A NEW CONSENSUS METHOD FOR SOCIAL NETWORKS VIABILITY

Debora Sarno
Department of Economics, University of Foggia, Italy

Matteo Gaeta
Department of Information Engineering, Electrical Engineering and Applied Mathematics, University of Salerno, Italy

Francesco Polese
Department of Business Studies and Research, University of Salerno, Italy

Abstract – This paper presents a conceptual model to allow communities self-detecting fake and inappropriate news on social network sites based on collective intelligence and inspired by Viable Systems Approach. The model is grounded on an extension of the Gruber model (on which Collective Knowlegde Systems are based) which incorporates a Consensus Method typically used in the Group Decision Making.

Key words – Fake news, Viable Systems Approach, Collective Knowledge Systems, Collective Intelligence

1. Introduction

Social Network Sites (SNSs) have become one of the main feeder of news and many studies state their ability to determine opinion formation of users (Xiong et al., 2017). However, since social communities and individuals have become more and more informed, abuses begin to occur, as in the case of the US presidential election campaign of 2016 when the false fact that pope had endorsed Donald Trump was spread out has gained the attention of the public.

Fake news are published every day, as demonstrated not just by subsequent denials of concerned person/authorities, and the biggest players of the market such as Facebook and Google started to manifest their attention (The New York Times, 2017) and are working to steam the phenomenon. Indeed, "social media sites can't allow fake news to take over" – as reports a page of The Washington Post on late autumn 2016 – since it is "key to their own credibility and survival". Another source of concern is the publication of inappropriate news in specific communities (due to topic or multimedia contents not compliant with users' community).

Measures to steam the phenomenon are starting to be put in place. For example, Facebook has acting both on the side of users and on the one of the social network management:

- on April 2017, a 10 rules-guide has been published on the home page to help self-recognize fake news;
- on May 2017, Mark Zuckemberg has announced the hiring of 3 thousand people (doubling the Community Operations team) over the next year in charge of checking reliability of suspected information.

While the former solution seems to be a palliative, the latter is clearly expensive and not affordable by niche social network. Indeed, the issue of SNS survival is not just confined to big communities, since even smallest SNS, eventually made by passionate people without any funds, can be damaged by fake/inappropriate news.

This paper proposes an innovative conceptual model to cope with fake and inappropriate news on SNS grounded on an extension of the *Gruber model* (on which *Collective Knowlegde Systems* (CKS) are based) which incorporates a *Consensus Method* (Herrera-Viedma et al., 2014) typically used in the *Group Decision Making* (Alonso et al., 2013) and is built according to the *Viable Systems Approach* (VSA) perspective

(Barile and Polese, 2010) and taking into account engagement (Bruni et al., 2017). Specifically, the proposed conceptual model answers to the following research question:

>   RQ: How can fake/inappropriate news be detected by groups of individuals belonging to an on-line social network?

The originality of the paper relies on:

- adaptation of the Gruber model to the issue of fake/inappropriate news in SNS and incorporation of a consensus method;
- adoption of the VSA lenses and models to cope with the issue.

The conceptual model could be adopted in private social networks within organizations but also extended to bigger and general purpose ones.

After an introduction to the issue (section 1) and a comprehensive literature review related to CKS, Gruber model, consensus methods and VSA (section 2), the conceptual model is described (section 3). Social and managerial implications close.

2. Literature review and model proposition
2.1 Collective Intelligence and value co-creation

This paper roots its basis in the *knowledge creating theory* (Nonaka I. and Takeuchi, 1995) in which cognitive systems (individuals) can have an impact on the development of a social system (as an organization) which, in turn, can influence their believes.

Given the Collective Intelligence (CI, Levy, 1994) logic, different micro-contributions to the understanding (Nielsen, 2012) can be provided in order to multiply instead of sum the intelligence of singles (Kerckhove, 1995). When one system provides to the other its ability to solve complexity, both the knowledge of each system and the collective knowledge are increased.

According to Wise et al. (2012), the concept of CI encompasses and surpasses many of the recent conceptualizations (such as open innovation, crowdsourcing and wisdom of crowds), representing the human tendency to do seemingly intelligent things in a collective manner (Malone et al., 2010). In particular, the development and appliance of CI fostered by internet connectivity leads to the potential co-creation of value by engaging stakeholders, thus leveraging creativity, innovation and responsiveness. A comparison can be made between Service Dominant Logic (S-D l) – a meta-theoretical framework steaming from marketing (Vargo and Lusch, 2017) - and CI. Synthetically, S-D l considers (Vargo and Lusch, 2011-2016):

- service provision as the application of resources (such as knowledge, physical, resources, etc.),
- service as the fundamental basis of exchange,
- mutual benefit as the purpose of exchange,
- value co-creation (which is phenomenologically and uniquely determined by the beneficiary) as the result of resource integration and service exchange.

If value is garnered from mutual consent, then the engagement for service exchange of a broad number of contributors can lead to the co-creation of greater value by means of knowledge integration: the concept of value, from a high level perspective, can be considered similar in both theories (Wise et al., 2012).

The continuous development of social media has changed the role of consumers from passive information "receivers" to information co-creators (Jahn and Kunz, 2012). Co-creation in social media accelerates learning and enlightens decision making through engagement and interactions (Ramaswamy, 2009).

Recent studies have recognized that social media are a way to exploit CI by co-creating value (Graham et al., 2009).

>   Proposition A: SNS (which belongs to social media category) are platforms in which users are engaged to build collective intelligence and co-create value exchanging service.

According to Payne et al. (2008), customer emotional engagement with a brand is the basic determinant of value co-creation. Similarly, user engagement with a social network site (SNS) – and not just with a brand on a SNS - can be the determinant of value co-creation. This has been specifically investigated in the field of company SNSs, in which it has been observed the propensity of engaged customers to actively participate in sharing messages and recommending sites to potentials (Martin and Patricio, 2013). Most managers of company SNSs agreed that highly engaged customers determine the survival of their company SNSs (Zhou et al 2013). A research demonstrated that customer engagement – and in particular conscious participation, but also enthusiasm and social interaction - has a direct and positive influence of customer value creation – mainly functional and social value – and these imply stickiness to the company SNS (Zhang et al., 2017).

Specifically, the research shown that when customers gets engaged in company SNS, hedonic value (pleasure) completely mediates with behavior based engagement.

Both intrinsic (engage for its own sake, without external incentives) and extrinsic motivations (obtaining a desired outcome or avoiding an undesired one, such as monetary compensation, or recognition by others and reputation) may be stimulated (Vivek et al., 2012).

> Proposition B: user engagement with SNS (in form of participation and social interaction) can foster SNS survival.

SNS can be assumed as a specific example of *Collective Knowlegde Systems* (CKS), which are a particular kind of system (Gruber, 2008) in which small groups of proactive users produce information artifacts that can be searched by other users which need information. In such human-machine systems, both humans and machines actively contribute to the resulting intelligence. Indeed, they are composed by:

- a social system supported by ICT, aimed at generating problems that can be solved by means of on-line discussions;
- a research engine, effective in searching demands and answers into the body of knowledge of the social system.

Many examples could be listed. Gruber (2008) chose RealTravel, a tourism SNS. This platform processed every user contribution (photo, tag, discussions) to classify contents based on proprietary algorithms. User needing travel recommendations were then clustered depending on their preferences and status by means of answers to questions. Finally, by matching the characteristics of users and contents (both obtained by Semantic Analysis), the system was able to provide recommendations to requiring users.

> Proposition C: SNS can be Collective Knowledge Systems able to solve user problems particularly when collective intelligence is based on ICT tools (analytics and research engine, etc.)

2.2 Group Decision Making and consensus method

When semantic analysis cannot be so effective due to technological limits, the human intervention is required to analyze data and provide solutions. In presence of multiple alternative choices and more than one decision maker involved, a *Group Decision Making* (GDM) problem can be adopted (Cabrerizo et al., 2008). It is usually made by a two steps process:

- a *consensus* step, in which a moderator may interact with a group of experts to reach the overall consensus (not necessarily the agreement) by asking some revisions and discussions among experts to overcome a certain threshold limit of general consensus (the consensus of the group is measured by comparing and aggregating the judgments of the experts);
- a *selection* step, in which, since the threshold level of consensus is reached, the best alternative is selected as the final decision of the group.

In the field of news assessment, the decision is binary (fake/no fake; appropriate/inappropriate) and different methods may be adopted to manage the judgments of the experts. An overview of the approaches has been provided by (Herrera-Viedma et al., 2014) based on:

- reference domain, related to the choice of the expert set or of the alternative set;
- coincidence of preferences and solutions, dealing with the need for a strict or soft coincidence among the opinions of the experts to reach the consensus;
- generation method for recommendations, which takes into account the automation or the presence of a moderator guiding the experts at each consensus round;
- consensus measure, based on soft of other types of consensus (as consistency measures).

An extension of the CKS using GDM was proposed to manage food frauds news (Ciasullo et al., 2016), in which possible food frauds news were signaled by users to a group of experts in the field. Then, the semantic analysis of the contents posted by the community of travelers of Gruber was substituted by the application of a fuzzy consensus model based on five point-scale (alternatives: completely false, partially false, neutral, partially true, completely true) performed by this decision making group. In particular, each expert assigned a utility value (from 0 to 1) to each alternative (the sum of the utility value on the alternative is 1), which examined food news to agree about the truthfulness of the news. Finally, another group composed by communication experts chose whether to publish and spread the food fraud news to the larger community (adopting the consensus model on the five alternatives: strongly avoid publish, avoid publish, neutral, publish, absolutely publish).
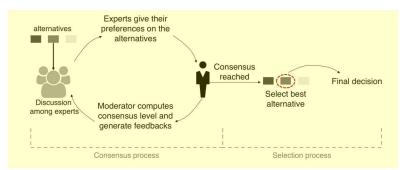
Figure 1. Group Decision Making process (Ciasullo et al., 2016)

Proposition D: CKS can benefit from Group Decision making processes, involving expert in making decisions for the community.

2.3 System Theories and Service Systems

In the *Viable Systems Approach* (VSA) perspective (Barile et al., 2015), the abovementioned studies could be interpreted as the attempt of the government of a country (the decision of a governing body of a system) to put in place control mechanisms (institution of an abuses gathering platform and two commissions of judgers composed by experts in food frauds and communication) to adapt to a supra-system controlling relevant resources (a risky markets) and survive (system viability).

Then, by adopting a holistic and systems perspective, the final aim of social networks corresponds to the fundamental concept of viability at the basis of VSA and, using VSA lenses, Facebook and Google's initiatives can be interpreted as the system's reaction to keep equilibrated and viable conditions adapting, thanks to its autopoietic traits, resetting relations with actors of the system's structure in order to re-configure the system towards a new equilibrium.

According to VSA, the behavior of a system can be interpreted by investigating the presence of positive potential relationships (consonance condition) with other entities belonging to the context which are considered relevant for system's survival (supra-systems). When these static and structural preconditions are activated by means of positive interactions (resonance), the respective resources owned by the entities are integrated and value is co-created (Barile et al., 2014). In the case of users and SNS, if SNS managers (governing body of the system) consider users as relevant supra-system (important for the SNS viability), structural conditions (relationships, consonance) can be designed to facilitate engagement and participation mechanisms (for example, feedback), then the user would be engaged in integrating his resources (knowledge) with others (positive interactions, resonance) in order to co-create new knowledge (collective intelligence) for the SNS.

The more will be the relevance attributed to the SNS, the more will be the engagement of users with the SNS, in terms of effectiveness of communication, degree of reciprocal understanding and degree of commitment (Barile and Saviano, 2013).

Proposition E: VSA helps in understanding why and how co-creation can take place in the interaction between user and SNS: users engaged with the SNS **can help the SNS to manage fake news and keep its viability** (connection with proposition B) by making users interacting and co-creating value by knowledge (resource) integration (connection with proposition A) adapting the structure of the SNS based on the potentials of ICT as a Collective Knowledge System does (connection with proposition C).

According to VSA, consonance can be analyzed by means of the model of information variety - derived from the requisite variety of Ashby (1958) – which takes into account the symmetry of information varieties of the involved entities. The information variety has three dimensions (Barile, 2009):
- information units, which are the amount of single units of data detained by an entity;
- interpretation schemes, or the cognitive schemes according to which the information are elaborated and understood;
- categorical values, which are the basic values and strong beliefs of the entity.

The knowledge of a system is not the sum of the information units of its entities, and the interpretation of a new information units depends on the information variety of each entity. Users having information units

similar to a new information have the background to interpret this information (experts), but the interpretation would change according to the interpretation scheme. Experts having similar interpretation schemes would likely interpret new information units (news on a SNS) in a similar way, while not consonant information variety would amplify the possibilities of analysis and possibly the reliability of understanding.

> Proposition F: The information variety model of VSA helps in explaining that the detection of a news can vary from person to person, even in presence of equal information units. In order to provide a reliable detection of fake news by a GDM, experts with not consonant information variety should be involved.

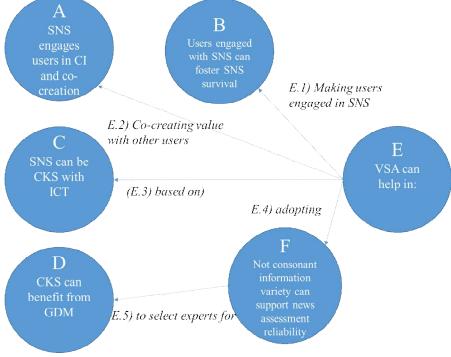To this extent, the abovementioned propositions can be linked as reported in figure 2.

Figure 2. Links between propositions to build the paper proposal

3. Proposal of a new consensus model for SNS

3.1 Conceptual Model

The proposed service method is based on the previously identified propositions (A-F) and can be adopted by system's governance to cope with fake news and moderation to modify the structure level of the system by introducing two groups of experts (in a variable number) coming from the community and interacting by means of a completely digital Consensus method:

- one in charge of making decisions on the validity of news,
- another one appointed to news moderation.

These groups of people (which can be seen as systems within the system) will be identified for having a specific information variety (according to the VSA perspective – Barile et al. 2015) that allows them solving the complexity of news credibility assessment. The decision will be made by a group of people and not just one expert given the demonstrated higher potentialities of Group Decision Making.

The model is conceived in a way to increase not only the reliability and then survival of the SNS but also the engagement of:

- judging experts and people posting news belonging to the community, who will be reworded with a competence score in a positive spiral of growing social identity within the community;
- other users of the social network, who will perceive the reliability of what they read and learn in a consonant relation with the community (while the not consonant behaviors of writers of fake/ inappropriate news are pushed away).

In such a way, the model will represent an engagement platform which increase users' engagement in the SNS, which is – according to Storbacka et al. (2016) – the microfundation of value co-creation within the SNS according to S-D logic. Engagement and containment of fake/inappropriate news will finally increase the social network viability.
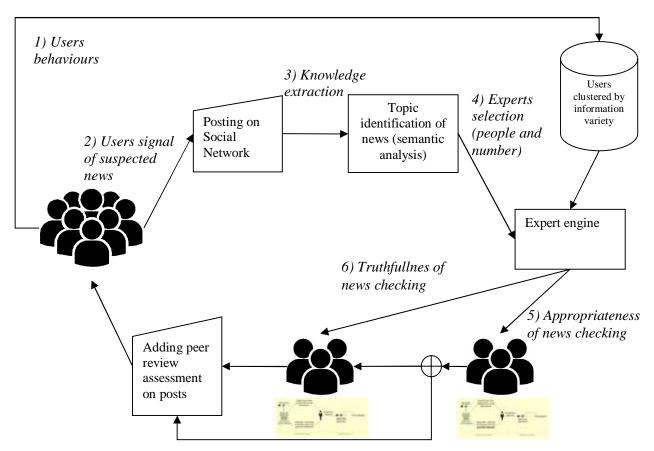

Figure 3. Collective knowledge system for social network sites (conceptual model)

In particular, the conceptual model works as follows. The collection of user behaviours in form of clicks, like, posts (step 1 in figure 3) allows the usage of social media analytics and cognitive intelligence to cluster the users with respect to their information variety (according to VSA). Data of the reliability of past user's news and services provided as expert are recorded. When a user signals a suspected news (2) which was posted on the social network site, a knowledge extraction is operated (3) to attribute a main topic to the news that can allow the selection of experts from the community (4). This activity is performed by matching news' and users' characteristics, with a variable number of experts depending on their information variety.

Steps 5 and 6 are GDM processes based on consensus method (figure 1). They are performed in sequence, checking the appropriateness of the news to the community before asking whether it is true since the first step is easier than the second and useless work on fake news consensus may be avoided. Taken into account the different possible consensus methods, it should be preferred an approach based on a soft consensus coincidence with automated feedback mechanisms which replaces the moderator, ideal in cases of crowded social environments (Alonso et al., 2010).

The final insertion of expert feedbacks on posted news (7) guarantees veracity of information for all users of the social network. To give an example:

- a positive double control results in a change of the font or colours of the text of the news, a double flag or similar;
- a negative response related to the appropriateness results in the removal of the news from the social network site;
- a detected fake news is marked differently from verified and other posted news, and the abuse is signalled to all users commenting or re-posting the news.

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The collection of behaviours of the experts and the first posting user is finally enriched by the assessment of the news (1) building the reputation of the users, which can become experts. Public ranking of the most reliable or active user in a field contribute to making the user engaged with the SNS. This implies the predisposition to resource integration and value co-creation according to service science

4. Conclusions, research limitations and implications

This research moves on the new frontier of SNS autopoiesis and will provide novel interesting contributions to the reflections on decision making in systems and viability of Smart Service Systems (Polese et al., 2017). The paper presents a conceptual model, and further researches are needed to find out the architecture of the logical/information system and the algorithms to identify experts and perform consensus method. Some variables would be the number and composition the group of experts to assign to each news to be evaluated in the consensus phase in terms of information variety and gained rewording score. Moreover, semiautomatic semantic filters should be defined to both classify news within expert classification categories and reduce the total amount of news to be evaluated (and, consequently, the lead time needed to make decisions), finally making the methods operating in a "quasi-real time" social network environment.

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