

**Ethics and safety of community-based geospatial data processes in
the resilient urban South**

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Inhabitants of rapidly growing cities in the Global South are vulnerable against risks in their everyday life, such as exposure to violence, diseases, major floods, and storms that leave behind casualties and damages in infrastructure and livelihoods. Vulnerability to disaster risks can be reduced with holistic and knowledge-based decision-making that aims for sustainable resilience building. Informed resilience building calls for accurate and up-to-date digital geospatial data about the existing infrastructure and its condition, population demographics, environmental features, and the risks and hazards themselves. However, such geospatial data is scarce in many parts of the Global South. To tackle the dearth of official geospatial data, community-based geospatial data processes have emerged. Since they are rather recent innovation in the Global South and they are conducted by variety of stakeholders from local community-led NGOs to official sources and huge international organisations, common agreements on safe professional conduct for such data processes are still non-existing.

The objective of this thesis was to study the ethics and safety of recently emerged community-based geospatial data processes in the context of urban resilience building in the Global South. Main ethical and safety domains was identified via reviewing existing academic research literature. The findings were used as a basis for interviewing community-based geospatial data professionals with expertise working in the Global South. Aim of the interviews was to generate a proper understanding of the ethical and safety considerations in the research context, based on the knowledge and experiences of the interviewees. Finally, the collection of ethical and safety issues drawn from the interviews were compared to existing ethical guidelines for assessing their adequacy in guiding safe community-based geospatial data processes in the Global South.

The results indicate that current academic literature does recognise number of ethical issues that might be encountered when engaging in community-based geospatial data processes in the Global South. However, it is evident that literature is needed from different ethics' application fields to generate a sufficient collection of possible ethical and safety considerations, not just from the geospatial world. Interviewed experts had experienced similar ethical issues as listed based on academic literature. The main ethical considerations where everything else seems to culminate in are transparency, trust, and truthful delivery of impacts.

The results showed that current ethical guidelines are not sufficient for community-based geospatial data processes taking place in the Global South but are rather quite ambiguous in nature and do not cover all relevant ethical domains. Both the academic literature and the interviewed experts called for commonly agreed ethical codes for professional conduct to ensure the safety of community-based geospatial data processes in the given context. However, the former calls for international guidelines that can be applied locally, and the latter would prefer national guidelines that would determine the best practices for e.g. compatible and high-quality data collection, open sharing, and ownership issues. National level guidelines would be able to consider also the ethical and safety problems deriving from the local context, and thus being more representative for the local stakeholders building resilience of their own surroundings than the international common guidelines.

Key words: ethics, safety, community participation, geospatial data, urban resilience, Global South

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Globaalin etelän nopeasti kasvavien kaupunkien asukkaat ovat haavoittuvia riskeille, joita he kohtaavat jokapäiväisessä elämässään. Riskejä ovat esimerkiksi altistuminen väkivallalle, sairauksille, kaupunkitulville ja myrskyille, jotka jättävät jälkeensä ihmisuhreja ja vahinkoja infrastruktuurille ja toimeentulolle. Haavoittuvuutta riskeille voidaan vähentää kokonaisvaltaisella ja tietoon perustuvalla päätöksenteolla, joka tähtää kestävään resilienssin rakentamiseen kaupungeissa. Tietoperustainen resilienssin rakentaminen edellyttää tarkkaa ja ajantasaista digitaalista paikkatietoa olemassa olevasta infrastruktuurista ja sen tilasta, yhteiskunnan demografisista piirteistä, ympäristön ominaisuuksista sekä itse riskeistä. Tällaista paikkatietoa on kuitenkin niukasti saatavilla monissa globaalin etelän maissa. Virallisen paikkatiedon puutteen paikkaamiseksi on kuitenkin noussut yhteisöperustaiset paikkatiedon prosessit. Ne ovat melko tuoreita tulokkaita globaalissa etelässä ja niitä toteuttavat useat sidosryhmät paikallisista kansalaisjärjestöistä virallisiin organisaatioihin ja suuriin kansainvälisiin järjestöihin, joten yhteisiä pelisääntöjä turvalliseen ja eettiseen toimintaan ei vielä juurikaan ole.

Tämän opinnäytetyön tavoitteena oli tutkia näiden yhteisöperustaisten paikkatietoprosessien eettisyyttä ja turvallisuutta resilienssin kaupunkien rakentamisessa globaalissa etelässä. Tärkeimmät eettiset ja turvallisuusriskit tunnistettiin tarkastelemalla olemassa olevaa akateemista tutkimuskirjallisuutta. Löydöksiä käytettiin haastateltaessa globaalissa etelässä työskenteleviä paikkatietoalan ammattilaisia, joilla on kokemusta paikallisten yhteisöjen kanssa työskentelystä. Haastattelujen tavoitteena oli luoda käsitys siitä minkälaisia eettisiä ja turvallisuusongelmia voidaan kohdata kun kerätään, analysoidaan ja käytetään paikkatietoa, joka on tuotettu yhdessä paikallisten yhteisöjen kanssa globaalin etelän kontekstissa. Lopuksi haastattelujen perusteella koottua eettisten ja turvallisuusongelmien kokoelmaa verrattiin olemassa oleviin eettisiin ohjeisiin, jotta niiden riittävyttä turvallisten yhteisöperustaisten paikkatietoprosessien ohjaamiseen globaalissa etelässä voitiin arvioida.

Tulokset osoittavat, että nykyinen akateeminen kirjallisuus tunnistaa useita eettisiä ongelmia, joita saatetaan kohdata yhteisöperustaisten paikkatietoprosessien yhteydessä globaalissa etelässä. Kävi kuitenkin ilmi, että lähdekirjallisuutta tarvitaan useilta eri etiikan sovellusalueilta, eikä pelkästään paikkatietoalalta. Haastatellut asiantuntijat olivat kohdanneet samoja eettisiä ongelmia omassa työssään kuin tieteellinen kirjallisuuskin osasi tunnistaa. Tärkeimmät eettiset teemat, joihin kaikki muutkin ongelmat kulminoituvat ovat läpinäkyvyys, luottamus ja todellisten vaikutusten turvaaminen paikallisille yhteisöille.

Tulokset osoittivat, että nykyiset olemassa olevat eettiset ohjeet eivät ole tarpeeksi kattavia globaalissa etelässä tapahtuvien yhteisöperustaisten paikkatietoprosessien turvallisuuden tukemiseksi, vaan ne ovat luonteeltaan melko moniselitteisiä eivätkä ota huomioon kaikkia olennaisia eettisiä osa-alueita. Sekä akateeminen kirjallisuus että haastatellut asiantuntijat vaativat yhteisesti sovittuja eettisiä ohjenuoria yhteisöpohjaisten paikkatietoprosessien turvallisuuden varmistamiseksi. Edellinen vaatii kuitenkin kansainvälisiä, paikallisesti sovellettavia ohjenuoria, kun taas jälkimmäiset suosisivat kansallisen tason ohjeita, jotka määrittäisivät parhaat käytännöt esimerkiksi laadukkaan aineiston keräämiselle, avoimelle aineiston jakamiselle sekä aineiston omistajuuden määrittelylle. Kansallisen tason ohjeistukset pystyisivät ottamaan huomioon paikallisesta kontekstista juontuvat eettiset ja turvallisuusongelmat, ja olisivat täten edustavampia kuin kansainväliset yleisluontoisemmat eettiset ohjeet.

Avainsanat: eettisyys, turvallisuus, yhteisö, osallistava, paikkatieto, resilienssi, globaali etelä

Contents

1. Introduction	6
2. Theoretical framework	9
2.1. The resilient urban South	9
2.2. Community-based geospatial data processes	10
2.3. Open data sharing in the digitalised South	13
2.4. Defining geospatial data ethics	14
2.5. Researching the ethics of geospatial data processes in a context	17
3. Data and methods	19
3.1. Research methodology	19
3.2. Systematic literature review	20
3.3. Expert interviews	22
3.4. Ethical guideline evaluation	25
4. Results	27
4.1. Ethical domains identified from academic literature	27
4.2. Experiences and new perspectives from expert interviews	29
4.3. Insufficiency of existing ethical guidelines	35
5. Discussion	39
5.1. Reflecting findings against theoretical framework	39
5.2. Success and challenges of the research methodology	41
5.3. Future prospects	43
Acknowledgements	45
References	46
Appendices	51
Appendix 1	51

1. Introduction

Inhabitants of rapidly growing cities in the Global South face extensive risks in their everyday life, such as exposure to violence or diseases, and larger-scale intensive risks occurring seasonally or in more irregular frequency, such as major floods and storms that leave behind casualties and damages in infrastructure and livelihoods (Adelekan et al. 2015; Dodman et al. 2013). Many of the risks are intertwined and the complexities can be difficult to fully understand. The effects of global climate change stir up the pot even more by exacerbating existing risks and introducing new phenomena, such as sea-level rise and prolonging heat waves to the list (e.g. Adil & Audriac 2019; Satterthwaite et al. 2018).

Risk to mortalities and economic losses due to disasters is highly correlated with countries' GDP and quality of governance (UNISDR 2015). Therefore, nearly 90 per cent of disaster-based losses in human lives and the economy between years 1990 and 2015 has occurred in low- and middle-income countries. Same trend is to be seen after the year 2015, too (UNISDR 2018; UNISDR 2015). Even though absolute *exposure* to hazards is rather evenly distributed over the Globe, *vulnerability* to disaster risks is disproportionately concentrated in low-income countries of the Global South.

Vulnerability to disaster risks can be reduced with holistic, sustainable, and knowledge-based decision-making that addresses vulnerability issues in all sectors – physical, environmental, social, and economic (UNISDR 2018). With functioning infrastructure, healthy environment, equal and secure society, and strong economy the people and businesses of the urban South are able to achieve *resilience* against shocks that they and their living environments face. Informed resilience building calls for accurate and up-to-date digital geospatial data about the existing infrastructure and its condition, population demographics, environmental features, and the risks and hazards themselves (Sutanta et al. 2010). However, data scarcity and marginalisation are pressing issues in the Global South and reliable geospatial data is either non-existing, outdated, inaccessible, or consists of a patchwork of small datasets that are not compatible with each other (Mehmood 2021).

The necessity of geospatial data for informed urban planning is acknowledged and it slowly increases in popularity within city officials of the Global South (Perez et al. 2017; Chu et al. 2016). However, lack of time, finances, digital solutions, and required digital know-how of geospatial data management hinders the pace of governments becoming spatially enabled. To tackle the dearth of official data, community-based geospatial data processes have emerged. Thus far many such processes have been facilitated by individual internationally led (academic research) projects where the local citizens have been participated, usually in the data collection phase via surveying them about their living surroundings and experiences. As digital capacities of younger generations living in low and middle-income countries have increased, solely community-facilitated geospatial data processes have also become more and more common in the Global South's data scheme (Borie et al. 2019).

Despite the massive positive impact on urban resilience, the growing popularity of community-based geospatial data processes calls for various ethical and safety considerations (Specht 2020; Wakunuma 2019). Since they are rather recent innovation in the Global South and they are

conducted by variety of stakeholders from local community-led NGOs to official sources and huge international organisations, common agreements on for example data ownership, dissemination, and data quality standards are still non-existing. In addition, because the form of collected geospatial data is more likely to be digital and openly available than traditional physical maps, the ethical dimensions rising from digitalisation and open sharing must be addressed too: access to digital resources, digital literacy and inequality, privacy issues, platform and data colonialism, data ownership and rights, misuse, and more (Specht 2020; Schopp et al. 2019; Kleine & Unwin 2009).

Other ethical issues and risks in community-based geospatial data collection, management and use processes arise from the context where they are conducted and from the nature of geospatial data itself (Schopp et al. 2019; Richardson et al. 2015). As an example of the former, the relationship between local communities and the local government must be addressed when thinking who can have access to the produced data: if the locals of whom the data concerns do not trust the city government, is it appropriate to disseminate the data openly for anyone to use? (Borie et al. 2019). As an example of the latter, geospatial datasets have their own unique form and possible anonymization of participatory data requires more effort than traditional matrix-type of data (Raymond 2016). The people who were participated in the geospatial data collection process must be aware that there is a risk that combining their location data to other data sources might reveal something about their identity, even if the location data was anonymized.

There is still somewhat limited amount of research related to ethics and safety of community-based geospatial data processes in the context of resilient urban South. Most of the ethical considerations are by NGOs who have long history in creating, managing, and using geospatial data in such contexts, such as UNICEF (Berman et al. 2018). Even though some ethical concepts that concern geospatial data processes can be drawn from the contexts they take place in (digitalization, urban development), some ethical issues and risks might still be invisible to current academic literature without further research.

The objective of this thesis is to study the ethics and safety of community-based geospatial data processes in the context of urban resilience building in the Global South. The context stems from the World Bank led Tanzanian Resilience Academy project, which works towards tackling urban resilience challenges that are faced by local communities via enhancing university-level students' knowledge and skills related to utilising geospatial data and digital tools (Tanzanian Resilience Academy 2022). Resilience Academy activities which I have had the chance to be closely part of rely heavily on collecting missing geospatial data through community efforts. The local students collect crucially needed geospatial data of their surroundings and hazards faced in the cities in close cooperation with local communities and organisations. Resilience Academy has its own codes of conduct to guide ethical implementation of the project activities and some World Bank's safeguards and data protocols are also applied, but motivation to study the ethical issues that are encountered in geospatial data processes conducted by and with local communities in the context of the Global South in detail was risen.

First, to achieve the aim of this research main ethical and safety domains will be identified via exploring existing research literature. Second, those findings will be used as a basis for interviewing community-based geospatial data professionals with expertise working in the

Global South. Aim of the interviews is to generate a proper understanding of the ethical and safety considerations in the research context, based on the knowledge and experiences of the interviewees. Finally, the collection of ethical and safety issues drawn from the interviews is compared to existing ethical guidelines for assessing their adequacy in guiding safe community-based geospatial data processes in the Global South.

Drawing from these premises, following research questions are posed:

1. What are the ethical and safety domains related to community-based geospatial data processes in the Global South based on current academic research literature?
2. What ethical and safety considerations for community-based geospatial data processes in the Global South can be identified from expert interviews?
3. Do the identified ethical and safety considerations align with existing ethical guidelines for community-based geospatial data processes in the Global South?

2. Theoretical framework

2.1. The resilient urban South

Urban resilience as a term has had several definitions in the academic research literature, as well as in the application field of urban planning, depending on the discipline of the research and stakeholders in question (Meerow et al. 2016). Reasons behind the fuzziness of the term are in its complexity and its cross-cutting nature that reaches all sectors of the society and the environment, across all spatial and temporal scales. Common grounds can however be found, which are enough for the scope of this research. Most generally, urban resilience is understood to mean that a city can survive a shock without paralyzing effects in any of its most important sectors (Adil & Aurdiaç 2019). Traditionally, the phrase “bouncing back” after a shock has been used to describe urban resilience, but in the context of Global South’s cities, the phrase has been formatted to “bouncing forward”. This means that when a community faces a shock – a natural, man-made or intertwined hazard, such as a tropical storm, drought, or a disease outbreak – the rebuilding and responsive measures lead to more sustainable and safer society and environment than before.

Urban resilience with a systems approach has grown to be a favoured framework to manage disaster risks in the Global South’s cities (Dodman et al. 2013; UNISDR 2015; Harrison & Williams 2016). Systems approach resilience building consists of variety of measures that recognises that all sectors of the society and environment in all spatio-temporal scales must be addressed simultaneously to achieve sustainable resilience. One widely executed key concept of these measures is disaster risk management (DRM) (UNISDR 2015). Disaster risk management is a method inside the larger disaster risk reduction (DRR) strategy that has widely been adopted by cities all over the Globe. In practice, DRM means that stakeholders from governments, NGOs, and the civil society work together to identify disaster risks, exposure, and vulnerabilities, and find solutions for reducing and preventing the risks, as well as enhancing adaptation capabilities when the risks materialise to hazards. These practices eventually lead to societies’ resilience against the possible risks and occurred hazards.

Disaster risk vulnerability in Global South urban context is created and enhanced by number of underlying drivers that seems to be endogenous for the contemporary development paradigm (Pelling & Wisner 2009; Pantuliano et al. 2012; Dodman et al. 2013). Uncontrolled urban growth, poor land-use planning, absence of social security, environmental degradation, uninformed decision-making, inequality, and poverty are among the most common drivers, to name a few. To give a concrete example, uncontrolled land-use planning and lack of safe and affordable housing options forces the poorest to build their shelters to informal settlements. The latest UN-Habitat report from 2016 estimates that up to 30 per cent of Global South’s urban dwellers live in informal settlements or slums, which are usually formed on land areas often more prone to hazards, such as the floodplains of a major river running through a city, or steep slopes of a mountain or ravine (UN-Habitat 2016). These hazardous areas do not have official validation for settlements from local governments, meaning functioning drainage, electricity and other critical infrastructure is lacking, which for their part aggravates local inhabitants’ disaster risk vulnerability (Weichselgartner & Kelman 2014; UNISDR 2015).

Previously, disaster risk management has mainly aimed to preventing and mitigating hazards, e.g., by building physical flood barriers (Adelekan 2015; UNISDR 2015). However, most recent paradigm has moved towards recognising the underlying drivers for vulnerabilities and emphasizing adaption measures. Adaptation measures are aimed to strengthening the overall security of the whole society and environment. For example, setting building codes and standards for buildings that are in hazardous areas, constructing functioning drainage systems, providing affordable insurance to exposed communities and making sure shelters and other necessities are available for those in need. With functioning adaptation strategies, communities' resilience towards known, but also latent hazards, is reinforced.

Latest paradigm shift in urban resilience building calls for more bottom-up led knowledge creation and concrete solutions that acknowledges the true needs of local citizens and businesses (Borie et al. 2019; UNISDR 2018). The paradigm shift also underlines the need to address the fundamental urban developmental issues that so often are the cause for fragile resilience. Early warning systems and emergency response are rather easy to add on top of existing urban policies, but intervening to those underlying risks like poverty, inequality and unsustainable land-use is notably more difficult and requires strong political will and major resources. Also, the widespread problem characteristic to the urban South – dearth of data and data-driven information – about the experienced risks and needs of local communities hinders reliable knowledge-based decision-making and sustainable urban development (Adelekan et al. 2015).

2.2. Community-based geospatial data processes

As other resources in the world, data is also unequally distributed between the Global South and Global North (Young et al. 2020). Most data-scarce areas are located in the South where reliable geographical information about the physical environment, demographical and socio-economical features, disaster events and their impacts, and more is limited. National Statistical Offices in low- and middle-income countries do not necessarily have the required technology or capacity to systematically collect a high-quality database of such information (Wiebe 2022). In addition, the urban poor and inhabitants of informal settlements who have the most pressing situation often remain completely underrepresented in geospatial data due to their informal status unrecognised by officials (Hoogeveen & Pape 2020; Wiebe 2022). Hitherto, geospatial data collection initiatives in the Global South have usually been controlled by individual development projects or academic researchers with a Western origin, which has led to a “*patchwork of datasets of short time duration, restricted spatial coverage, and limited availability*” (Mehmood 2021).

When official data sources are scarce, outdated or completely abundant, or already collected data is not available, other means of information generation and eventually knowledge creation for informed decision making is needed (Perez et al. 2017). To tackle this problem, community-based geospatial data processes have emerged and gained ground in the geospatial urban South. The academic world has known community engagement in geospatial data processes from the 1990's when Participatory GIS (PGIS) became a common research methodology due to emergence of critical geographies alongside of the postmodern research paradigm shift (Corbett et al. 2006). Later, the methodology was adopted also in urban planning, especially in cities in Global North. However, these authority-led participating data processes are not the only way

communities can influence geospatial data processes that aim to strengthening the resilience of their everyday life.

In this research, the term *community-based geospatial data processes* is used to determine such cases where the community of which the geospatial data concerns is an active actor in the data value chain – from determining initial objectives to data generation, its management, dissemination, usage and ownership. Research literature recognises variety of terms referring to such situations in the context of resilience building in the urban South: citizen-generated geospatial data (Jungcort 2022), community-led spatial data collection (Jelks et al. 2018), citizen science (Paul et al. 2017), collaborative GIS (Liu et al. 2018), crowdsourced GIS (Goodchild & Glennon 2010), community mapping (Soden & Palen 2014), participatory GIS (Yusuf et al. 2018), volunteered GIS (Goodchild & Glennon 2010; Haworth & Bruce 2015), and others. Some of these terms are used as synonymous to each other, and some have their own nuances in different contexts. Common for all of them is the role of the people – whether they are the sole contributor of the data process, member of a data management team, or the target of a participating data collection survey.

To give examples of the given terms, citizen-generated data is informatively defined by the International Institute for Sustainable Development:

“citizen-generated data is ‘data generated by people, for people,’ meaning that the individuals who stand to benefit from data collection are directly involved in the design, collection, analysis, and use of data that describes them” (Jungcort 2022).

An example of a citizen-generated geospatial data case comes from Uganda, where an NGO, The National Slum Dwellers Federation of Uganda (NSDFU), initiated a mobile mapping campaign in 2014 together with local inhabitants, which resulted to a geospatial database with basic information about Kampala’s informal settlements’ infrastructure and disaster risks (Dobson et al. 2015). The mapping project catalysed discussion with the local city government about concrete problems the local community faces and ways to take evidence-based action to increase the resilience of the areas. It is also noteworthy to mention that the local community leaders were members of the NSDFU, and since the organisation was the direct data collector and manager, the communities had automatically ownership for the whole data process. Hence, the collected data was indeed generated by the people, for the people.

The before mentioned and well understood methodology of participatory GIS, and its close relative public participatory GIS (PPGIS) aims to participate local communities to geographic information processes for empowerment, inclusion, access, and representation in planning and research processes (e.g. Corbett et al. 2006; Brown & Fagerholm 2015; de Carvalho & Giatti 2017). Via P/PGIS practices, otherwise hidden knowledge of the people can be revealed when the communities can choose to share their perspectives. The people can be participated in some or in every stage of the data and information processes, from planning to knowledge creation and data usage, with variety of tools and methods which eventually adds authority and ownership to local knowledge. P/PGIS practices are usually expert-driven, meaning that an authority figure – e.g., a researcher or an urban planning official – is the key figure in organising and curating the data process and who actively participates the communities, although the term has grown to cover much broader set of cases as well.

A classic example of P/PGIS practices in building resilience in urban settings in the Global South comes from an informal settlement area in Guarulhos municipality, Brazil (de Carvalho et al. 2022). A Brazilian-Finnish research team conducted a participatory mapping project in 2017 together with a local NGO to engage local youth in recognising their community's needs regarding urban nexus elements – access to water, food, energy, and shelter. The team organised a mapping campaign and discussions with the young community members to pinpoint existing locations of the basic resources, and locations for crucially needed developments. After mapping activities, the research team hosted an event where the youth and local city managers discussed together about the suggestions for development needs and planned the next steps of urban planning activities that aim to improve the community's access to the basic resources.

As the examples above demonstrate, the ways of community engagement in geospatial data processes are vast. The listed individual terms are not sufficient for this research on their own, which aims to recognise all different kinds of cases where the local community has an agency in the data processes, whether it is being the sole actor, or one of many. Therefore, *community-based geospatial data processes* is used as an umbrella term to cover all such scenarios and more, even though the term does not have a clear ground and definition in the research literature within the discipline.

Community-based geospatial data processes have become common in filling the data gap in the urban South for number of reasons. Firstly, when the civil society participate in or facilitate the data processes, they are directly able to monitor, demand, and drive change on those issues affecting them (Jungcurt 2022). Involvement of locals ensure that the actual needs of the communities are recognised which eventually leads to problem-solving of the issues that matter the most. In addition, they get direct representations of their perspectives which otherwise often remain hidden, and an alternate to data generated by governments or international institutions. Secondly, the informal groups most vulnerable to disaster risks can be difficult to reach by official or international organisations, which can lead to data exclusion and inequalities in decision-making (Thinyane 2018). Local NGOs and other community-based organisations are often already embedded and trusted within the local communities and are able to facilitate increased participation of the vulnerable and marginalised groups.

Thirdly, community-based geospatial data processes provide a possibly much cheaper and more efficient data collection alternative when compared to officially collected data, which can take considerably great deal of time and other resources. Especially crowdsourced geospatial data collection methods with the efforts of the public are a quick way to gather large amounts of data (Soden & Palen 2014). The OpenStreetMap project is a great example – anyone can add objects and attributes to the map with a high-resolution satellite imagery as a reference, either by themselves, or during an organised data collection campaign. As a result, an entire town can be added to the map in one evening, which once again contributes efficiently to acute disaster risk management efforts in data-scarce areas.

The usage of community-based geospatial data processes in building resilient urban South has grown rapidly, which has left behind the development of common agreements how to execute the processes safely and ethically (Wakunuma 2019; Specht 2020). Individual projects and organisations do have their own safeguards and code of conducts, but the GIS community admits

that there is still a need for a research-based ethical guideline that would recognise crucial ethical questions in the whole data lifecycle, and in different contexts. Commonly known challenges are for example privacy, data quality, ownership, representation, and data rights issues, but without a thorough research some crucial safety considerations could be missed. This research attempts to identify them in detail within the context of urban resilience building in the Global South.

2.3. Open data sharing in the digitalised South

The massive wave of digitalization that has been sweeping across continents in the Global South during the last decade continues to provide new possibilities for resilience building and knowledge-based urban development (Schopp et al. 2019; Buryayidi et al. 2020). The amount of digital geospatial data for decision-making, research, education, and community efforts increases when novel geospatial data collection, management, usage and sharing technologies are introduced as the needed skills and know-how are materialised to resources and innovations. For example, with mobile mapping technologies geospatial data creation is cheaper, faster, and more accessible for the public than ever before. Free and open source (online) technologies for geospatial data management, such as the GeoNode project, QGIS software or GeoServer, allows professional data curation, analysis and dissemination possibilities without expensive software licenses and heavy hardware (What is Open Source? 2022).

Digital solutions also enable new ways for the civil society to gain power in determining the development paths of their everyday life (Fox et al. 2006; Schopp et al. 2019). They are able to produce geospatial data of their surroundings, communicate it to local authorities and thus use it for their benefit to foster sustainable planning of their neighbourhoods. They get access to data and information dissemination channels and to different digital location-based applications that may ease one's everyday life by enabling for example digital navigation, service maps, and hazard extent information during disaster occurrence. New digital business opportunities are also vast and provide people the possibility to transfer their skills and knowledge to livelihoods.

As accessible digital solutions in the Global South have emerged, open sharing of (geospatial) data has increased in popularity, and researchers, third sector organisations and the civil society publish their datasets in numbers (Manyika et al. 2013; Serwadda et al. 2018). Popularity of open sharing is of course also dependent on the cultural shift from protecting property to sharing it for others to utilise as well. NGOs, humanitarian organisations and individual data collection projects have been the engine in creating the culture of open data sharing. The academic world has followed their footsteps while universities and article publishers have begun to require research datasets to be published for increasing transparency and "giving back" to the communities. Private organisations and low- and middle-income countries' governments still tend to be more careful and often hold their datasets in their own use.

Open data sharing means that a collected set of data is eventually published on a digital platform and is accessible for the public with a license that allows the data to be explored, downloaded, analysed, modified, re-used and re-shared by anyone (Manyika et al. 2013). Benefits of open sharing for public use are vast: the shared datasets are resources for fostering innovations, it prevents duplicate work, increases transparency in data processes and allows others to validate

the data collection and analysis methods. Open data sharing is especially crucial in areas suffering from data scarcity, such as the Global South.

As always, regardless of the benefits of digitalisation and open data sharing, problems can be identified too. Firstly, digitalisation in the Global South is not equal even though it grows rapidly (Schopp et al. 2019; Wakunuma 2019). Digital demographic divide accumulates the use of digital technology to younger generations with higher income level living in urban settlements. Access to internet is neither self-evident even on areas with proper connection infrastructure, since local governments may restrict access to internet for example during elections which in turn diminishes trust both to internet-based technologies, and the government. Digital illiteracy also hinders the adoption of digital technologies which can affect for example data collection projects conducted with mobile mapping technologies together with local communities.

Secondly, open data sharing policies are not ingested as widely as the geospatial community working with urban resilience issues in the Global South would wish for. Especially governmental organisations have concerns about data misuse and data subjects' privacy (Richardson et al. 2015; Serwadda et al. 2018). Lack of technical solutions for sharing governmental data is also contributor for the public not having access to such datasets. Creating governmental spatial data infrastructures requires time, finances, political will, well-thought data sharing policies, and the know-how of how spatial data infrastructures should be installed and managed in a professional manner. Only few national governments in the Global South have initiated such processes, one being the Kenya Open Data Initiative established in 2010 that promotes the citizens right to governmental data and has resulted to over 800 publicly shared governmental datasets, both geospatial and non-spatial (The Kenya Open Data Initiative 2016).

2.4. Defining geospatial data ethics

Ethics is a field of philosophy that studies morality and defines the code for what is considered as “wrong” and “right” (Feldman 1978). To a large extent, moral values are tied to the culture we live in (Hugman 2008). To give a simplified example, Western cultures are known to value individuals' freedom of expression, whereas many Asian cultures value societal harmony. These values can manifest as Westerners expressing comfortably a full range of emotions during conversations, when Asians tend to act more reserved in public to maintain a peaceful environment. However, there are moral values that can be considered common to the whole humanity, such as “hurting others is wrong”, because no-one wants to be hurt themselves. If someone acts against these shared moral values, they are punished either by the arm of the law or via social disapproval. These (almost) universally recognised moral values are gathered to the Universal Declaration of Human Rights which acts as a basis for national and international law, and different ethical guidelines (Universal Declaration of Human Rights 1948).

The moral principle “not harming others” does seem quite straightforward, but when examined more closely it quickly becomes evident that in real-life situations there are several variables that stir the pot and force us to ponder between options, to compromise and make difficult choices. How should we act if protecting one person harms someone else? Is it ethical to displace families and endanger their livelihoods by building flood barriers in place of their homes to protect rest of the neighbourhood from flooding? Should a humanitarian organisation retrieve their

employees from a serious armed conflict where they are in immediate danger, even though they are the only actor being able to provide medical assistance in the region? Is it ethical for a pharmaceutical company to patent their vaccines in the face of a global pandemic to secure financial profit that will enable further research and innovation?

In the search for solutions, ethical dilemmas can be approached from different angles. As a detailed dive into history of philosophy and ethic's theory is out of the scope of this research, it is reasonable concentrate on the nature of ethics' application fields. Applied ethics can in most cases be reduced to "Do no harm, do good" rule (Raymond 2016). By ethics' theories, this rule follows the branch of normative ethics, and deontological and consequentialist viewpoints within the branch (Moore 2005). Normative ethics aims to determine how us humans should behave to "do good". Deontological viewpoint focuses on the rightfulness of the premises behind actions and the rightfulness of actions themselves. For example, bulldozing homes to build flood barriers is "doing good" because the act itself has good intentions, despite of the loss of homes and livelihoods of the displaced families.

Consequentialist viewpoint in turn judges the rightfulness of an action based on how good the consequences are (Moore 2005). To continue with the same example, consequentialist approach is more careful in stating that bulldozing is an ethical act, because even though it does good by protecting the larger community from flooding, displaced families might struggle to find new places to live and restart their businesses. In practice, when making ethical decisions the perspectives explained above are mixed. People do not knowingly choose a perspective to act by but rather follows their moral instincts.

The main objective of applied ethics is to identify ethical dilemmas and provide guidance how to overcome them with morally sound choices – choices that once again follow the shared moral values of the society (Lake 1993). Ethical guidelines in different application fields are usually a list of issues that most probably will need ethical evaluation, and straightforward rules which should be obeyed while applying the guidelines to real-life cases (Loukides et al. 2018). For example, the shared moral value of peoples' right to privacy is not only declared in the mother of all ethical guidelines, the Human Rights, but it is also repeated in ICT-, digital technologies- and data ethics' guidelines. The Urban and Regional Information Systems Association's (URISA) GIS Code of Ethics states this moral value in the following format: "*Protect individual privacy, especially about sensitive information*" (GIS Code of Ethics 2003). What this means for individual GIS related processes is however case-specific and the process facilitator must have the know-how of identifying possible privacy issues and how to overcome them.

The target of this research – community-based geospatial data processes – falls under the application field of data ethics. Data ethics is a rather new ethics' branch and its theoretical founding fathers are Floridi and Taddeo (2016) with their article "What is data ethics?" published as recently as in 2016. Their definition of data ethics has been repeated in various other research articles, and it has not been contested or reformed. According to the definition, data ethics

“studies and evaluates moral problems related to data (including generation, recording, curation, processing, dissemination, sharing and use), algorithms (including artificial intelligence, artificial agents, machine learning and robots) and corresponding

practices (including responsible innovation, programming, hacking and professional codes), in order to formulate and support morally good solutions”.

Floridi and Taddeo (2016) gives privacy, consent, transparency, responsibility, and trust as examples that are crucial topics requiring ethical consideration throughout the whole data lifecycle. Even though data ethics is a new theoretical concept, the field of data science has not been working in a vacuum. It has applied e.g. information ethics guidelines, which is a close relative to data ethics, but concentrate only on the final stages of the data processes.

Geospatial data has its own unique nature when compared to matrix-type data, which brings more dimensions to the table when identifying ethical and safety issues (Haque 2003; DiBiase et al. 2011). The whereabouts of peoples’ homes, workplaces, day-to-day routes, and other valued locations are all sensitive information which can be disclosed if proper anonymisation or masking techniques are not implemented in the data management process. Disclosure and other ethical issues of GIS has been widely discussed in academic writing, starting from the 1990s by Crampton (1995) with their article “The ethics of GIS”, and soon continuing by e.g. Abbot et al. (1998) with the article “Participatory GIS: opportunity or oxymoron?”. The early discussion concentrated on privacy issues, consequences of data aggregation, and visualising and publishing sensitive location information, which all are still common topics in the discipline due to technology and digital data development that poses new possibilities and threats.

Public, private and third sector organisations within the GIS community have produced several ethical guidelines and codes of ethics for geospatial data processes, either for the organisation’s own use or for the wider community to adopt (e.g. GIS Code of Ethics 2003). Despite of the vast production of such guidelines, a common set of applicable rules for responsible creation, management and use of location data is still missing. The American Geographical Society has initiated a project, EthicalGEO, in 2021 that aims to participate various stakeholders within the field to create a commonly agreed set of internationally applicable principles for ethical practice when working with geospatial data (EthicalGEO 2022). This set of principles carries the name Locus Charter, which actually recognises the theoretical framework of data ethics (Locus Charter 2022). Locus Charter is currently perhaps the most prominent co-created and commonly agreed ethical guideline for geospatial data processes, but it is to be seen whether it achieves the goal of becoming the globally applied ethical framework for the whole GIS community it desires to be.

In the course of creating globally applicable ethical guidelines for responsible geospatial data processes, it is important to note that each culture carries moral parameters and values of their own (Rambaldi et al. 2006). In their research, Seehawer (2018) noticed that 70 global ethical guidelines (out of 80 researched) from different disciplines was of Western origin carrying Western ethical principles, and thus asked whether these guidelines can truly be *global* if they are only built on Western philosophical grounds? Globally applicable ethical guidelines should be global and local at the same time, meaning that they must be able to be applied everywhere regardless of the cultural context, and at same time they should recognise cultural diversities. This calls for the recognition of different philosophical and moral traditions around the world, such as Buddhism in Asia and Ubuntu in Africa.

Ubuntu, for example, carries a communalist fundamental principle where one’s existence is experienced through other humans and the nature (Mbiti 1990; Coetzee & Roux 2003). The high

value of community and others around one in Ubuntu is the main ontological difference when compared to the Western ideal of individualism (Seehawer 2018; Keymolen & Linnet 2021). Therefore, in many African cultures group privacy is much more relevant concept for the local communities than the concept of individual privacy. As such differences are identified, those moral values that has been considered as universal (e.g. peoples' right to privacy) must be taken under a magnifying glass when creating common codes of ethics that should be able to be applied in different cultural contexts. When the Human Rights and majority of global ethical guidelines have a Western origin, Western ideologies have an inevitable grip of what is considered "doing good". If only Western viewpoints are applied in (community-based) geospatial data collection processes in all cultural contexts, do we dismiss some important characteristics of other cultures?

2.5. Researching the ethics of geospatial data processes in a context

Ethics of geospatial data, GIS and participatory GIS are broadly discussed within the academic research community, and the importance of identifying ethical and safety issues related to them is highly recognised. Still, the discussion is mainly concentrated on the ethics of the data itself and excluding the broader contexts where the data is collected or used in, such as resilience building in the Global South. There is little to no research on the ethics and safety of community-based geospatial data processes taking place in the Global South, except of the UNICEF's Office of Research Innocenti discussion paper by Berman et al. (2018). In addition to ethics and safety of geospatial data and GIS technologies, the discussion paper takes into account e.g. the sensitive role of marginalised groups that partake geospatial data generation, the power relationships emerging when large international organisations facilitate or fund data generation processes in the Global South, and the importance of acknowledging different cultural contexts when planning data collection, conducting analysis and utilising the generated information for evidence creation. Finally, the ethical and safety issues are collected to an ethical guideline to be used by GIS and geospatial data projects taking place in the Global South. However, the paper does not express what was the identification process of the listed ethical issues.

The geospatial data science discipline also lacks research that verifies the quality of the existing codes of ethics and ethical guidelines, so it is difficult to estimate reliably whether they are representative and adequate or not (Keymolen & Linnet 2021). Such research has been done for ethical guidelines steering the use of artificial intelligence algorithms (Mittelstadt 2019). The research resulted to a notice that only 10 organisational ethical AI guidelines out of 160 were applied properly and had adequate implementing measures in place. They also found out that the guidelines were heavily voluntary in nature in both private and public sectors, and commitment to them depended only on the organisations' internal culture. Thus, it is safe to assume that existing ethical guidelines should be verified within the geospatial field as well to ensure all crucial ethical and safety considerations can be taken into account in different data processes.

A discipline that has a great representation in identifying practical ethical issues related to data processes in the Global South is the medical field. There are several research papers that have studied for example the ethical issues rising from open sharing of biomedical demographic data (Anane-Sarpong et al. 2017), the relationship between data subjects' consent and secondary use of health data (Ballantyne 2019), and the power inequalities in North-South research projects

that collect or use public health data in low- and middle-income countries (Walsh et al. 2016). Common for all these studies is that the researchers interviewed multiple stakeholders when identifying the ethical issues, and as results they proposed new ethical considerations that should be considered in further projects within the discipline. Similar research approach is applied in this research for validating existing ethical guidelines for (community-based) geospatial data processes and identifying possible hidden ethical and safety issues not recognised previously.

3. Data and methods

3.1. Research methodology

The methodology of this research consists of systematic literature review, semi-structured expert interviews, and ethical guideline evaluation that all answer to one research question (Figure 1). The three parts contribute to each other and thus are conducted in consecutive order where results from the systematic literature review are used to structure the expert interview question pattern, and the results from the interviews are used in evaluating the existing ethical guidelines for safe conduct of community-based geospatial data processes in the Global South.

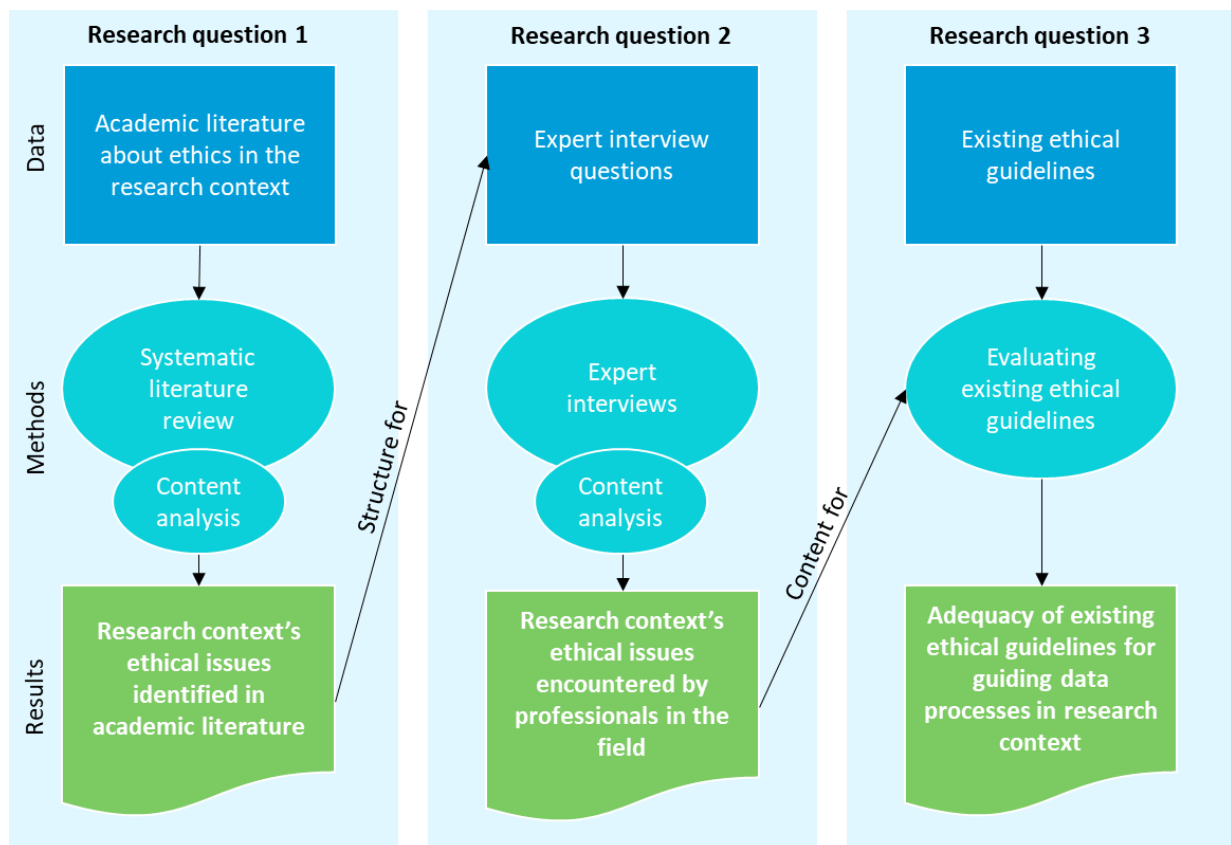


Figure 1. The methodology of this research consists of three parts which all answer to one research question and are related to each other. The data, methods and results and their interconnectedness of each part are illustrated in this figure.

The systematic literature review paints a picture of the state of the current academic knowledge about ethical issues emerging in community-based geospatial data processes in the Global South, and thus answers to the research question one. A list of ethical domains discussed in the reviewed literature is created, which is then used as a theoretical basis for the semi-structured expert interviews' question pattern. With a solid theoretical background, comprehensive discussion about ethical domains and how the interviewees have encountered them in their own work can be conducted. Room for discussing about other ethical issues not mentioned in the reviewed academic literature is also left to ensure the possibility for new findings.

As a result from the interviews, once again a list of ethical and safety issues identified and encountered by the experts working in the field is collected, which answers to the second research question. Finally, three existing ethical guidelines that are used within the field to guide

safe professional conduct are evaluated. The evaluation answers to the third and last research question and provides insights how well the guidelines provide guidance for solving ethical dilemmas emerging in the research context. The methods used in these three entities are discussed more detailed in the next sections of this chapter.

The context of this research – ethics in community-based geospatial data processes conducted in Global South – and the execution of expert interviews are closely tied to Tanzanian Resilience Academy project, which is familiar to me via working in it for couple of years. Tanzanian Resilience Academy is led by the World Bank, funded by the United Kingdom's Foreign, Commonwealth and Development Office (FCDO), and implemented by four Tanzanian universities (University of Dar es Salaam, Ardhi University, Sokoine University of Agriculture and State University of Zanzibar) and the University of Turku (Tanzanian Resilience Academy 2022). The project's mission is to tackle urban resilience challenges that are faced by local communities in Tanzania via enhancing university-level students' knowledge and skills related to geospatial data and digital tools. Main activity of the project is to train the local students to collect crucially needed geospatial data of their surroundings and hazards faced in the cities in close cooperation with local communities and organisations.

All the elements of this research's context are present in the Tanzanian Resilience Academy project activities. The project enables variety of community-based geospatial data processes via data collection conducted by local students, communities and organisations, and the reason for data collection is to create the possibilities for evidence-based decision-making to build sustainable urban resilience in Tanzanian cities which are obviously located in the Global South. Since the Tanzanian Resilience Academy is an international and multi-stakeholder project, a diverse set of professionals with broad experience from the field of community-based digital geospatial data from the local universities, the World Bank, local governmental and non-governmental organisations are part of its networks. As I have had the chance to work in the Tanzanian Resilience Academy, a door opened to me to contact some of the experts for an interview, with the assistance and guidance of key figures implementing the project.

3.2. Systematic literature review

In this research, the purpose of systematic literature review was to identify the main domains of ethical and safety issues embedded in community-based geospatial data processes taking place in the Global South that are recognised in current academic literature. Identified domains (for example privacy and data quality issues) was then used as a basis for interviewing experts working within the field. Systematic literature reviews are used to understand what the state of current academic knowledge within a certain theme is (Xiao & Watson 2017). The methodology consists of planning the theme of the review, searching, identifying, and screening appropriate academic writings, analysing them, and finally reporting the findings. Analysing is usually conducted as content analysis where the desired issues from selected articles are coded to collections or themes which are then used to create the overall understanding of the state of current academic knowledge. The existing knowledge can then be evaluated in its validity,

quality, depth, and currency, or used as a basis for identifying further research needs for filling in possible knowledge gaps.

The rather specific context of this research posed challenges in finding relevant academic writings for the systematic literature review. Thus, articles from different ethics' application fields were explored to find as comprehensive set of ethical and safety issues related to community-based geospatial data processes for resilience building in the Global South as possible. The fields were: ethics and safety of 1) GIS and geospatial data, 2) PGIS and community participation in Global South, 3) digitalisation in the Global South and 4) resilience building in the Global South (Table 1). Search keywords used were selected from article descriptions and from research keyword repositories.

The literature was searched from Google Scholar, ResearchGate, University of Turku library collection and via traditional Google search. Academic research articles published in journals and peer-reviewed book chapters with open access, or access via UTU libraries were screened, and the most relevant articles were accepted for further analysis. The number of screened articles was higher than what were selected to the analysis, but most of the literature that was excluded cited the selected original articles and repeated similar issues as mentioned in them.

Table 1. Articles selected to the systematic literature review.

Ethic's application field	Search keywords	Selected articles
Geospatial data and GIS	<i>gis; geospatial; geospatial data; location-based data; ethics; safety; risks; safeguards; review</i>	The ethics of GIS (Crampton 1995) Towards a collaborative knowledge discovery system for enriching semantic information about risks of geospatial data misuse (Grira et al. 2013) Beyond professional ethics: GIS, Codes of Ethics, and emerging challenges (Verrax 2017)
Participatory GIS, community-based data, community participation in Global South	<i>participation; participatory; participatory GIS; PGIS; community-based; community; civil society; citizen; local communities; ethics; ethical; safety; risks; safeguards; review</i>	Participatory GIS: Opportunity or oxymoron? (Abbot et al. 1998) Practical ethics for PGIS practitioners, facilitators, technology intermediaries and researchers (Rambaldi et al. 2006) Participatory geographic information systems and land planning: life experiences for people empowerment and community transformation (Orban-Ferauge 2016) Volunteer geographic information in the Global South: barriers to local implementation of mapping projects across Africa (Young et al. 2020)
Digitalisation in the Global South	<i>digitalisation; digital development; global south; south; developing countries; low and middle income countries; ethics; ethical; safety; risks; safeguards; review</i>	Ethical questions of digitalization in the Global South: Perspectives on justice and equality (Schopp et al. 2019)

		Power as an ethical concern in the Global South's digital transformation: Power or empowerment? (Wakunuma 2019)
Resilience building in the Global South	<i>resilience; resilience building; disaster risk management; disaster risk reduction; disaster risk response; global south; south; developing countries; low and middle income countries; ethics; ethical; safety; risks; safeguards; review</i>	Mapping narratives on urban resilience in the global south (Boric et al. 2019)

When appropriate literature was selected, it was transferred to content analysis program NVivo, read in whole in an iterative manner, and analysed with a qualitative content analysis. Qualitative content analysis method aims to find words, facts, or larger themes relevant for research questions from the data material (Hsieh & Shannon 2005). In this case, a rather simple analysis was conducted for creating a collection of ethical and safety issues related to the research context. Ethical and safety issues mentioned in the articles were identified and coded as such to thematic collections (e.g. privacy, trust, data quality, misuse). In most writings the ethical considerations were discussed in their own thematic sections throughout the article or book chapter, and in some cases they were clearly listed as bullet points in the conclusions. After all ethical and safety issues mentioned in the articles were coded into thematic collections, a list of ethical domains that are recognised by the current academic could be created. The list was then used as a basis for the expert interview question pattern that would guide the interview discussions.

3.3. Expert interviews

A pool of community-based geospatial data professionals with extensive experience of working in the Global South was interviewed about their own experiences about ethical and safety risks that might be embedded to community-based geospatial data processes. Expert interviews methodology has been widely utilised to reveal data-related ethical issues in the field of medics (e.g. Walsh et al. 2016; Anane-Sarpong et al. 2017; Ballantyne 2019), and thus it was selected to accommodate this research as well. The aim of the interviews was to deepen the understanding about ethical issues identified in the systematic literature review, to validate the literature findings, and to identify possible new ethical and safety issues not visible for the current academic literature. The interviewees' own experiences reveal how the academic research about ethical and safety issues manifest in real-life geospatial data processes, and their perspectives are up most valuable in finding the most recent information and validating existing knowledge.

The interviewees were searched through Tanzanian Resilience Academy (Tanzanian Resilience Academy 2022) networks that extend to the Tanzanian academic field, to local NGOs, governmental offices, and international organisations, namely the World Bank. Also, few other experts with appropriate expertise outside the Tanzanian Resilience Academy networks were identified. Demographic diversity was secured when searching the interviewees. Thus, a pool of total 18 experts with diverse professional backgrounds (Table 2), ages and gender were contacted and requested for an interview. The interviews were conducted both face-to-face in Dar es Salaam, Tanzania and in Zanzibar, and remotely via video call.

Table 2. Interviewees' organisational backgrounds displayed in numbers.

Organisational background	Number
University	6
Government	4
Non-governmental organisation	6
International organisation	2
	Total: 18

The interview method selected for this research was semi-structured interview, which serves the purpose of revealing information about selected themes but allows flexibility during the interview discussion (Kallio et al. 2016). Semi-structured interview consists of a selection of pre-made questions that are asked from all interviewees. The question generation was inductive in nature, meaning they had a theoretical basis behind them, namely the results obtained from the systematic literature review. All the identified ethical domains identified in systematic literature review were integrated to set of questions that aimed to reveal the interviewees' own experiences regarding ethical and safety issues in their own work within the field (Table 3). As a result, eleven thematic questions were formulated that concentrate to the ethical considerations: how the experts have encountered the ethical issues in their own work, and how such safety risks could be avoided. In addition to these thematic questions with a theoretical background, room was left for new perspectives, too. The interview questionnaire can be examined as a whole in **Attachment 1**.

Table 3. Illustration of how the identified ethical domains were integrated to interview questions.

Main ethical domains	Research question(s) related to the domain
Data quality	6, 7 & 8
Privacy	4, 5
Misuse	4, 13
Open sharing	10, 11
Data access	10
Ownership	11, 12
Informed consent	4, 5
Cultural collision	14
Trust	4, 5 & 14
Digital inequality	4, 9

Neo-colonialism	14
Power inequality	14
Community exclusion	4, 14
Dismissing environmental issues	13

To give examples of the generated questions, thematic interview question number fourteen (14) has the ethical domains “neo-colonialism” and “power inequality” as the underlying drivers for the discussion. The terms are not mentioned in the question itself to avoid unnecessary guiding of the discussion by the interviewer, and to rather let the interviewee rise those issues to the discussion that they have experience of. However, the terms could be mentioned if the interviewee asked for examples or more clarity on the question to conceptualise their answers.

- Question 14: Quite often, digital data collection efforts are funded by various international projects and actors. Do you identify any particular risks related to foreign actor involvement in the open community data projects?

The ethical domain of “data quality”, in turn was integrated in three questions:

- Question 4: Based on your own experience, what kind of geospatial data collection challenges that affect data quality have you encountered in your work?
- Question 5: According to your opinion, what risks may come for real if poor quality data is used?
- Question 6: How would you avoid quality risks in practice? Do you have any tips of good practices which you have seen to work well?

By some definitions, the order of the questions in semi-structured interviews should be same for all participants, whereas others allow the order to be changed (Kallio et al. 2016). This research follows the latter definition, and the questions were asked in an order that was natural for the discussion. Although the questions were same for all participants, the depth of the discussion for each theme varied depending on their experiences and professional knowledge. For example, some interviewees had more experience related to participating local communities and some in data quality related issues. Thus, more time could be spent on those issues that were familiar to the interviewees.

Interviews were recorded and transcribed. Length of the interviews varied between 30 minutes to one and half hours. Anonymity of the participants was secured so that the recordings did not include specific titles or names of the participants, their family members, or close colleagues. Each recording file was named anonymously (P1, P2 and so on). The recording and transcript files were saved to secure cloud service Seafile of the University of Turku. The anonymity of the interviewees is considered in this research documentation as well, and thus names or specific titles of the interviewees is not published. Privacy notice with explanations on the safe management of the interview recordings and transcriptions, how they are used, and the right to opt out were given to each participant prior the interviews.

The interview transcripts were made using Microsoft Word and Otter software. The transcription method selected was intelligent verbatim transcription, which includes only the meanings of words and sentences in the discussion and excludes irrelevant fillers, unspoken expressions, ticks, and hesitations (Poland 2002). This way, the relevant information from the discussion could be transferred in black-and-white.

To identify ethical issues the interviewed experts have encountered in their own work, once again qualitative content analysis was conducted (Hsieh & Shannon 2005). In this research, ethical issues and safety risks in community-based geospatial data processes in the given context manifest as words and sentences in the transcribed interview discussions. They were searched from the material in multiple iterations and coded thematically both in abductive and inductive manner, meaning some of the coding followed a pre-thought structure, and some of it was created on the fly (Poland 2002). Ethical considerations mentioned by the interviewees were coded to thematic collections based on the systematic literature review, but it became apparent that new codes for such discussed issues that could not be coded to the pre-defined ethical domains were needed, too.

3.4. Ethical guideline evaluation

There are several ethical guidelines and codes of ethics available for geospatial data practitioners to utilise in their own work when ensuring the safety of participants throughout the whole data processes. Even though a specific guideline for community-based geospatial data processes taking place in the Global South is non-existing, other guidelines can be applied. However, as Keymolen & Linnet (2021) stated in their research, such guidelines have not been quality controlled in any way by the academic field. This research aims to contribute to the knowledge gap by scrutinising the content of three existing ethical guidelines and comparing them to the results of the expert interviews, and answer to the question whether the guidelines cover same ethical dilemmas as mentioned by the experts.

The three ethical guidelines and codes of ethics selected for the comparison were the UNICEF's Checklist for ethical use of geospatial technologies for evidence creation based on the Innocenti paper by Berman et al. (2018), the GIS Code of Ethics by URISA (GIS Code of Ethics 2003) and the Locus Charter founding principles (Locus Charter 2022). The UNICEF checklist for ethical conduct is aimed for development and humanitarian organisations, and thus takes community participation and working in vulnerable settings into account. The GIS Code of Ethics in turn is aimed for GIS practitioners in general and is more approximate in nature. Lastly, the most recently established Locus Charter is a proposed set of common ethical principles aimed for the whole international community of location-data users. The Charter is still in its development stage, but the first founding principles generated via multi-stakeholder cooperation have been published.

As research from the discipline of geospatial data sciences that evaluates the quality of ethical guidelines is non-existing, an article from the field of medicine was used as a basis for the comparisons in this research (Strech & Schildmann 2011). In their article, they use the Appraisal of Guidelines for Research and Evaluation (AGREE) quality assessment instrument to assess the

quality of ethical guidelines for end-of-life decisions. Even though the AGREE instrument is created for clinical practice guidelines and the cited paper is from the discipline of medicine, the overall research structure of comparing ethical guidelines to another list of statements could be applied for this research. The comparison was executed by creating a table where the identified ethical domains are listed on one column which acts as the “criteria” where the content of the guidelines is compared against. Then, those checklist points from the three evaluated guidelines that mention the identified ethical domain were attached to the table on the corresponding row and to their own guideline columns. Thus, a complete table could be created which shows which identified ethical domains are mentioned and given instructions in which guidelines.

4. Results

4.1. Ethical domains identified from academic literature

As a result from the systematic literature review, a collection of 14 ethical domains could be identified (Table 4). Some domains, such as “privacy” was repeated in more than one article from different ethics’ application fields, but for the sake of clarity of the list, such domains are mentioned only once. The literature discussed the main ethical issues rather broadly, and sub-terms and themes for the main terms were mentioned in numbers. These sub-terms are displayed in the table as well, as they too guided the planning of expert interviews. As one can see, the main ethical domains given in the academic literature are in many cases overlapping with each other. For example, as “data access” is widely discussed ethical concern within GIS and geospatial data ethics, it contains the sub-theme of “digital inequality” that is one contributor to poor access to data or GIS technologies. At the same time, “digital inequality” is one of the main ethical issues within the field of digitalisation in the Global South. Example quotes from the articles give glimpses how these ethical issues are discussed in the examined academic literature.

Table 4. Ethical domains that were identified with the systematic literature review.

Ethics’ application field	Main ethical domains	Sub-terms	Examples
Geospatial data, GIS	Quality	Accuracy, metadata, quality standards, currency, unsuccessful operationalisation, unreliable use	<i>“there are numerous examples of information available but in the wrong format, with incorrect resolution, or being incomplete” (Verrax 2017)</i>
	Privacy	Individual/group privacy, disclosure, aggregation, open sharing	<i>“one of the strongest critiques of the GIS-structure is that it encourages a “surveillance society” which threatens peoples’ data privacy.” (Crampton 1995)</i>
	Misuse	Unpredictable consequences, open sharing, exploitation	<i>“the assumption of safe usage of the data has led to a number of accidents and other adverse consequences that remind the need to protect users against the risks of data misuse” (Grira et al. 2013)</i>
	Open sharing	Copyright, licensing, subject’s rights, misuse	<i>“Two main questions arise from the issue of property: who owns the information displayed in GIS, and how are contributors of a particular knowledge to be compensated?” (Verrax 2017)</i>
	Data access	Skills, technologies, cost, openness, digital inequality	<i>“ethical challenges in order to ensure equity in access to GIS are much broader than just the design or property of GIS: it concerns the society as a whole, regarding how the citizens have access to education, and what kind of technical and cultural facilities they are provided” (Verrax 2017)</i>
Participatory GIS, community-based data and community participation	Ownership	Data privatisation, community ownership, subject’s rights, access, opting out	<i>“Villagers and their leaders should be at the helm, for the purpose of projects of this sort is to produce maps that they can call their own. You want to establish in them a sense of ownership; without this, they will usually do nothing with the maps.” (Rambaldi et al. 2006)</i>
	Informed consent	Understanding consent,	<i>“participation must be voluntary. In order for participation to be voluntary, the participant</i>

		unpredictable consequences, clear intentions, reasoning of the project	<i>needs to know what kind of map is going to be made, the type of information that will be on the map, and the possible implications of the maps being made public. People must agree to participate and be able to withdraw at any time without prejudice.” (Rambaldi et al. 2006)</i>
	Cultural collision	Local context, local culture, hierarchies, outsiders	<i>“All of these findings offers lessons for researchers attempting to implement crowdsourcing projects in the Global South. These projects must be carefully designed so that they account for digital divides, local cultural views of volunteerism and open data, and orientations toward government or organizational hierarchy” (Young et al. 2020)</i>
	Trust	Transparency, retained knowledge, intentions, “giving back”, publishing community data	<i>“academics trust peer review and H factors; local rural communities may trust traditional leaders and some NGOs, but rarely trust Government, (do they trust academics?)” (Orban-Ferauge 2016)</i>
Digitalisation in the Global South	Digital inequality	Digital illiteracy, digital demographic inequality, marginalisation, ICT access, Internet access	<i>“Barriers include strong regional differences in internet and ICT adoption rates, high costs of internet (e.g. mobile data), existing social inequalities which may reinforce or exacerbate access barriers, and government-facilitated internet shutdowns.” (Schopp et al. 2019)</i>
	Neo-colonialism	Platform ownership, data ownership, technology importing	<i>“From a postcolonial perspective, digitalization processes in the Global South are a cause for concern as the dominance of foreign players and foreign ICT – and therefore foreign values, perspectives, and ideas – resembles colonial structures.” (Schopp et al. 2019)</i>
	Power inequality	Digital dependency, politics, exploitation, Western organisations in GS, crediting, commerciality	<i>“The persuasive tactics are a form of power that digital platform proprietors hold over their users. Such power is influential in enabling dependency on the proprietors. This has im-plications for data control and ownership of said data because data is generally owned by the digital proprietors.” (Wakunuma 2019)</i>
Resilience building in the Global South	Community exclusion	Lack of participation, ignoring informal groups	<i>“When deciding development paths for urban neighborhoods, there is the risk of epistemic domination as a result of assumed ‘expertise’ on the part of one group or other” (Borie et al. 2019)</i>
	Dismissing environmental issues	Conservation areas, land ownership issues, unplanned urban growth, illegal deforestation	<i>“it is hard to with the nature. Either we are in the way of nature, or the nature is in the way of us. Whilst urban greenery is protected and planted in the city centre, a forest is cut down on the edge. Unplanned urban growth and sustainable resilience building does not walk hand-in-hand.” (Borie et al. 2019)</i>

The systematic literature review paints a picture of the current stage of the academic knowledge related to ethical and safety issues that might materialise in community-based geospatial data processes conducted in the Global South. Ethical issues are discussed in depth, and many of the identified domains are recognised by multiple sources. Some of the selected articles, such as the “Ethics of GIS” by Crampton (1995) have grown to a mature age, but they are still cited in the newest writings as well. Even though GIS technologies and geospatial data have evolved enormously, same ethical issues are still relevant, such as privacy and data quality related

dilemmas. Although none of the articles are directly connected to the specific context of this research, it is evident that all the mentioned ethical issues are relevant for community-based geospatial data processes contributing to urban resilience building in the Global South.

Articles concerning ethics of GIS and geospatial data discuss broadly the technical issues, such as data aggregation, disclosure risk, operationalisation during data collection, and data quality problems (Crampton 1995; Grira et al. 2013; Verrex 2017), but dismiss the context where the GIS and geospatial data processes happen in. The ethical issues rising from the context of resilience building in the Global South are considered in the three other ethics' application fields selected for the analysis. The field of PGIS and community participation take into account the rights and safety of individuals and groups, ethical issues regarding digitalisation in the Global South adds the broader picture of digital inequalities and power play to the mix, and finally the context of resilience building reminds to consider the nature and environment as well.

All of the 14 identified main domains of ethical issues were mentioned and discussed in the articles, although two different articles could have had a slightly different view for one domain. For example, privacy as an ethical and safety issue was broadly discussed in GIS and geospatial data related articles, but the writings about ethical issues of digitalisation in the Global South discussed privacy, too. In the former, privacy was considered as an important issue that must always be carefully examined, but still it could be solved via different methods of data anonymisation or masking (e.g. Grira et al. 2013). The latter, on the other hand mentioned privacy as an ethical issue when e.g. foreign mobile application owners collect user data from the dwellers of the Global South, and manage, use and sell it as they please due to lack of data privacy laws and other protection measures by the citizens' home countries (Wakunuma 2019).

4.2. Experiences and new perspectives from expert interviews

The pre-defined ethical issues dwelling from the academic literature were discussed in depth with experts working with community-based geospatial data processes in the Global South. The experts provided examples on how the ethical issues have manifested in practice and thus gave insights on how complex the ethical and safety considerations for location-data can be when working with communities in resource scarce settings. Many of the interviewed experts discussed similar issues, which indicates that the issues are commonly encountered.

The interviews provided deeper insights on for example how local community members' mistrust towards data collectors affect the whole process, how the experts have considered challenges related to data quality issues, and how the digital divide affects local communities' and organisations' possibilities to store and disseminate large sets of geospatial data efficiently. In addition to the pre-identified ethical domains, new nuances of ethical challenges were discussed, too. Such themes were for example how governmental organisations' attitude towards data processes not facilitated by themselves shapes the whole culture of what is considered reliable geospatial data, whether data is suitable for decision-making, and how data ownerships should be defined. The main ethical domains that structured the interviews are listed on the left in the Table 5 below, and the themes that relate to those domains are listed on the right. As one can see, new domains are added to the list, too: "political culture" and "over-researching".

Table 3. Ethical and safety considerations discussed with the experts during interviews.

Ethical domain	Ethical issues discussed with the interviewees
Data quality	Low compatibility of existing geospatial datasets
	Rapid changes in infrastructure and environment lead to data outdatedness
	Poor quality and misrepresentation in existing official datasets
	Non-existing national geospatial data quality standards
Privacy	Insufficient know-how of data anonymisation
	Communities' doubts towards data safety
Misuse	Unpredictable data usage
Open sharing	Deciding which data should be shared publicly and which not
	Communities mistrust towards certain organisations in having access to data concerning them
	Monitoring data usage is difficult
	Non-existing national guidelines for open data sharing
Data access	Communities' limited capacity to access and use geospatial data
Ownership	Communities' limited capacity to manage and own their data
	Complex data ownership relationships
Informed consent	Skills and know-how to request truly informed consent
Cultural collision	Mismatch of agendas between foreign organisations and local communities
	Misunderstanding of which issues are most pressing for the local communities
Trust	Mistrust towards certain organisations might lead to incorrect information provided by the communities
	Unclear reasoning of the data collection
	Concrete impacts after data collection take time or do not realise at all
Digital inequality	Lack of resources for data managing
	Power and internet shutdowns endanger data storage on both hardware and on cloud services
	Difficulties in cooperating with local community members with limited access to digital technologies and digital skills
Neo-colonialism	Over-researching communities cause fatigue
	Exporting data, information and knowledge to overseas
Power inequality	Lack of leadership by local community members in foreign organisation-led projects
	Force to use foreign commercial digital services

Community exclusion	Ignoring the importance of community participation in resilience building
Dismissing environmental issues	-
Political culture	Governments' mistrust towards non-governmentally generated, managed, and owned geospatial data
	Data ownership contest
Over-researching	Fatigue amongst local community members due to over-researching and without clear and concrete impacts

Geospatial data quality issues were widely recognised by all interviewees. They explained that lack of existing national-level standards for (geospatial) data quality and recording of matching parameters hinders the compatibility of new datasets. Organisations collecting and managing geospatial data in Global South's cities do not have the information of how certain basic attributes of demographics or administrative areas should be recorded in a commonly recognised way. An interviewee from a local Tanzanian NGO noted also that even when there is an officially produced dataset with attributes that could be attached to new datasets to ensure compatibility, the original attributes might be misrepresenting. For example, a geospatial dataset representing the national administrative wards have such inconsistencies in the wards' coding that analysis with those codes becomes nearly impossible.

As another interviewee with a background in teaching in a university and long history of working with a local NGO to engage youth in geospatial data collection, management and usage said:

“High-quality [geospatial] data can only be achieved with skills and knowledge. I have seen many times a great data generation initiative stumble on mistakes that could have been avoided with proper understanding of correct operationalisation, better planning, and more careful attribute recording. And when it is time to start cleaning and analysing the collected data, those quality issues deriving from the collection are impossible to correct.” (Interviewee, university and local NGO professional)

As one of the interviewed experts from a local university explained, cities in the Global South expand and shift their form rapidly, which means that even basic infrastructure data outdates quickly. Thus, data collection must be almost constant to keep up with the pace and be of good quality and reliable for decision-makers within the urban resilience community. Non-automated geospatial data collection where people are the ones to conduct mapping or validate the datasets by fieldwork requires great number of human resources, or alternatively time. The interviewed expert called for the exploration of automated processes to support the human-driven data generation, management, and analysis.

A few interviewees had been part of participatory geospatial data collection campaigns where the data had a sensitive nature, i.e. it could reveal something very personal about the participated peoples' lives. They all elaborated that if sensitive information – such as HIV hotspots within a city – is collected, it is highly important to secure the participants' privacy and understand how geospatial data anonymisation and masking should be done. Such methods require professional skills, and still there is a risk that future technologies or new datasets could endanger the privacy

of the data subjects and lead to disclosure of their personal information. This example was given by an interviewee working in a local NGO, and they admitted that it is always risky to decide to collect such data. However, the benefits are eminent: health-related data is valuable for the healthcare system to allocate their resources, both the locations of healthcare facilities, but also educational measures.

Ethical issues related to privacy are closely intertwined with the culture of open data sharing. Open sharing becomes tricky when working with local communities, particularly when the collected data is directly about the lives and lived environment of the local people, such as dataset showing which houses have experienced flooding. Interviewee working in a local NGO stated that:

“The people do hesitate when we tell them the data will be published openly. Even though they do trust the data in our hands, or in the hands of the university, they have doubts towards the city government and outsider organisations. This kind of mistrust and the desire for open data sharing are a tricky puzzle when tried to match.”
(Interviewee, local NGO)

Sometimes it is difficult to decide who has the right to share community-based geospatial data. Several of the interviewees have been pulling their hair when trying to negotiate the ownership of community-based geospatial datasets. Communities can voluntarily and by themselves create data about their environment and share it openly for example via the OpenStreetMap project, but when there is an external organisation facilitating and/or funding the whole data process, the determining of community-based data rights and ownership becomes complex. An interviewed member of an NGO frequently facilitating geospatial data collection together with the local communities mentioned that even though their organisation promotes open sharing for all data they have collected, at the end it is the decision of the funder – in their case the city government – whether the data will be determined as open, *“and it rarely will”*, says the interviewee.

The governments also have a major role in determining which datasets are acceptable for decision making and which are not. More than one interviewee either from local or international NGOs or from the universities mentioned the issue of governments not recognising geospatial datasets as reliable when they are collected by non-governmental stakeholders, even if they would be relevant for decision-making and building urban resilience. Furthermore, if the same, previously unreliable dataset is later transferred to the possession of the governmental organisation, it suddenly becomes trustworthy and usable. An interviewee from a university pondered that a reason behind this could be in an ownership contest:

“A kind of data ownership competition can be seen taking place right now. Governments tend to think that if a dataset is not owned, it cannot be trusted. Perhaps the saying of ‘the one who has data and information, has the power’ is some kind of underlying driver in this contest.” (Interviewee, university professional)

These issues deriving from the political culture amongst local governments can be seen to be related to a new main ethical domain, “political culture”. Of course, the domain “cultural context” has a similar connotation, but it is more related to ethical issues emerging when foreign

parties engage with local community members without properly understanding the cultural context.

Once again, there are no clear guidelines for determining data ownerships for complex settings where geospatial data contains information from the local community members, is collected by a local NGO, is funded by an international organisation from a request of a local governmental office. Without an exception, all the interviewees desire well-thought guidelines for determining community-based data ownerships and policies for open data sharing. Some of the interviewees also remind that not all data must be open, even though the culture of open sharing accelerates in popularity. An interviewee who currently works in a governmental institute but has a long history from a local university tries to promote open data sharing in their current occupation with rather hesitant colleagues. However, they still underline that the decision for sharing data openly should always be done case-by-case. If open sharing is a presupposition for the collected community-based geospatial data, and the organisation collecting the data must conduct convincing and persuasion of the local community members, informed consent is endangered.

Thus far, none of the interviewees both from non-governmental organisations, universities and from the government have had conflicts with the community members regarding data ownerships. Participated communities have not demanded full ownership for the datasets, but they do carry concerns about not being able to affect how the data is used in the future or reverse their consent. An interviewee from a local NGO pondered that communicating to the locals about their data rights, possibility to opt out and ownership issues might be much easier for them than for example for foreign actors, governments, or universities with larger institutional structures and more vague relationships towards the local communities.

The communities' concerns well mostly from the vagueness of how the collected datasets might be used in the future, and by whom. If the data is shared openly, with current technologies the possibility to track how the data is re-used is extremely difficult. In the name of transparency, this notion should also be told to the community members when asking their consent for data collection. As one of the interviewed university professionals with great experience within the field stated:

“[Community members] always have concerns. They question why we do the surveys, why we collect the data and for what it is used for, and whether the data is safe. They always, always have doubts that can only be answered to via trust.” (Interviewee, university professional)

Ways to build trust are vast, and transparency and clear communication are one of the best practices. Participating the communities throughout the data process and being honest about any limitations, threats or other open-ended questions regarding the whole data process is crucial – even after the dataset is already stored, shared and used.

Clear communication is also crucial for sharing the intentions of the geospatial data process conducted in cooperation with the local communities. The ethical concern of not being clear about data process outcomes were mentioned by all interviewees. When geospatial data is collected amongst the communities, they usually expect impacts after the data collection. For example, if a group of students collect information about drainage functioning in a

neighbourhood, the dwellers expect improvements to the drainage system in the near future. However, in many cases concrete impacts are not the intention of data collection process, or the next development steps materialise only after a long time. Such cases can cause fatigue amongst the community members towards future data collection measures in their premises. A citation from the discussion with an interviewee with a deep understanding of the phenomenon elaborates this issue more:

“—and in general, Africans’ fatigue towards data collection campaigns are tied to the promised interventions, they (foreign organisations) always promise interventions. And when they don’t come, the communities become tired. If someone else with good intentions come and do their surveys again, the community members might not even give truthful information to the surveyor.” (Interviewee, local governmental office)

The same interviewee continued that this kind of over-researching and absent concrete impacts for local communities have usually been problem within international research projects. Research projects often aim for scientific publication, which has nothing to do with the local communities as such. Of course, the research results can be utilised by local decision-makers for informed urban planning measures if the research project succeeds in communicating the availability of the relevant results and collected data. However, too often the collected research datasets remain on the researchers’ hard drives or if published openly available, the information about the data location does not reach the local officials.

Geospatial data projects led by foreign organisations contain also ethical issues related to true participation of local community members and experts. Many times, the participation starts only in the data collection phase when the planning of the objectives is already set by the organisation. This may lead to mismatch of agendas and *“foreign organisations prioritising such issues that are not most pressing for the locals”* (Interviewee, university professional). Thus, community-based data is collected, and it might be used for resilience building activities, but not the data nor the activities answer to the most acute development needs of the locals.

The phenomenon of fatigue and mismatch of agendas can emerge in local officials’ data generation projects aimed for urban resilience building, too. The ethical issue of over-researching was mentioned by multiple interviewees, and since over-researching can also be done by local organisations, it does not fall under the ethical domain of neo-colonialism, but rather is its own ethical domain. Interviewee from a governmental office conducting urban planning efforts elaborated this with an example:

“Normally, when conducting urban planning the initial analysis about development needs and such is done by analysing existing data. For example, analysing which income levels are represented in areas without public transportation services, or how many businesses are in danger of flooding. But in our [Tanzanian] context, the lack of data forces the officials to conduct data collection first for the sake of planning. And when data is collected first amongst the local people, they expect immediate results. But they don’t understand that the planning process that comes after the data collection takes a lot of time and money, and concrete results might conceptualise until after several years.” (Interviewee, governmental office)

Several interviewees underlined the importance of monitoring the consequences of data processes after a project or an assignment has ended. For example, when informal settlements' basic infrastructure is mapped together with the local inhabitants during a project with a deadline, it would be important to keep in touch with the community after that as well. Communication could be for example, how the data was processed, was it used somehow, where it is stored or shared, are there other use cases in sight, and does the community members have any concerns about the whole process.

All interviewees recognised issues deriving from the divided digitalisation both in global scale, but also in national scale between rural and urban areas, and between different demographic groups. Geospatial data collection with digital mapping technologies requires more training resources with community groups who have limited access to and experience of using such technologies. Voluntary geographic data can also be produced only by those who have access to the required technologies – e.g. in the case of OpenStreetMap, one needs digital hardware, a solid internet connection and the digital skills to conduct reliable mapping of their surroundings. Also, disseminating digital data process results, whatever they might be, may not reach all relevant community members if they do not have access to required digital technologies and data dissemination platforms. Thus, it is up to the data process facilitator's efforts that all relevant stakeholders have access to results and possible openly shared data.

Digital inequalities also reach the organisations when basic technologies, such as electricity and the internet are not available. The organisations who facilitate geospatial data storage and dissemination are increasingly concerned about sustainable and safe data storing. *“Power shortages might endanger datasets stored on centralised hard drives, and internet shutdowns cuts the access to cloud services”*, summarised an interviewee from a local NGO. All of the interviewees named internet shutdowns during elections as a problem for all kinds of data-related work and explained that preparing to the shutdowns require extra human resources from their offices.

To conclude with the ethical issues related to dismissing the nature and environment, three of the interviewees had worked together with local communities to generate data about the natural environment, namely about conservation areas and endangered species, such as large mammals or marine life. Surprisingly, none of the experts identified ethical risks related to collecting such data, and possibly sharing it openly available. The lack of such data was seen as a greater risk, and available maps about conservation areas and sighting locations of the species were seen as resources for conservation and as a safeguard for local communities interacting with the species.

4.3. Insufficiency of existing ethical guidelines

Three ethical guidelines for geospatial data and GIS users were scrutinised against the ethical and safety domains identified from academic literature and discussed with the expert interviewees. Each ethical domain raised by the experts were compared to the guidelines to find out whether they contain instructive statements that would guide the professionals facing such issue in their own work. Table 6 below illustrates which of the three guidelines could give guidance for each discussed ethical domain.

Table 4. Illustration of which ethical guidelines contain instructions for safe conduct for each ethical domain.

Ethical domain	Guideline(s) containing instructions for issues related to ethical domain		
	UNICEF	GIS Code of Ethics	Locus Charter
Data quality	X	X	
Privacy	X	X	X
Misuse		X	X
Open sharing		X	X
Data access			X
Ownership	X		X
Informed consent	X		X
Cultural collision			
Trust	X		X
Digital inequality	X		X
Neo-colonialism			
Power inequality			
Community exclusion	X		X
Dismissing environmental issues			X
Political culture			
Over-researching			X

When examining the three ethical guidelines and codes against the identified ethical issues from academic literature and expert interviews, it is eminent that the guidelines do not take into account few important ethical and safety domains, such as the effects of cultural collision, power inequalities, neo-colonialism, and political culture. All these domains are related to conducting activities in the Global South and to the cultural context where the geospatial data processes take place in, so it is not too surprising that the guidelines that are rather general and global in nature, such as the GIS Code of Ethics and Locus Charter, do not consider such ethical issues. There are as many cultural contexts as there are cases related to geospatial data collection, management and use so it would not even be possible to cover all contexts in one guideline. However, perhaps a notion to remember to consider the societal issues and local culture would be beneficial to be included also in the general ethical guidelines and codes.

What is surprising is that the UNICEF's checklist for ethical use of geospatial technologies for evidence creation does not either consider those ethical issues emerging when conducting geospatial data processes in the Global South. The checklist is targeted for development and

humanitarian organisations who often work in vulnerable settings where issues related to cultural collision, neo-colonialism and power inequalities have high chance of materialising. Thus, guidelines for safe professional conduct when foreign actors are involved in projects taking place in the Global South would be important to be included in the UNICEF's checklist.

Overall, the Locus Charter principles for ethical conduct for location data processes are most comprehensive. They are also the most recently developed set of principles collected in cooperation with multiple stakeholders from different disciplines and backgrounds. The Locus Charter documentation does not though tell anything more about the backgrounds of the participated stakeholders, that is from which academic field, type of organisation or geographic region they come.

One of the interviewees from a local non-governmental organisation reminded that instructions for safe conduct regarding for example privacy issues that are developed by mainly Western-based stakeholders often state that the data process facilitator must obey the privacy laws of the country where the process takes place in. Such notice dismisses the fact that in many countries in the Global South such legislation is not up-to-date or is completely non-existing. In those cases the process facilitator must then consider following other internationally recognised legislation or best practices, and not to be lulled into thinking they should not consider privacy issues at all due to absent legislation.

As in the reviewed academic literature and expert interviews, ethical issues related to the environment and nature have very little representation in the examined ethical guidelines, too. Only the Locus Charter ethical principles mention the nature and other species than humans:

“Physical proximity amplifies the potential harms that can befall people, flora and fauna. Data users should ensure that the individual or collective location data pertaining to all species should not be used to discriminate, exploit or harm.” (Locus Charter 2022)

Even though the existing guidelines have not been academically evaluated and verified, they have provided a basis for safe professional conduct that could have been applied by individuals and organisations involved in the field of location data and GIS. A collective voice can still be heard loud and clear that a commonly agreed ethical rules are critically needed. It is notable that all the academic writings related to the ethics of GIS, geospatial data and community participation in geospatial data processes selected to the literature review concluded that more research and common agreements on ethical conduct are needed (Crampton 1995; Abbot et al. 1998; Rambaldi et al. 2006; Grira et al. 2013; Verrax 2017). As one can see, the articles spread over twenty years, which indicates that besides of the need, the academic research community within the discipline has not yet taken initiative.

The same need was raised by almost all of the interviewees from NGOs, governmental organisations and universities. However, the consensus of the interviewees who mainly conduct their work locally in the Global South diverted from the academic literature. They underlined the need of national guidelines for safe professional conduct as well as national standards for geospatial data quality, ownership issues and open sharing, rather than globally applicable guidelines that were called by the researchers in the reviewed academic literature. Thus, a

conclusion can be drawn that the ambiguous goal of the Locus Charter to be a universal ethical guideline for location data collectors, managers, and users is not what the people within the field in the Global South need. Rather, an academically verified global ethical codes that could be applied locally together with national laws and guidelines would provide the best resources for the experts.

In addition to ethical guidelines, proper knowledge how to apply them is also crucial, as pointed out by one of the interviewed university professionals. They underlined that teaching ethical professional conduct is not very well rooted in university-level programs within the GIS and geospatial data disciplines. They call for more such education to ensure that

“-- the new generation of professional would have best possible knowledge and capacity to consider ethical and safety issues in their own work and in all stages of the data lifecycle. A pool of professionals working in the field without proper education and understanding of the ethical dilemmas could be catastrophic, especially when working with vulnerable and marginalised communities in sensitive settings.” (Interviewee, university professional)

5. Discussion

5.1. Reflecting findings against theoretical framework

The results of this research validate and repeat the findings from previous academic literature regarding what kinds of ethical issues emerge in community-based geospatial data processes. Ethical and safety dilemmas related to data quality, privacy issues, disclosure risk, transparency of the whole data processes, problems stemming from mistrust when communities participate in data collection, and the multifaceted challenges of determining data ownership that the interviewees had great experience on are all discussed by many of the most cited researchers within the field, such as Floridi and Taddeo (2016), Di Biase et al. (2011), Abbott et al. (1998) and Crampton (1995). It is safe to conclude that the ethical and safety risks stemming from the nature of geospatial data are well understood, and they are widely encountered in the field every time such processes are conducted, too.

The interviewees complained about the lack of common guidelines for collecting compatible geospatial datasets which leads to difficulties in utilising existing data in urban planning and other decision-making. This is a concrete example of the issue criticised by Mehmood (2021) that the Global South is often full of patchwork of datasets collected by different organisations without shared data quality and compatibility guidelines.

Discussion about privacy concerns emerged repeatedly throughout this research in the reviewed academic literature, in the expert interviews and in the evaluated ethical guidelines. It is also perhaps the most well scrutinised ethical domain within the field of geospatial data sciences because geospatial data has its own unique challenges when it comes to privacy - locations of peoples' living areas, habits, and location-based values are all sensitive information and location always reveals something about peoples' lives (Specht 2020).

Usability of geospatial data is in many cases also dependent of the dataset's currency. The rapid changes in urban landscapes and its effects to continuous need to update existing basic data about infrastructure and the lived environment was discussed in the conducted interviews of this research. Continuous data collection demands human resources which are not always sufficient, and automated data collection processes were mentioned as solutions. However, automated processes are still in many cases in their testing or piloting phases in the context of urban South, and the establishment of such systems especially for officials will take time due to low digitalisation of governmental institutes in the Global South (Wiebe 2022).

When moving on to ethical issues related to digital geospatial data processes and open data sharing, the results of this research somewhat repeat the existing literature. Similar ethical issues related to digital inequalities and determining the good practices of open sharing could be identified as mentioned e.g. by Schopp et al. (2019) and Serwadda et al. (2018). The interviewees shared experiences from their own work in the field related to challenges emerging from access to digital resources, digital illiteracy and open data sharing. Also, the point briefly discussed by Manyika et al. (2013) of governments being in many cases the hinders of sharing any kind of data openly available for the public was well recognised by the interviewees of this research, too.

However, previous research that discusses the ethics of open geospatial data sharing (e.g. Specht 2020) mainly focuses on the lack of adequate research that would identify ethical and safety issues of open data sharing. Similar views could be found from the reviewed academic literature where e.g. Verrax et al. (2017) do discuss ethics of open geospatial data sharing, but still in their results call for more research. The interviewees in this research in turn did identify many ethical dilemmas emerging in sharing geospatial data openly and shared their experiences of difficulties in determining who can share data openly, where it should be shared and to whom. They only called for national guidelines for open data sharing that would provide assistance in solving the challenges they so often face in their own work.

The doubts of local communities regarding data sharing and possible misuse were also widely encountered by the interviewed experts of this research. Tackling these doubts is best done through transparent communication towards the local dwellers, which is easiest for NGOs with steady relationships towards the communities. The same notion is made by Thinyane (2018) who in their paper state that as local NGOs with close connections to the communities have the best abilities to conduct participatory data processes, build trust, and discuss any hesitations the locals could have.

New aspects for ethical and safety issues that might emerge in the research context are also found in this research. Previous research nor ethical guidelines within the geospatial field have not addressed the problem of over-researching that is encountered especially within vulnerable communities in the Global South, but it is recognised on other disciplines, such as the field of medical sciences where the academic research literature has started to recognise this phenomenon in the recent years (Koen et al. 2017). However, the term lacks clarity and agreed definition, and it is also absent from any major ethical guidelines within the discipline.

Over-researching was mentioned by more than one interviewee in this research, and its harming effects to data quality, trust, and communities' willingness to participate in data processes were well known. Koen et al. (2017) argues, over-researching as an ethical issue should be included in ethical guidelines for any kinds of projects or research conducted in resource-limited settings in low- and middle-income countries, within all research disciplines. Further research regarding this subject in the geospatial sciences discipline is most definitely needed, and especially the local professionals in the Global South have great deals of knowledge and concrete experience on the issue.

The ethical issues that were left rather unnoticed in this research were the ones that might emerge in community-based geospatial processes about the nature and environment. The interviewees who had been part of collecting conservation area or endangered species datasets did not recognise ethical dilemmas related to them. The reviewed academic literature doesn't either name ethical and safety issues of such datasets, but perspectives can be drawn from for example biology and conservation discipline (e.g. Lindenmayer & Scheele 2017). Disclosing locations of endangered species could pose them at risk of illegal exploitation outside of the local communities, and thus careful consideration of to whom such data is shared should be made.

The nature or other species than homo sapiens is also only mentioned in one of the evaluated ethical guidelines. Perhaps the absence of environment and nature in the examined ethical

guidelines has roots in the fact that they have Western origin, and the Western moral values have seen nature as an exploitative resource throughout the history, and not an entity that has value in itself (Coetzee & Roux 2003). Of course, the current crises of biodiversity loss and climate change has changed the views of the Western world, too, but giving the nature value as an equal entity is still in child's shoes (e.g. Piccolo 2017).

This research provides one new dimension to the Floridi and Taddeo's (2016) data ethics framework regarding the stages of geospatial data processes where the ethical considerations must be applied. They determine that ethical issues should be considered in following phases of the data lifecycle: generation, recording, curation, processing, dissemination, sharing and use. Several interviewees of this research raised concerns about the lack of giving back to the communities, abundance of interventions after data collection, and absence of monitoring efforts of the effects of data processes. Thus, the new added dimension to the data ethics framework – monitoring – would come after the data usage and remind the whole geospatial data community about the importance of monitoring the effects of their data projects. Since the point of ethical conduct is to “do good”, how is it possible to know whether the community-based geospatial data process actually did any good, if the consequences and true effects are not properly monitored?

The evaluation of existing ethical guidelines intended to answer to the knowledge gap that is present in the geospatial sciences' discipline where there is no research that would have validated the quality and representativeness of ethical codes and guidelines that are applied during geospatial data processes (Keymolen & Linnet 2021). All of the three evaluated ethical guidelines lacked notions that would consider the dilemmas rising from local cultural, societal and political context. This is not surprising for rather general guidelines, such as the Locus Charter and the GIS Code of Ethics, but such considerations would have been expected to be found from the UNICEF's checklist for ethical conduct in geospatial processes that is targeted for humanitarian and development projects often taking place in the Global South and with marginalised and vulnerable communities.

Still, more deeper understanding of what ethical guidelines for geospatial data processes should contain is needed, which then could be used in developing as sufficient global or national best practices as possible. Such process could be a whole research project with multiple stakeholders, which is the desired method for creating comprehensive ethical codes as noted by Rambaldi et al. (2006). To answer to the concerns regarding heavily Western-based ethical guidelines raised by Seehawer (2018), stakeholders should have diverse geographical backgrounds to be certain that the principles could in fact be globally applicable.

5.2. Success and challenges of the research methodology

The most interesting and fruitful results of this research are the shared concrete experiences of the interviewees regarding ethical and safety issues they have encountered during their careers, which also add novelty to the academic knowledge within the geospatial sciences' discipline. Expert interviews as a method were a good choice to verify academic knowledge, bring forward concrete experiences from the field and even reveal new information, as seen from previous

research from the discipline of medics (i.e. the papers from Walsh et al. (2016), Anane-Sarpong et al. (2017) and Ballantyne (2019)) that were used as a theoretical background in this research.

The diversity of views during interviews was ensured by interviewing experts with different backgrounds. It became clear that the organisational background does affect the views regarding for example data ownership and open sharing. The interviewees provided their own experiences how they had seen ethical issues materialise, but also how they think the issues should be controlled. Most important take-home messages are the availability of high-quality ethical codes and other guidelines that would equip the individuals and organisations to conduct safe geospatial data processes, but also the proper education of the next generation of professionals about ethical and safety issues and how to control them. To conclude, the expert interviews were the core of this research and did provide important examples and new information that answered to the research question and that could be used in creating either international or national ethical codes or other guidelines for safe professional conduct in community-based geospatial processes taking place in the Global South.

Challenges in executing the methodology of this research were also faced. First and foremost, the shortage of relevant academic literature that could be scrutinised in the systematic literature review posed the suspicion of whether the review can really be representative to the academic knowledge in the geospatial field. Discussion about ethical and safety issues regarding to community-based geospatial data processes in the Global South could also be found from blog post texts, columns, and news articles, but only few original academical and peer-reviewed articles that discuss the ethics and safety issues in the given context could be identified. Other articles discussing the theme were also available, but they cited the original articles and only repeated the findings and linked them to their own research context. However, the reviewed articles throughout decades, such as the papers from Crampton (1995), Abbot et al. (1998), Rambaldi et al. (2006), Grira et al. (2013) and Verrax (2017), concluded that further research regarding ethical issues in the given context is needed, which indicates that the academic field has noticed the same challenge of dearth of research of the subject, as this thesis.

In further research, it would be beneficial to analyse other types of resources in addition to academic literature to create a solid understanding of the state of the knowledge about geospatial data processes' ethical and safety issues in different contexts. For example, columns, book chapters and non-academic articles written by professionals who have extensive experience working in the field, but who have not transferred their knowledge to academic literature, would provide even more perspective and views, and perhaps even new ethical domains that might emerge in geospatial data processes.

Another methodological challenge emerged during the evaluation of existing ethical guidelines which was done against the findings from the expert interviews. Proper methodological model for conducting such comparison was not available, and thus an ethical guideline evaluation instrument (AGREE) from the field of medicine was applied (Stretch & Schildmann 2011). For the purpose of master's level thesis, a reference that would have been able to be applied in more straightforward manner would have been a better choice. The application of the AGREE instrument was done in a simplified manner in this research, and the content that was compared

to the ethical guidelines was not a list of quality indicators, but a list of ethical issues found from academic literature and expert interviews, which also affects the replicability of the method.

Third challenge of this research is the representativeness of results to the Global South as a geographical context. It became evident that local context where community-based geospatial data processes are conducted always brings their own ethical considerations to the table, and since majority of the interviewed professionals were from Tanzania, the local context's ethical issues identified in this research mainly represent the Tanzanian context. If the research was conducted in another country in the Global South, there would most probably be variety in the results, depending on the characteristics of the local culture, societal hierarchies, political atmosphere, and so on.

When assessing the ethicalness of this research, one important aspect is my – i.e. the researcher's – position. As I am a Western master's level student, have I had the ability to conduct the interviews with the local professionals in such a way that all relevant information from their perspective were discussed? Or was I able to create such atmosphere during the interviews that the interviewees could share their true thoughts about the ethical issues related to for example neo-colonialism and digital inequalities between the Global North and South, or did they filter their answers because of my background? Seehawer (2018) criticised that global ethical guidelines are heavily Western-based and thus voices from the experts in the Global South have been dismissed. In this research, I provide suggestions for the future work in developing ethical guidelines, and thus the suggestions have origin in the interviewed experts' experiences and perspectives, they are filtered by me. These issues do not necessarily have clear answers, but my positionality is important to be taken into account when reading this research.

5.3. Future prospects

When looking into the future, since the geospatial community longs for a co-created and academically verified ethical guideline to guide their work in research and in different projects, like the Tanzanian Resilience Academy, such should be created as soon as possible. Locus Charter aims to answer to this challenge, and in this research it indeed was found to be the most comprehensible currently available ethical guideline for the geospatial field. However, the ethical and safety issues rising from the context where the geospatial data processes take place in are not included in the Locus Charter, nor the other evaluated guidelines.

Thus, projects conducting (community-based) geospatial data processes must utilise other resources to ensure safe conduct in the local context. The resources could for example be local legislation or national guidelines for data privacy, compatibility, ownership, and open sharing. National legislation and guidelines are still lacking in many parts of the world, though, and developing them and bringing to action might take years. In the meantime, projects should have the ability to create their own ethical guidelines and codes of conduct that considers the local context. This might require additional resources and careful planning in the beginning of the project but creating such guidelines and codes in close cooperation with local experts would ensure the safety and ethicalness of the project, from the beginning of the project to monitoring its impacts in the long run.

This master's thesis is a small contribution to the academic knowledge regarding ethical and safety issues emerging in community-based geospatial data processes in the Global South. The experiences and perspectives of professionals working in the field could be recorded, collected together and transferred to black and white, which contributes to the important practice of knowledge transfer. However, similar to so many previous academic papers within the geospatial field, this also joins the choir of calling for even further research related to ethics and safety of geospatial data processes in different contexts, as well as educating the next generation of geospatial data scientists to secure ethical professional conduct during data processes around the world.

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Appendices

Appendix 1

Interview questions for expert interviews.

General questions

1. **What is your current occupation/role in your organisation?**
2. **How is your work related to digital data/geospatial data field?**
3. **Could you give examples of what kind of community data projects have you been involved in?**

Thematic questions

4. **In your experience, what are the strongest benefits of community data overall? What about weak points?**
5. **Have you encountered any situations where the participants would have raised their concerns over the data collection and related risks?** (*keywords: individual/group privacy, trust, consent, safety, disclosure risk*)
6. **Based on your own experience, what kind of geospatial data collection challenges that affect data quality have you encountered in your work?** (*keywords: unprofessionalism, unsuccessful operationalism*)
7. **According to your opinion, what risks may come for real if poor quality data is used?** (*keywords: unrepresentative results, unreliable decision-making, wasted resources*)
8. **How would you avoid quality risks in practice? Do you have any tips of good practices which you have seen to work well?** (*keywords: training, quality standards*)
9. **Have you faced problems in community data collection processes that are derived from societal features, such as income inequality? How to secure inclusion?** (*keywords: digital literacy, possibility to participate, equality, representation of groups*)
10. **In your opinion, what are the most important benefits of open data sharing, what about problems?**
11. **In your experiences, when geospatial data is community collected and open, how does that impact data ownership?** (*keywords: access, benefit, hosting resources, usage abilities, empowerment, unexpected use*)
12. **Whose datasets these community-based datasets are and what risks do you think may raise related to ownership and power with data?** (*keywords: misuse, usage tracking, data accumulation, privacy breach, trust, wasted resources, common good*)
13. **Have you experienced misuse or somehow questionable usage of data about the nature or lived environment, such as in protecting natural environments or in urban planning?** (*keywords: nature degradation, disclosure of species' location, bulldozing, protected areas/objects*)

14. **Quite often, digital data collection efforts are funded by various international projects and actors. Do you identify any particular risks related to foreign actor involvement in the open community data projects?** (*keywords: power dynamics, local representation in the process, credits, commercial products, understanding local context, data colonialism*)
15. **Are there some other issues we have not yet covered but should?**
16. **Have you or your organisation somehow systematically considered risks in geospatial data projects (e.g. ethical guidelines, discussions prior projects, own thoughts)?**