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Documenting the re-transformations of the built environment in Chingalire village, Malawi, for a Sustainable Development and Resilience Strategy. Practice Contribution

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Laura Natalia Chocontá Villamizar

DOCUMENTING THE RE-TRANSFORMATIONS OF THE BUILT ENVIRONMENT IN CHINGALIRE VILLAGE, MALAWI, FOR A SUSTAINABLE DEVELOPMENT AND RESILIENCE STRATEGY

PRACTICE CONTRIBUTION

Contents

Abstract
The village of Chingalire, Malawi, is being transformed into a model of sustainability. For the formulation of a development strategy, information on the village's changes was gathered over a year, focusing on the built environment since its beginnings in 1976. This research aims to initiate the documentation of these changes while reflecting on the quality, sustainability, and resilience of the village's built environment. It also provides an outlook for the development strategy, based on the acquired knowledge. Through semi-structured interviews with experts and villagers, the results show that most buildings were constructed by local builders (with no qualifications and a series of malpractices), with unsustainable materials, and following a 'modern' imaginary that negatively impacts the environment and is unaffordable for the locals. The lessons learned from previous constructions in Chingalire point towards preserving vernacular architectural values and appealing to new spatial designs.

Keywords
Strategic rural sustainable development – Rural resilience – Sustainable architectural design – International cooperation

Eine Dokumentation der Umgestaltung der bebauten Umwelt im Dorf Chingalire, Malawi, im Hinblick auf eine Strategie für nachhaltige Entwicklung und Resilienz

Praxisbeitrag

Kurzfassung
Chingalire, Malawi, wird derzeit in ein Modell der Nachhaltigkeit umgewandelt. Für die Formulierung seiner Entwicklungsstrategie wurden ein Jahr lang Informationen über die Veränderungen des Dorfes gesammelt, wobei der Schwerpunkt auf der bebauten Umwelt seit seinen Anfängen im Jahr 1976 lag. Ziel dieser Untersuchung ist es, diese Veränderungen zu dokumentieren und gleichzeitig über die Qualität, Nachhaltigkeit und Widerstandsfähigkeit der baulichen Umwelt des Dorfes nachzudenken und auf der Grundlage der gewonnenen Erkenntnisse einen Ausblick auf die Entwicklungsstrategie zu geben. Anhand halbstrukturierter Interviews mit Experten und Dorfbewohnern zeigen die Ergebnisse, dass die meisten Gebäude von lokalen Bauunternehmern (ohne Qualifikation und mit einer Reihe von Missständen) errichtet wurden, die nicht-nachhaltige Materialien verwendeten und einer „modernen" Vorstellung folgten, die sich negativ auf die Umwelt auswirkt und für die Einheimischen unerschwinglich ist. Die Lehren, die man aus früheren Bauten in Chingalire gezogen hat, weisen darauf hin, dass man die Werte der einheimischen Architektur bewahren und neue Raumkonzepte ansprechen sollte.

Schlüsselwörter
Strategische nachhaltige Entwicklung des ländlichen Raums – ländliche Resilienz – nachhaltige architektonische Gestaltung – internationale Zusammenarbeit

1 Introduction

In 2009, Ben Mankhamba, who enjoyed a successful music career, was installed as Village Headman Chingalire (RFI 2022). Ever since, he has been implementing changes in Chingalire to transform it into a rural growth centre. His fame in the music industry brought contacts and practices to boost the village's cultural agenda. Eventually, his international touring experiences and his social-oriented village development prompted foreign alliances.

Among such alliances are those with Silvia Hesse, German politician and development cooperation authority, and Gayighayi Mathews Mfune, director of Music Crossroads Malawi, who contributed new opportunities to Chingalire. Some examples of projects include the establishment of a reforestation program and tree nursery (since 2011), the opening of an under-fives clinic (2014), the empowerment of women through entrepreneurship (2014-2016), the implementation of solar-generated electricity (2016), the education of youngsters in traditional dancing and music (since 2016), the introduction of super-plants in the local crops (2015-2017), and the hosting of the Pakhonde Ethno Music Festival every May since 2022 (Face of Malawi 2022).

During the formulation and implementation of these activities, new allies joined Chingalire's transformation for sustainable development. Such is the case of Gerd

Runge, assistant to Silvia Hesse on her 2015 and 2018 visits. He is a successful freelance German architect, social and urban activist, and co-founder of numerous companies, associations, and a housing cooperative. He decided to support Chingalire with his private funds in 2019. Initially, the agreement with the village was to build a maternity clinic in Chingalire after two young pregnant mothers and their babies died of birth complications. However, the planning of this initial project was sporadic, a medical expert was required for consultation (2020), and a halt was called to the project during the pandemic (2020-2021). In late 2021, Gerd Runge Architects resumed its cooperation with Chingalire. By then, the village's needs had shifted as post-pandemic rural Malawi was recovering from the effects of inflation and the climate shocks that are detrimental to agricultural production (World Bank 2022).

In 2022, a series of events created an opportunity to arrange strategic partnerships between stakeholders to tackle challenges and take advantage of potentials in an integral development strategy for the village. First in April and then in June, Gerd Runge Architects organised two workshops for Chingalire locals to collect the villagers' perspectives on the project to be implemented. As a result, they proposed four ideas for action in Chingalire:

1 Implementation of beekeeping

2 Health and environmental education

3 Dairy farming

4 Protection and conservation of the forest

All ideas, while in line with the community's rural character, were beyond the architecture company's expertise.

In May of that year, the Pakhonde Ethno Music Festival took place with many difficulties. The village infrastructure could not offer enough accommodation for guests. It was difficult to access the area due to the dam's collapse at the main access road three years previously, and the performance area needed to be enlarged for the artists and to facilitate logistics. These hardships were forcing Music Crossroads Malawi, the event organiser, to establish the festival in another location, which meant that Chingalire would lose its primary source of income. Silvia, who has a strong friendship with Village's Headman Ben and with Gerd, proposed the creation of a strategic partnership between the village's stakeholders. The strategy required Gerd Runge Architects' expertise and funds to upgrade Chingalire's infrastructure so that Music Crossroads Malawi could continue hosting cultural events. At the same time, during the preparation of the cultural events, the villagers would receive entrepreneurial training to take advantage of the business opportunity. The fulfilment of each performance would bring a substantial income for the village to pursue more sustainable approaches to agriculture. Meanwhile, Silvia would contact different organisations in Malawi that could join the partnership and provide expertise in the fields that the villagers proposed.

Gerd Runge Architects readily agreed to the idea. They quickly started conversations with other stakeholders to understand the current spatial needs of the village as well as people's expectations for its development. Just as quickly, various challenges were revealed in addition to those identified by Music Crossroads: an unreliable electricity supply that made it difficult to organise activities, watershed mismanagement that created not only flooding inside the compound during rains, but also droughts during the dry season, and fluctuating material and fuel costs, etc.

As needs were discussed, a mind map started to shape "branches" of the development strategy for a sustainable and resilient Chingalire. Some examples included conserving rural culture, a healthy natural environment, and accessible and relevant education for rural life. As the strategy grew, so did its complexity, the interconnections between branches (see Figure 1), and the urgency of involving experts in critical areas (such as the healthy natural environment). However, it soon became evident that the research could hinder other actions. First, the Pakhonde festival preparations needed improvements before the rainy season started and blocked construction works (from November until April). Second, documentation on the village was limited to the reports of development cooperation projects and needed to be more comprehensive to understand the dynamics of village life and its changes in a way that could provide an outlook for the sustainable development strategy. New actions must be taken and recorded to assess Chingalire's safety, sustainability, and resilience in its intentions to change.

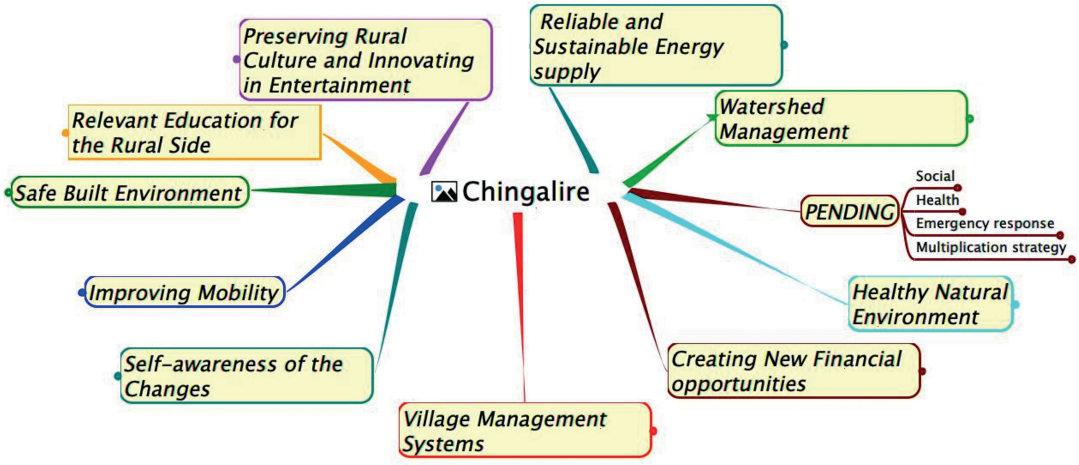

Figure 1. Mind map for Chingalire's development strategy / Source: the author

As the experts for the built environment, the architects' team decided to take the lead in action. This decision was made in order to fulfill the previous promise and also because of the uniqueness of this development cooperation project that could make a real difference to the sustainability and resilience of rural Malawi villages. Gerd Runge

intends to provide professional and financial support for the next five to ten years, depending on the village's self-sufficiency capacity. This medium-term horizon is unusual in small-scale development cooperation projects, as it is to formulate an integrated development strategy with a group of experts with ample flexibility to implement funds.

Additionally, the project's unique approach to rural development can provide new methods for adaptation, communication, and acceptance of transformations. The engagement of experts aims to provide both advice for the formulation of the development strategy and stable guidance for the locals interested in engaging in a specific branch. For example, Village Headman Ben and Music Crossroads, as experts in Malawian culture, supported the education of young people in traditional Malawian music and dancing. And while dancing tends to be seen as a waste of time and rejected as an activity for children, in Chingalire, young dancers earn a small income by performing across the country (RFI 2022; Face of Malawi 2022).

Accordingly, as the architects initiated construction in Chingalire and exchanged knowledge and experiences with other experts, they also documented past and current changes in the village. As part of this enterprise, the present paper organises the information collected during the project's first year (2022), focusing on the built environment as the pilot branch while reflecting on its safety, sustainability, and resilience. Based on the acquired knowledge, this research aims to provide an outlook for a safe built environment in Chingalire as a branch of the development strategy.

The remainder of this paper explains the methods by which the information was collected, organises the data in chronological order, discusses the results in terms of quality, sustainability, and resilience, and finally concludes with how the findings influence the implementation of the development strategy in the village.

2 Methods

As mentioned, the project involves the need for new construction and collaboration with a multidisciplinary group of experts and locals. For each scenario, the documentation had a specific approach. Thus documented audits of the new buildings and their construction process were undertaken, semi-structured and unstructured interviews with the expert architects were held, and unstructured interviews were unconducted with Chingalire villagers. In specific cases, such as with Malawian vernacular architecture, online data complemented the collected information.

When planning the construction work, the Pakhonde festival's needs were given priority, and complexity and costs were the deciding factors determining which construction to undertake before May 2023. Four structures were therefore built: two hostel houses for the accommodation of guests (August 2022), bamboo furniture for the hostel houses (November 2022), a rural bridge to establish access on the entry road (November 2022), and dry toilets (February 2023). Each construction process was subjected to audits by the architects with digital information from the site provided by Chief Chingalire.

Simultaneously during this process, the associated project pioneers (those mentioned in the introduction) held semi-structured interviews (see Figure 2) with the architects' team. They recommended professional contacts suitable to work in the remaining branches. For new members, it was essential to have interdisciplinary professional experiences and knowledge so that their encounter with other disciplines would contribute to the interconnection of development branches. Online connectivity was also a condition to facilitate the digital interactions between members. By March 2023, the expert team comprised ten experts who had participated in semi-structured interviews with the architects, supplemented by unstructured interviews with other experts. Their knowledge was essential in understanding practices on the construction sites, the overall Malawian context and culture, and its rural side. The profiles of all team members can be seen in Table 1.

Changes in the Malawian Rural Landscape.
Would you say that Malawian rural landscapes are changing? How and why? (if there is a change) What would you say has been the role of international cooperation projects in this change?

What are some of your concerns about the shift in the Malawian rural landscape? Have you addressed these concerns in your work? Why, or why not? And what challenges have you faced in dealing with such problems?

What would you consider are positive aspects of the changes in the landscape?

Have you discussed these changes with other stakeholders (i.e. local population, academics, local authorities, and international agencies)? What have these discussions focused on? What are their concerns in comparison to yours?

What changes should we (actors and stakeholders of the landscape transformation) pursue and enforce? And what could be some challenges to doing so? What changes would you like to see?

Changes in construction practices
Have construction practices also changed? How and why? (if there is a change) What would you say has been the role of international cooperation projects in this change?

What are the challenges to mixing modern technologies (i.e. solar panels) with traditional construction methods?

Numerous global networks of construction professionals are invested in changing the unsustainable practices of their sector. But what would you say is, in the case of Malawi, the difficulty to downscale their efforts or upscale the use of traditional (and local) construction methods?

What are the effects (beyond the physical space) of development cooperation construction projects?

How can international cooperation have a more positive & sustainable impact in Rural Malawi?

Figure 2. Questions for experts' semi-structured interviews / Source: the author

Name & Association	Profile
Village Headman Chingalire, Ben Michael Mankhamba	Custodian of Malawian culture. Guitarist, singer, songwriter, composer, performer, producer, percussionist, and choreographer. Winner of different music awards and with experience performing in Zimbabwe, Algeria, Germany, and Japan, among others. In 2009 was installed as Village Headman Chingalire.
Silvia Hesse, Freundeskreis Malawi e.V	Architect with a long history of international cooperation between Germany, Malawi, Colombia, Poland and other countries. Works in international networks for the global Sustainable Development Goals (SDGs). Experience in nature protection and climate change mitigation, gender equality, arts, culture, renewable energy, fair trade, and education.
Gayighayi Mathews Mfune, Music Crossroads Malawi	Promoter of Malawian arts and expert on cultural entrepreneurship. Director of Music Crossroads Malawi.
Gerd Runge, Gerd Runge Architekten BDA	Registered german architect and carpenter craftsman with over 40 years of experience in architecture design, construction, real estate, and renewable energies in Germany. He has also taken part in development projects in Nicaragua and in a well-known social and urban activist in Hannover.
Laura Chocontá, Gerd Runge Architekten BDA	Colombian architect and Master in Territorial Development. With five years of experience in international cooperation projects in Colombia, Germany and Malawi.
Alexandra Poncet, Mud&Leaf architecture·design	French chartered architect settled in Malawi in 2017, specializing in low-impact building, working with local materials in holistic systems for longevity and eco-sensitivity. Has a preference for raw mud, bamboo, timber, stone, and other location-dependent building techniques. Trained in building in natural hazards environments (seismic, floods), and a practitioner of regenerative gardening and farming. Eighteen years of experi- ence in solo work and multidisciplinary teams for architectural and urban projects, furniture design, construction coordination and supervision in Europe and Africa. Source: Mud&Leaf architecture·design 2022

Name & Association	Profile
Megan Banda, Green Growth Development	Permaculture artist with collage, performance, drawing and street art. Afri-futurist thinker and multidisciplinary creative, using visual and sound art to explore the ancestral pathways that keep us connected to the earth and each other. She is a strong believer that at this point in human history, we must focus on re-indigenizing the parts of our lives that were erased by colonialism. Source: Megan Banda Portfolio 2023
Dauda Diouf, Green Growth Development	Biochemist engineer and PhD candidate on tissue culture. Born and raised in France with Senegal and Cameroon ascendance. Musician and capoeira practitioner.
Andrew Goodman, Green Growth Development	Owner and manager of Horizon Farming Ltd (2004), a Malawian-owned and operated agribusiness, producing commercial crops, rearing livestock, loaning machinery and equipment, delivering landscape and watershed management, and offering comprehensive extension services for crop production, post-harvest management and marketing. Horizon Farming is often in collaboration with USAID and government-backed projects. Andrew has been following permaculture practices for decades and holds a degree in Agriculture from Winchester University, UK. Source: Green Growth Development 2023
Lana Howard Green Growth Development	Lana is British and has been working on Malawian agriculture ventures since 2018. She offers a wide range of business experience, from business planning for a $250m+ firm and growing start-ups to overseeing launches in new geographies. Lana was Chief of Staff to the CEO of an FTSE 100 global company Bio-Energy Resources Ltd, and has held various board roles, including in East Africa. Source: Green Growth Development 2023

Table 1: Experts' profiles / Source: the author's depiction

In February 2023, the project reached a crucial moment when all experts met personally for the first time to agree on the overview of the development strategy, sketch the action plan for the project, and present their ideas to the local community. During this month, Chief Chingalire and the village elder Donata Mankhamba participated in unstructured interviews with the architects and other experts to state the village's baseline before broad interventions. The architects' team talked with Chief Chingalire, Ben Mankhamba, Village Co-founder and Elder, Donata Mankhamba; and with the Chingalire's traditional dancers and village's tailoring teacher. The first two were especially significant in tracing the village's timeline and the changes in its built environment, using their own drawings to represent the physical space.

3 Results

Due to the overlapping of information, Chingalire's timeline is used in the following section to organise the data. The chronological order also aims to clarify the before and after of the interventions in the village. Therefore, the results are collected on: the beginnings of Chingalire, the first decade of the Chingalire Rural Growth Centre, and recent constructions.

3.1 Beginnings of Chingalire

In 1976, Michael Chingalire Mankhamba bought 0.4 km^2 of rural land some 30 kilometers away from Lilongwe. His wife, Donata Mankhamba, left her job to move with their three children to the acquired area. The couple's efforts transformed the land into a homestead. It took five years of "cleaning" the area's bushes and planting. During this time, Michael finalised his studies at Bunda College and visited the United States, while the children stayed in the nearby (3 km) trading center to go to school, and Donata managed the land. Tobacco crops were initially planted for the family's subsistence and the children's studies, even after the birth of three more. Temporary workers helped with night security by making fires to keep hyenas away and harvest the crops. Due to the poor profits from tobacco, the family changed to maize and groundnuts, and brought chickens to sell their eggs and cows to milk.

At the end of his studies, Michael Chingalire moved in with his family and worked as a development officer for the Malawian government. At the time, it was common practice to clear existing vegetation altogether and grow the desired crops, but Chief Chingalire opted to plant trees as well to mark the limits of the open space. He was part of Agricultural Extension Aid Working, a local-level planning office in charge of agricultural developments. Among the most relevant intervention of this office for Chingalire are designated areas for housing, the dam at the main access road, and the waterways system (see Figure 3). These last two were part of a greater rural infra-structure project that facilitated irrigation in Chingalire and the whole region and worked in union with its natural systems.

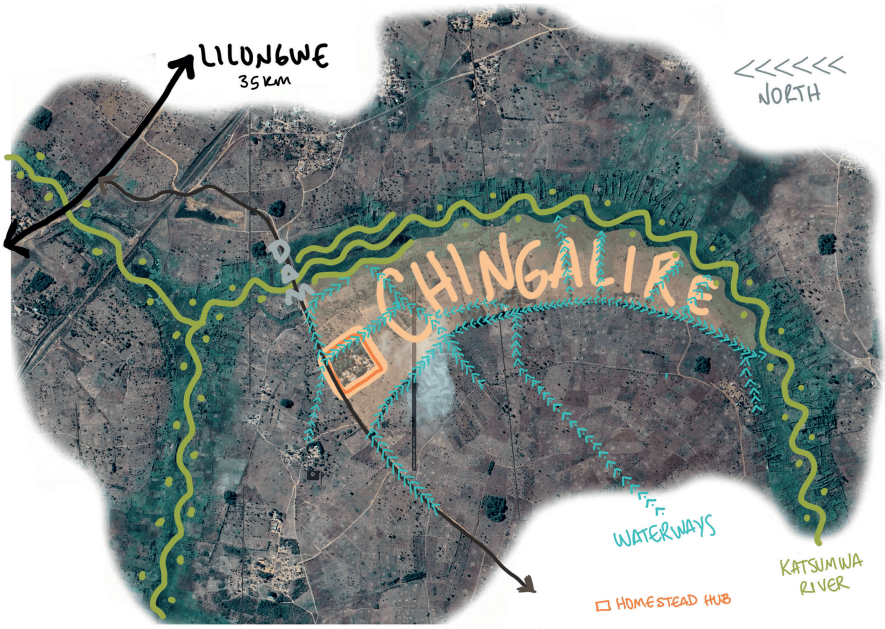

Figure 3: Chingalire's overall area / Source: the author based on semi-structured interviews

Around 1986, Chief Kanyambwe installed Michael as Chief Chingalire, and the family's land became the village. At this point, the architecture had a vernacular style. While the online information on Malawian vernacular architecture is minimal, the following picture is a depiction based on locals' descriptions and drawings and the Jon Sojkowski Malawi Vernacular Architecture database. Figure 4 sketches a homestead from before the 1990s, taking that of a freshly married couple as an example.

"A homestead is a collection of structures that belong to a family group, it could be a family of four or an extended family" (Sojkowski 2016a). Unlike Western homes, a homestead is not composed of a single construction but rather several small places that fulfill individual purposes and allow most activities to occur in the open space. About half of the structures have an agricultural purpose: pigeon coops, chicken coops, granaries, and goat pens. The domestic buildings were for the kitchen, latrine, bathroom, and bedroom. Because there were no trees and the house was the highest point in the homestead, the thatch roofs were a fire hazard during storms. In Chingalire, buildings were demolished and rebuilt depending on the homestead's needs and following the directions of Chief Chingalire. Builders were not trained but would instead join in with the construction work following simple instructions, e.g. carrying materials to the site; tasks became more difficult as the worker's reliability increased.

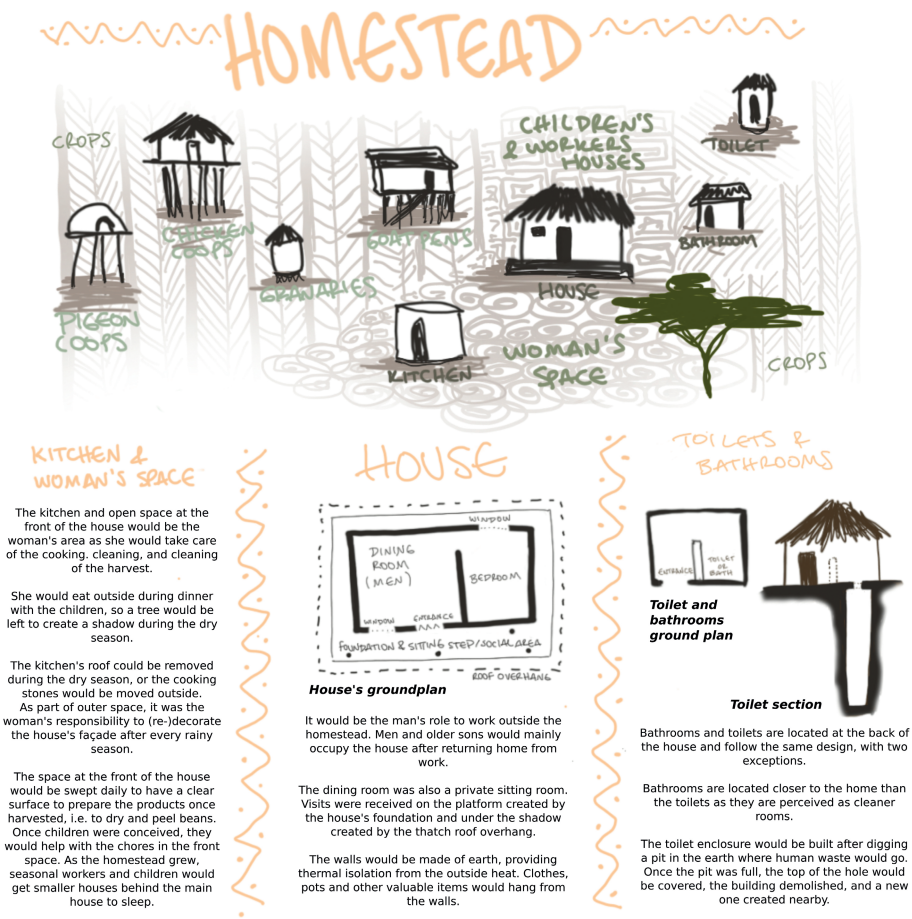

Figure 4: Description of a Malawian homestead before the 1990s / Source: the author's depiction based on semi-structured interviews and Sojkowski 2016a

With the change of government in 1993 and progressive changes in agricultural policy, the rural infrastructure and development support deteriorated. The waterways were used as roads, compressing the earth and triggering erosion problems, or as space for expanding crop cultivation, which would be washed away during the rainy season. Once used by people all over the area for agriculture and leisure, the dam progressively deteriorated and finally collapsed in 2020. After his retirement, Chief Chingalire cared for his family's homestead until he passed away in 2009.

Figure 5: First house at Chingalire's homestead / Source: Gerd Runge 2022

Figure 6: Chief Michael Chingalire watering crops / Source: Mankhamba's family photos n.d.

3.2 The first decade of Chingalire Rural Growth Centre

Ben Mankhamba, second son of Michael Chingalire Mankhamba, was chosen by the village's women as the new Chief Chingalire. His expertise in the cultural and music industry and his travels brought a fresh perspective to the development of the village. "In 2012, he established the non-governmental organisation Chingalire Rural Growth Centre (CRGC), a model teaching and learning centre for children and different communities" (Bazaar 2015). He started building classrooms for music and dancing lessons (Face of Malawi 2023), walls around the homestead, concert areas for security and privacy purposes, and all the support spaces for these new activities (single-room huts, boreholes, toilets, solar-powered electricity).

Figure 7: Aerial view of Chingalire's hub / Source: Gerd Runge 2023

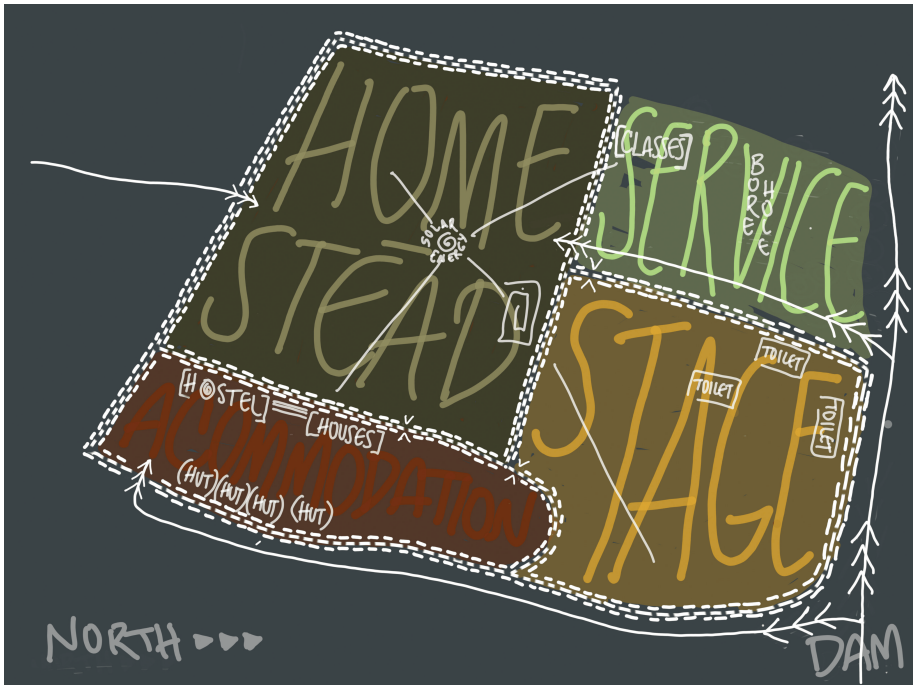

Figure 8: Sketched the location of development cooperation construction projects and recent constructions / Source: the author

The resulting projects boosted social and cultural activities in the village, and while the spatial interventions lacked interconnections and had limited long-term effects, they provided valuable lessons for the sustainable development of Chingalire. Figure 9 gives a summary of these results.

Construction	Lesson learned
 *Figure 9a: Community classrooms / Source: the author*	The classrooms were (and still are) booked on a daily basis and host the widest range of activities. Tailoring classes, dancing practices, movie productions, and group games, among others, take place in these rooms with more or less enough comfort. For their design, slight modifications to vernacular architecture designs resulted in an appropriate climate response and longer-lasting results, as a concrete foundation would last longer than a mud one.
 *Figure 9b: Huts construction workshop / Source: Freundeskreis Malawi archive 2019*	The single-room huts made as part of a workshop with mud walls and thatch roofs disappeared among new space distributions but left significant lessons: the mud walls were very resistant (and difficult to demolish); the thatch roofs made a comfortable inner environment but, due to deforestation, it was difficult to find the material for maintenance or replication; and the overall knowledge of the construction was unfortunately lost for the community as the participants of said workshop moved away. Also, the locals saw the vernacular style of the hut as old-fashioned and were not interested in replicating it.
 *Figure 9c: Borehole / Source: Gerd Runge 2023*	The borehole was dug during Chief Michael Chingalire's time in an accessible location for outsiders. However, there is no collective contribution to the regular maintenance required. Only Chief Ben Chingalire takes responsibility, and while there were members interested in contributing, the benefited community has yet to participate in the routine fixing of the borehole.
 *Figure 9d: Dead solar rechargeable batteries / Source: Chief Ben Chingalire 2023*	The solar-generated electricity brought an adaptable alternative to the energy supply network. However, it is not yet economically viable for the local community, and once the solar rechargeable batteries expired, the adaptation possibilities were shortened. Additionally, there are no e-waste management options in Malawi to properly dispose of the batteries.

Figure 9: Lessons learned from development cooperation construction projects / Source: the author

3.3 Recent constructions

The new interventions started in August 2022 with the Hostel Houses, followed by a Bamboo Furniture Workshop, a Rural Bridge on the access road in November, and Dry Toilets in February 2023. As lessons were learned with each construction, they immediately changed the approach to the next project.

Hostel Houses
The hostel houses' construction objectives were to provide insights into the construction processes in the village, increase the income for Chingalire by expanding and improving accommodation spaces, and show goodwill for cooperation. By following the same procedures as for any other local construction, the operation took less time, and the architects could observe Chingalire's construction process approach. Once finished, the houses immediately increased Chingalire's income by providing accommodation for up to 72 people, convincing Music Crossroads Malawi to continue hosting the Pakhonde Ethno Music Festival. However, the construction combined unsustainable materials with ineffective construction methods and applied inadequate designs for the local conditions, and the overall final costs make the construction approach unaffordable for locals.

Figure 10: Finalised construction of hostel houses / Source: Chingalire 2022

The hostel houses were made of homemade sun-dried bricks, plastered cement, corrugated iron sheet roofs, and steel-framed windows, all materials that result in poor building performance or have high environmental and economic costs.

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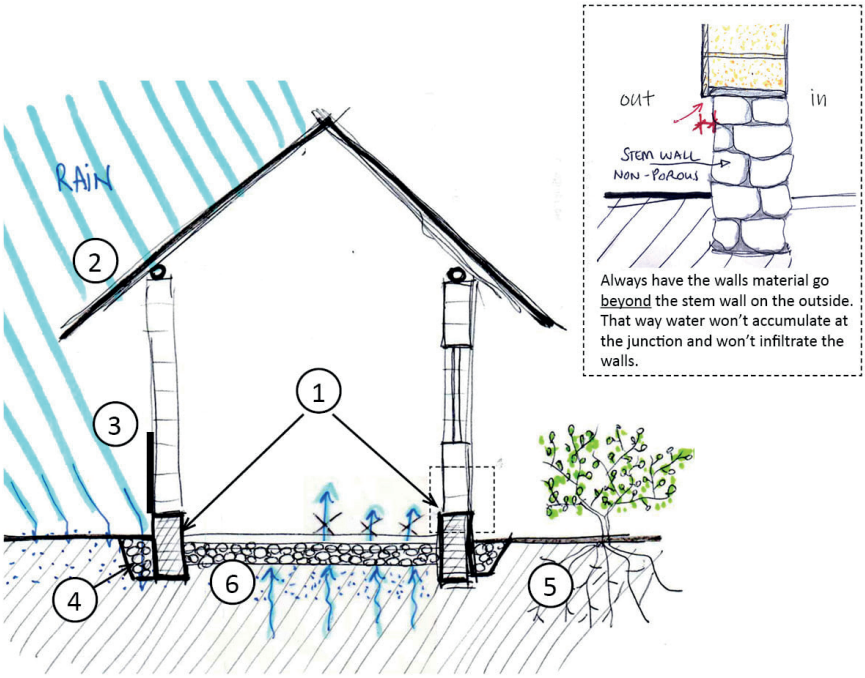

A/ Keep porous material away from water

Provide «good boots» and a «goot hat» to your building :

1. Foundations and stem wall (min 30 cm above the ground, ideally above the flood line) in non-porous material: stone, cement or lime concrete, ... *(not* bricks or mud blocks*)*.
2. Large overhangs of the roof will protect the walls from getting too much rain, and be washed by it
3. Plaster the most exposed areas with a water-repellent material : lime, soil and cow dung...for raw mud techniques (*not* cement), that can be re-done every 2 or 3 years.

B/ Avoid accumulation of water against the foundations and walls

4. Dig trenches 30-35 cm wide, the same depth as the foundations, and fill them with stones. Rainwater won't be retained by the stones and will infiltrate the ground below.
5. Plant around the building ! The roots loosen the soil and have a good water retention capacity, helping the rainwater to infiltrate the ground.

C/ Avoid water rising from the ground

6. Don't build the floor directly on pounded earth and broken bricks (porous materials): Dig 20 cm and fill with stones, then pour the floor material on this layer.

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PRINCIPLES FOR DRY, RAIN-RESISTANT BUILDINGS
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Figure 11: Principles for dry, rain-resistant buildings / Source: Mud&Leaf architecture•design 2022

The vernacular sun-dried bricks (Sojkowski 2016b) will fail when not protected from water by a proper foundation and a generous roof overhang (see Figure 11). The concrete used for joining the bricks and plastering walls is one of the most polluting materials in the construction industry. It has additional environmental and economic costs due to Chingalire's location (remote and rural) and the cheap imports on the Malawian concrete market (Research and Markets 2019). Additionally, there was an overuse of cement on the bricklaying (instead of cement equivalent to ½ of the thickness of the brick, it was almost half), translating to unnecessary and expensive additional environmental and economic costs of the construction (see Figure 12). Similar prices are also valid for other materials, such as iron and steel, but their implementation has different adverse results. During the dry season, corrugated iron-sheet roofs absorb the heat and hold it inside the building. To isolate the undesired heat, wood to create a ceiling is needed, and unnecessary costs are added (see Figure 13). During the rainy season, iron-sheet roofs make for poor internal acoustics as the surface amplifies the noise of raindrops inside the building. Additionally, exposure to extreme amounts of sun and water quickly deteriorates the corrugated iron sheets, which are also known to be blown away by the strong winds in Malawi.

Figure 12: Bricklayer during hostel houses' construction overusing cement / Source: Chingalire 2022

Other malpractices seen in the building procedures are common on Malawian construction sites and result from a lack of know-why and know-how. To level the floor, large amounts of water were applied to press the earth before the cement floor was laid, retaining the moisture. The resulting humidity inside the room was challenging to reduce, considering the windows' relatively small size (in proportion to the room) and the lack of cross ventilation. Such malpractices are common in construction as the local builders, called bricklayers, do not receive training. Bricklayers are called

upon to do brickwork on different construction sites. Rather than being apprentices or receiving an introduction to the know-how and know-why in building work, they repeat what they see older colleagues doing. There is usually no trained builder on construction sites. The lack of know-why and know-how of workers greatly challenges the quality of the constructions. By February 2023, the furniture inside the hostel houses started to grow mold and construction corrections had to be made to mitigate the humidity problem.

Figure 13: Ceiling structure on hostel houses / Source: Chingalire 2022

While the construction was larger than buildings on the rural side, the techniques and materials used remained, per request, the same as those commonly used in the area. The final cost was 66,341 MKW/m^2, in a country where 70% of people live on less than $2.50/day (World Bank 2019) and housing finance is highly underdeveloped (Housing Finance Africa 2022), for a construction that could have provided a safer and more comfortable built environment and a lower ecological footprint.

Bamboo Furniture Workshop

Based on the lessons learned from the hostel houses construction, it was considered necessary to have a professional on-site who could direct the building process, provide some basic training for the construction workers, and start employing natural materials available on-site to lower the costs.

Mud&Leaf architecture•design started its collaboration in the enterprise with responsibility for these tasks, proposing a three-day Bamboo Furniture Workshop as an introduction to building training. Building bamboo beds in Chingalire could reduce the costs of furnishing the hostel houses, and new jobs and qualifications would be

created in the community. At the beginning of November 2022, fifteen locals (including some of the bricklayers from the hostel houses constructions) learned how to do basic bamboo constructions by successfully building a bed out of bamboo (see Figure 14).

Figure 14: Group picture of Bamboo Furniture Workshop participants / Source: Chingalire 2022

The medium- and long-term ambitions for Chingalire and a sustainable approach were decisive for the Bamboo Workshop implementation. The material's local availability and the teaching strategy were assessed before agreeing to the workshop proposal. It was decided to treat the bamboo with salt and water because this did not involve the complicated management of residue chemicals and was an alternative for villagers for future treatments which did not require external financial support. The villagers' circumstances were considered for the teaching/learning methods, so rustic tools were used rather than electric power tools. An experienced carpenter from Mud&Leaf, and a native Chichewa speaker, also participated in the event to support the teaching/learning experience.

The combination of a sustainable construction expert and the preparation and results of the Bamboo Workshop provided insights into the Malawian construction sector's limitations for sustainable development. The highlights of these observations are:

> There is a need for more construction professionals who take a sustainable approach to architecture because the market does not demand it. Throughout the country, there is a false imaginary of "modern construction", which creates a

high demand for materials such as iron, steel, and cement. This trend probably started after the Second World War when concrete offered an inexpensive and simple way to rebuild cities devastated by bombing. It began to be massively used worldwide for construction projects. This image is so ingrained in the general perception of development that the Malawian government subsidies for housing consist of small loans of corrugated iron sheets and bags of cement as part of its "Decent and Affordable Housing Subsidy Programme (DAHSP)" (The Nation 2016; Nyasa Time 2019; Housing Finance Africa 2022; The Guardian 2019).

> Given the low market demand for sustainable materials, it is more of a professional choice to pursue their use and a career in green construction. However, a growing number of organisations have adopted a sustainable approach to development (especially using permaculture). These organisations network online and provide many examples of sustainability and resilience in Malawi.

> Furthermore, macroeconomic crises (such as the pandemic and the invasion of Ukraine) that create significant fluctuations in the prices of imported materials have positively affected sustainable options as people are forced to look for local and less costly alternatives. The recent prohibition of 2018 on burned bricks opened growth opportunities for green materials (Housing Finance Africa 2022).

> Due to a market that is still creating sustainable product chains, combined with deforestation problems, there are shortages of natural materials. Nevertheless, the benefit of specific raw materials (like bamboo and mud) is that if there is access to land and financial investment, materials can be produced on-site without additional costs and may represent a business opportunity. Such intentions require medium- and long-term entrepreneurial planning.

> Construction malpractices are not limited to cement and negatively affect the reputation of natural materials. Bamboo, grass, mud, and other vernacular materials are still used in rural constructions, mainly because they are more affordable. However, malpractices with these materials cause failures in the structures, which in turn it spreads the belief that cement and steel are better options. For example, bamboo needs to be treated and must be at least five years old before being used in construction. Otherwise, it will rot, be vulnerable to insects, and fail under pressure.

> It was important for the participants' learning experience to have both genders and Chichewa native speakers as teachers. For the only female participant, having a female architect as an instructor was inspiring to continue learning in a male-dominated sector. For the majority of participants who were not fluent in English, the involvement of a native Chichewa speaker with a similar background to them was vital to guide them and build trust.

After the workshop, the builders received an order of ten bamboo beds to furnish the hostel houses. The purchase gave them opportunities to practice their knowledge after the workshop and provide a new income.

Rural Bridge on Access Road

The road that serves as Chingalire's primary connection to Lilongwe town crosses the Katsuma River. In the time of Chief Michael Chingalire, the village's accessibility was guaranteed by a dam which created a lake that locals used for agricultural and leisure activities. During the first decade of Chief Ben Chingalire's time, the dam collapsed due to a lack of maintenance, impeding the passage towards medical centers and schools once the water levels rose in the rainy season. The Chief contacted an engineering company that did similar projects for the government and received a quote for over €100,000 for rebuilding the dam and access road. Despite development cooperation support, the village was unable to cover these costs.

In October 2022, during a visit to a neighbouring village, Chief Chingalire saw a "Rural Bridge" establishing the connectivity of a community across a small river and in a geographical situation similar to Chingalire's. To diminish the emergencies caused by access impediments during the rainy season, Chief Chingalire organised the construction of a rural bridge on the main access road to the village. He received financial support from the German architect, contacted the builders of the initial rural bridge and requested their help in constructing a similar structure for Chingalire, and called local builders to help and learn about the building process. The rural bridge on the access road to Chingalire was finished in two weeks and was inaugurated by locals in a big ceremony with traditional music and a dance performance (see Figure 15).

Figure 15: Inauguration ceremony of the rural bridge on Chingalire's access road / Source: Chingalire 2022

The architects saw the construction of the rural bridge as an opportunity to evaluate the effects of the bridge on Chingalire's resilience. The new construction significantly increased the connectivity of the village during the rains. Still, the locals' ability to repair the structure was a significant factor in the village's efficient response to shocks.

Figure 16: The first collapse of the rural bridge was in January 2023 / Source: Chingalire 2023

Figure 17: Locals repairing the bridge after the second collapse in February 2023 / Source: Chingalire 2023

During the first rainy season after the rural bridge's construction, access was blocked three times for several hours, in contrast to the situation before the bridge when a blockage could last weeks. In every collapse, it was not the new structure that failed but rather the earth around it. Locals would undertake the repairs without professional supervision a day after the damage was caused and use wood or bamboo poles, rocks, and sand to replicate what was learned during the bridge's construction.

However, the rural bridge's construction revealed other aspects to consider for the future development of Chingalire's resilience. To grow Chingalire's resilience, new construction designs must be understood by the locals and they must be able to carry out repairs, which requires the availability of materials, tools, and necessary finance. Also, there is potential to increase the resilience of the broader area by involving owners of neighbouring lands and other local authorities. Risks of droughts and floods can be reduced if natural structures like waterways are reestablished, and there is collective support for their maintenance.

Dry Toilet Pilot

The last construction to date was the Dry Toilet Pilot, meant to increase the level of building complexity that local builders can tackle and explore the implementation of outside ideas in the village context. While the building is not yet in use, the local reactions towards the new concept of toilets provide valuable perspectives for the future. Of the nine participants, six participated in the Bamboo Furniture Workshop and were interested in furthering their experience with the new material. With most builders trained in bamboo techniques, the new lesson focused on constructing a simple building by applying the same principles as furniture construction. The preparations for the workshop faced a first challenge as bamboo owners in the areas increased their prices by 50% as word of Chingalire's interest in buying bamboo spread. The builders, now trained to properly cut and treat the material, had to travel long distances to acquire bamboo for a reasonable price. For the locals, one of the most attractive aspects of the dry toilet was the creation of manure from the toilets as the consistent increase of fertiliser prices hampered local productivity. The possibility of having a permanent location for toilets was also favored, as the filling up of previous models and the necessary digging of a new pit were significant family expenses. The builders embraced the building challenges that came with the increased complexity of the construction. The best learning tool was a small model of the structure, which they could interact with. They were asked to explain to the rest of the community how the dry toilets work and to spread construction know-why and know-how. Still, the all-male builders' team was reluctant to take on conversations related to the sanitary disposal of women's hygiene products in the toilets. This solid social separation of roles also impacted the design of the constructions; even the design had to strictly provide two toilet cabins (one for women and one for men). The last construction challenge faced was a sustainable and permanent roof solution. A thatch roof that the locals could repair was rendered unviable by a shortage of grass, while concrete plates were too costly. It was decided that corrugated iron sheets would have to be temporarily installed, and a lime-covered roof could be experimented with. Success with the lime-covered top would allow the re-use of the iron sheets for repairs of other roofs in the homestead.

Figure 18: Participants use the model to explain to visitors the working of the dry toilets / Source: Gerd Runge 2023

Figure 19: Construction of Dry Toilets Pilot / Source: Gerd Runge 2023

4 Discussion

Table 2 summarises the significant findings and learned lessons of the project as a table listing the construction; notes on the built environment's quality, sustainability, and resilience; and outlook for Chingalire's development strategy and its implementations. The viewpoints for Chingalire's development strategy can be separated into those which relate to the design and construction process of future interventions and other overall recommendations for Chingalire's transformation.

Project	**Notes on Chingalire's built environment quality, sustainability and resilience**	**Outlooks for Chingalire's Development Strategy**
Vernacular Homestead	– Loss of native biodiversity + Use of natural and locally available materials made them affordable and good in bioclimatic reponse – Thatch roofs as fire hazards due to lighting strikes – High maintenance	> Use of natural and locally available materials to keep costs within local's financial possibilities and contribute to a good bioclimatic response > Make of biodiversity a source of food and well-being for the homestead
Development cooperation Classrooms	+ Small modifications to vernacular design made for good climate response – Use of non-sustainable materials + Lower needs for maintenance	> Create flexible spaces to comfortably host a wide range of activities and increase use > Reduce maintenance needs through the selective use of materials
Development cooperation Huts	+ Created a positive image of natural materials – Location did not consider future space arrangements – Trained builders left and community lost their construction knowledge > Design was not replicated because villagers perceive vernacular architecture as old fashioned	> Consistent bioclimatic design > Have plans for future development and built being mindful of their locations > Create economic opportunities > Have builders sharing their knowledge with others > Architecture style needs to be socially desired
Development cooperation Borehole	+ Location allows accessibility for outsiders – No collective contributions for maintenance	> Include collective systems to tackle maintenance costs of communal services

Project	Notes on Chingalire's built environment quality, sustainability and resilience	Outlooks for Chingalire's Development Strategy
Development cooperation Solar-generated electricity	+ Diversification of electricity creating options – Not affordable for locals – No strategy to dispose e-waste	> Implement different options of energy provision > Limited possibilities for ewaste management
Hostel Houses	+ Malpractices in construction site – Construction costs not affordable for locals	> Train builders on know-hows and know-whys
Bamboo Furniture Workshop	+ Bamboo available in area + Bamboo treatment installed	> Trainers should be of different genders and Chichewa speakers
Rural Bridge	+ Locals can promptly implement repairments	> Alliances with neighboors can increase resilience
Dry Toilet's Pilot	- Reduced availability of bamboo in the area and unjustified increase of raw materials costs + The resulting fertilizer from the toilets motivated its acceptance - Strong gender roles separation limit communication in the community	> Create economic alliances in the surroundings to maintain a fair price for materials > Grow bamboo in Chingalire to have a permanent source in the medium and long term > Design needs to be mindful of social dynamics (i.e. gender separation) << Social acceptance pending to see

Table 2: Summary of significant findings / Source: the author

The outlook aligned with the development recommendations from other branches and was rapidly implemented. The healthy natural environment experts suggested the growth of kitchen gardens inside the enclosure to diversify food sources and tackle land erosion. The design of said gardens, new constructions, updates of the energy network, and waste management points are currently being put together in the form of a Master Plan for Chingalire to clarify spatial occupation and coordinate action. The creation of economic opportunities became a branch in itself to incentivise people to remain permanently in the village; entrepreneurial training for locals is being planned.

The specifications for a built environment that supports the development, sustainability, and resilience of Chingalire include the central values of vernacular architecture and simultaneously call for a new take on the architectural design.

Implementing natural and locally available materials is vital to keep costs within locals' financial possibilities and contribute to a space's good bioclimatic response. Similarly, the new construction must be mindful of social dynamics to accommodate the local culture respectfully. The use of materials other than those locally available should be pursued if necessary to reduce maintenance times and costs. The building process should also train workers on construction know-hows and know-whys and promote sharing knowledge among locals. Finally, new architectural designs need to be consistent in the bioclimatic approach and not just be satisfied with the use of natural materials; they must create flexible spaces to comfortably host a wide range of activities and increase a building's use, and they need to be socially desired.

The current paper has successfully initiated the collection and documentation of Chingalire's transformation. The directions for Chingalire's Sustainable Development Strategy and its built environment are valuable for the project's focus but need to be improved in terms of a resilience vision. The layout of Chingalire's timeline will be essential in the continuation of the documentation of both current and past events. The outlook considerations have covered all branches of the Development Strategy. The specifications for new constructions, explicit and within the project's possibilities, will continue to be implemented and tested. Nevertheless, the construction of the rural bridge taught lessons to build Chingalire's resilience. This could be due to Chingalire's risks being focused on the degradation of the natural environment rather than related to the built one.

However, the complexity of the project and the abundance of undocumented information and sources make a deeper and more sophisticated analysis possible. Because the document project covers different scales and interconnections of the village's lifestyles, focusing on just a sole aspect of the situation limited understanding of the drivers of change in the community. For example, the politics of land ownership and the interdependencies of the built environment and the natural one in a rural village were barely noted. The documentation exercise could be undertaken for each development branch and their interactions investigated thoroughly.

Additionally, there could be more clarity on the terms "quality", "safety", "sustainability", and "resilience". As an international cooperation project with a multidisciplinary approach, diverse worldviews, professional perspectives, diverse cultures, and life expectations affect the definitions of such critical terms for the research. As the project continues, it might become necessary to agree on the meanings of key terms to avoid cultural shocks in village life and rather have constructive discussions on the approach to "development".

The project must continue growing its documentation and experience before recommending the transferability of results. The intricacy of Chingalire's Sustainable Development Strategy must continue to evolve to consider the perspective of branches relevant to the built environment. This would thus include a Healthy Natural Environment and Relevant Rural Education to develop systems for the growth and availability of natural and local materials and educational programs for local builders to raise their level of performance.

Similarly, other enterprises tackling holistic approaches to sustainable development and the transformation of Malawi have yet to document and organise as a united force (The Guardian 2015). Across the country, many NGOs have been implementing a permaculture approach to development in agriculture, health, finances, education, and construction, among other fields. However, their operations have not always been documented and, as a collective, they have yet to bring together their findings to provide a clear view of which actions should be replicated, how and why.

5 Conclusions

The formulation of Chingalire's Sustainable Development Strategy is highly dependent on lessons learned from previous activities. Therefore, it is fundamental to continue the project's documentation and growing capacity to understand the complexity of the village's dynamics and the implications of the new implementations. This includes continuing the Safe Built Environment branch and other branches in the Strategy, and considering their interconnections. The same is recommended for other enterprises, such as NGOs and private companies, whose experiences could bring together relevant guidance for Malawi's sustainable transformation.

However, the challenge is to function under the permanent pressure of various crises while methods to assess the transformation processes are being developed. As the present paper was written, cyclone "Freddy" hit Malawi setting a world record for the longest-lasting tropical storm (DW 2023). At the same time, the country is still recovering from the economic consequences of the COVID-19 pandemic, has an inflation rate of 25.9% (Trading Economics 2023), and outbreaks of cholera repeatedly hit the capital. The country constantly faces critical situations and will continue to do so due to its climate change vulnerability and lack of systems that can act promptly after shocks. Because the formulation and implementation of Malawi's (and Chingalire's) resilience and sustainable development strategies need to be simultaneous to states of emergency, they must be responsive under stress and effective in action.

Further research can significantly benefit resilience and sustainable development by collecting and organising information on previous actions nationwide. While the current project focuses on Chingalire, there are excellent prospects for guidance from the experience and knowledge of the large pool of international cooperation projects and programs, private green enterprises, and local and international NGOs across Malawi. However, as their work still needs to be collectively documented and assessed in its replication potential, the lessons learned cannot yet be implemented in new action.

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