a</sup>HySA Infrastructure, North-West University, Potchefstroom, South Africa: <u>moronaphtaly84@gmail.com</u> <sup>b</sup>Data to information, Pretoria South Africa: <u>nancy@aims.ac.za</u>

<sup>c</sup>University of Witwatersrand, Johannesburg, South Africa: <u>nixon.muganda@gmail.com</u>

\*Corresponding author

## Abstract:

**Background**: The paper explores the emergence of *covidiots* during an infodemic in the context of the COVID-19 pandemic. Pandemics are a fertile breeding ground for *covidiots*, who emerge as a consequence of public health infodemic such as COVID-19. The core challenge of a public health infodemic is the distortion of compliance information which inhibits positive public recovery from a pandemic. *Covidiots*, the individuals who are susceptible to, and emerge from infodemic; exacerbate pandemic recovery efforts and interventions.

**Methods**: This paper employs Soft Systems Methodology (SSM), a system thinking analytical lens to explore and explicate the nature of *covidiots* during the COVID-19 infodemic.

**Results**: The role of information *echo chambers,* as facilitated by advancements in ubiquitous (digital) technologies, are deemed as an effective tool in eliciting *homophily* among susceptible digital citizens, resulting in *covidiots*. Societal interventions and suggestions which can be instrumental in mitigating d(m)isinformation) and ultimately emergence of *covidiots* are proposed.

**Conclusions**: This study demonstrates a correlation between emergence of *covidiots* and *infodemic* as fueled by ubiquitous digital technologies.

Keywords: Misinformation; COVID-19; infodemic; covidiots; health; SSM

## **1.0 Introduction:**

The avalanche of information associated with a crisis, such as the COVID-19 pandemic, challenges the cognitive ability of the society and her individuals. This makes it difficult to process, filter or glean the jargon from the sensible, hence, an infodemic (See *Figure* 1)[1–4]. The World health Organization (WHO) defines an infodemic as *an over-abundance of information, some accurate and some not, that makes it hard for concerned citizens, health authorities, social media platforms, journalists and fact-checkers to find trustworthy sources and reliable information[5,6]. Hence, when it comes to COVID-19, fighting the pandemic while ignoring the associated infodemic is a zero-sum game[7]. As Antonio Guterres, Secretary General of the United Nations, succinctly puts it "Our common enemy is COVID-19, but our enemy is also an "infodemic" of misinformation. To overcome the coronavirus, we need to urgently promote facts & science, hope & solidarity over despair & division."[8].* 

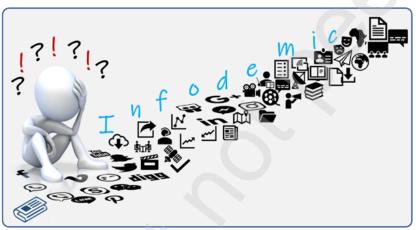


Figure 1: Infodemic illustrated

This contribution is anchored on the logic that an infodemic is an artifact that is sociomaterial; a concept that is an amalgam of two words, the 'social' and the 'material'[9]. The *sociomaterial* nature of the society coupled with the democratization of the Internet, has made individuals more dependent on the affordances of digital technologies in their day-to-day activities such as navigation, education, information, communication, validation, banking and even popularity[10]. This has led to new terminologies like *trending*, *hits* and *likes* among others that have made individuals instant celebrities with the itch, hunger and desire to blog, post and share information that satiates their ego and

information appetite[1,4]. At times, this can be dangerous in crisis situations such as the COVID-19 pandemic since information is only good when it empowers an individual with the right information[11,12].

In an infodemic, gleaning the right information is taxing and this may lead to individuals seeking information and knowledge from their *trusted* sources (e.g. social networks, celebrities, and favorite blogs). This may result in individuals having access to either disinformation, misinformation or both[2,4]. Disinformation and misinformation (refence henceforth in this manuscript as d(m)isinformation), depending on the source and who spreads either, has often eroded confidence in subject-matter experts when it comes to informing the public with the right information and advice[7]. This has led to an exponential increase in pseudo-experts, opinion leaders and conspiracy theorists[13]

The activities of both *pseudo-experts* and *opinion leaders* while at times in coherence with those of subject-matter experts, their attempts at either *dumbing down* the information to resonate with the society's knowledge *consumption* capacity or *spicing up* the information, by adding anecdotes and theories the society relates with. This is done with the aim of getting more likes and hits (*click bait*) to trend and may lead to information asymmetry which gives rise to their audience(s) acting contrary to recommendations of subjects' matter experts. In the case of COVID-19, it is these audience(s) that are referred to as *covidiots*[14].

Unlike infodemic, the definition of *covidiot* is still nascent. It is a pronoun coined from the actions of individuals who during the COVID-19 pandemic disregard advice from subject-matter experts, are clueless and ignorant of the pandemic and, needlessly spreads fear and panic over the pandemic[14–18]. To understand how to stem the increase of *covidiots*, there is need to know the reach of infodemic in nurturing the emergence and proliferation of *covidiots* and hence this study. Within this study, a system thinking lens is used to elucidate how *covidiots* emerge in an infodemic.

## 2.0 Related Work:

A simple search on Google since 2020 using disinformation and/or misinformation as key word(s) results in more than seventeen thousand (>17,000) publications, an indication

that research in d(m)isinformation is courting attention. These studies have looked at political[19], climate change[20,21] and health[12,22] d(m)isinformation. However, most of these studies have used the term misinformation and disinformation interchangeably.

While investigating the impact of d(m)isinformation in health, Swire-Thompson & Lazer, (2020) observed that the democratization of health information on the Internet has contributed to the dilemma individuals face in distinguishing between the right information and d(m)isinformation [12,22]. The deployment of artificial intelligence (AI) in recommender systems by social media platforms, have also compounded the problem by *feeding* d(m)isinformation to their users based on their respective search history [22]. The footprints of conspiracy theorists who exacerbate COVID-19 health d(m)isinformation continue unabated[23]. Those in denial of COVID-19 also manifest in various guises. Instances such as when the Brazilian president played down the seriousness of the disease by terming it as *a little flu* and did not advocate for masking or even social distancing has posed a challenge to experts advising on how to flatten the COVID-19 curve. The president even went against the advice of his then health minister who had encouraged people to mask, social distance and to take the pandemic seriously[24]. This resulted in tremendous increase of COVID-19 cases and Brazil become one of the worst hit countries globally[25].

Nevertheless, irrespective of the magnitude of d(m)isinformation, studies[22,26] highlight that it is the responsibility of health care providers, as custodians of the right information, to guide the patients to evidence based resources. They flagged improved e-Health literacy, physicians' collaborative use of the Internet, creation and distribution of correct information coupled with increased frequency of correction as instrumental in tackling health related d(m)isinformation online.

## 3.0 Analytical Model: Soft Systems Methodology

In systems thinking, abrupt changes and *shocks* to/in a society (system), such as the COVID-19 infodemic, may result in a unique and complex ecosystem that can be fodder for information and d(m)isinformation. In coining soft systems methodology (SSM), Checkland and coworkers envisioned the application of soft operations research (OR) in investigating a system with complex stochastics (i.e. a system comprised of

interdependent and interacting parts with flexible and porous boundaries [27–29].) Since then, SSM has conveniently been deployed in investigating complex, messy, fuzzy and ill-defined real-world problems where, the definition of the problem situation is not obvious and there is no convergence of ideas/views by stakeholders when it comes to; the problem situation itself as well as the change that will improve it [30–33].

Notably, several tools and concepts (**Table 1**) have been explicitly developed for the SSM process. At the core of SSM is the notion that real world complexities can be simulated/modelled as a learning process with learning starting from problem situation identification, to its definition, and eventually to reasonable actions taken to improve it [34–37]. The SSM process often entail a seven-step process as proposed by Checkland and coworkers [27–29]. The seven-step process can be simplified into a four-step cycle [36] (see Figure 2). This study adopts the four-step cycle.

SSM:	Acronym for soft system methodology		
Rich picture:	Pictorial expression of problematical situation		
Root definition:	Statement that describes the system being modelled		
CATWOE:			
C:	Customer:	Beneficiaries or victims of the problematic situation that	
<b>A</b> :	Actor:	require an improvement intervention Individuals involved in performing the improved interventions	
T: W:	Transformation: Worldview:	The change process Underlying assumptions that make the improvement intervention worthwhile and important	
О:	Owner:	The actors that are responsible for the improvement intervention and who decide whether it will be implemented or not	
E:	Environment:	The contextual factors/constraints that may influence the problematical situation and the improvement. intervention.	
PQR Formula	Root definition formula		
	P:	What should be done	
	<b>Q</b> :	How should it be done	
	R:	Why should it be done	
Three Es (3Es)	Assessment criteria		
	Efficacy:	Is the intervention leading to intended outcome?	
	Efficiency:	Is the intended outcome achieved minimal resources?	
	Effectiveness:	Is the intervention capable of achieving higher aims?	

Table 1: SSM terms and acronyms glossary (adapted from[36])

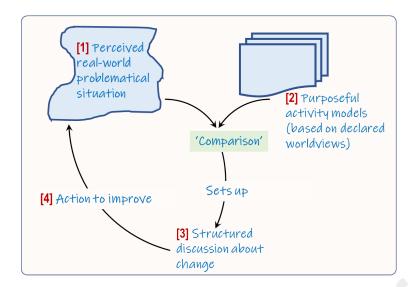




Figure 2: A generic SSM learning cycle (Adapted from[36]).

The four phases involved in the SSM learning process (**Figure 2**) include: Phase-1: Finding out about the problem (the problem situation is identified, defined, and presented in the form of a rich picture). Phase-2: Formulating relevant purposeful activity models (PAMs) – the conceptual model is developed from the root definition using the PQR formula and CATWOE mnemonic (see definitions in Table 1). The PQR formula can be stated as: *Doing* **P** *by* **Q** *to achieve* **R**. The conceptual model is then assessed using the 3Es; *efficacy, efficiency, effectiveness* (Table 1). Phase-3: Debating the situation using the models. This phase can be described as bridging the *world-as-imagined* to be in line with the *world-as-is*. Phase-4: Taking action to bring about improvement, this phase involves identification of opportunities for improvement based on the previous activities and tests whether desirable changes are realized. In other words, *change-in-context realized*.

## 4.0 Application of SSM to the COVID-19 Infodemic

As mentioned in the introduction section and illustrated in **Figure 1**, an infodemic thrives in crisis situations such as COVID-19 pandemic. The reason being that in crisis situations, the citizenry often thirsts for knowledge regarding the crisis with the goal of understanding

the crisis itself, its causes-and-effects to them, as well as how they can navigate through the crisis. As result, *the where*, *the how* and *the when* the citizenry taps, obtains or access knowledge on the crisis is extremely important. This is mainly because of the trust an individual places on the source of information or knowledge. However, the *socialmaterial* nature of the society coupled with the *democratization* of the Internet has led to a situation akin to *virtual classrooms*, where a *student* (citizenry) taps information and/or knowledge from a *poisoned well*. Reason being, unlike conventional learning regimes or paradigms, in these *virtual classrooms*, there is no vetting and/or moderation of either the *instructor* (teacher) or the *content* (instruction) or both. Thus, in times of a crisis, the citizenry is at best either gullible or susceptible to exploitations stemming from the infodemic.

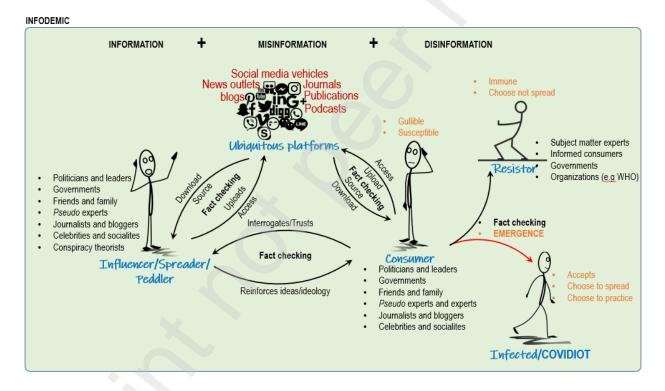


Figure 3: Rich picture of the problematic situation.

## 4.1 Identification of the Problem Situation

There is *modest* consensus that the genome of an infodemic consists of information and d(m)isinformation [38–40]. Information is good whereas d(m)isinformation can lead to a citizenry that are considered *covidiots* in this study. Hence, the view (*worldview* within

the CATWOE analysis) that; *a COVID-19 infodemic is directly related to the emergence of covidiots*. The rich picture (**Figure 4**) illustrates the problem situation (infodemic) as gleaned from both peer and non-peer reviewed sources (e.g., blogs, journals, news articles etc.) on d(m)isinformation and infodemic. The rich picture shows the different elements of an infodemic system and how it leads to the emergence of *covidiots*.

# 4.2 Formulating Relevant Purposeful Activity Models (PAMs) - Conceptualizing the Emergence of *Covidiots*

In formulating the conceptual model in this study, SSM tools (root definition and CATWOE) were used.

Root definition:	A system that interrogates how d(m)information propagation in an infodemic, leads to the emergence of <i>covidiots</i> .	
PQR Formula	P:	interrogation of
	Q:	how d(m)information propagation in an infodemic
	R:	leads to the emergence of <i>covidiots</i>
CATWOE:		
C:	Customer:	<i>Covidiots</i> , susceptible individual, experts and pseudo experts, researchers and academics, bloggers, politicians, and leaders, socialites and celebrities, reporters and journalists, conspiracy theorists
А:	Actor:	<i>Covidiots</i> , pseudo experts, bloggers, politicians and leaders, socialites and celebrities, reporters and journalists, conspiracy theorists
T:	Transformation:	<i>Covidiots</i> emerge from the propagation of d(m)isinformation via different mediums (social media platforms/vehicles, news outlets, mass and print media, one-on-one etc.) in an infodemic
W:	Worldview:	There is a direct relationship between d(m)isinformation and <i>covidiots</i> i.e. d(m)isinformation will always lead to the emergence of <i>covidiots</i>
0:	Owners:	Subject matter experts, researchers, governments, organizations (e.g. WHO), social media platforms/vehicles
E	Environment:	Policies, laws, and regulations, factchecking, advocacy and awareness

Table 2: SSM application in the problematic situation

#### i) Root definition

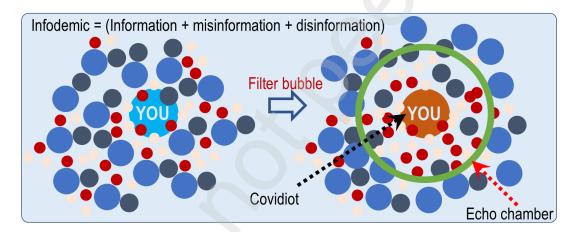
From the perspective of the COVID-19 infodemic, the concept of a root definition is considered as *a system that interrogates how d(m)information propagation in an infodemic, leads to the emergence of covidiots.* Table 2 shows the PQR formula applied in formulating the above root definition and the CATWOE elements based on the root definition of the problem situation.

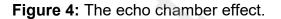
## ii) CATWOE analysis

It is of note that *covidiots* (the *customers* in CATWOE analysis) start as innocent citizenry who in their thirst for knowledge, are either gullible or susceptible to exploitation by entities possibly with ulterior motives. As a result of an infodemic, the influencers (the actors in CATWOE analysis) will spread/peddle d(m)isinformation (the *transformation* process within the CATWOE analysis) with the goal of either exerting their influence/dominion or eliciting/soliciting a cult-like following or both. These entities are likely to be: politicians or leaders who aim to either attain or retain some form of relevance within their constituencies; celebrities and socialites who want to *trend* frequently; *pseudo* experts who with little or no information insist on being subject matter experts; friends and family members who (un)intentionally want to assume higher status within a social network; conspiracy theorists who assume to know intimate details about the situation; journalist(s) who also wants to trend and bloggers who wants hits on their blogs. These entities can also form part of the customers in the CATWOE analysis as they directly benefit from an infodemic by, tapping knowledge (d(m)isinformation) from the infodemic and spreading/peddling the knowledge (d(m)isinformation) from the infodemic via different information channels such as social media vehicles, one-to-one communications etc. These entities are also likely to be affected if interventions (changes) are made within the infodemic system. Thus, in the worldview, d(m)isinformation will always lead to the emergence of the covidiot.

In the case of the COVID-19 infodemic, the barrier between information and d(m) is information can be very imperceptible or blurred in the battle between science and

politics especially, with politicians, scientists, and leaders as main protagonists. The *democratization* of information and advancements in ubiquitous technologies (such as social media, blogs, vlogs, podcasts, other online platforms) have become the **owners** in the CATWOE analysis, and act as the canvas upon which the citizenry draw, etch or curve ideologies and beliefs. This is what leads to polarization of discourse when it comes to the COVID-19 interventions, radicalization of thought depending on a leader's *cult-like* following and eventually the emergence of *covidiots* when the citizenry refuses to adhere to intervention and protocols meant to safeguard them. This is largely attributed to information asymmetry, amplification of d(m)isinformation and a decline in the reliability of information, creation and propagation[42]. As depicted in **Figure 5**, an *echo chamber* is an environment where a person only encounters information or opinions that reflect and reinforce their own.

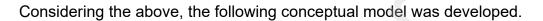




A characteristic of an *echo chamber* is their ability to fend off or fight information, thoughts and ideologies that are counter to it and hence, are very effective in reinforcing d(m)information leading to the emergence of *covidiots*. *Echo chambers* can spring up anywhere there is information exchange and thus very effective in recruitment of *covidiots*. Within the *echo chamber*, an individual can easily find and/or assemble a network of like-minded people (homophily) and with constant bombardment and regurgitation of the biased information, *covidiots* will manifest as conceptualized in **Figure 6**. These *covidiots* will also in turn recruit other susceptible individuals using the very

same channels they were recruited with and over time, the citizenry will witness an ensemble of individuals and groups who disregard warnings and advice from experts. These groups may take different forms and may aggregate to form bigger movements that eventually morph into revolutions stemming from the radicalization they undergo within their respective *echo chambers*. This is analogous to the insurrection witnessed in the US in the recent past [43]. It is only through the enforcement of policies, rules, and regulations (*Environment* in CATWOE analysis) that *echo chambers* which leads to mushrooming of *covidiots* can be neutralized.

## iii) Conceptual model



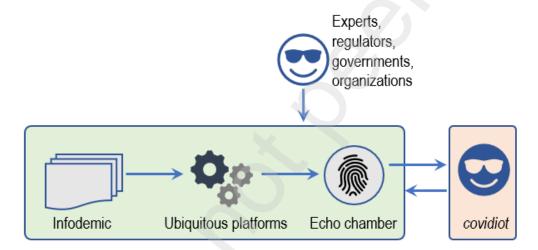


Figure 5: Conceptual model

## 4.3 Explicating the Emergence of Covidiots (Model Vs Real World)

Based on the analysis above, an interpretation of the real world of *covidiots* is presented in the sub-sections below through reference to **Table 3**.

#### Table 3: Model vs real world

Model	Real world	
Infodemic	Information avalanche contributes to d(m)isinformation that leads to	
	recruitment of <i>covidiots</i> .	
Ubiquitous	Social media vehicles/platforms, blogs, mass/print media etc., can	
platforms	rapidly and effectively be used to generate and spread	
	d(m)isinformation in an infodemic and hence, effective tools to recruit	
	covidiots.	
echo chambers	Facilitated by ubiquitous platforms in an infodemic, information echo	
	chambers are likely to emerge as efficient tools in the recruitment of	
	covidiots	
Covidiots	Individuals ignorant of COVID-19 warnings/interventions and actively	
	spread d(m)isinformation to recruit like-minded individuals.	
Experts, regulators,	Those responsible for stopping the spread of d(m)isinformation and in	
governments,	turn stopping the recruiting of covidiots	
organizations		

## i) Infodemic

The infodemic associated with the COVID-19 has seriously curtailed the interventions being put in place by experts in trying to mitigate the spread of the contagion through d(m)isinformation. The COVID-19 contagion has created a fertile ecosystem that is conducive for the spread of d(m)isinformation, fake news and doctored videos to instigate mistrust among the citizenry. An infodemic can cause confusion leading to mistrust of subject matter experts and undermines the interventions put in place[3,4]. This is because when citizenry is unsure of what to do to protect themselves and their loved ones, the infodemic may prolong/lengthen the contagion outbreak or even intensify the spread of the contagion. According to Islam et al., (2020), rumors stemming from d(m)isinformation have resulted in fatalities. For instance, the analogy that alcohol consumption could disinfect the body and kill the COVID-19 virus resulted in approximately 800 deaths, 5,876 hospitalizations and 60 complete blindness due to people drinking methanol as a cure of COVID-19. Hence the need to fight the contagion infodemic.

#### ii) Ubiquitous platforms

Technological advances in this era of Internet of everything has contributed in part to the increase in digital citizens who believe they are experts in soliciting information. This has made big-tech giants such as Facebook, Twitter etc.to be key players in the creation as well as transmission of information to their respective consumers. Media outlets and bloggers have also fomented their footprints in this sphere[4]. With the former American president declaring that it is social (online) media that made him president, these ubiquitous platforms have gained prominence both as information channels as well as created the opportunity for recruiting adherents. The power of these ubiquitous platforms is unrivalled and has been witnessed in the past during the Arab spring when they were used to organize protests and mobilize protesters to overthrow governments, recruitment of terrorists by terrorism organizations, manipulations of voters in elections and presently the source of the COVID-19 infodemic and the spread of d(m)isinformation stemming from the infodemic[1–3]. Majority of the studies so far has identified social media platforms as the main source and spread of d(m)isinformation of the infodemic contagion [3,4].

These platforms have also emboldened politicians and leaders in influencing the ideologies of their constituencies who in turn may become *covidiots* thanks to the information they receive from these leaders. Being mesmerized by the thoughts, opinions and ideologies of politicians and leaders can be considered as one of the greatest travesties committed to constituencies who rely on them. Current affairs have vividly revealed how political factors play a role in mediating the formation of ideology and beliefs among susceptible individuals. Thus, the dystopia engineered by some leaders in an infodemic can be the catalyst needed to reinforce ideas, thoughts, and beliefs. These leaders are known to capitalize on the innocence and gullibility of susceptible individuals via eliciting a form of cult-like following, with their followers either being hypnotized by the leader's ideology or have residency in utopia and hence, the *covidiot*. Using these ubiquitous platforms, these leaders have an unmitigated access to adherents who dance to their whims.

Specimens of the above include when; disinfectants disappeared from shelves when the then US president suggested them as cure for COVID-19[44]; presidents including Andrés Obrador (Mexico), the late John Magufuli (Tanzania) and the late Pierre Nkurunziza (Burundi) advising their citizens to ignore the existence of the pandemic and to not adhere to the interventions suggested by scientists[45]. In the US for instance, the then president would not even mask while holding mass political gatherings. Their followers/adherents in attendance would in turn also not mask even though such events were classified as *supper-spreaders* hence, they also became *covidiots*.

When such d(m)isinformation was uploaded/shared on some of these platforms, they were read, retweeted/reposted several times to the extent that experts were considered *pariah* among some of the users of these platforms thus fomenting d(m)isinformation[46]. One of the notable examples is in Brazil where the health minister had to resign from office following the president and his adherents exploiting ubiquitous platforms to counter expert advice[24,25].

### iii) Echo chambers

Thanks to *echo chamber(s)* in the COVID-19 infodemic, the emergence of *covidiots* within the society can be related to a form of *self-organization* (homophily) where, susceptible entities/individuals in an infodemic either gravitate towards an ideology or coalesce around entities/individuals and thereby, end up reinforcing ideologies they subscribe to. As argued earlier, the information *democratization* has enhanced the spreading of d(m)information (*Transformation* in CATWOE analysis) to susceptible individuals (*Customers* in CATWOE analysis) in the COVID-19 infodemic. The d(m)information peddlers (*Actors* in CATWOE analysis) and the *customers* (within CATWOE analysis) interact via different platforms such as social media, mass media and print media (*Owners* in CATWOE) leading to the formation of *echo chambers* that filter out information that a susceptible individual (the *Customer* in CATWOE) does not like. In such a system, it is easy for a leader/politician (*Actors* in CATWOE analysis) to control the action of a susceptible individual by imparting distrust in sound advice, fact or science[3,4].

This is even worse in the case of COVID-19 pandemic because ideological difference(s) in politics has been shown to polarize ignorant constituencies, hence the mushrooming of *covidiots*. Studies have shown a direct relation between political ideologies (conservative and liberal) and implementation of COVID-19 interventions[47,48]. This in turn leads to homophily (susceptible individuals within the constituency, desiring to associate only with those of similar beliefs or ideology (emergence of order)). Homophily can easily be nurtured in *echo chambers* that are also easy to create on different digital platforms[4]. It is through the *echo chamber*, that entities that neither associate nor identify with the beliefs or ideologies of an *echo chamber* are dropped from the system i.e., homophily is what determines whether an entity belongs to the system or not.

## 5.0 Implications of the Findings

The analysis and interpretation outlined above can be the basis for understanding the plethora of interventions currently underway that are seeking to address the COVID-19 infodemic. While these interventions are useful and required, an explicit explication of the nature of the rise of *covidiots* has largely remained superficial. Therefore, the discussion on the implications of the findings in this study provides the needed rationale for the infodemic interventions currently being witnessed. For instance, under the CATWOE analysis under Environment, it was emphasized that homophily is on the rise. Without the enforcement of policies, rules, and regulations (*Environment* in CATWOE analysis), homophily resulting from *covidiots* will continue to rise and this may be detrimental to the society. Enforcing fact checking, information source verifications and stringent policies by both governments and social media platforms is what is needed to slow down the mushrooming of echo chambers that counter scientific advice on COVID-19 and in turn slowing the emergence of *covidiots*.

Several social media platforms have made proactive interventions towards curbing d(m)information stemming from infodemic. Of note is the suspension of accounts that are actively spreading d(m)isinformation as well as banning users from their platforms who are actively spreading d(m)information. Twitter for instance has been very proactive in burning influential individuals and groups from its platform such as former president Donald Trump and his associates for peddling falsehoods on elections. Though such

actions may be viewed as laudable, the jury is still out there as to whether such interventions have curbed the COVID-19 d(m)isinformation[49]. From such interventions, the followers of individuals peddling d(m)information are expected to exercise some form of caution, which may lead to a homophily that counters the emergence of *covidiots*. Twitter is also enforcing a *strike system* that will eventually lead to a permanent ban from the platform in case of COVID-19 d(m)isinformation after the fifth offending tweet[50]. Several organizations such as The International Fact-Checking Network also continue to provide a valuable service in curtailing the emergence of *covidiots* in echo chambers. Governments also continue to play a role in fighting the infodemic. Some countries have put in place very punitive measures for individuals spreading d(m)isinformation. Better international cooperation, based on solidarity and goodwill among countries, can contribute to achieving this goal [5].

#### Conclusions

Since the emergence of COVID-19, the associated infodemic has proliferated together with the escalation of the pandemic. In an infodemic, as demonstrated in the study, gleaning the right information can be laborious and taxing for any digital citizen. This leads to these digital citizens outsourcing the right to credible information to leaders, news outlets and social media platforms, among others. In the analysis and interpretation put forth in this paper, a number of preliminary inferences are proffered: the first is that due to the ubiquity of the Internet and its attendant technologies and information filter bubbles, individuals are susceptible to d(m)isinformation; particularly since detecting lies online is a daunting task [51]. Secondly, that such susceptible individuals relying on suspect digital information about COVIS-19 are likely to be confined to echo chambers, a phenomenon that allows such individuals to be labelled as *covidiots*. In arriving at these two inferences, the paper relied on soft systems methodology (SSM), an analytical lens of systems thinking tool that aided in laying bare, the nature of covidiots in the context of the COVID-19 infodemic. Implications of the study focused on remedies for the COVID-19 infodemic that elevate the need for stricter, tough, ethical enforcements of pandemic protocols; making factchecking platforms more ubiquitous; and demanding more accountability from d(m)information channels and social media platforms. While the conclusions highlighted

may be regarded as tentative, these insights can be used as a foundation for investigating in depth, the phenomenon of infodemics and *covidiots* in specific public health contexts to contextualize findings that can be the basis of more relevant policy interventions. Further, while the 'soft' approach of SSM allows for preliminary exploration, the findings from this study can be a trigger for the use of 'hard' operations research approaches for modeling of public health infodemics.

## References

- J. Hua, R. Shaw, Corona virus (Covid-19) "infodemic" and emerging issues through a data lens: The case of china, Int. J. Environ. Res. Public Health. 17 (2020). https://doi.org/10.3390/IJERPH17072309.
- [2] Z. Hu, Z. Yang, Q. Li, A. Zhang, Y. Huang, Infodemiological study on COVID-19 epidemic and COVID-19 infodemic, Preprints. (2020) 1–11. https://doi.org/10.20944/preprints202002.0380.v2.
- M.S. Islam, T. Sarkar, S.H. Khan, A.H.M. Kamal, S.M. Murshid Hasan, A. Kabir,
  D. Yeasmin, M.A. Islam, K.I.A. Chowdhury, K.S. Anwar, A.A. Chughtai, H. Seale,
  COVID-19-Related infodemic and its impact on public health: A global social
  media analysis, Am. J. Trop. Med. Hyg. 103 (2020) 1621–1629.
  https://doi.org/10.4269/ajtmh.20-0812.
- M. Cinelli, W. Quattrociocchi, A. Galeazzi, C.M. Valensise, E. Brugnoli, A.L.
  Schmidt, P. Zola, F. Zollo, A. Scala, The COVID-19 social media infodemic, Sci.
  Rep. 10 (2020) 16598. https://doi.org/10.1038/s41598-020-73510-5.
- [5] WHO, The Permanent Mission of Latvia to the United Nations, 2021. https://onu.delegfrance.org/IMG/pdf/crossregional\_statement\_on\_infodemic\_final\_with\_all\_endorsements.pdf (accessed May 27, 2021).
- [6] WHO, An ad hoc WHO technical consultation managing the COVID-19 infodemic: call for action, 2020. https://www.who.int/publications/i/item/9789240010314 (accessed June 1, 2021).
- [7] D.L. Baines, R.J.R. Elliott, D. Baines, R. Elliott, Defining misinformation, disinformation and malinformation: An urgent need for clarity during the COVID-

19 infodemic, (2020). https://econpapers.repec.org/RePEc:bir:birmec:20-06 (accessed June 1, 2021).

- [8] UNODC, UN tackles 'infodemic' of misinformation and cybercrime in COVID-19 crisis | United Nations, (2020). https://www.un.org/en/un-coronaviruscommunications-team/un-tackling-'infodemic'-misinformation-and-cybercrimecovid-19 (accessed June 1, 2021).
- [9] W.J. Orlikowski, Sociomaterial practices: Exploring technology at work, Organ. Stud. 28 (2007) 1435–1448.
- [10] N.M. Ochara, N.A. Odhiambo, Sociomateriality of digital technologies in collaborative decision-making counter-terrorism contexts, in: ICMLG 2018 6th Int. Conf. Manag. Leadersh. Gov., 2018: p. 219.
- [11] B.E. Weeks, H. de Zúñiga, What's next? Six observations for the future of political misinformation research, Am. Behav. Sci. 65 (2021) 277–289.
- [12] B. Swire-Thompson, D. Lazer, Public health and online misinformation: challenges and recommendations, Annu. Rev. Public Health. 41 (2020) 433–451.
- [13] J.O. Zinn, Introduction: Towards a sociology of pandemics, Curr. Sociol. (2021) 00113921211020771.
- [14] A. Mahdawi, From Covidiot to doomscrolling: how coronavirus is changing our language, (2020).
- [15] Dictionary-Cambridge English, COVIDIOT | meaning in the Cambridge English Dictionary, (n.d.). https://dictionary.cambridge.org/dictionary/english/covidiot (accessed June 1, 2021).
- [16] Urban-Dictionary, Urban Dictionary: Covidiot, (n.d.).
  https://www.urbandictionary.com/define.php?term=Covidiot (accessed June 1, 2021).
- [17] The-Angry-Grammarian, Are you a covidiot who coronasplains? | The Angry Grammarian, (n.d.). https://www.inquirer.com/opinion/coronavirus-covidlanguage-lexicon-slang-20210121.html (accessed June 1, 2021).
- [18] D. Trottier, Q. Huang, R. Gabdulhakov, Covidiots as global acceleration of local surveillance practices, Surveill. \& Soc. 19 (2021) 109–113.
- [19] J. Jerit, Y. Zhao, Political misinformation, Annu. Rev. Polit. Sci. 23 (2020) 77–94.

- [20] R. McKie, Rebranding the climate change counter movement through a criminological and political economic lens, Northumbria University, 2018.
- [21] K.M. d'I Treen, H.T.P. Williams, S.J. O'Neill, Online misinformation about climate change, Wiley Interdiscip. Rev. Clim. Chang. 11 (2020) e665.
- [22] A. Sturgill, Health care providers can help combat harmful misinformation about the pandemic, N. C. Med. J. 82 (2021) 68–70.
- [23] W. Ahmed, F.L. Segu\'\i, J. Vidal-Alaball, M.S. Katz, Covid-19 and the "film your hospital" conspiracy theory: social network analysis of twitter data, J. Med. Internet Res. 22 (2020) e22374.
- [24] S. Felipe, Bonon, Soares;Raquel, Recuero;Taiane, Volcan;Giane, Fagundes;Giale, Research note: Bolsonaro's firehose: How Covid-19 disinformation on WhatsApp was used to fight a government political crisis in Brazil, (2021).
- [25] L. Taylor, Covid-19: Brazil's hospitals close to collapse as cases reach record high, (2021).
- [26] B.G. Southwell, J.L. Wood, A.M. Navar, Roles for health care professionals in addressing patient-held misinformation beyond fact correction, (2020).
- [27] P. Checkland, An application of soft systems methodology, Ration. Anal. a Probl. World. (1989) 101–119.
- [28] P. Checkland, Systems thinking, Rethink. Manag. Inf. Syst. (1999) 45–56.
- [29] P. Checkland, Soft systems methodology: a thirty year retrospective, Syst. Res. Behav. Sci. 17 (2000) S11.
- [30] B. Bergvall-Kåreborn, A. Mirijamdotter, A. Basden, Basic principles of SSM modeling: an examination of CATWOE from a soft perspective, Syst. Pract. Action Res. 17 (2004) 55–73.
- K. Kotiadis, A.A. Tako, E.A.J.A. Rouwette, C. Vasilakis, J. Brennan, P. Gandhi, H. Wegstapel, F. Sagias, P. Webb, Using a model of the performance measures in Soft Systems Methodology (SSM) to take action: a case study in health care, J. Oper. Res. Soc. 64 (2013) 125–137.
- [32] M.R. Mehregan, M. Hosseinzadeh, A. Kazemi, An application of soft system methodology, Procedia-Social Behav. Sci. 41 (2012) 426–433.

- [33] P. Checkland, J. Poulter, Soft systems methodology, in: Syst. Approaches to Manag. Chang. A Pract. Guid., Springer, 2010: pp. 191–242.
- [34] O.G. El-Taliawi, K. Hartley, The COVID-19 crisis and complexity: A soft systems approach, J. Contingencies Cris. Manag. 29 (2021) 104–107. https://doi.org/10.1111/1468-5973.12337.
- [35] S. Asadi, Soft systems methodology approach to IS change management, University of Hormozgan, 2020. www.ijiems.com (accessed June 1, 2021).
- [36] H. Augustsson, K. Churruca, J. Braithwaite, Re-energising the way we manage change in healthcare: The case for soft systems methodology and its application to evidence-based practice, BMC Health Serv. Res. 19 (2019) 1–11. https://doi.org/10.1186/s12913-019-4508-0.
- [37] H.A. Khayame, M.M. Abdeljawad, Systems Thinking in Upstream Social Marketing: Using Soft Systems Methodology to Improve Midwifery Policy in Jordan, Soc. Mar. Q. 26 (2020) 167–183. https://doi.org/10.1177/1524500420925810.
- [38] Y. Han, B. Jiang, R. Guo, Factors Affecting Public Adoption of COVID-19 Prevention and Treatment Information During an Infodemic: Cross-sectional Survey Study, J. Med. Internet Res. 23 (2021) e23097.
- [39] J. Macnamara, New insights into crisis communication from an "inside" emic perspective during COVID-19, Public Relations Inq. 10 (2021) 237–262.
- [40] A. Sharma, P.S. Kapoor, Message sharing and verification behaviour on social media during the COVID-19 pandemic: a study in the context of India and the USA, Online Inf. Rev. (2021).
- [41] R. Bowen, D. Dmitriev, S. Galperti, Learning from Shared News: When Abundant Information Leads to Belief Polarization, 2021.
- [42] R. Srinivasan, Contemporary Issues in Platforms, in: Platf. Bus. Model., Springer, 2021: pp. 315–328.
- [43] D. Canon, G.-U. Charles, E. Foley, R. Hasen, L. Manheim, C. Stewart III, D.
  Tokaji, Restoring Trust in the Voting Process, Elect. Law J. Rules, Polit. Policy.
  (2021).
- [44] M.A. Chary, D.L. Overbeek, A. Papadimoulis, A. Sheroff, M.M. Burns, Geospatial

correlation between COVID-19 health misinformation and poisoning with household cleaners in the Greater Boston Area, Clin. Toxicol. (2020) 1–6.

- [45] S. Buguzi, Covid-19: Counting the cost of denial in Tanzania., BMJ. 373 (2021) n1052--n1052.
- [46] M. Malta, A.W. Rimoin, N.A. Hoff, S.A. Strathdee, The 2019-nCoV pandemic in the global south: A Tsunami ahead, EClinicalMedicine. 23 (2020).
- [47] P. van Esch, Y.G. Cui, S.P. Jain, The effect of political ideology and message frame on donation intent during the COVID-19 pandemic, J. Bus. Res. 125 (2021) 201–213.
- [48] D.P. Calvillo, B.J. Ross, R.J.B. Garcia, T.J. Smelter, A.M. Rutchick, Political ideology predicts perceptions of the threat of covid-19 (and susceptibility to fake news about it), Soc. Psychol. Personal. Sci. 11 (2020) 1119–1128.
- [49] I. Alexandre, J. Jai-sung Yoo, D. Murthy, Make Tweets Great Again: Who Are Opinion Leaders, and What Did They Tweet About Donald Trump?, Soc. Sci. Comput. Rev. (2021) 08944393211008859.
- [50] A. Cimorelli, M. Bollinger, K. Newman, B. Wood, Social Media Sentiments Towards Vaccines, Available SSRN 3833625. (2021).
- [51] Y. Zhao, J. Da, J. Yan, Detecting health misinformation in online health communities: Incorporating behavioral features into machine learning based approaches, Inf. Process. \& Manag. 58 (2021) 102390.