Understanding the role of communication and mediation strategies in community-led territorial innovation: a systematic review.

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Abstract. This article brings together empirical academic research on community-led territorial innovation initiatives. By engaging in a systematic literature review, the research analyses the role of digital technology in supporting community-led initiatives. Besides identifying the technologies used, this research develops an understanding both on its purpose of use and on its relation to communication and mediation strategies. A clear gap is found not only in terms of research reporting on community-led initiatives, but also on research studying the specific use of digital technology by those communities, highlighting a need for future research in the area. From an initial set of 1312, six articles are identified which meet the inclusion criteria for this review and only five of them report on technology use. Results show that a diversity of digital technologies, from blogs to online repositories, is used by the initiatives analysed, leveraging on the global coverage of the Internet. Besides a key role in supporting community collaboration and cooperation, digital technology also emerges as an important vehicle for community debate and as an enabler of community empowerment and advocacy.

Keywords: Territorial innovation; Community-led initiative; Digital Technologies; Digital Media; Communication; Mediation.

1 Introduction

The world today is undergoing profound transformations and sustainability and resilience are currently a necessity and concern for all people. This has been brought to the forefront by the 2030 Agenda for Sustainable Development, but has long been manifesting, namely through citizen-led initiatives. Groups of people from civil society have been acting to development of a better, more sustainable and more resilient world, in initiatives that target social issues, from malnutrition [1] to green energy [2], and climate change [3].

The literature has framed these actions under a plethora of concepts, such as: grassroots innovation, social entrepreneurship, and social innovation. Grassroots innovation has been conceptualized as networks of activists and organisations, operating in civil society arenas, that generate novel bottom–up solutions that respond

to the local situation and the interests and values of the communities involved [4]; these are often driven by social good, rather than by pure monetary motives [5]. This notion of experimentation and innovation is also present in the concept of social entrepreneurship, which denotes that an innovative use and combination of resources is carried out to pursue opportunities to implement social change and address social needs [6]. The role of network organising forms in the development of innovative solutions for the common good is particularly interesting to investigate in relation to the sustainability of territories through the lenses of social entrepreneurship [7].

While looking into social innovation and rural development, striving towards identifying determinants for success, [8] concluded that citizen participation is key. A very specific skillset must stem from the individual participant actor, which cannot be transferred through top-down approaches, but rather the opposite, regardless of its intended external stimulation.

Approaches to community involvement are increasingly used in different areas to attain diverse goals. Examples of these approaches include: citizen participation in health service co-production [9]; governments participatory budgeting; community engagement to promote rural development [10]; and collective management of urban green space, where co-design is enacted to develop locally-appropriate services and harness local assets [11]. Indeed, studies confirm that there has been a growing interest in social innovation. Social entrepreneurship activities [12] and examples of community-led initiatives appear to be on the rise, reinforcing the relevance of investigating such initiatives, specially from a territorial approach.

The territorial dimension relates to a relatively new field of knowledge – territorial innovation – where innovation can no longer be considered without recognizing the essential role of the territory, because its relation to people, the natural milieu, and cultural resources, is truly at the heart of the emergence of something new [13].

Another important dimension pertains to the role of digital technology. The latest developments in this area have been radically reshaping the world and are at the helm of what [14] coined as the fourth revolution of mankind; a profound transformation that is impacting all sectors of society. In this scenario, technology plays a role of utmost importance, where traditional networks and forms of social organization are amplified and empowered by technology in such a impactful way that cultures are re-shaped and changes manifest across all social structures [15]. This is also explained by Scolari [16], who discussed how current social structures are characterized by hypermediations rather than mediations. While digital media are tools society uses to communicate, mediations refer to the process rather than the media itself; a process that nowadays evolved into hypermediations: “a complex network of social production, exchange and consumption processes that take place in an environment characterized by a large number of social actors, media technologies and technological languages” [16].

To our knowledge the impact of digital technologies on territorial innovation has not yet been systematically studied. It is therefore urgent to address this gap and investigate how digital media are used in this context to then develop the necessary understanding of how they are impacting communities, economies, and others, in the scope of community-led territorial innovation (CTI).

Information and Communication Technologies (ICT) play an essential role in enabling social entrepreneurship [1] and have also been used to trigger development and empower underprivileged communities in disadvantageous underdeveloped or

remote areas [10][17]. Furthermore, digital tools have been appropriated for different purposes, namely political activism [18]. Social media, in particular, are increasingly used as a means to redefine political action and spaces [19]. Realizing political opportunities, activists use digital media to give voice to social movements and mobilize people to discuss grievances and concerns [20].

Leveraging the capabilities of the Internet, digital media have the potential of eliminating geographical divides and linking actors who are spread across different territories [21][10]. However, while both intuition and discourse around the potential of emerging communication technologies indicate that generalized access to digital technology may lead to the elimination of distances and the democratization of access to resources, Davidson & Poor [22] found that digital communication platforms exacerbate tendencies of clustering around more favoured locations and further intensify the advantages enjoyed by centrally located ones.

Despite the growing interest and increasing body of literature on the topics outline above, little attempt has been made to provide a comprehensive view of the digital technologies used to support CTI. This study then offers a timely analysis and takes a step forward towards addressing this gap. While, due to its typically practical and informal nature, it is possible that this type of CTI initiatives do not reach scientific-oriented venues, it is first important to confirm this assumption. With this goal in mind, this research then takes a first step towards addressing the identified gap, by engaging in a systematic review of the literature at the intersection of CTI and the digital technologies used to support it. This research examines published empirical evidence to ask the following questions: (i) What is the current state of the research reporting on the use of digital technologies to support CTI? (ii) What are the digital technologies being used and how are those facilitating the process of CTI? and (iii) What are the communication and mediation strategies that emerge in the context of CTI? In answering these questions, this paper aims to contribute to a discussion about the topic by eliciting implications and recommendations for future research.

To accomplish the outline above, this paper is structured as follows: after outlining the strategies used in applying the systematic review method, the eligible studies are described and analysed for emerging trends. The research then offers a synthesis of results and practices regarding the use of digital technology in support of CTI. The paper concludes by discussing and drawing out implications for both theory and practice.

2. Materials and Methods

The rising interest in the topic of CTI combined with the gap found in the research concerning the digital technologies used to support these communities is the backdrop for this research. To provide an overview of the studies reporting on the use of digital technology in promoting CTI initiatives, this study carried out a systematic review. Building on medical science research methods, systematic reviews combine cross-referencing between researchers, comprehensive searches, and agreed selection criteria [23][24]. Systematic reviews have been receiving rising credibility in the social sciences on the basis that they offer consolidated, unbiased, and thus more rigorous and

reliable reviews [23][12]. Systematic reviews are powerful in identifying conceptual gaps, and directing future research [23].

2.1 Search Strategy

In order to identify eligible studies, an electronic search was undertaken in the Scopus database, which, compared to the Web of Science database, is the database that offers the highest coverage of studies in the field of Social Sciences [25]. The search strategy included running a number of search strings, the first in English, as displayed in Table 1. The searches were carried out in April 2018 and were limited to international peer-reviewed journal articles published from 2013 onwards, reflecting the development of the field. Additionally, searches of the correspondent English translations were carried out in Portuguese, Spanish, and French, to maximize coverage.

Table 1. Search string in English.

Innovation AND Community AND Mediation; Innovation AND Community AND ("Digital Technology" OR ICT): Innovation AND Community AND network; Innovation AND Mediation AND network; Innovation AND Mediation AND ("Digital Technology" OR ICT); Innovation AND ("Digital Technology" OR ICT) AND Network; Community AND ("Digital Technology" OR ICT) AND Network; Community AND ("Digital Technology" OR ICT) AND Mediation; Community AND Mediation AND Network; Mediation AND Network AND ("Digital Technology" OR ICT)

2.2 Eligibility Criteria

Following an extensive searching phase, records retrieved were reviewed to identify eligible studies. Inclusion criteria were:

- Article reports on organized community-led initiative (from any sector, area of society, or country);
- It is clear that the initiative(s) reported in the paper emerged from a community, i.e.: "a group of people who share affinities and, voluntarily, develop joint actions, in a physical and/or virtual environment, in the context of a territory and produce, repurpose and share information relevant to the development of that territory"[1].
- The initiative described in the article leverages a resource of a territory, from people's knowledge to natural resources.
- Initiative promotes an innovative product or service.

Exclusion criteria were:

- Date of publication precedes 2013

[1] The term community was defined in the scope of the CeNTER Program/Project. This definition and others can be found at http://center.web.ua.pt/

- Insufficient evidence of organised community initiative or not possible to characterize the initiative, e.g.: regarding name, start date, goals, and target audience.
- Motivated and/or funded by an external stakeholder, e.g.: university research or government.
- Not primary research, but instead narrative or systematic reviews, or alike.

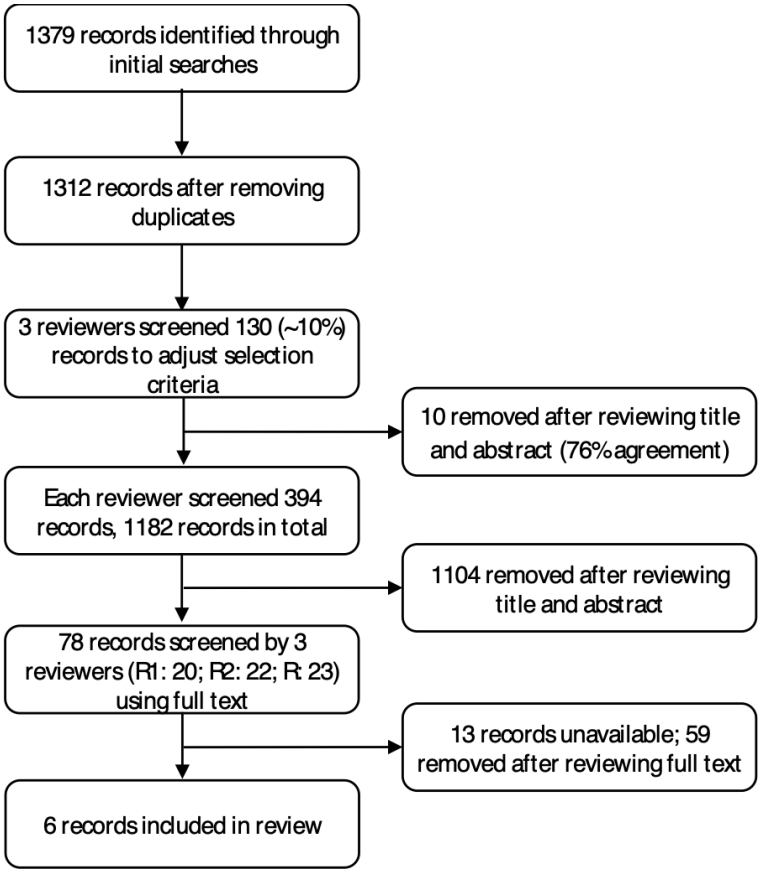
2.3 Data extraction

To support in the process of data extraction and analysis, a data extraction form was developed to summarize each study and capture: publication date, title, research design, name of initiative reported, year of initiative described, place (city and country), settlement urban/rural, target audience, endogenous resource explored, area of application, technologies used, communication strategies, and mediation strategies. This standardized way of data extraction followed the guidelines of Tranfield et al. [24] and was intended at reducing reviewers' subjectivity. One reviewer consolidated the data from the studies deemed relevant.

3 Results

Figure 1 summarizes the screening and selection process. The initial search yielded 1379 records, from which 67 duplicates were removed. Three reviewers screened the titles and abstracts of the 1312 articles. To ensure consistency, the reviewers involved in the screening process first examined the title and abstract of ~10% (130) of the records independently. This analysis led to an initial agreement of 76% among reviewers. Conflicts were resolved in a meeting, which allowed researchers to further align and converge towards the selection criteria. At the end of this step, ten articles were excluded. In a second phase, the three reviewers independently screened the titles and abstracts of an equivalent number of records for eligibility (394 each) to yield 78 articles. The reviewers then read the full text of the 78 articles, while filling out the data extraction form. At completion of this phase, 72 records were excluded, 13 because it was not possible to retrieve their full text, and, the remaining, because they were narrative reviews, did not report on a community-led initiative, or did not meet other eligibility criteria. Six articles were found eligible which remained for analysis.

Figure 1. Overview of screening and selection process



3.1 Quality of the evidence

In gauging the quality of studies and sources both in terms of methodology and reporting of results, this review adopted the assessment tool proposed by Long & Godfrey [26], which includes items such as the clarity of the research question, data collection procedures, data analysis, outcomes, key findings, strengths and weaknesses of the study, and practice implications. Three reviewers independently assessed each study, and an average was calculated using a four-point scale (0-not applicable, 1-low, 2-adequate, 3-high), following a similar approach as Kalakay and Conway [27]. The ratings are indicated in Table 2, under column 'Study design (QA) and article focus', where QA stands for Quality Assessment.

Table 2. Overview of studies.

Article	Name and year	Study design (QA) and article focus	City, Country, Settlement	Description of the initiative, target audience, and endogenous resource explored
(Schoor et al., 2016)	– Drentse KEI (in Drenthe), Year NAv – Us Kooperaasje (in Friesland), 2013 – Groninger Energie Koepel (GrEK, in Groningen), 2012	– Case study (1) – Community networks and sustainable energy.	– Drenthe, Friesland, and Groninger – Netherlands – NAv (appears to be both)	– Three umbrella organizations and cooperatives of local people who invested in producing energy based on natural resources to promote sustainability and later got organized as a group to sell the energy produced. – The beneficiaries of the initiative are ordinary citizens and the initiative leverages any natural resource that can produce energy.
(Martiskainen et al., 2018)	– Energy Cafés, – Year NAv; manuscript submitted in 2016 and mentions initiative activities dating 2013.	– Six case studies, resorting to semi-structured interviews (2) – Grassroots innovations, politics, fuel/energy poverty	– East and West Sussex, North Yorkshire, North and West Cornwall, Worthing – England – Urban and rural	– Energy Cafés provide help understanding and managing energy bills (e.g. switching to a cheaper tariff or supplier) and offer advice towards low carbon transition on energy efficiency, renewable energy and behaviour change. – Even though Energy Cafés target people who experience fuel poverty, they welcome everyone and leverage people's knowledge on the topic.

Article	Name and year	Study design (QA) and article focus	City, Country, Settlement	Description of the initiative, target audience, and endogenous resource explored
(Ferrari, Jong, & Belohrad, 2015)	– Programa de Vigilancia Territorial Indígena Independiente' (FEDI- QUEP 2015), 2006. – Name NAv, Year NAv – Name NAv, Year NAv	– Three case studies (1) – Community-based monitoring and biodiversity	– Corrientes, Pastaza and Tigre rivers, Peru – Wapichan in Guyana (South America) – City NAv, Indonesia – NAv (appear to be rural)	– Monitoring initiatives involving indigenous people and local community organisations with the goal of monitoring community's well-being and state of their territories, applying a mix of traditional knowledge and innovative approaches. The community of Corrientes watched for the Pastaza and Tigre rivers. The community of Wapichan detect illegal activities and sets priority actions and inter-community agreements for securing legal rights over customary land and ensuring sustainable use of natural resources. In Indonesia, communities engaged in participatory mapping activities to document customary lands to tackle situations where health, livelihoods and well-being were at risk. – All initiatives rely on local people, the monitors, and are directed at governments.
(Pohjola & Puusa, 2016)	– Electric Cars – Now!, 2007	– Qualitative case study, triangulation and interviews (2) – Communities of practice, group dynamics, climate change, sustainability	– City NAv; Finland, and later, all over the world. – Finland, later international. – NAv (some activities online)	– Community initiative with climate change concerns that aims at making electric cars affordable for everybody by making the blueprints of conversion kits available and leaving manufacturing to the markets. – The initiative targets global citizens and market and leverages community's R&D that made open-source blueprints of electric car conversion kits available globally.

Article	Name and year	Study design (QA) and article focus	City, Country, Settlement	Description of the initiative, target audience, and endogenous resource explored
(Bonomi et al., 2017)	– REBUS, 2004	– In-depth longitudinal study, with field study and semi structured interviews (3) – Social entrepreneurship, food surplus/malnutrition	– Verona – Italy – Urban	– To address food surplus and poor nutrition, a group of non-profit organisation volunteers conceived a network-based service involving for-profit organizations (e.g. supermarkets, which can donate surplus food), non-profit organizations (e.g. charities, which can collect the surplus food), and government bodies and public sector organizations (which legitimate, supervise, incentivise the process). – The initiative targets people with excess food who want to avoid food waste and people with poor nutrition. The key resource is free and safe surplus food.
(Thapa & Sæbø, 2016)	– Nepal Wireless Networking Project (NWNP), 2001.	– Interpretative case study and interviews (2) – Participatory development, social capital, ICT4D	– Mountain Villages: initially Nangi and Tikot and eventually 175 villages. – Nepal – Rural	– Realising the impact of ICT in empowering remote mountain communities, an individual sought for technological resources (e.g. computers, phones, etc.) and like-minded people to set up a wireless station (TV-dish antennas and Wi-Fi equipment). There were no computers, nor telephone or Internet. Initiative benefits later extended to schools, hospitals, etc. In 2003, NWNP registered as an NGO, initiative went global and donations rose. – The initiative targets remote mountain communities and has people and technology as its key-resources.

3.2 Studies characteristics

Table 2 provides an overview of the publications included in this systematic literature review. All studies address social concerns, three focus on energy-related issues [5] [3] [2], one on preserving biodiversity and property rights [28], another on ICT4D - Information and Communication Technologies for Development [17], and another on

food surplus/malnutrition [1]. All studies report on community-led initiatives, yet each study approaches community-based activities differently, emphasising topics from community networks [2] to social entrepreneurship [1].

Table 3. Overview of mediation and communication strategies.

Article	Digital tools used	Communication and mediation strategies used, how, what purpose?
(Schoor et al., 2016)	– The article does not report on the use of digital technologies.	– Community volunteers visit villages 2-3 times a week to run local information meetings. These meetings are important for local cooperatives to share knowledge and experience. Specifically: – The Drenthe's community is a cooperative of voluntary members. The community was founded by and works for the local initiatives, which apply to become members the larger community, once they set up their local organisation, have a statutory description and a plan of work. The community has a board and is largely dependent on motivated board members and volunteers. – The Friesland's community is a cooperative that depends on voluntary work, with only five members, no office and no employees. The initiative organizes instruction meetings and helps other initiatives with legal procedures and fiscal advice. – The Groninger's community is a working group, which depends on voluntary work that supports, stimulates, links, and encourages local initiatives to get started. The initiative has one employee, a full-time volunteer, who is assisted by students doing their internships. The initiative focuses on sharing of knowledge and recognises an undeniable and sheer amount of valuable local knowledge.
(Martiskainen et al., 2018)	– Social media.	– Social media made citizens aware of the initiative and led debates to form. – Energy Cafés are pop-up meetings run by volunteers (three initiatives also have staff members, for details see Table 2 in Martiskainen et al. (2018)) at various places (mostly at cafés but also include home visits) to give advice on energy bills and energy consumption behaviours over tea and cake. Energy efficiency measures are the focus of the meetings and a number of materials are shared and used to aid this process, e.g.: free samples of energy efficiency measures such as energy light bulbs, or low-flow shower heads. Energy Cafés provide a space for local energy debates, with groups getting involved in local energy discourse, through discussions on energy bills, concerns over nuclear energy, energy-saving devices, and on what fuel poverty means. Volunteers had to reassure citizens they were a non-profit cooperative and that they would give impartial advice, citizens lacked trust.

Article	Digital tools used	Communication and mediation strategies used, how, what purpose?
(Ferrari et al., 2015)	– Peru and Indonesia: no specific information on technology use. – Guyana: smartphones, photographic and geo-referenced information, GPS data, digital GIS database, map printer, aerial vehicle, and website.	– In Guyana smartphones, data collection tools, photographic and geo-referenced information and GPS data are used to monitor ecosystem health, land use change, and external threats (e.g. rights violations by illegal mining and logging). The aerial vehicle is used to monitor extractive activities. The website is used to host monitoring information, display public mapping data, through an interactive map, and show information on social, cultural and community development. The website is viewed as an open source tool for communities to easily view, manage and publish geographic data that could be adapted for use by other communities in other parts of the world. – Peru: indigenous monitors received training from local indigenous federation to track and document the impacts of oil exploitation activities. Monitors were key for the success of communities' advocacy activities. – Guyana: village-level consultations and collective inter-village meetings to create plan for a sustainable territory. Community consists of local monitoring team, whose participants were self-selected by the villages. Monitors conduct monitoring trips at the request of the villages. Monitors received training from international NGO; at the time they successfully developed own customised community monitoring forms on smartphones. – Indonesia: communities took part in participatory mapping activities to fight for land communities' rights violations, document ownership, and protect their lands. This allowed communities to take informed decisions.
(Pohjola & Puusa, 2016)	– Maturing stage: community used Internet, e-mail lists, technologies that enable virtual forms of work, and an open innovation platform. Social media, Facebook, and the platform were used in the final stage of the community. Article also mentions: blog, FAQ and discussion forum, without specifying the period of use. Technology use is not specified for other stages of the community.	– The community formed because participants had a shared interest and the lack of bureaucracy allowed them to work together. At this stage, ICT (not specified) served as way of informing interested parties and of sharing and refining ideas. Email lists were created to involve more people and to communicate and share information. – In the maturing phase, physical face-to-face meetings took place playing an important role in developing relationships of companionship and trust. Different roles and responsibilities were assigned but no hierarchy was established. At this stage the community became international and part of the work was online, eventually extending to an online open innovation platform, in which the community posted all important things relevant to the community. Communication over the Internet made it possible for knowledge capital to rise to an international level. – In the investors-involvement phase, information was no longer available online via the Internet for protective concerns; this led to community fragmentation and feelings of suspicion and competition emerged. The core group could not revert this unwanted situation. – In the final stage of the community, ICT (e.g. platform and social media) were viewed as a forum of discussion for the continuity of the community and for participants to keep in touch.

Article	Digital tools used	Communication and mediation strategies used, how, what purpose?
(Bonomi et al., 2017)	– At first, e-mails, phones, online archive, database. – In 2008, dedicated website developed with: database of beneficiaries, algorithm of needs, a database with available goods, reporting system covering involved parties and registered activities, and pickup confirmation. Used only open source software. – Mobile application under development to support registration/login, food listing, food searching, food request, pickup scheduling, and pickup confirmation.	– The different technologies used served a number of purposes: – ICT tools supporting activities of pioneering phase did not require training or costs, but technically were a sub-optimal solution. Despite its simplicity, the first information system enabled day-by-day coordination and monitoring activities, as well as support in the solution of emerging problems. – In 2008, regional government funded and incubated the project and the project gained greater dimension. This required the development of new software not only due to the growing demand of the service, but also to comply with the regional government's ethical principles and policies. The system embeds the rules and the principles of the REBUS project to maximise fairness, ethics, and societal impact, as well as efficiency and effectiveness. The system interface is as simple as possible in order to reduce training, as users are often volunteers of diverse ages and backgrounds. – New IT solution will leverage a mobile application and a website working off the same database to allow donors and distributors to directly enter data, and this way improve management and reduce REBUS administration staff and volunteers' workload. – The REBUS project involves the creation of a highly distributed activity system with REBUS serving as the bridging organisation for all partners and in charge of coordination, information flows, monitoring, and, when necessary, problem-solving and cultural alignment across the three different partner categories. The key factors of REBUS's success, such as replicability, accountability, and economic self-sufficiency, emerged and as the result of the long-term collaboration of multiple people from several organisations.
(Thapa & Sæbø, 2016)	– E-mail, wireless station consisting of TV-dish antennas and basic Wi-Fi equipment	– E-mail was used to connect with a TV channel, volunteers and supporters of the initiative, and to attract physical resources such as computers and antennas. The service created then promoted communication and collaborations among people involved in distance education, telemedicine, and e-businesses, etc. – The consolidation of the ICT service led to the development of other services in the areas of education, health, and business. This development and consolidation of services led to the creation of an NGO, which in turn led to the expansion of the network to several parts and organizations of the world (more donations of equipment happened at this stage) and the definition of more formal ways of organization among participants and members.

Four studies report on initiatives taking place in Europe – The Netherlands, England, Finland, and Italy – while the remaining cover one initiative from Asia and a set of initiatives located in South America. Regarding their target audience, with exception of the study from South America which targets the governments of the countries involved [28], and the initiative from Finland which reach communities globally, all remaining initiatives target population in general, and in particular the citizens of the territories they are linked to. The publications are mostly omissive regarding their settlement type (urban, rural). However, based on the text it can be inferred that one

initiative refers to an urban area and two to rural areas. The remaining allowed for both types of settlements, with one of them bringing attention to its online, thus virtual, nature.

Regarding their research design, five publications [28] [5] [3] [2] [17] follow a case study design, describing one or more particular cases. The remaining article [1] reports on an in-depth longitudinal study. Furthermore, four of the publications [1] [5] [3] [17] use interviews to carry out their research, with Bonomi et al. (2017) applying a participatory approach as well. The specific mediation and communication strategies each initiative employs are synthesised in Table 3, which gives an overview of how the initiatives operate.

3.3 Digital technologies used

From the articles included in this review, one of them makes no reference to technology use [2], therefore this section solely analysis the five remaining articles. For the correct interpretation of the results, it is important to highlight that while three articles address the issue of technology [1] [3] [17], another does not directly address it [5] and the other [28] only discusses technology with regards to one of the three initiatives reported in the article. Conversely, the initiative reported by Bonomi, Ricciardi, and Rossignoli [1] reports on an initiative that makes an intense use of technology and focus on how technologies have evolved together with the initiative.

The analysis of the studies shows that the Internet emerges as the backbone for all the services alluded to in the articles. In the initiative reported by Thapa and Sæbø [17], the Internet assumes a pivotal role in which making the network of networks available in indigenous mountain villages is the goal and purpose of the initiative described.

E-mails and websites are the most frequent tools referred in the papers analysed. While Bonomi et al. [1] and Thapa and Sæbø [17] use email to facilitate communication between people, by exchanging asynchronous messages, in the initiative described by Pohjola and Puusa [3], the use of emails extends to the benefits of creating a mailing list. Email played a key role for Pohjola and Puusa [3] in efficiently connecting and keeping the community up-to-date on activities, and for Thapa and Sæbø [17], because, reaching out to a TV channel led the community to expand and gain visibility. Websites are used by three initiatives [1] [28] [3] to gather and share information. In the initiative described by Bonomi et al. [1], the website is the central hub of operations. Two projects also use social media [5] [3], stating their importance to raise awareness, promote debate. Pohjola and Puusa [3] additionally use of a blog, discussion forum, and FAQ service.

Not much detail is provided in terms of the type of equipment used to support the initiatives reported in the articles. Still, two initiatives allude to the use of smartphones, which are used to fill in monitoring forms [28] and to access the mobile version of the website [1]. In Ferrari et al. [28], smartphones are more than an alternative to accessing the website, and are key in collecting information 'in the wild', being part of a larger set of tools that includes an aerial vehicle, and a printer, used to collect GPS and GIS data. One last project reports on the use of TV-dish antennas and Wi-Fi equipment [17].

Into what concerns the software solutions used, there is a tendency towards the use of commonplace software solutions, i.e.: free access productivity tools everyone can

easily avail of everywhere. This is particularly true for the initiative discussed by Bonomi et al. [1] where a number of day-to-day tools are mentioned, such as: spread sheets, databases, and an online file archive. This project additionally emphasizes the importance of using open source applications, which others can leverage and use, a preoccupation that is also highlighted by Ferrari et al. [28]. Another dimension implicit in most initiatives and especially relevant in Pohjola & Puusa [3] is the use of tools which allow for virtual forms of work.

3.4 Communication and mediation strategies

The studies were analysed with regards to their activities and organization to elicit communication and mediation strategies. All initiatives, largely or totally, depend on volunteers. Still, as initiatives grow, full-time staff may be required, as indicated by [1].

As initiatives evolve, its structure may become more formal, and membership application may be required [2] and a board may be created [3] [2] [17]. For Pohjola & Puusa [3] and of Thapa & Sæbø [17], the formation of a board led to the definition and assignment of specific roles. Boards adopt a more or less hierarchical/flexible structure, and may be both deliberately not hierarchical [3] and centralised in one person [17]. As initiatives grow, they are likely to interest other sectors of society. For instance, the positive impact of the community initiative described by Bonomi et al. [1] grabbed the attention of the local government, which then funded and incubated the initiative, providing it with the necessary means to advance towards a more solid and robust ICT platform. Likewise, the initiative detailed by Thapa & Sæbø [17] led to the creation of an NGO.

Community meetings and get-togethers take place at different locations, including online. Some initiatives do not have an office [2], and others meet in casual locations, such as cafes, to maximise exposure [5]. Ferrari et al. [28] report face-to-face meetings only. Bonomi et al. [1] and Thapa & Sæbø [17] make no specific reference to meetings location, still there are indications that activities take place both locally and remotely. The initiative described by Pohjola & Puusa [3] runs both remote and face-to-face meetings, recognizing advantages in both approaches. While the first approach allowed the community to become international and grow wider, the latter enabled the development of relationships of companionship and trust among members. The development of these relationships is noteworthy, because the lack of these strong ties may lead to community fragmentation [3], as a consequence of geographic distance and the manifestation of suspicion and competition [3] or of distrust and lack of familiarity [5].

Initiatives met with the purpose of sharing information, exchanging member's experience, and eventually leverage these to benefit the initiative itself and community at large. While Bonomi et al. [1] report on the use of meetings to organize work, one of the initiatives described by Schoor et al. [2] underlines the sheer value of local knowledge. Another community initiative specifically prepared instruction meetings, in which members of the community provided fellow community members with information and training [2]. Training involving external organizations was carried out by two of the initiatives described by Ferrari et al. (2015). The activities of the

initiatives promote advocacy and community empowerment [28] [5], economic profit, while still promoting sustainability [2], and learning and refinement of ideas [3].

4 Findings and discussion

Two main themes emerge from this review and analysis: one relates to the purpose of use of digital technology, being it the motive or the result of its use; the other concerns the context in which initiatives unfold and develop. The following sections elaborate on these subjects.

4.1 Purpose of digital technology use

The analysis presented in the previous sections shows that initiatives avail of a breath of digital tools, from websites to e-mail and social media, which initiatives use in support of their communication and mediation strategies. While little is reported regarding the specific purpose of use of each of those digital tools, results indicate that *information sharing* is often the motive of their use, either as a way of keeping interested parties informed or of sharing ideas. This concurs with the findings of other studies, which found information sharing is the most frequent reason why people use digital technology [29].

Still, sometimes, the purpose of use of technology largely extends information sharing *per se*, because it is through technology that all monitoring, managing, and coordination activities take place, making *technology the central hub*, through which all work and activities of the initiative are organized [1]. The literature reports other cases, in which the digital platform:

> "not only fulfills its principal aim of bringing together producers and consumers to promote direct sales, but it also helps develop new and more substantial ties between local producers within, and equally importantly, beyond their local context, thereby enabling greater information transfer and sharing" [10], p. 620.

This 'hub' is part of a larger *ecosystem* that not only supports initiatives in storing and managing information [1] [28] [3], but also enables new forms of work and communication [1] [3] [17]. Another aspect that emerges from three studies [1] [28] [3] relates to the *use of open source and commonplace software solutions*, where there is a preference for familiar, readily available tools, which do not require training, can be widely reused, and made available internationally at no cost. This resonates with other current trends and echoes the findings of other studies that found that companies and communities alike consider that adapting readily available technology should be included in the definition of innovation, namely in rural areas [30].

Digital communication and mediation strategies are central in supporting community initiatives both in reaching out to external actors and in connecting internal members. Digital tools, in particular social media, are also used to *promote the initiative*

and give it national and international visibility. This is observed in Martiskainen et al. [5]; other studies have reported similar strategies [31]. In the case of Pohjola & Puusa [3], social media enabled the community to grow and become international, following earlier stages, in which the community blog, FAQ, and discussion forum tied together the physical meeting place and the virtual community. Social media is also used as a way of *keeping community members in touch* [5] [3], echoing previous research findings, where social media are crucial in supporting scattered communities [32], namely in finding information and joining events [29]. Social media is also appropriated to *raise awareness and stimulate debate*. Previous studies confirmed the use of digital tools for digital activism practices, where further to serving as a means to facilitate participation, organize, mobilize, and direct action [18], digital tools serve as a means to redefine political action [19]. Similarly, social media and discussion forums are crucial in the initiative described by Martiskainen et al. [5].

While it is compelling to highlight the use of new media, it is equally relevant to underline the *importance of traditional media*. Television played a vital role in reaching out to foreign volunteers in the initiative studied by Thapa & Sæbø [17]. One then cannot disregard the importance of traditional media, newspapers and other printed media, as previous studies emphasised [29] [31] [33]. Similarly, it is important to underline the pivotal role of the Internet – the infrastructure most digital tools build upon.

4.2 Contextual concerns and capacity building

The Internet has enormous potential for broadening people's relational experiences. Particularly in rural scenarios, new technologies that use the Internet are especially useful, because those technologies link actors, who are spread across different territories and enable them not only to share resources and experience, but also to keep in contact and up to date with new information, partnerships and markets [21]. This is observed in the example described by Thapa & Sæbø [17], where the Internet is an important enabler and catalyst for economic, health, and education developments to unfold. Indeed, to develop broader connections, that allow communities to access resources and infrastructures (e.g. education, trained employees, markets), is crucial for innovation to unfold [21].

As noted earlier, most services nowadays leverage the potential of the Internet. This has been introducing changes in society and the way people interact with one another. Requena & Ayuso [34] studied the interaction between face-to-face and digital social networks and concluded that digital networks enrich face-to-face networks and digital communities complement face-to-face relationships. Furthermore, McCormack [29] found that on-going mediated and face-to-face interaction, not only strengthen weak ties, turning them into strong ties, such as friendship, but also led to a person's incorporation in the community.

The relationships that develop over the ever-growing digitally supported aspacial world of the Internet are of extreme importance for community-led innovation, because studies indicated that informal ties are responsible for perpetuating innovation communities and networks [35]. Additionally, as observed in some of the studies included in this review [1] [3] [17], community-led initiatives can quickly reach wider, digitally-supported frontiers, thus lending increased relevance to this subject. However,

in the particular case of Pohjola & Puusa [3], the fact that the community existed and still exists through its online presence, did not avoid disarticulation and community defragmentation; an event attributed to feelings of distrust and competition, exacerbated by the fact that the community was not only international but also virtual.

As studied by Kadushin [36], one of the factors that predicts the formation or discontinuation of online communities is propinquity, which explains that people are prone to develop more ties with those with whom they are geographically close. Still, Baker & Ward [37] argue that people get together based on a shared interest, rather than a mere coincidence of geographic proximity. Furthermore, trust between actors is crucial in fostering relationships and promoting the exchange of resources [38], and members' motivation is also important [3]. If it is true that networked communication links geographically distant communities, how this happens and can be supported is not clear and it seems that the link technology creates will not be enough to establish and sustain initiatives. While some studies argue for the promotion of a wider participation [21], others conclude that, unless the interest that made a given person join a virtual community of interest affects that person's daily life, as a physically-instantiated and geographically-centred individual and citizen, that person will not continue an active membership [37]. This is complex to determine and consequently to support, foreseeing the articulation of many aspects.

Another interesting aspect that emerges out of this analysis relates to capacity building. While empowering participants may not be the principal goal of the initiatives analysed, training and support in the development of skills is a spill over effect. Formal training is provided both internally [2] and by an external organization [28]. Other informal approaches to training, through providing advice and information, are also reported, for example in Martiskainen et al. [5]. Previous studies report that information and experience sharing are both essential and valuable for knowledge construction within the community [33] [39].

4.3 Limitations and future research

There are some limitations to this study, which can stimulate future research. This review used only one database to retrieve potential eligible studies – Scopus. Although research has demonstrated Scopus offers the highest coverage in the Social Sciences [25], arguably the database selection may have omitted relevant research. Furthermore, while aiming for a comprehensive coverage, by choosing to include articles in different languages and by using various search strings, the fact that only international peer-reviewed journal articles were considered and that a rigorous systematic process was followed, may have left out pertinent studies. Still, the inclusion of international peer-reviewed journal articles ensures only high-quality studies were included and a systematic review process lessens the chances of researcher bias, so often present in traditional narrative reviews [40]. Nevertheless, the choices in methodology and database selection warrant further research, where this study can be replicated and extended to other databases and more articles types. Targeted searches and snowballing from relevant sources could further increase the number of included studies and thus help cover a more complete set of papers.

Another limitation pertains to the time span. While this study followed a replicable, methodical and transparent process, this study is time-bound – articles dated pre-2013 have been excluded –, thus representing a snapshot in time. The rationale for this choice is found in the recency of the area of study, since, as discussed in the introduction, the field of territorial innovation is relatively new and so are the impacts of the fourth revolution of mankind.

A small number of studies met the inclusion criteria. This may simply be a result of the infancy of the area to which contributions on community-led territorial initiatives only recently started to emerge. It may also mean that, due to the nature of these initiatives, often practical, small and aiming at common good, these initiatives have not been subject of analysis, and, thus, are not reported in scientific venues. It may be the case that initiatives are only studied and reported after they have gained visibility and reached a 'more mature' phase, reflected in the creation of a company or a non-profit organization, as happened with some initiatives described in this review [1] [3] [17]. This may suggest that, had more permissive illegibility criteria been defined, for example, which had considered the inclusion of lay literature, an ampler number of cases could have been identified.

The small number of studies did not allow for an analysis regarding, for example, application area, country, or settlement type. The latter is particularly relevant for a thorough understanding of territorial innovation. Innovation networks in the periphery, where aspacial networks are included, seem to be crucial, especially when referring to connections to extraregional actors [41]. Yet, these vulnerable areas, which have the greatest need for social innovations, are also the less resourceful and the ones that have the most difficulty in motivating and mobilising local actors to develop social innovations [8]. Research is needed to determine how digital technologies can support initiatives, depending on the regions those initiatives are and the resources they have available to them.

The heterogeneous structure of the articles was also a challenge. Possibly deriving from the diversity of phenomena studied in the articles, the studies were hard to relate; this restricted the analysis and the conclusions derived from their examination. Most importantly, the references to digital technology are incomplete and not explicit in half of the articles. This may mean that technology is regarded merely as a tool, which then takes second place to the main topic of the articles. However, unless the use of digital technology is described, it is not possible to determine, for example, if an initiative indeed does not use 'social media', or if it simply did not mention it. In addition, the case study methodology is the primary data collection method, with only one longitudinal, thus more robust, approach [1]. Findings from case studies cannot be uncritically transferred to other realities, limiting the extent to which the results of this review can be applied.

This review brought clarity over the types of digital technologies used in the context of CTI initiatives as well as the purpose behind their use. However, more and better-quality studies are needed to effectively understand to what extent initiatives adopt digital tools to support their activities and how these tools affect their changing dynamics. Further, when studying the topics of this review in future research, it would be particularly interesting to analyse, whether the use of digital technology, both in terms of quantity and the specific tools used, changes over time as the initiative gains maturity. Likewise, a thorough investigation would shed light into how technologies

are being appropriated to foster CTI. Studies report that different digital tools are appropriated to achieve different goals and to target different audiences [18], so it would be valuable to determine what specific tools and contents should be used depending on the purpose the initiative.

Finally, it is important to recall, that regardless of the changes digital technology brings to society, it does not mean that changes are inherent to the technology, as, used in different contexts, technologies yield different effects [20]. Changes are also not necessarily positive, requiring further investigation. Studies have also reported that CTI may chose not to use technology [42]; so these eventual inhibitory effects also have to be pondered when studying digital technology as a means to promote community engagement and articulation.

5 Conclusions and final remarks

By developing a systematic review of the literature on community-led initiatives, this article provided an understanding of the use and role of digital technologies in the context of community-led initiatives and elicited communication and mediation strategies in that scope. In doing so, this research aimed to take stock of the available literature by integrating research findings developed elsewhere, to then build an understanding on the subject.

Six studies met the inclusion criteria for this review, with only five of them reporting on technology use. From those studies, two neglected the subject providing incomplete descriptions on the use and purpose of technology. All studies resorted to qualitative methods. With a diversity of topics and styles, no reporting consistency was found regarding areas of application, technology use, communication and mediation strategies, or else. This limits the findings of this study.

Still, a number of important conclusions can be drawn from this systematic review. First, a lack of studies was found reporting not only on CTI initiatives, but also on the use of digital technologies supporting those. This addresses RQ1, where results evidence that little attention has been paid to research at the intersection of CTI and the digital technologies used to support the first. Additionally, and partly addressing RQ2, the lack of studies found limits what is known about technology use and their specific role in supporting community-led innovation initiatives, warranting future research. Without knowing what specific technologies are used and by having no awareness on its specific purpose of the use, it is not possible to provide communities with credible solid guidance on how to leverage technology to facilitate and strengthen their initiatives. This is tightly related to RQ3. It appears, that research so far has largely neglected the link between technology and specific communication and mediation strategies in the context of CTI initiatives. This shows that research in this area is still in its infancy.

Still, it is possible to say that communities resort to a diversity of digital tools, from e-mail, to blogs and social media in their digital communication and mediation strategies. Through digital tools, communities share information, promote their initiatives, keep in touch with members, raise awareness and stimulate debate. In this

way, and leveraging the potential of the Internet, digital technology can then be seen as a set of tools that contributes toward addressing community needs and concerns, playing a particularly important role when communities reach larger national and international arenas. However, this does not come without concerns as much is still to be understood regarding how relationships among members unfold when considering aspacial communities. Regardless of the location where community members meet and the means they avail of, capacity building is inherent to these communities. Training has an intrinsic role in informing and empowering community members and consequently in enabling community-led territorial initiatives to succeed.

This systematic literature review serves as a platform for future research by outlining the need for future studies, which specifically address the role of digital technology in CTI initiatives and provide an understanding of how these intertwine with communication and mediation strategies. Without further studies, it will continue to be challenging to understand the extent to which a territorial initiative and its community can be supported by digital technology.

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