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THE USE OF DIGITAL LAYERS IN POST-GROWTH COMMUNITIES - AN EXPLORATORY STUDY

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Abstract: *The pursuit of infinite growth on a planet with finite resources is leading to a failure in achieving global sustainable transition goals. The concept of Degrowth or 'post-growth' has emerged as a counter-movement advocating for alternative approaches focused on living within resource constraints. Within this context, small-scale communities with post-growth orientations are particularly interesting, as they actively explore their own alternative development models. These communities have potential to act as decentralised laboratories for radical change, translating Degrowth/post-growth theory into actionable practices.*

This paper examines how the operational tools have changed for post-growth communities since 2004 (Web 2.0). Through in-depth interviews with tech-savvy representatives in this field, the study explores the potential of "new" technologies to empower post-growth communities.

The findings indicate that using digital layers had potential to support community setup, organisation and evolution, in particular having impact on i) improving access to community; ii) facilitating internal communication and coordination; iii) enabling a common boundary and internal diversity; iv) encoding alternative development models into sharable and adaptable systems. However, despite the identified benefits, the main barrier was how to introduce technologies that community members were not already familiar with. People tended to only use tools they already knew - often particularly unsuited for community coordination. While the study hints at potential solutions, the introduction of truly useful technologies to communities deserves further investigation since their power depends on learning how to use - and adapt - these tools for community purposes. This exploration provides insights into how digital layers can aid and abet communities developing their own paths towards sustainability. It represents a step towards identifying strategies and tools for implementing post-growth theories in practice, contributing to the discussion on how to transition towards a diverse and resilient society.

Keywords: *Post-growth, Technology, Communities, Laboratories of Change, Interviews*

1. Introduction

The world needs alternative development models. More than 30 years after the sustainable development paradigm emerged, the intended harmonisation of economic growth, social welfare and environmental protection has proved elusive (Asara et al., 2015). Despite this, the dominant line in mainstream economics is to continue to pursue perpetual growth (Hickel, 2019) - although this goes counter to a well documented empirical record of the relationship between economic growth and ecological breakdown (Hickel, 2020; O'Neill et al., 2018).

A potential alternative path might be found in the concept of Degrowth, or 'post-growth' economics, a paradigm that calls for the abolishment of economic growth as a social objective and signifies a desired direction where societies will use less natural resources and "*organise to live very differently than today*" (Kallis et al., 2015, p. 1).

Implementing this paradigm in practice, however, might face difficulties depending on the context they are being developed within. As housing and jobs centralise (United Nations, 2023), cities continue to be the main drivers of the growth paradigm (Florentin, 2018; Molotch, 1976). Developing post-growth approaches might be shaped and limited by this context (Florentin, 2018) - the alternative solutions are trying to emerge within the very systems they are trying to change. Instead, we could look towards options of how to develop post-growth practices in decentralised forms and contexts, not from within the very centres of the 'engines of growth' (GTIPA, 2018).

One group that have been pointed out as decentralised 'laboratories of change' (Nogueira et al., 2019) is intentional sustainable communities working towards developing their own alternative development paths. Intentional communities have been described as groups that create a whole way of life for the attainment of a certain set of goals (Schenker, 1982). They encompass a wide variety of conglomerations, but the classic definition by Metcalf (2018) is "*five or more people, drawn from more than one family or kinship group, who have voluntarily come together for the purpose of ameliorating perceived social problems and inadequacies*" (Metcalf, 2012, p. 1). Traditionally, these communities often take the form of alternative habitation such as ecovillages, but with the rise of networked technologies not necessarily place based forms, such as associations and coops, are also emerging.

These communities are not a new occurrence, nor is their ability to be innovative catalysts or "seedbeds of society" (Morgan, 1942). However, the operative tools for coordinating groups have vastly changed in the last 20 years, and there is limited research on how post-growth oriented communities are using technologies in their day-to-day operations. Although the impact of the fourth and fifth technological revolutions on society have been extensively researched (Knell, 2021), the potential of digital layers to support in particular intentional sustainable communities as socio-technical innovators -i.e. 'agents of change' - is currently underexplored (Nogueira et al., 2019).

Therefore the primary aim of this paper is to explore which aspects of post-growth communities can be aided by a digital layer, in order to support them as decentralised laboratories of change. Through purposive interviews with tech adept representatives that have both professional and personal knowledge of community, this explorative study aims to provide a better understanding of *how post-2004 technologies can support decentralised communities in developing their own alternative development models*.

2. Background: key concepts

The below sections expand on the key concepts: intentional ‘post-growth’ communities, the definition and role of ‘technology’, and the concept ‘laboratories of change’.

2.1 Identifying ‘post-growth’ communities

Modern self-organised communities often emerge as a response towards the inadequacy of conventional governmental structures (Edelenbos et al., 2018; Nederhand et al., 2016) and the sustainability challenges that the neoliberal and capitalistic economic system has not been able to tackle (Nederhand et al., 2016). In this sense they can be associated with the Degrowth and post-growth movements (Asara et al., 2015; Pansera and Fressoli, 2021). Some organisations are more *“informal and loosely structured”* (Edelenbos et al., 2018: 52), while others are more defined (Comfort, 1994) and explicitly pursue self-governance (Nederhand et al., 2019) by embracing *“an internal point of view on the world and deliberative standpoint, supporting the literal applicability of intentional description”* (Ismael, 2011, p. 23). For the purposes of this paper a broad definition is applied, modified from Metcalf (2018): Five or more people, drawn from more than one family or kinship group, who have voluntarily come together for the purpose of ameliorating perceived unsustainable social, environmental and economic patterns through self-organising around their own alternative development model.

2.2 Definition and potential role of technology

‘Technologies’ in the context of this paper refers to network enabled innovations developed post 2004, when the emergence of Web 2.0 (Hesse et al. 2011) introduced the ability to contribute with content and interact with others on the Web. The unprecedented progress networked enabled innovations (Roldán Bravo et al., 2016) have made over the last decades expresses a potential for supporting the sustainment of self-organised communities (Morrow, 2019). ICT (Information and Communication Technology) can support *“a better use of knowledge and data (...) across a wide range of groups that share one or more characteristics that define them communities”* (Hesse et al., 2011, p. 15), as well as organisational forms not previously seen - from open source platforms such as GitHub (Padhye et al., 2014) to blockchain technology that displays *“potential for facilitating redistributive and regenerative post-capitalist economies.”* (Howson, 2021, p. 1). The potential role of technology in this paper chimes with the view of Kostakis et al. (2023) as *“a vital component of modern society cutting across all its other aspects, required to achieve social and environmental sustainability”* (Kostakis et al., 2023, p. 1).

2.3 On post-growth communities as laboratories of change

Nogueira et al. (2019) explores small scale communities such as intentional communities from their *“potential as laboratories for the emergence of innovative practices and their possible capacities for the introduction of change in the sociotechnical regimes and, later, for their transition”* (Nogueira et al., 2019, p. 17). By incorporating technologies to co-create knowledge and solutions for a wide range of social needs *“at a scale and speed that was unimaginable before the rise of the internet”* (Bria, 2016, p. 9) these communities might be strengthened, and *“provide a glimpse into what ‘innovation without growth’ could mean in terms of technology and social organisation* (Pansera and Fressoli, 2021, p. 380) Still, these authors recognize that existing studies are incipient and further research is needed to disentangle such a potential from the romanticisation of such communities and better understand how they have been using technologies in their day-to-day operations.

3. Research approach and methodology

This paper adopts an exploratory research approach, which is useful when the object of study is relatively underexplored (Stebbins, 2001). The data was gathered through semi-structured interviews, focusing on insights from tech-savvy participants with in-depth experience of community. *Figure 1* outlines the three major steps and associated methodologies of the process.

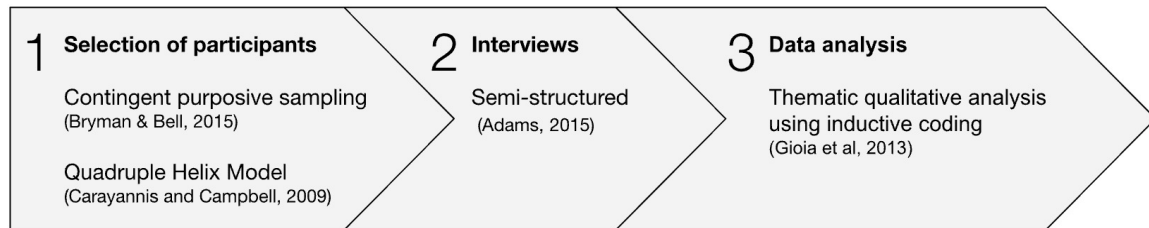


Figure 1: Research design

3.1 Selection process

The participants were selected using contingent purposive sampling (Bryman & Bell, 2015) and the Quadruple Helix Model (Carayannis and Campbell, 2009; Schütz et al., 2019). Slight adaptations of the model helices were made for the context of this paper, find their specifications in Table 1.

Selection criteria were a) professional or practical experience of technology in relation to community b) relation to one or more communities with a post-growth approach c) representing multiple aspects of the Quadruple Helix Model ('Affiliation', Table 1). For example, being both an active member of a community and a software engineer indicated an affiliation with both 'Community' and 'Industry' aspects.

The final selection resulted in seven participants. As the purpose of this paper was to make an explorative study to identify patterns of interest in relation to the topic this smaller focus group was deemed sufficient. The group represented six countries and three continents. The community the representatives related to varied between being at the forefront of using technologies to using very little technologies at all, approximately half representing tech-proficient communities and half non-tech proficient.

3.2 Conducting the interviews

The data was collected primarily in the form of semi-structured interviews (Adams, 2015), conducted conversationally with one respondent at a time through open-ended questions. This allowed for focusing on the topic while still being able to explore relevant ideas that came up in the interview, talking through participants' thoughts and beliefs. The questions covered their general relationship to community and perspectives on technology use in this context (Table 2).

The interviews were conducted in September and October 2023. One of the interviews was conducted in Swedish, and the remainder in English. All interviews took place through video call and were between 1-1.5h in length.

Table 1: Participant profiles

Participant	Quadruple helix*				Country	Affiliation**	Rationale for involvement
	A	G	I	C			
#1			●	●	United States	Weaving Water (C) Software Engineer (I)	Resident in an intentional community, Software engineer, setting up the tech stack for their community
#2	●		●		Puerto Rico	Holochain (I) Political Theorist/ Applied Philosopher (A)	Director of Business Development for Holochain - a free and open source framework for building peer to peer applications. Member board of directors for 'Toward Warm Data'. Founded co-housing spaces, helped run a makerspace.
#3		●		●	Portugal	OASA (G) Traditional Dream Factory (C)	Founder of OASA: a nonprofit which has as its purpose to acquire, conserve and regenerate land, and Traditional Dream Factory: A regenerative village run through a Decentralised Automated Organisation (DAO).
#4			●	●	Spain	Can Mas Deu (C) Software Engineer (I)	Long term resident in an intentional community, group and tech knowable, Software Engineer student.
#5			●	●	Sweden	Uddebo/ Borderlands (C) Technologist (I)	Builds collaboration tools for networks and communities. Co-founded Cobudget and Blivande, works with Edgeryders and Open Collective. Worked with Uddebo, Borderlands.
#6		●	●		United States	Timebank (G) Holochain (I)	Former Executive Director of a Timebank, Holochain advocate, previously involved with a range of companies relevant within the field, currently independently researching technologies used by communities
#7	●			●		University of Edinburgh (A) Village resident (C)	Chair of Design Informatics, explores how design provides methods to adapt, and create products and services within a networked society

* Quadruple Helices and their adaptations for the context of this paper:

Academia - Academic research, both independent and institutionalised

Government - Institutions involved with governance mechanisms

Industry - Entrepreneurs and developers

Communities - Small scale communities with post-growth intentions

** In most cases participants represented more than two affiliations.

This table lists only the primary roles through which they relate their experiences in the interviews.

Table 2: Interview questions

General	Tell me about yourself - what is your relationship to community?
Community focus	From your perspective, for what do communities use technology? From your perspective, why would communities use technology?
Technology focus	Progression of tech in community - what have you seen? Which specific technologies have you heard about or used in relation to community, and what are your experiences with these? What is the future of technology in communities?

3.3 Data analysis

The analysis used the approach of (Maguire and Delahunt, 2017; Vaismoradi et al., 2016) for thematic content analysis with inductive coding in qualitative semi-structured interviews. To enhance the qualitative rigour, the analysis was based on methodology developed by Gioia et al (2013). An example of the process can be seen in Table 3.

Table 3: Coding scheme, extract

Example sentence	First-order codes	Second-order theme	Aggregate dimension
<i>“...these kinds of digital tribes that are globally connected and that can identify around certain values and purposes rather than just by where they’re born.”</i>	Connecting with like minded people Non place based engagement	Finding community	Setup

Fireflies.ai was used for automatic transcription of the interviews. All subsequent analysis was manual, using the productivity software Notion to organise the data. The initial analysis focused on informant-centric terms, and aimed for a wide initial scope. This resulted in a total of 192 first-order codes. Next, the relationships between these codes were analysed in order to merge and cluster the result into eight themes. Finally, the themes were aggregated into dimensions. The final coding scheme is seen in Figure 3.

4. Findings

The interviews ranged from the practical to the theoretical, spanning extremes of technology use - from communities setting up their own decentralised governance to communities barely using email. An encompassing trend was the importance to understand the nature of the discussed communities, and the need to respect where technologies may be of use - and where they may not. *‘...none of us are joining community so that we can make more spreadsheets [...] we’re joining it for the heart work. We’re joining it for the connections and what it brings in happiness and joy. Those things are not tangible, but when you’re bringing 50 some people together there’s work that goes into those logistics.’#1*

Three dimensions emerged where technologies were seen by the participants as having potential to constructively support community operations: their setup, organisation and evolution. The findings section is structured according to these aggregated dimensions, their second-order themes and first-order codes – seen outlined in Fig.3. The impacts and barriers involved in the findings are summarised in the discussion.

Aggregated dimensions	Second-order themes	First-order codes
Setup	Finding community	Searching for and connecting with like-minded people
		None place based engagement
	Establishing community	Defining the membrane of the community
		Enabling diversity/creative chaos within the membrane
	Designing community	Fast implementation and iteration of digital infrastructure
		Setting up alternative ownership models
		Translating community values into local economies
Organisation	Self-organisation	A messy, rich stumbling towards grace
		Keeping it simple, solving existing problems
	Communication	Group coordination and transparency
		You use the tools you know
	Administration	It's all volunteer work
		Making more time for the heart work
Evolution	Collaboration	The role of interoperability
		Finding and accessing new technologies
	Resilience	The value of conflict
		Software supporting continuous change

Figure 3: Coding scheme/summary of findings

4.1 Setup

4.1.1 Finding community

From the interviews it was apparent that the ways to find and connect with like-minded people had changed drastically in the last 20 years: *"I mean, 20 years ago, if I was starting a community, it would be like I'm going fully offline. I'm going to create my little bubble with my friends. We're not really going to communicate with the outside world and that's it. We're just going to be living together on this plot of land. Whereas today in this space, for example, we get people visiting from all over the world. We are digitally connected."*#3

The participants shared various experiences of using post-2004 technologies in relation to finding like-minded others. Specifically, sites which gather information on existing initiatives (such as cohousing.org) and apps that enable distance communication with others in conglomerative contexts (such as Discord) were mentioned. These platforms were seen as giving individuals an increased awareness of, increased access to, and increased agency in relation to searching for and finding people and contexts they wished to engage with. *"Most of those who use these [technologies] do it to get access to a community [...]/participant #5*

Network technologies were seen as enabling groups of people to be *"...globally connected and identify around certain values and purposes rather than just by where they're born."*#3 and as an opportunity for distance communication and engagement *"...it can turn into movements that allow community to be non place based as well as place*

based.”/7. This non place based engagement was seen as an inclusive way to connect on your own terms: the participants did not have to be physically present in order to build or affect a community, and they could remain an individual and be part of the collective simultaneously.

4.1.2 Establishing community

The code ‘defining a membrane’ summarises statements on what keeps the community together, setting “... *our membrane, our container*”/6. The importance of this container not being too restrictive was stressed. Technologies such as the decision making platform Loomio were mentioned as examples that let communities make their own choices on how to collaborate. A main lesson the Traditional Dream Factory (TDF) - a regenerative village that operates as a Decentralised Automated Organization (DAO) - learnt since their start was not to use the DAO for managing everything, instead be “...*the holder of what the community actually wants*”/3. Although setting up a general boundary for the community was deemed important, it was crucial to not “...*make people feel like they're just clocking in for a second shift*.”/1. Despite most of the communities involved could be prefixed ‘intentional’ there was an aversion to defining the actual intentions of the community too strongly. Scepticism towards defining too rigid/strong structures were expressed, best summarised in the quote “*if you claim that any community is very strong you'll be leaning toward a cult*.”/7.

The opposition to this dangerous rigidity was seen as enabling a rich diversity within the community membrane, a form of creative chaos. “*It's just that's how community actually works. It's actually a whole ecology of relationship*.”/2. The charm of being in community was seen as precisely the lack of too formal organisation and the richness and diversity of internal interactions. A repeatedly stressed point was that community is not conducive to the same organisational structures as companies. Communities are “...*not a system or a design that lends itself to control*.”/2. Where corporations will always try to have “...*a standardised experience in order to reduce the complexity they have to deal with to serve the larger customer base*”/2, the community aim was instead to support complexity, in order to have “...*a rich ecology of interaction and communication and relationship*”/3.

4.1.3 Designing community

A potential for how technologies can “*disrupt different economies and cultures*”/7 was identified, but this was dependent on translating alternative development approaches into systems “*If we actually want to be sustainable [...] we have to create systems that can last and persevere [...] otherwise they're just going to disappear*.”/3. Digital infrastructure can be easier to implement than physical infrastructure “... *software can build, measure, learn much faster than perhaps laying cable, laying networks. Having said that, you do need the two*.”/7. Some of the communities attempted through such infrastructure to design different economies and cultures into the very foundations of their operations, relating to the statement “...*there's a possibility that software can rewire some of those old things that we can't change*.”/7

In relation to setting up alternative ownership models technology was seen as “...*tools to kind of hack the legal system a little bit*”/3. An example is OASA - a nonprofit land trust emulating wrapper for Web3 villages that tries to acquire, conserve and regenerate land through blockchain technology. Holochain - a free and open source framework for building peer to peer applications - also involves ideas along the same lines, having: “...*a*

vision for what they call land weaving society”/#6 that lets communities put land that they already own or collectively pull together, as well as purchase land to create common spaces.

Some participants talked of how technologies were helping define alternative economies - and what ‘value’ or ‘wealth’ meant in relation to their own communities. Technologies were seen supporting how individuals could share in and add to this value, for example in the case of how Timebanks can help visualise how to share competencies with each other, or in the case of TDF - using blockchain to set up own currencies that embody their value system and ties it to governance. Their alternative economic model includes the ‘TDF’, an access token that can be thought of as a timeshare, the ‘Proof of Presence’, indicating the time you’ve spent physically on site, and ‘Proof of Sweat’, indicating how much work you actually contributed to the community projects. These currencies combine to give you voting rights within the community.

4.2 Organisation

4.2.1 Self-organisation

Technology was here seen as a way to support coherence without top-down hierarchy being a dominant part of the equation, enabling “...*very different patterns of organisation and coordination*”/#2. Self-organisation was standard in almost all the communities and described as - “...*a messy, rich stumbling towards grace*”/#2 - being compared to the dynamics of dancing, where despite “*A lot of stepping on toes*” eventually you collectively (hopefully) figure out how to make it work. The Holochain ecosystem represents an approach that attempts to develop online tools inspired by how natural living biological systems are organising themselves. Here organisational technologies operating on interoperability principles allow for users to continuously test, combine and change their online toolbox, in order to pick up on “...*that individual creativity, and provide the mechanisms for seeing what actually worked or not.*”/#2

Most of the participants expressed that they as the ‘tech literate’ members of their communities had identified needs for using specific technologies to make day to day interactions and logistics easier, making these smoother and less frustrating “...*so that we can enjoy the shared meal together and not have to say, oh, well, we bought so many leftovers that we have 20 more meals.*”/#1. This translated in practice to preferring simple technologies that help solve the many small logistical problems of self-organisation: who wants food tonight, who takes out the trash, organising a party, pooling funds... and then picking and choosing to use these technologies as they’re needed.

4.2.2 Administration

The phrase ‘It’s all volunteer work’ kept appearing in relation to daily operations. Simply the person who had time did what was needed. This was tied to frustrations relating to lack of time and issues with the right skills in the right place.

Here technologies were seen as able to ease the burden of administration by using systems that could easily connect, organise and share information, such as cloud services and project management software. These technologies were seen as useful in supporting administration by making it easier to break down and distribute responsibilities and decision-making as well as help with accounting and expenses.

Overall *“In the best of worlds, [using technologies] just opens up so much more time and opportunity for the heart work.”*/#1

4.2.3 Communication

All communities used asynchronous communication tools *“...the way people travel nowadays, how do you [otherwise] go away for a month and get your voice heard?”*/#1, alongside their use to *“capture the notes from what you decided”*/#1. Communication platforms were beside their use for coordination seen as ways to increase transparency into interactions and actions of community, although some mentions were made of how this transparency might not be welcomed by all.

In terms of which platforms were used this was again and again expressed as the sentiment ‘you use the tools you know’. For example, *“They start using Slack at work - and then they think ‘we can have Slack for our coop [bostadsrättsförening] as well’. It’s convenient.”*/#5. This translated to most communities using WhatsApp, Messenger and Facebook groups for their communication - sometimes, frustratingly, even several of these platforms at the same time, depending on each individual’s familiarity. ‘Single thread’ technologies from the interviews appear particularly unsuited for community communication, as illustrated through the quote *“...there’s suddenly 80 people in the [WhatsApp] group and you can’t even friggin follow the conversation because people are talking so fast, there’s so many conversations going on that it just becomes a friggin waste of time [...] you send a message and it’s gone forever”*./#4.

In contrast, the conversations involving channelled communication tools - such as Discord or Slack - did not mention such frustrations. Dynamic organisation and search are key design features in these tools (see Figure 4). This seems to indicate they are more suitable for communities than a single, ‘black hole’ approach.

Several participants mentioned that this tendency to only use tools that are already known - despite their drawbacks - often resulted in them giving up attempts to introduce better suited technology, since it was like *‘pulling teeth just to get people to friggin make an account’*/#1 and overall compared the experience to *‘herding cats’*/#1. It does not appear to be resistance to technology per se, though, rather *“...they just didn’t get around to it.”*/#1. In terms of successful attempts to introduce new technologies two major approaches were mentioned: to increase familiarity with the tool using a loose guiding hand, and to be consistent: *‘...it was the way you contacted the board’*./#4

Single -thread communication
eg. WhatsApp, Messenger, Telegram

CHAT
Post 1
Post 1: answer 1
Post 2
Post 1: answer 2
Post 1: answer 3
Post 2: answer 1
Post 3
Images
Post 2: answer 2
...

Channeled communication
eg. Discord, Slack, Teams

Search		
CHANNELS		
#1	Post 1	Answer 1
		Answer 2
		Answer 3
#2	Post 2	Answer 1
#3		Answer 2
#4		Answer 3
#5	Post 3	Answer 1
		Answer 2
		Answer 3

Figure 4: Simplified difference between single vs channelled communication tools

4.3 Evolution

4.3.1 Collaboration

The more technically inclined communities were actively collaborating on developing software. TDF is, for example, via the platform Closer building an operating system for land stewardship communities. Here interoperability emerges as a crucial concept, indicating systems that can function and communicate with each other. This principle allows for the users to change the apps as they wish: “ [about Holochain apps] *if it's not working well enough, you can take it and tweak it and try again.*”/#2. Parallels were drawn between interoperable digital layers and the aims of post-growth communities in general, “*there's a really interesting overlap between the decentralised web and the idea of autonomous communities*”/#1

Participants use the same technologies for the purposes of building community as they do in their other lives, which meant they used search engines for finding information on other communities, and forums to connect and learn from each other (in particular Discord). However, how to find exciting new projects, and which groups were able to access them was questioned. Needs were identified for better overviews of what's available as well as ways to access new tools for non tech savvy people.

4.3.2 Resilience

Building community was described as complex, often involving conflict. Perhaps a bit surprisingly, this was not expressed as a problem per se. Instead conflicts were seen as crucial to enable necessary changes “*I'm very skeptical of utopias. Anything that has perfect harmony is dead, or at least not going to be very resilient.*”/#2. To have “*enough diversity, tension, maybe even disagreement, fighting*”/#2 was seen as a natural process to enable the community to handle new challenges “*And if it doesn't work out well, the whole community doesn't just go away. Right? There's not a catastrophic failure*”/#2.

The role of post-growth communities as laboratories of change was seen as tied to their ability to continue to evolve and, importantly, never getting there entirely *“because if we get there entirely, then there's no more movement and change happening in the world”*/#2. The lifecycle of developing software was compared to that of developing community. *“There's a cycle of build, measure, learn.”*/#7, and this cycle was seen as having potential for supporting community evolution. The goal being to foster vibrant ways of being responsive to the circumstance we face *“individually, collectively, subgroup collectively.”*/#2 In practice, the evolution of the community was seen as being supported by adopting a changing suite of technologies *“...rather than trying to build your own or building something centralised.”*/#7. *“Everytime I've launched something it has been a simple idea.”*/#5. In general, technologies focused on *“...empowering that community to augment very slightly its ways of operating.”*/#2 were seen to be of most use, because these focused on solving particular problems, not setting up encompassing structures, and so did not hinder the evolution of the community by locking it into one form.

5. Discussion

The aim of this study was to explore how post-growth communities can be supported through digital layers, specifically by leveraging technologies developed in the past 20 years. This exploration gathered data from seven interviews with tech adept representatives having in-depth professional and personal experience of community, and attempts to synthesise their insights. The next section summarises the contributions of this study in relation to specifying the potential impact technology can have in the setup, organisation and evolution of post-growth communities, while the second section expands on identified barriers. Following this, we discuss limitations of the study and finally summarise conclusions and directions for further research.

5.1 Impact

Digital layers were found to support the communities in the interviews with:

- *Setup* - Finding, establishing and designing community
- *Organisation* - Self-organisation, administration and communication in community
- *Evolution* - Collaboration and resilience of communities

The impact can be summarised as: i) *improving access to community*; ii) *facilitating internal communication and coordination*; iii) *enabling a common boundary and internal diversity*; iv) *encoding alternative development models into sharable and adaptable systems*.

Improving access to community

Traditionally, communities form around place based attachments (Manzo and Perkins, 2006). The findings of this study indicate that using online platforms and forums for the particular purpose of finding and engaging in community might be able to mitigate the divide between what Appleyard (1979) in a now classic study calls “insiders” and “outsiders”, relating to the “ingroup/outgroup” concepts in social identity theory (Tajfel, 1970), meaning we tend to discriminate against people not from our ingroup (Hewstone et al., 2002). Here we can identify a risk that awareness of and access to community might be limited to only spread within those who have the privilege to have heard of it within their own networks, for example, within an ingroup of a well-educated, white middle-class.

It is apparent from the interviews that the landscape for finding and defining your ingroup has changed drastically in the last 20 years. The participants describe how they through online platforms could search and engage with like-minded people from a distance - whereas prior to networked computers engaging in community was largely dependent on location, physical connections and frankly, luck. Technologies that are described as allowing for non place based visibility, initial engagement and in-group formation independent of an individual's original location or group attachment show promise of democratising access to community, radically changing who gets to be involved in the innovation of alternative futures.

Enabling a common boundary and internal diversity

Organisation design has a significant impact on how people work together (Burton and Obel, 2018). In community, organisation was not seen as having the role of reducing, but supporting complexity, enabling diversity within the defining membrane of the community that lets it dynamically evolve. This tendency of communities to organise around a common boundary has been previously identified (Georgiou and Arenas, 2023) and chimes with anthropological research that has found a common ideology keeps communities together for longer (Abramitzky, 2011; Dunbar and Sosis, 2018). Enabling self-organisation in practice, however, was from the interviews described as difficult to do offline. The ability of the web to self-organise millions of individuals operating independently and having a variety of backgrounds, knowledge, goals and cultures without a central authority has been documented since the beginning of the 2000's (Flake et al., 2002), perhaps the most classic example being Wikipedia. This study identified that communication and coordination platforms were seen of particular use for self-organising communities. The participants rejected encompassing systems that attempted to structure the whole community, instead preferring simple tools that were already anchored in a context that helped self-organise around practical issues - such as deciding on ideas, financing a project or dinner logistics.

Facilitating internal communication and coordination

The results of this study specifies which form of communication tools appear to be least suitable for community organisation and suggests which designs might be a better match. Specifically, the results indicate that 'single-thread' communication tools such as WhatsApp are particularly unsuited to communities, since they do not allow for organising and searching inputs. Channelled tools (such as Discord or Slack) were ideally preferred due to the ability to sort the community discussions into channels, posts and threads - essential dynamics for enabling self-organisation of the preferred approach described in the interviews: a form of constructive creative chaos.

Encoding alternative development models into shareable and adaptable systems

The interviews identified a hope of 'rewiring the old things we can't change' by translating alternative development models into code. Since software is cheaper and faster to implement than physical infrastructure it was seen as a way to test out and tweak new models, providing tools for the members of a community to themselves design how they want their community to operate. TDF, OASA and Holochain are implementing this in practice by encoding cultural and organisational practices into systems - setting up their own local currencies and alternative ownership models, bypassing central institutions. CityDAO is another example of how to use digital layers for alternative purposes, a DAO was there used to organise around collectively buying land and collaboratively planning a new city (*Could a DAO Build the Next Great City?*,

2022). Such digital layers can allow the community to set up a governance structure that both translates its ideas into governance mechanisms, as well as lets this governance structure quickly adjust and be updated according to bottom-up inputs, allowing the community to respond quickly when there is need to change. As such, these technologies could be impactful in providing supplementary digital layers that make community easier while still allowing for continuous evolution of the community, opening up for implementing own decentralised versions of how they want the future to look, and therein experiment with what works for them and doesn't.

5.2 Barriers

There are challenges involved with fulfilling the potential described in the above sections, even if we disregard the technologies requiring significant technical knowhow - DAO's, local currencies and alternative ownership models. These barrier fall under: i) *You only use the technologies you know* ii) *Thresholds to introducing new technologies* iii) *Communities are not companies* vi) *Finding and developing interoperable technologies*

You only use the technologies you know

Although there exists technologies showing a lot of promise to support communities, they might not be used. Channelled communication tools such as Slack or Discord were frequently mentioned by the participants in the interviews as tools they considered superior for communication, but they also repeatedly pointed out difficulties with actually getting the members to use them. The reason for this boils down to 'You use the tools you know' - a main takeaway from this study. This results in communities attempting to coordinate hundreds of people in WhatsApp or Messenger groups - technologies designed for simple interactions - which results in frustrations and overwhelm. These technologies appear particularly unsuited for the forms of complex interactions involved in the vibrant, active webs of relationships that define these communities.

Thresholds to introducing new technologies

This strong tendency of only using technologies you already know - regardless how unsuitable they are for the purpose - unfortunately could mean some of the communities discussed in the interviews do not benefit from changes in the technology field these last 20 years. This threshold to learning new technologies is understandable, and not an issue isolated to these communities, for example teachers have difficulty adopting and persevering with new technologies (Pelton and Pelton, 2008). However, since technologies are used to boost for example startups, an organisational form aiming "to grow company value by driving sales of new products (goods or services) through the creation and application of innovative technologies leading to a growth in productivity and increase in domestic and global market share" (Skawińska and Zalewski, 2020, p. 5), communities wishing to propose an alternative future to growth - and develop and spread their own alternative development approaches - *not* using appropriate technology for their own purposes could mean shifting the playing field towards those who tailor their supporting software to their operational, technical, schedule, political, legal and economic needs (Sakthivel, 2023).

Using technologies to assert control - communities are not companies

Organisation focused around conformity is a classic trope in science fiction in relation to dystopias (Seeger and Davison-Vecchione, 2019), where attempting to assert social control tends to result in fragility and the eventual fall of the system. Perhaps counterintuitively, a 'strong' community was described as the most fragile. For the

communities in this study a 'strong' community could also be negatively associated with 'cults', in this context indicating top-down organisational structures that limit personal freedom and development. Interestingly, this aversion to association with cults emphasises the differences between communities and companies, which in some cases develop into extremes called 'secular business cults', characterised by an ultrastrong culture, formalised manipulation, manipulative hierarchical relationships, competition, and operations efficiency tools (Kulik and Alarcon, 2016).

Despite this being an extreme example, the interviews point out that companies in general strive for order and simplicity where in contrast, the values of communities was to enable complexity, rich and diverse evolving webs of relationships, and to embrace internal conflict as a natural part of community - a way to enable change and develop a flexible approach to challenges. Attempting to create conflict-free, 'strong' communities would kill dynamics that lead to resilience.

This crucial difference might hint as to why some of the participants talked of how the ecovillage movement in general is 'technophobic'. Perhaps this could be due to an association between the tools used by such companies and technology in general.

Finding and developing interoperable technologies

When discussing particular technologies, it is important to be aware that these forms of communities are not all the same, and that they do not lend themselves to control. Technologies used should reflect this, and focus on enhancing the community, not restrict it. A need was identified for technologies that match the particular makeup of communities and doesn't lock them into one form. This appears to represent an emerging tendency to translate alternative development models into software that can be shared and continuously improved upon by any community wishing to do so. Here, interoperability emerged as a term of importance, as it allows for communities to share, edit and continuously update their digital layers. Parallels between the decentralised web and autonomous communities came up in the interviews, relating to the discussion on how to demonopolise the internet: Alphabet owns search; Amazon runs e-commerce; Apple has the hardware; Meta controls social networking; and Microsoft dominates business software" (Arnao, 2022), but interoperability can empower communities and individuals to escape monopoly platforms (Doctorow, 2021). There are promising projects on the horizon, exemplified by Holochain, OASA and TDF present in this study, but such projects accessibility, spread, and most of all - introduction - to communities deserve further attention.

5.3 Limitations

This paper focused on identifying links between how post-growth oriented communities wish to operate and areas where technologies could be used to support them in their approach. Although mentioning the technologies discussed, it did not dig further into the specifics of each technology. Further study is needed on the current landscape of existing technologies and their characteristics - eg, whether the design fits the purposes of the community, the intention matches with the community ideology, and whether they are truly 'sustainable' - in order to outline a map of available choices to communities.

The participants in this study were chosen particularly because they were both community and tech proficient, in order to identify the *potential* of using tech in community. They do not represent all communities, and some of the interviews indicated other communities may be either uninterested in technology or actively technophobic.

6. Conclusion

Using a supporting digital layer was seen as having potential to support community setup, organisation, evolution and, ultimately, spread the impact of the community's alternative development model. Specifically:

- Using open forums and online platforms can *democratise access to community*, drastically changing who gets to be involved with and develop alternative futures;
- *Bottom-up self-organisation* in communities can be supported by adaptable technologies that channel creative chaos into constructive avenues;
- *Communication* can be simplified by channelled communication tools that promote transparency and overview, and finally;
- Alternative culture, value, land and ownership *models can be encoded into interoperable systems, and shared with other communities*.

The potential of using digital layers was seen as making it easier to self-organise around, test and share alternative approaches to the growth paradigm, and radically change how communities form, learn from each other and spread - supporting their impact as laboratories of change.

Despite the use of digital layers appearing game changing, far from developing their own digital infrastructure, most of the communities were just starting to use even the simplest of communication tools. The main barriers found were:

- *People tend to only use technologies they already know*, often resulting in working with particularly *unsuited* technologies, and subsequent frustration and rejection of technology.
- *There are thresholds to using new technology*. Introducing new technology requires analysis of what the community actually needs - usually problem-solving tools, not encompassing systems - combined with that tech adept community members attempting to introduce new, better suited, tools often gave up due to the first barrier.
- *Communities are not to be confused with companies* - technology would need to enhance the community, not impose unwanted control. Some technophobia may be due to technology being associated with the growth paradigm, specifically its use in companies.
- Lastly, *software of particular use to communities are still in their infancy*, and appear to depend on incorporating interoperability principles that do not lock the community into one form - instead allowing for free adaptation. Such technologies can at present be hard to find and use for non tech-savvy community members.

Although some of the reasons as to why these barriers exist and potential approaches to counter them are hinted at in this explorative study, they deserve further research. In particular, the criteria for how to introduce specific technologies useful to post-growth communities.

This study finds that using digital infrastructure has the potential - if overcoming the barriers - to empower communities to better compete with entities that advocate for continuous growth by making it easier to explore and disseminate their own alternative models of development. In essence, supporting such communities in developing, implementing, and sharing paths towards a diverse future where our way of life has hope of differing significantly from the present.

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