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Indigenous People

Edited by Purushothaman Venkatesan

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Notice

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Meet the editor

Dr. P. Venkatesan is currently working as a senior scientist in the Division of Extension Systems Management of ICAR-National Academy of Agricultural Research Management (NAARM). He specialized in agricultural extension and has 15 years of experience as a developmental scientist and 3 years as a core scientist. He joined NAARM in May 2014. He specialized in the area of indigenous technical knowledge, participatory technology development, participatory impact monitoring and assessment, tribal development, technology assessment, and refinement of socioeconomic and environmental impact assessment. He has published several research papers, books, manuals, and policy papers. To his credit, he has guided a number of research scholars in rural development and management. He is a recipient of four national and two international awards.

Contents

Preface

Indigenous communities, peoples, and nations are those that, having a historical continuity with preinvasion and precolonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing on those territories or parts of them. They form at present nondominant sectors of society and are determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions, and legal system. But the interactions between indigenous peoples, governments, and resources have historically often been contentious. Throughout the world, indigenous peoples are growing in political strength and commercial capacity. Some governments are beginning to redress historic injustices by recognizing indigenous ownership and cultural and human rights.

Writing a comparative history of indigenous peoples is a challenging and humbling experience. *A Global History of Indigenous Peoples* came out of a desire to search for patterns and processes in the history of indigenous to the newcomer encounter and to make connections across continents and centuries.

There was a tremendous response by the authors to the book on *Indigenous People* by contributing high-quality research chapters, which necessitated the publication of this book. Moreover, noncontributors could also be largely benefitted from the chapters of this book. The present book is based on selected manuscripts submitted by the authors on the theme of indigenous environment, indigenous technical knowledge, indigenous resource governance, indigenous entrepreneurship, and empowerment to InTechOpen publisher. The process of publication went with different steps starting from selection of high-quality manuscripts to finalization.

I hope that this book would definitely offer a general overview and hope that it would stimulate debate and further investigations of the comparative dimension of the indigenous experiences is work, then, is a speculation on a broad, globally significant issue; I welcome the opportunity to expand, enhance, and rethink on the experiences around the world.

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Section 1

Indigenous Culture

Chapter 1

Usages and Customs of the Indigenous Communities in Favour of the Reduction of the Digital Divide: A Case Study of the Ñuu Savi People

Olivia Allende-Hernández and Jesús Salinas

Additional information is available at the end of the chapter

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Abstract

This research is of ethnographic nature, focusing on the study of the Ñuu Savi people (people of the rain), also called the Mixtec people, of pre-Columbian origin belonging to the Mixteca Region of the state of Oaxaca, Mexico. On the basis of sociocultural theory and the theory of the diffusion and adoption of technological innovations, the study on the cultural identity of the ethnolinguistic group, whose social platform is the "uses and customs," is carried out. As a result of this research, the descriptive analysis is presented, detailing the effect of information and communication technologies (ICTs) on the situation of the vulnerable and disadvantaged group. Likewise, cultural elements have been identified that allow the formulation of a model for the development and inclusion of the ethnic minority. An educational strategy is designed and implemented through the model. However, in the process of implementing the educational strategy, it was observed that the Ñuu Savi people experience a conjunctural stage where technological adoption coexists with some beliefs, aptitudes, and attitudes, characteristic of its form of government of "uses and customs," which create sociocultural barriers that make social and digital inclusion difficult.

Keywords: cultural identity, digital divide, indigenous peoples, ICT

1. Introduction

According to studies carried out by the Organization for Economic Cooperation and Development (OECD) [1], in developing Latin American countries such as Mexico, the benefits of technology are not being reflected in the poorest societies. This finding has been supported by Boltvink's socioeconomic study [2], which mentions that more than 93 million poor exist in Mexico. This figure is impressive, given that, according to the census of the National

Institute of Statistics and Geography (INEGI by its Spanish acronym) [3], in the year 2010, Mexico had a total of 112,336,538 million population; therefore, the figure given by Boltvink represents 82.7% of the total Mexican population, of which the population in extreme poverty is 60.4 million, including of ethnic groups. Of this figure, 64.9% is found mainly in rural localities and 35.1% in metropolitan areas.

In addition, factors, such as debt, ignorance, disease, globalization, among others, prevent developing countries from being at the forefront of the use of technology in order to be exploited for socioeconomic development in highly marginalized communities. Under this scenario of poverty and inequality, it is paradoxical that of the huge cultural wealth of 68 ethnic groups, survivors of pre-Columbian Mexico, 16 are registered in the state of Oaxaca [3].

In the world today, where globalization is responsible for making available ubiquitous new information and communication technologies (ICTs), and specifically the existence of the Internet, indigenous people are struggling to maintain their identity and preserve their transcendental culture. The results of this research acquire greater importance considering the fact that of the 517 municipalities that exist in the state of Oaxaca, 418 are governed by "uses and customs." In other words, 80.8% of the population of the municipalities responds to a government in their own cultural forms [4].

According to figures provided by the National Council for Evaluation of Social Development Policy [5], the state of Oaxaca is considered to have a high poverty rate. These data may give rise to the hypothesis by some studies that maintain that the dramatic situation of the indigenous people in almost all cases—which the World Bank describes as abysmal and severe poverty—is due to their isolation and marginalization [6]. Then, the questions arise: Why isolation and marginalization of ethnic groups underlie an environment of innovation and technological globalization? The answer could be that they have a digital illiteracy profile mainly in the adult population, which, some scholars say, widens the digital divide and is a direct threat to ethnic identity [7]. Then, why consider the culture of the Ñuu Savi people as strength to reduce their gaps, not only the digital divide, but also the economic and social divides?

In response to the questions identified, the culture of the Ñuu Savi people (people of the rain), also called the Mixtec people, is taken as the framework of study in this investigation, which allowed interpretation of the cultural values, as well as Identification of social agents involved in their development and determination of strengths and weaknesses of the minority group. For this case study, rather than considering ICT as a phenomenon forced acculturation of indigenous people [8], it is seen as an agent for reducing gaps by promoting equal access to information for the integration of people with social disadvantages. Likewise, promoting the development of marginalized areas by geographic barriers, as well as the rapprochement between people, economic, and social sectors.

2. Methodology

With the objective of acquiring an extensive knowledge on the ethnolinguistic group, which would permit the establishment of a strategy contributing to the reduction of wide gaps in

the social and technological aspects, methods and tools have been applied through quantitative and qualitative research. In the framework of the quantitative research, data were gathered from 11 localities belonging to the Mixteca Region of the state of Oaxaca in Mexico, are considered by the National Institute of Statistics and Geography [9] and by the National Commission for the Development of Indigenous Peoples [10], as municipalities with high and very high marginality index, where there are Ñuu Savi ethnic origin people and speakers of the Mixtec language. The instrument used for choosing data with reference to the module "availability and use of information technologies in the homes" was designed by the INEGI [11] and was applied through a survey stratified according to different areas of the locality between residents in the year of 2013 and updated in January 2016. In accordance with the instrument of work and objectives of the research, the observation unit was the home, and the basis of the sampling frame was formed by a total of 689 houses of the Mixteca Region population. Likewise, within the framework of an ethnographic research and participatory action, the study of descriptive type is carried out, which allowed us to understand the ethnic group, its organization based on the uses and customs, the construction of their meanings, as well as to identify its strengths and weaknesses that originated in the sociocultural factors and technological changes that exist in the minority group.

3. Theoretical framework

The study of the behavior of acceptance of technology of the ethnolinguistic group, where the contribution of its culture and the subjectivity of its emotions take relevance to this research, has its foundation in the framework of the Social Cognitive Theory (TCS) and the Theory of the Dissemination and Adoption of Technological Innovations (TDyAIT). The TCS puts the foundation of the study of the behavior of the ethnic group in the process of acceptance, from a joint complex of interactions between the environment and the individual ethnic features and the situational factors. This human potential is clearly exposed by Bandura [12], creator of the TCS of the learning, when it enunciates: "The concept of human nature assumed by the psychological theories is more than a mere philosophical question. When the human knowledge is taken to the practice, the conceptions on those who rest the social technologies have even major implications. These can influence by indicating the type of human potentials that must develop and that not, of this form, the theoretical conceptions can influence in what really reach the people to be" [14, p.31]. This theory has a descriptive character, classifier and taxonomic, given that it describes in detail the determinants of the behavior of individuals. The theory gives importance to the symbolic processes, vicars (imitation or observational), and self-regulation. The cognitive social perspective of the learning departs from a model of reciprocal determination between the Environment (E), the Conduct (C), and the Personal factors (P) [12, pp. 2–8]. This conduct depends on the environments and personal conditions (cognitive and emotional between others). These, in turn, depend on the behavior of the person and the environmental context. Bandura et al. [13, 14] argue that reciprocity does not mean symmetry, as for the intensity of the bidirectional influences. The relative influence of the factors E, C, and P changes depending on the individual and the situation. For the present case study, if ethnic people had a contextual environment where the information communication

technology infrastructure was within their reach, the behavior of the young population (children, adolescents, and young) would be practically adopted. On the contrary and consistent with the present case study, when the infrastructure, expertise, and competencies in the ICT are weak, personal factors (culture, reasons, emotions, cognition, among others) become predominant in the social system.

4. Individual ethnic features and situational factors

An ethnic group is considered a group of people whose members identify with each other, through a shared common heritage, for example, lineage, culinary art, culture, traditions, language, and religion. In general, it is a set of norms that passes from one generation to another by means of the uses and social customs that forge an ideology on which its existence rests. Smith and Bond [15] view culture as a relatively organized system of shared meanings, something like "collective mind programming" [16], a group whose members identify with each other on the basis of a common history, background, or ancestry. Considering this definition, it is possible to describe the events that intervene in the affective and emotional feeling of the members of the Ñuu Savi culture of the Mixteca Region, which are associated with events in the community, generating cognitive and behavioral reactions that include shared experiences of other niches of the dominant society acquired through their observation during migration, as well as attributes recognized by technological artifacts that can benefit the ethnic community.

There are relevant factors that are derived from their "usages and customs," such as the case of the Tequio and the way of learning ones language. The Tequio is a custom of the original civilizations of Mexico and has it origin in the nahuatl Tequitl, which means work or tribute. It consists in the community work oriented to the common welfare. The present study considers the Tequio as a fortress, pillar of Ñuu Savi people. The Tequio holds the Mixtecos people together through collective efforts, allowing them to leverage their resources to contribute with activities and services for the progress of the community. In addition, it creates a sense of achievement and belonging, which strengthens their identity and commitment to their community. Currently, the law of the State recognizes the shape of the Tequio and gives it legal character. With regard to learning their language, it has been made verbally through the teaching by parents to their children, which is the reason why it variants are not known by writing by the majority. Wichmann [17] reported a population of 446,236 speakers with 32 variants of the Mixtec language. At present, the Mixtec is the language of the Indigenous people with more speakers in the state of Oaxaca after the Zapoteco. The global scope of the functionality of the languages in an ethnic community is essential, since these depend directly on the status, force demographic, institutional support, social and psychological skills that establish the group and the individual. The flow and development of collective entities is determined by ethnic interaction patterns constituted by economic and political relations of their own transcendental culture established within and outside the community. **Table 1** shows that the population aged 5 and older speaking indigenous and Spanish language is 81.66% nationally. In the case of the Ñuu Savi people, the native language is Mixteco, which is the second most widely spoken indigenous language in Mexico, with 7% (471,710 inhabitants).

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Condition native speaking and Spanish speaking	Mexico	Oaxaca	National position
Population 5 years and over	100,410,810	3,405,990	
Speaks native language	6,695,228	1,165,186	1
Speak Spanish (%)	81.7	82.3	19
Population that does not speak Spanish (%)	14.7	16.2	3
Unspecified (%)	3.7	1.6	31

Source: National Institute of Statistics and Geography (INEGI), 2010 Census.
Oaxaca statistical perspective

Table 1. Status of population aged 5 and older as indigenous and Spanish speaking.

In the legacy of "uses and customs," humanitarian values are reflected, such as collaboration, cooperation, equity, solidarity, tolerance, and respect, directed mainly toward their community. Sensitivity, religiosity, manual skills, creativity in the design, the mixture of colorful clothing and craft products, as well as the relationship of coexistence and respect that occurs between the ethnic groups are characteristics that distinguish the ethnic group. The Mixtec people have a broad knowledge of their origins and biodiversity, coexist in a natural environment, possess ancestral knowledge—the use of medicinal properties of plants, the motion of heavenly bodies, that to say, of the adults and the elderly—announce the climate change and therefore the preset/change dates for agriculture.

5. ICT and the "Ñuu Savi" people

5.1. The digital divide

From the social perspective, information and communication technologies are a means to access information that allows the creation of knowledge, which in turn leads to improvement and progress, thus forming a set of tools that contribute to decrease poverty indices [18].

However, in order to establish an interconnected society that benefits from ICT and reduce poverty rates in ethnic communities, interconnection indicators, such as access to networks in terms of availability, cost, quality of networks and infrastructure, must be integrated into productive and social activities, so as to favor the development and progress of the community. Despite the efforts of the Federal Government to make available ICT to all Mexicans, the results are not favorable. According to the sociocultural variables analyzed in the present study, there has been a lag in the consolidation of an information society in ethnic communities, which leads to the presence of the digital divide.

The digital divide (BD) is understood as an inequality of opportunities in the access to the ICT, such as personal computers, the Internet, and cell phones, among others, of some social groups with respect to others. The intensive and extensive use of ICT has accentuated the gap between the different social groups and their access—or lack thereof—to technologies, in a

phase of economic, social, and legal development, which is called the digital divide. In a general conception, the BD is defined as "… the separation between people (communities, states, countries…) who use Information and Communication Technologies as a routine part of their daily life and those who do not have access to the same ones and that although they do not know how to use them" [19]. For the OECD, the BD concept refers to "the distance between individual, residential, business and geographical areas in the different socioeconomic levels in relation to their opportunities to access new information and communication technologies as well as to the use of the Internet, which ends up reflecting differences both within and between countries" [20].

The Federal Government has applied a strategy to reduce the digital divide to provide ethnic communities of Community Learning Centers (CLC), equipped with technological infrastructure, such as computer equipment and Internet access. However, it is not enough just to reduce the digital divide because, in addition to the infrastructure and connectivity, there is a need for qualified staff to provide preventive and corrective maintenance on a regular basis to the hardware for optimal state of technological equipment. It is also necessary that staff have technological skills to make use of the resources and services provided by ICT, such as educational use of virtual platforms, access to teleworking, e-commerce, portals of health and social welfare, among others (i.e., knowledge and mastery of the software).

The minority group has a material fortress. It is located in the set of goods and services (transportation, telephone, television, electricity, radio, etc.) that are in the community or that the community has access to. The percentage of the statewide as well as all the cases concerning cities in the present study shows that households have one of the major services required for the digital inclusion process: the electricity, livelihood of the digital age. According to the National Commission for the Development of Indigenous Peoples (CDI), it is observed that the indigenous population at the State level has an electrical infrastructure of 91.5%. This certainly is an important fortress, in addition to covering one of the main basic needs of ethno communities, it is a factor that is considered as an aid in the process of the reduction of the "digital divide."

5.2. Transition of knowledge

The transition of knowledge in the ethnic community under study is constituted by the survey of data from people who have used a computer, the Internet, and a cell phone. The sample is composed of 801 people from nine communities of the Ñuu Savi population. As shown in **Figure 1**, there is a variation in the numbers, in terms of the total number of people surveyed. This variation occurs because some people have used computers, but they do not have access to the Internet; some have used computers and they also have access to the use of a cell phone; in other cases, there are people who have not used any type of device and have not used the Internet.

The transition of knowledge implies possession of the specialized knowledge and capacity for the use of information technology and communication, as shown in **Figure 1**. It is observed

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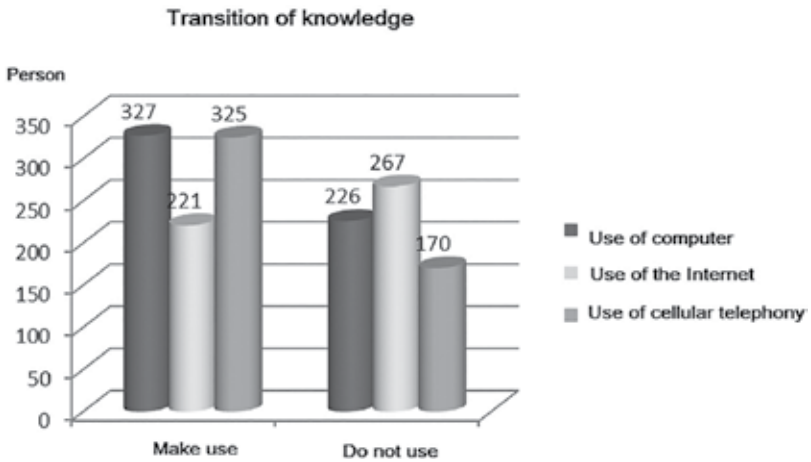

Figure 1. Transition of knowledge.

that the transition of knowledge is increasing in ethnic communities, as shown in the results, where 60% of people have used computers, 45% have made use of the Internet connection, and 66% reported using a cell phone. It is important to clarify that these figures correspond to people surveyed who are younger than 35 years. As already explained, policies on the use of technology and ICT implementation strategies in the country have contributed to the transition of knowledge, especially at the school level with students from the communities at primary and secondary levels (basic education), where the initiative of educational reform is a key factor for the transition of knowledge through the updating of the school curriculum for ICT literacy.

Ethnic communities are made up of nuclear families, where young people who have emigrated and stayed for long or short periods in large cities feel that having a cell phone, computer, and/or Internet connection puts them at the forefront of information and communication technologies. In a way they are right, except that even with this infrastructure, it is not enough when there are deficiencies in the speed of data transmission, a situation that still prevails in the communities. Surveys confirm this phenomenon where each household has at least one cell phone, a tablet, or a laptop. The last two, in spite of having an architecture that supports WIFI, are not used for this purpose in the homes, since in the communities, generally there is a lack of telecommunications infrastructure that hinders wide access to the service of Internet. However, the Mexican government has created a National System called e-Mexico [21, 22] through a federal policy, which focused mainly on four aspects: e-government, e-health, e-economy and e-learning. With the initiation of these actions, ICT penetration strategies have been implemented in marginalized communities, such as Community Learning Centers equipped with computers and Internet access, to provide services to the general population, provision of computer equipment to students of fifth and sixth grades, and satellite connection to health and educational centers.

5.3. Digital commerce strategy for the use of technology in minorities

The Mixtec communities have adopted the strategy of digital commerce through the Qiubo Network [23]. This strategy is aimed at small merchants ("local grocery stores and miscellaneous") and is implemented by the union of three companies: the largest bakery company in the Mexican Republic, "Grupo Bimbo," the telecommunications company "Blue Label Telecoms," and "Better than Cash," which have set out to break the barrier of natural resistance that small business owners (microentrepreneurs) have to approach for the use of technologies. This collaborative action greatly benefits localities marginalized by geographical issues.

Through the Qiubo Network, the massive distribution of point-of-sale terminals (**Figure 2**) was started among the more than 700,000 small businesses that make up the Bimbo distribution network, mainly focused on three objectives:

1. Implement terminals that allow transactions involving the purchase of air time and payment of services (**Figure 2**).
2. With the support of commercial partners such as Visa and Bancomex, banking is offered from the point-of-sale terminal, i.e., to carry out financial operations as well as the payment of products.
3. Operate correspondent transactions, i.e., stores (micro-businesses) become a distribution channel of the financial institution (e.g., cash withdrawal).

The sense and importance of the use of Qiubo Network technology is to meet community needs, notably for the payment of the digital television service (suppliers VeTV and Sky) and for the purchase of air time for the mobile phone. Otherwise, the community could obtain the service at a high cost in time (2 hours and 30 minutes of distance to the nearest population) and money by payment of transportation.

With the purchase of air time for the mobile phone, they gain access to social networks, textual and voice communication, entertainment applications, music in digital format, among other applications, provided by the Internet. Therefore, the use of ICT through mobile technology is promoted as an appropriation by members of the Mixtec culture and not as an imposed

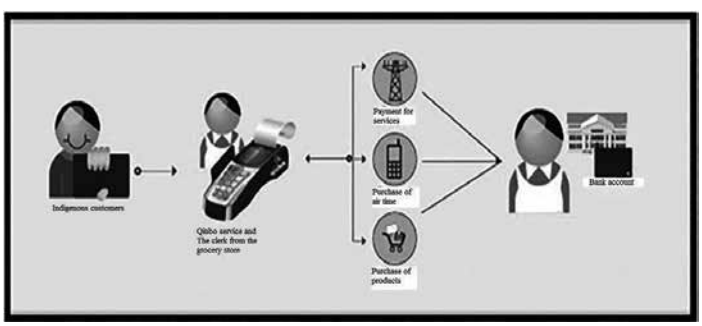

Figure 2. Qiubo Network (Bimbo and Blue Label). Source: http://www.redqiubo.com/en/index.php.

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extension of the dominant society, involving the manipulation and extermination of its cultural identity. In this connection, the Omar Dengo Foundation [24] defines social appropriation of digital technologies as "Appropriating something means making it proper to the point of being able to apply it in accordance with the requirements and characteristics of specific situations" [24].

5.4. Knowledge building: ICT and the Ñuu Savi people

Through action-participatory research, it is observed that the acceptance behavior of the technology by the ethnolinguistic minority Ñuu Savi group contributes to the development of its personality; at the same time, it enhances self-esteem and facilitates the construction of knowledge, skills, and technological skills. This statement is based on the framework of the Social Cognitive Theory (SCT) and the Theory of the Diffusion and Adoption of Technological Innovations (TDyATI). In other words, the behavior of the ethnic group in the process of accepting ICT is conceived from a complex set of interactions between the environment and individual ethnic traits and situational factors [25].

In this sense, it is relevant to the attitude of the Mixtec children and adolescents, who learn by imitating the actions of the adult and the environment that surrounds them in terms of the use of technology (**Figure 3**). In the process of constructing their knowledge, they present a behavior that is mainly derived from two sources: the first one is given by the interaction with the environment of the big cities, which the Mixtecos experience in their short periods of migration (from 2 to 6 months). The second source has its origin in personal subjective factors,

Figure 3. Social Learning (father-daughter).

to maintain a communication with the dominant social environment, which mainly motivates young members of the ethnic group to make use of ICT through Internet applications, such as Facebook, Twitter, YouTube, among others.

The construction of knowledge is based on a vicarious learning, in this respect, reaffirms the position of Bandura [25], noting that the group of children and adolescents has the capacity for attention and retention, which leads to social learning in an immediate, unconscious and without the need for a process of practice and knowledge development. The theory gives importance to the symbolic and vicarious learning processes (observational or imitation). Thus, considering that Mixtec language is one of the main symbols of the culture of the ethnic group, the use of ICT through mobile technology acquires relevance in the process of communication of the Mixtecos. The cultural development of the Ñuu Savi people, originated by technological influence, is manifested by holding dialogues in their native language (Mixteco), through the mobile phone as an instrument of communication. It should be emphasized that the Mixteco language is tonal; therefore, the ease of sending voice messages strengthens the preservation of the language. For text messages in their native language, there is still a barrier, mainly for two reasons: for the few Mixtecos with knowledge of the morphosyntax of their language, not having technological tools that facilitate writing complicates the development of their texts; and in the most common case, the writing of their own language is unknown.

In this way, the use of the technological devices modifies the behavior of the ethnic group, their vision of the world, the time allocated for the use of the physical space which is now shared with the cyberspace on the Internet. Today, when people carry out their work, but they carry their cell phones and hearing aids all the time. The factor of the communication without geographical barriers (mobile technology) constitutes the essence of their daily lives (**Figure 4**). For this reason, its sociocultural system is influenced by affecting its behavior, its way of being, the way of thinking, and of seeing things.

Figure 4. Police in wireless-mediated communication from CLC.

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6. Model for the development and inclusion of ethnic minorities (MODIEM)

After presenting the analysis and diagnosis of the communities of the Mixteca Region, the following is the Model for the Development and Inclusion of Ethnic Minorities (MODIEM) (see **Figure 5**). In this model, the strengths of the ethnic group are emphasized under an autonomous vision of the Ñuu Savi ethnic community, protected by the principle of recognition of their indigenous rights, uses and customs established in Article 4 of the Political Constitution of the United Mexican States. The sociocultural and technological factors identified in the ethnic identity of the study group define the strategic circles for the strengthening and development of their quality of life.

Why consider a palm plant for illustrating the model (**Figure 5**)? Because it is part of its natural context, the royal palm is a plant that the Ñuu Savi people have considered as a symbol of the Mixtec culture. The leaves of the palm are the raw material for the Mixtec artisans, with which they make products like hats, clothes, flowers, bags, among other items, that are marketed to obtain an economic benefit. In addition, palm is a plant that generates a sense of belonging and identity among the minority group of this study.

6.1. Description of the MODIEM model

In the study group, the main variables in the identification of ethnic social structure are migration, culture, schooling and poverty, as can be seen in the base of the stem of the royal palm (**Figure 5**). Also, each of the variables shows the factors that impact on their development and

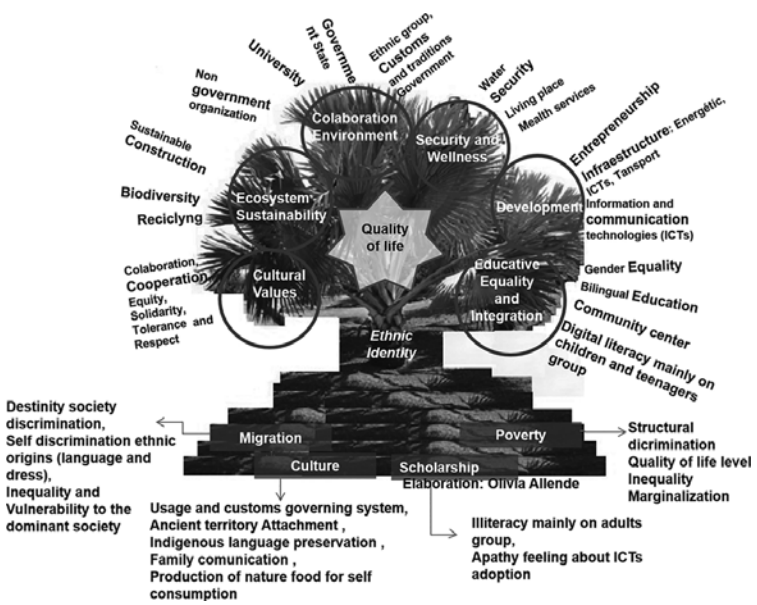

Figure 5. Model palm tree for the development and inclusion of ethnic minorities.

quality of life, as mentioned earlier. Although these factors are not exclusive to an ethnic minority group, in this study they were a constant in the diagnosis of the 11 communities studied: El Molino, San Francisco el Chico, San Francisco Yosucuta, San Jerónimo Silacayoapilla, San Pedro and San Pablo Tequixtepec, Santa Maria Camotlan, Santa Maria Chachoapam, Santa Rosa, Santos Reyes Yucuna, Saucitlan de Morelos, and Villa de Tamazulapan del Progreso.

The crown of leaves that forms the top of the palm is composed of branches representing six circles in red: inclusion and educational equity, development, safety and well-being, collaboration environment, ecosystem sustainability, and cultural values. The circles represent the strategic dimensions that have been identified as priorities for fostering actions that reduce the digital divide and promote social inclusion. Thus, for each dimension, there are a number of influential factors in the process. The following describes the dimensional circles that concentrate the relevant factors in the context sociocultural of the Nuu Savi people.

6.1.1. Dimension of the circle: inclusion and educational equity

Inclusion and educational equity has been considered as a strategic development circle because it contemplates factors that provide opportunities for all the people of a community to develop their potential, regardless of gender, age, or any other sociocultural condition. Sen [26, pp. 297–298] stresses that "development is, in fact, a transcendental commitment to the possibilities of freedom." And that "freedom is inherently a diverse concept, involving considerations related to processes, as well as considerations related to opportunities." As a consequence, the actions taken by the Federal and State governments in relation to the social development objectives include the strengthening of the education sector, deepening of human rights, democracy, and gender equity. Therefore, in this dimension, the following factors were identified: gender equity, bilingual education, community learning center (digital village), and digital literacy preponderant in children and adolescents.

6.1.2. Dimension of the circle: development

Development requires the elimination of the main variables identified as weaknesses in the social structure of the Ñuu Savi people (see **Figure 5**), such as illiteracy, migration due to the scarcity of economic opportunities, the limitation of public services and the poverty they entail to the deprivation of liberty, necessary to satisfy the needs of the human beings. In this regard, Sen [26, pp. 282–292] states that the development can be conceived like "a process of expansion of the real freedoms that enjoy the individuals." Sen still says: "Focusing on human freedoms contrasts with stricter development visions, such as their identification with the growth of gross national product, with increasing personal incomes, industrialization, technological advances, or with the social modernization." Sen further states, "Development has to do more to improve the life we live and the freedoms we enjoy." Likewise, according to Gimeno and Monreal [27, p. 5], "development is a product of the imagination of each other, an imagination that is always the result of a social, cultural and material history. To consider development as a social and historical construction is to recognize that it is a contingent product and, therefore, can be modified."

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The strategic dimension of the development circle presented here is part of the expansion process of freedom raised by Sen [26] and of the sociocultural foundation expressed by Gimeno and Monreal [27]. Therefore, development and quality of life are conceptualized from within the ethnic group; that is to say, taking the liberty that the government entails of its uses and customs, its values, beliefs, and symbols that give meaning to the daily life of the Ñuu Savi people. It has already been shown that among the members of the Ñuu Savi people, there coexist principles of fraternity, cooperation, and collaboration that are socially cohesive for the economic and sociocultural growth of the people, through collective and community projects that are implemented in the ethnic community. These projects are mainly aimed at economic development, social and human development, basic social infrastructure, human rights, cultural development, technological communication networks, and environmental protection. According to the interviews conducted with the municipal presidents and with the data provided by the National Commission for the Development of Indigenous Peoples, the main dependencies and associated programs, contributing to the development process that impacts on the quality of life of the Mixtec people are SAGARPA (projects for the development of the agricultural field), SEDESOL (social development programs), SEP (scholarships for education), CDI (production projects), CEVI and SINFRA (housing projects), and health sector (medical consultation and food supplements). It should be mentioned that in addition to the aforementioned units and government programs, by linking the Technological University of the Mixteca through the Division of Promotion to Development, the State has implemented programs to support communities in the Mixteca Region. The main objective is to provide technical assistance and training in the different productive areas for the human, economic, and cultural development of the social sectors of the region. With the formation of interdisciplinary working groups, where teachers and students participate, projects for the development of communities have been undertaken. In some cases, financial support has also been received, mainly from calls issued by the Federal and State governments. In general, these resources have been applied to the training of women, men, and children involved in entrepreneurship, such as backyard orchards, nurseries, design and creation of handicrafts, metal management through blacksmithing techniques, courses for improvement and human development, among others. Although the immediate impact is on adults, it also helps to create an entrepreneurial and regional belonging mentality in children and young people, in order to reduce migration rates.

6.1.3. Dimension: safety and well-being

This strategic dimension arises from the point of view where safety is the state of well-being that the human being perceives and enjoys. Consequently, the most relevant factors are health and well-being, which for this study have been considered health services, water, and housing. Generally, the communities have a health clinic installed in the municipal head of the localities, which only provides service from Monday to Friday. To reduce this fact, the Federal and State governments have implemented vaccination, health and nutrition programs and campaigns. Due to the insufficient drinking water that the Mixteca Region suffers to cover the needs of the population, especially in the months of February to May, rainwater

harvesting systems have been implemented for human consumption, through construction of cisterns made of ferrocement or acquired through the support of a social program. The cisterns are stocked with rainwater captured through the laminated ceilings of houses in the months of June to October. Each family unit is responsible for ensuring that the tank is hygienically clean, the water is free of impurities and chlorinated, which does not penetrate the air or light, as well as the stored water is aerated, to prevent it from generating a bad odor or extraneous agents. This strategy, undertaken by the National Water Commission, has been successful due to the commitment and active participation of its municipal agents and the Tequios carried out by the members of the community. As for the housing factor, communities in extreme poverty have been favored with the support that the Federal Government has given for the construction of standard and affordable housing in the communities. The program envisages sustainable construction model involving water and electricity services, education for the treatment of solid waste, as well as recycling and care for biodiversity.

6.1.4. Dimension: Tequio (collaboration and cooperation)

The Tequio is one of the principles of the Ñuu Savi culture and is present in all dimensional circles of the MODIEM model, through the collaboration and cooperation of the Mixtec. Efforts by governmental agencies and non-profit non-governmental organizations (NGOs) would not be successful without the community-made Tequios that facilitate actions and tasks to achieve goals. That is, there is an added value that the community gives to the development and inclusion, which involves voluntary non-profit work, only the satisfaction of having contributed to public works, to social welfare. Likewise, the convergence in the commitment made by the members of the groups guarantees the equality to eliminate the inequalities. The effort and the active participation of the Mixtecos and all the actors involved who provide public goods and services to the communities allow teamwork for community development and a better quality of life.

6.1.5. Dimension: ecosystem sustainability

The biological and cultural biodiversity of the Mixteca Region is an ancestral heritage for present and future generations. At present, municipal governments have given importance to the strategic circle of ecosystem sustainability; it has begun to raise awareness in the ethnic communities about the benefits of maintaining a balance between species and the environment. This is why the population is sensitized, informed, and educated through environmental education. Programs and actions have been implemented, for example, recycling techniques for materials such as paper, books, plastic bottles, among others. Techniques for the elaboration of composts such as organic fertilizers, "biodigestor baths," "ecological stoves," and "packing of materials for housing" include material for the construction of housing with thermal and ecological characteristics. In the last three years, 506 homes have been built in 14 municipalities in the state. Fifty-five percent of the study communities have benefited from these programs, impacting their quality of life.

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6.1.6. Dimension cultural values

The main cultural values that strengthen their social development are collaboration, cooperation, equity, solidarity, tolerance, and respect present in their government of uses and customs. In the Ñuu Savi culture, value emerges from coexistence with the members of the community and its context; it is a social consequence that forges its identity. Principles such as the Guelaguetza, which alludes to an attitude with which one is born and grows, is a feeling through which the ethnic brother is accepted and esteemed, feeling of kinship, of brotherhood. Their values are forged and cultivated today; however, these can change due to the effect of time and space, and the Mixtec people wisely recognize the positive impact these values bring to the community. The solidarity and mutual help they keep among themselves are feelings that reflect when receiving the economic supports and that is distributed in an equitable way among the members of the community.

7. Conclusion

This study has corroborated the active participation of the Federal Government of Mexico in reducing the digital divide and social exclusion by promoting the use and application of ICTs in education, health, security, and the fight against poverty. Among other aspects, as mentioned, this has been raised through various programs and projects set out in the digital agenda. However, the way national strategies have been developed so far has emphasized three aspects: (1) the installation of infrastructure through the Community Learning Centers installed in the municipal head offices, (2) training Instrumental to the beneficiaries on the use of technological tools; however, a staff turnover is observed due to the migration factor, which brings with it the absence of qualified personnel to coordinate the CLC, and (3) the impulse to the generation of contents considered socially useful (generally from governmental agencies, institutions, and agencies that promote social security and public education welfare). The lack of public mechanisms for sustained monitoring and submission of complementary assistance to ethnic groups by all involved (Federal, State, and Municipal Government) has limited the access of members of ethnic communities to the use of ICT.

However, as the use of technological devices modifies the behavior of the ethnic group, this change is observed with greater effect in the Mixtecos children and adolescents through their migratory stays and their coexistence with the dominant societies of the surroundings of the big cities. Skills, attitudes, and knowledge, which transform their sociocultural state of origin, affect their way of thinking, doing, living together, feeling, and expressing themselves. For this reason, it can be inferred that the ethnic group is in a conjunctural process of sociocultural transformations where the Mixtecos give a special meaning to the technology of information and communication for their family and communal context. Therefore, it is visualized that in a medium term the new generations of Mixtecos adopt technology to promote their skills and knowledge through the use of digital devices, gradually contributing to narrowing the digital divide and social exclusion.

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Chapter 2

The Indigenous School: A Space of Ruptures and Tensions within Local Culture

Germán Alejandro García Lara and Oscar Cruz Pérez

Additional information is available at the end of the chapter

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Abstract

The study analyzes tensions and ruptures within indigenous community practices, school devices, and subjectivities that are built among their actors, based on the significance of their experience as educational agents in the school environment. The work is interpretive, carried out through interviews applied to students, teachers, and school principals of two schools in San Andrés Larráinzar, in Chiapas, Mexico. The information obtained was analyzed through the understanding of the records, their integration into categories, delimitation, and interpretation. The results include six thematic content units: space and context; expression and resistance, dynamics of the culture; disruption of culture order; students outside the norm: alcohol, graffiti, and pornography; courtship and its reconfiguration; and school supports, peer tutoring, and teacher criticism, in which the realization of the school formation process becomes a complex phenomenon, full of tension and conflict between the demands of the school institution and the local culture.

Keywords: indigenous school, local culture, language

1. Introduction

Human activity is developed predominantly based on the pedagogical action, whose discourse is closely related to education promoted at home that prepares men to be part of a political community and the one referred to by the culture in which they grow to form a home [1]. Thus, every educational system educates from the social ethos, but it relies on institutions such as the school for the formation of the whole man.

The school has been the driving force behind this pedagogical system, which has its presence in different social formations [2], which has become naturalized as the founding element of education in modern enterprise, with a hegemonic presence in all societies, whose practices are not free from tensions, conflicts, and purposes not initially considered [3].

The school is proposed as the essential instrument for the establishment of the modern national state [4], a symbol of progress [5], a space that allows a career open to talent, merit, and social mobility, but also as a representative of an educational system that regulates and normalizes the actions and desires of the subjects through specific devices of discipline, the formation of curricula, universal and uniform practices, ordering, and decontextualization of academic content [5].

The fact that the school constitutes the axis of the formation of man derives from its connection to other processes such as socialization, education in a broad sense, and literacy itself, as well as its hegemonic presence in all societies. All this sums up a modern vision of education, which includes the inculcation of the dominant social and market values through a unique reference of knowledge, which is science and technology.

Such imposition is legitimized in an environment of socio-political-economic globalization, a condition that sets out from the school to be a free and equal access for individuals into cultural objects, an illusion that results lacerating in the subjective student conformation. However, the school has maintained a vertiginous success, standing as an instrument of self-realization of the individual, of social progress, and of economic prosperity, aspect severely questioned from studies that discard such achievements, pointing out their disarticulation to other spheres such as labor and socioeconomics [3].

Having become naturalized, by living others' speeches as one's own, it is clear that this will awaken in students' and parents' expectations of social mobility, economic improvement, and even other work possibilities than those commonly planned for a social group. In an indigenous community, this is linked with the desire to continue studying and thereby transforming their present condition of life, through the appropriation of the word and hegemonic discourses of the dominant culture. In an indigenous community, this mates with the desire to continue studying and thereby transforming their present condition of life, through the appropriation of the word and discourses of the hegemonic or dominant culture.

The proposed education for indigenous communities has been the way in which historically the development of a national identity has been promoted, and an attempt that has been made to "Mexicanise" these peoples [6]. In this context, a curricular proposal has been developed for indigenous schools in which the tensions that emerge from the relations between local and western culture, from the subaltern and hegemonic, as well as from the indigenous and mestizo worldview, are replaced by "A new imaginary utopian, national and intercultural (…), which assumes equality, respect and coexistence in diversity without conflict [7]."

Indigenous schools develop a curriculum that favors contents that correspond to the dominant culture. In this process of "colonization of knowledge" [8], knowledge alien to the local culture is legitimized, which causes tensions, and conflicts with respect to one's own and others.

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Negation of the culture of the indigenous subject in the school processes leaves aside the daily life of a family, his previous learning, and all those elements that give him meaning. Family life is the space in which the identity of the child is formed, through which he enters and becomes part of the community, through observation and participation in work, religious tasks, preparation of festive activities or community life such as assemblies; when he counters this experience, tensions, and ruptures are established between the forms of interaction and knowledge developed in the school and the culture of the community itself. Another area of concealment of culture is the banning of the use of the mother tongue, which does not appear in didactic interactions with teachers or because it even encourages students' castellanization (using Spanish as a second language).

All these actions are narrowed in school practices that can be combined in rituals of instruction, revitalization, or events that seek to exalt the commitment and forms of work in accordance with what is expected for the community and nation: rituals of intensification, which direct relationships and belonging to the group, and resistance rituals, which counterpose the legislation and ways of proceeding assumed by the school for the development of academic work [9].

Rituals express myths of the culture, which are usually performed in the community by members with authority, and in the school, by principals, teachers, and the parents' representative, are constituted in everyday, hegemonic and functional practices of the relationships that imply the exercise of authority, and belonging to the group. Therefore, the closer approach to their actions, language, and resources, the greater internalization of the institutional; in addition, they mediate much of the daily activity in the school practices of the different educational agents.

School practices are explained as the framework of experiences that take place in the classroom and school, in which "the objective reality is internalized by the actors, but at the same time it is shaped and shaped according to a variety of possible options, According to the individual and collective practices and knowledge that mediate reception [10]." In this social space merge different actions in which the participation or not of other agents of the community configures a way to develop school tasks, closer or not to the local environment. In this way, there is a dialectic of school practice, conceived as problematic acts [11], a diverse and contradictory scenario, of institutional demands promoted by the school and those formed from the culture.

The relations between agents with unequal power related to each other lead to processes of continuous confrontation in a relationship of domination-subordination [10]. In this process, the teacher embodies the role of a cultural and political mediator, in which family and local culture are opposed to the school, whose hegemonic representation tends to deny or appropriate their presence and manifestations. However, pupils and parents and even teachers themselves because of their own original condition (indigenous, peasant, or worker) rest importance or oppose to such hegemony in daily work, as well as transgressing school or social rules [10].

Educational practice operates as a dynamic force for continuity and social change [12], which is constructed historically and politically through the meanings of action, available

not only subjectively but also by the interpretation others make of it, which makes possible a critical form of reasoning, which enables a reflexive process, of participation, of relationship with the other, of encounter, and of present dialogue through the recognition of the other, which denotes openness to the community. If such recognition is omitted in school practice, the practice develops from a hegemonic perspective, denying the conflict itself of such contradiction.

In this context, the present work describes the tensions, ruptures, and resistances that are presented between the indigenous community practices, school devices, and subjectivities that construct their actors.

2. Methodological approach

During the course of the school in an indigenous community is problematized through the interstice and encounter between the educational agents of an indigenous community with the school device, in its social and historical development.

From this position, this study is carried out with a qualitative approach, which has as its main source natural situations, their spatio-temporal and contextual references, of particular relevance for the approach of social relations and experiences of the subjects in certain environments, considering that "local, temporal and situational (…) limited narratives are now required from the expressions and activities of people in their local contexts" [13].

In this perspective, what is attempted is to give an account of how subjects "construct the world around them, what they do or what happens to them in terms that are meaningful and offer a full understanding of wealth" [14].

The study is made from critical hermeneutics, a position characterized as the valuation of meanings in light of historical conditions, in order to clarify the conditions under which the understanding of reality may have occurred, a situation that should lead to an emancipatory action/practice [15].

Such an interpretive approach tries to approximate the meaning and sense that the concrete subjects have in their condition of being schooled.

2.1. Techniques and instruments

The techniques allude to specific and particular action procedures for compiling information related to the research method used. In this case, the compilation of information was made from non-participant observation, individual and group interviews, and the analysis of students' narratives about their experience in school.

Observation is the process of rapprochement with the object of study, which allows having a vision of the context, its development, and the events that happen. Observation is a systematic description of incidents, events, and behaviors in the social scene studied [16]. Observation is useful to researchers in a variety of ways, as they provide methods for revising nonverbal

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expressions of feelings, determining who interacts with whom, allowing participants to understand how participants communicate with each other, and verifying how much time is being spent on particular activities [17].

In order to do this, the field journal was one of the instruments used, through the registration of all relevant information for the investigation, the recording of topics, people, impressions, comments, and other significant events.

In this description throughout the observation process, we were part of the study group, to the point that the members included us in some of the activities performed.

In addition to the observation, the interview was used, which is "the most usual form of face-to-face verbal exchange" [18], one of its forms of application is the unstructured interview, which "attempts to understand the complex behavior of the members of a society without imposing any prior categorization that may limit the field of investigation" [18]. Besides, the interview is inevitably related to the context, historical and political elements, a situation that rejects any hint of neutrality; therefore, it can be used for or against participants or groups that are interviewed.

2.2. The research context

Mexico is a multicultural country with diverse ethnic groups. The most populated area of these groups is the southeastern part of the country, especially the state of Chiapas. There is the municipality of San Andrés Larráinzar, whose inhabitants belong to the cultural and Tsotsil linguistic ethnic group, which, in turn, is part of the Mayan groups.

The research work was carried out in the municipal seat of the municipality of San Andrés Larráinzar, which has the same name, located in the Tsotsil Tseltal economic Altos region. It is 28 km from the city of San Cristobal Las Casas and 90 km from the state capital.

According to the Secretariat of Social Development [19], in 2010 the municipality had 20,349 inhabitants, 15,271 speak the native language, more than 60% are bilingual (Tsotsil/Spanish). The inhabitants of the community are mainly engaged in agricultural activities of maize and coffee, breeding sheep and domestic animals, with a production of self-supply.

A total of 98.69% of the population is indigenous, and 83.97% of the population speak an indigenous language. A total of 22.67% of the population speak an indigenous language and does not speak Spanish. In San Andrés Larráinzar, there are 786 housing units. Of these, 96.74% have electricity, 85% have piped water, 98.26% have sanitary facilities; 43.91% radio, 49.78% television, 12.61% refrigerator, 6.09% washing machine, 9.35% automobile, 3.91% personal computer, 12.61% telephone Fixed, 31.96% cell phone, and 1.52% Internet [20].

A total of 12.90% of the population is illiterate (7.63% of men and 17.93% of women) [21]. The level of schooling is 6.18 (7.16 for men and 5.22 for women). According to the State Secretariat of Education [22], at the end of the 2007–2008 school year, the number of pupils at the primary level was 4584, at secondary level 909, and at high school level 360; it is clear that as the academic level increases the student population decreases. In this sense, it is important to give an account of the psychosocial problems of adolescents attending

basic education and higher education, secondary and high school[1] in the community. In the school year (2011–2012), there was a population of 594 secondary school students and 369 high school students, who constitute the study population. In the educational field, the coverage from primary to secondary, from this level to high school and from college to university is decreasing.

Within the community, there are cell phone shops and the main antenna of one of these companies, various commercial stores, including clothing, music records, groceries or bakeries, pharmacies, inexpensive dinners, and beer stores. House structures are made of concrete, wood, adobe, or lamina. Clothing is different between men and women, some men no longer use typical clothes while women still use it. Some institutions are the Integral Family Development office and a health clinic. At the entrance of the community there is a military detachment unit. There is a difference between traditional and municipal authorities.

This municipality had a prominent role during the movement of 1994 in which the Zapatista army uprising happened, because this was the municipal seat where the agreements of San Andrés were signed, an agreement made between the Mexican Government and the Zapatista Army of National Liberation (EZLN) to end the war.

2.3. Participants

This study was carried out before informed consent with the secondary school and high school students from San Andrés Larráinzar, Chiapas, who live in different municipalities in the area, many of which live in places and rancherías (a group of ranches) of these municipalities, the reason why they have to move to school every day on foot or by public transportation, from 1 to 2 h. Likewise, interviews with parents, teachers, and schools managers were carried out.

Access to school space was done on a number of occasions, once a week for just over a year and a half. In this process, our presence was becoming less new and more ordinary for the school staff and the students themselves. Another important aspect of this process was the attempt to approach and understand the language and culture of the participants. The fact that one of the members of the working group was originally from the same community, with knowledge of the mother tongue, made it possible for the significance of the facts, comments, and interpretations not to lead to misunderstandings.

The presentation was made in front of the participants, it was like teachers who wanted to learn about the school life of the students and teachers of the schools we visited; the frequency of our presence in different spaces of the school allowed us to have more confidence from our interlocutors, and gradually a greater understanding of their situation and the way they see the world.

[1]The educational system in Mexico considers as basic education: preschool, which begins at age 3 and lasts 3 years; primary school, which begins after preschool and lasts 6 years; secondary level, which takes place after primary and lasts 3 years. Higher education comprises different kinds of high school or preparatory courses, it generally lasts 3 years and starts after high school, after high school one can start a higher level, in universities, and institutes.

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Informants were approached among those who were during school breaks, waiting for the development of physical education activities, in the school cafeteria, or library. Some agreed more willingly to dialogue with us, others showed some caution, but there were always some who showed willingness to chat with us.

During the process, it was important to have field notes taken each time the schools were visited, some of which were recorded immediately after the observations or interviews were carried out, and the analysis of these working notes was subsequently carried out.

2.4. Information analysis

The analysis of the information was performed through the extensive understanding of records, unit extraction, category development, its delimitation, and interpretation [23]. The information analysis technique was applied [23], which consists of selecting or extracting units of text, which are coded by codes developed by researchers. Afterwards, the data are analyzed simultaneously to develop concepts.

This application involves a comparison of subcategories or first categories, which arise along a study in successive time frames or contexts.

This procedure is developed in four stages: the first involves understanding of the data; the second involves an integration of each category with its properties; the third requires delimiting the findings; and the fourth operates on the analysis and interpretation of the information obtained, after a process of relation, comparison, and reduction of the units belonging to each category.

The study is carried out with strict adherence to ethical standards such as the informed consent of the participants, respect for the privacy of the informants, and protection against damages.

3. Results

The analysis of the information obtained from multiple encounters with students, teachers, and school administrators allowed, through a continuous process of analogy, contrast and delimitation, the construction of six large categorical content units. The first of them, space and context, abounds in the characteristics and school dynamics, which allows to have a more comprehensible vision on the sense that is given to the school from its different actors; the second: expression and resistance, the dynamics of culture, shares the significance and change that is manifested around the use of traditional clothing, language, and identity of the subjects, regarding the demands of wearing uniform in civic activities and using Spanish in the process of education; the third was named disruption of the culture order, it exposes conflicts and tensions that arise with respect to the narrowing of the relation between men and women promoted by the school and the difference and distance that the local culture establishes in this sense; the fourth was students outside the norm: alcohol, graffiti, and pornography, presents the rupture that students assume regarding the rules of the school itself, but also the model of community life, which finally show what is tried to hide or deny, the tensions around the education and training received by adults; the fifth content unit: courtship and its reconfiguration,

expresses one of the nodal aspects that specify the rupture between school provisions, which promotes interaction and communication between peers, within the school and that continuous outside of it; and local culture, in which such interaction is a foundational expression of marriage; and, the content unit: school supports. Peer tutoring and teacher criticism expose the way teachers and students try to approach school content, but also representations underlying the process of students' castellanization (using Spanish as a second language). The units of analysis retrieved from the records are now analyzed in detail, which give account of aspects related to each of the mentioned content units, as well as their interpretation.

3.1. Space and context

The schools in which the study was carried out are the Technical Secondary School No. 57 (EST. 57) and the Colegio de Bachilleres de Chiapas (COBACH), which is a state high school, campus 60. The former, with 35 years of foundation, currently has 18 groups; it is the oldest and the largest of the region at this level. Students attend this school from different places and adjoining localities. It is a school of complete organization, with teaching staff that presents high labor mobility, situation that limits the development of programs or strategies of didactic work in the mid- and long-term; only one of them has his residence in the community and none masters students' mother tongue. The educational practice is developed in Spanish, Tsotsil is used in informal spaces of the school (corridors, sports areas, and meetings outside the classroom); it is a marginal language in the curricular educational process, it is not promoted as an element of learning. English is part of the curriculum and is one of the subjects that the student must take and approve. From their students, approximately 65% of them receive daily food support and more than 50% have some type of complementary economic scholarship.

The COBACH, campus 60, has 369 students distributed in 10 groups [24], it is one of the high schools recognized by the High School National System, which assesses the quality of schools according to the guideline pointed out in the Comprehensive Reform of Higher Education (RIEMS) and certifies those who meet the requirements, as evidence of their management processes and in particular the teaching-learning process. In this campus, about 80% of its students receive some kind of scholarship support.

In the secondary school, teachers live in other communities, and only the principal of the campus masters the native language, a situation that enables interaction and communication with students and parents. The process of schooling in basic education is considered important for parents; however, this is limited to primary education and preferentially to men. Therefore, those who study middle and high school can be considered privileged, due to the small number of students who complete higher education. For this reason, scholarship supports play a fundamental role in the students' stay at this school level.

Having scholarships, conditions the students' attendance, since many of them only attend for this incentive

> *… there are families that only send their children to receive this financial support, or the student does not come for self-interest, he only comes because parents themselves ask them to obtain that financial benefit. (COBACH principal)*

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Access and permanence to secondary and high school is related not only to the competences and learning developed by students but also by the exclusive use of Spanish in the school work, their second language, whose understanding is limited, as well as the precarious economic conditions of the students and their families, a situation that forces them to commute up to 2 h on foot to get to the school or a limited and nutritious diet. About this, one of the students notes the following:

> *…sometimes the father and the mother work one day and the others they do not, because there is no work!, there are also students who live too far and because of the ticket price they cannot come!, or because they have to buy school supplies ! The sum of these factors, makes a bigger expense for the family. (Francisco, EST student)*

Another student points out:

> *… I know that I won't be able to continue studying – beyond high school, so why should I make an effort? (Juan Carlos, COBACH student)*

For most students, this will be the pinnacle of their education; after that, it only remains to work and make a life as a marital couple.

The principal of COBACH campus 60 notes:

> *…society, the culture of the natives did not conceive school to be important. Perhaps elementary and middle school feels as an obligation for their children, because in high school with young people who are 17, 16 or 15 years, parents do not have to look after them; however, we have tried to make them see during parents' meetings that their effort is worthwhile and we have seen the participation of the parents! We have changed that mentality! The school has a good image and some of its graduates are teachers, professionals that help! In addition, in the ENLACE[2] test we are above the national average, 15 or 20 percent.*

In San Andrés schools, you can find wide corridors and walkers that look like mazes that meander the school buildings. Between classes, classrooms are filled with students who go from one classroom to another, where they will receive the next class or during the 10 min between classes. Classrooms, administrative areas, and laboratories are connected to each other through wide open air corridors; you can find pine trees, gardens with green leaves, and flowers that define the landscape of the school. Taquerias (taco-stand) and tricycles with people selling tamales, soft drinks, and rice with milk and coffee invade the school during the break time. Outdoor chairs and tables are covered by the shade of trees or by galvanized sheets. The structure of the school, its wide corridors, the shade of the trees, and the aroma of the environment invite people to walk, to accompany, and to talk among students. This place provides an opportunity for the match among peers.

In this school landscape, teachers and managers emphasize the academic, artistic, and cultural achievements of their students. At the same time, an aspect repeatedly mentioned by students and teachers, it is the care of the image and conditions of school facilities whose organization and order are carried out through campaigns and teams.

[2]In Mexico, the ENLACE test is applied in Higher Education to determine the extent to which young people are able to put into practice, in real-world situations, the basic disciplinary competences in the fields of Communication (reading comprehension) and Mathematics acquired throughout their academic career (Secretary of Public Education).

Some teachers of COBACH consider these aspects as high priority, they note:

> *… boys have contributed to keep the bathroom clean!, the classrooms clean! We go to other campuses and the classrooms are dirty!, the chairs are painted! The walls are painted! (Professor Edith, COBACH)*

> *…Everyone think it is pretty! (The school), we have an image as a school that not only us have seen, but those who come from outside. As a school we have distinguished in many cultural, sports and civic activities, that also make it beautiful!, Apart from the infrastructure, some have stood out academically, in dances, people from outside have come to visit us, from other schools and they have admired the cleanliness!, the green areas!, due to the kind of students and values! (Professor José, COBACH)*

> *When students arrive, they say: how nice the campus looks!, how clean! But it also has to do with the work of us as teachers, what we have done, the cleaning activities, which take place every two months, the good maintenance of green areas, the work in classrooms with students and encouraging the habit of placing everything in its place. Students have to learn to adapt, it is a radical change! Which they also give, it is different to change from secondary school to high school because they have other classrooms, subjects, and the infrastructure is different and changes all the work. (Professor Maria, COBACH)*

However, this is not the EST No. 57 situation, in which one of the students refers to the facilities:

> *… There is no water in the bathrooms, they are dirty, a change is required in the school, in order to have a better school. (Francisco, EST)*

Thus, while in COBACH the facilities and space are a symbol of pride; in EST No. 57, it is evident the insufficiency of the infrastructure and services offered.

3.2. Expression and resistance, the dynamics of culture

There is an idea of a school that arises not in terms of teaching contents but with an ideological component, which indicates ruptures regarding the conditions of the students:

> *Students are expected to change their way of thinking, so that they are not left behind! For that they have to learn what is taught in school. (Professor Enrique, EST)*

Customs are respected, but at the same time, forms of expression of other cultures are proposed.

In terms of communication, students speak Tsotsil, but teachers do not, so that Castellanization (using Spanish as a second language) is a process that is privileged, in areas of a greater labor and economic development for the future life in other communities.

Nobody has been denied of using his mother tongue, they try to speak more Spanish here in school and their mother tongue at home, their parents tell us:

> *My son at school speaks Spanish, here (at school) I do not care if he speaks my dialect because he already knows it, I want him to speak Spanish, so when he goes to the city he can understand. (Professor Candelario, EST)*

For teachers, recognition of the inherent difficulties of language mastery is maintained, although it is not appreciated as one of the aspects that should be considered for their improvement as teachers.

> *… We have communication difficulties with students, we have barriers, language is an obstacle, we have difficulties because we speak different languages. (Professor Irma, EST)*

This situation is also clearly recognized by the students, but their answer is to try to learn directly from the teacher, even with the consequent difficulty that it entails.

> *…during their participation they find it difficult to speak Spanish, sometimes they even stutter or speak slowly. (Francisco, EST student)*

> *… It is not well understood … sometimes they give an instruction and it is difficult to do it (Laura, COBACH student).*

We do not know how to say or write a word. (Guadalupe, COBACH student)

> *… Sometimes we do not understand some words, teachers only say them in Spanish; then we talk to them and we understand something, but sometimes the word is not clear. (Luis, COBACH student)*

This reality establishes an asymmetric relation between us (students) and the others (teachers), between the discourse of superiority of Spanish language against Tsotsil, a situation that perverts the pedagogical and social relations among the actors. Schools that deny the use of their students' mother tongue in their daily activities carry out a homicide of the indigenous language in their classrooms, a murder to language codes, and the word, because the language is not only an element of communication but also serves to name reality and to name ourselves, as well as being the way to understand other cultures [25].

Under these circumstances, it is not surprising that there are strong communication problems in the school, in understanding the curricular contents and in the learning process.

In interviews, students express emphatically that Spanish constitutes a barrier of communication that brings as consequence difficulties and problems in understanding the thematic content of the subjects. The seriousness of this situation is not only the impossibility of students accessing the contents of the official curriculum, but goes further; it does not only violate the individual, it annuls a whole group of what he/she represents, it eliminates a culture and a way of being and living in the world [26]. It is a slow and silent death, it leaves no traces to pursue, no guilty, tolerated, and encouraged.

Students' attire is another element that distinguishes them. Regarding school uniform, this has been an aspect that has been intended, especially in sports activities in which teachers persuade parents that their children, men and women, wear this clothing, but it not a requirement for attendance to school.

In the institutions addressed, there is a greater use of traditional attire in secondary school and a little less in high school. Two situations are closely related to this situation; on the one hand, in secondary school, parents have a much more active and close presence concerning decision-making, not so much in high school; on the other hand, the greater mastery of Spanish and with that the approach to the culture of the speakers of this language, as it happens with COBACH students, foster the desires of greater belonging to this culture, from the use of other types of clothing, musical interests, and use of digital media, to even avoid discrimination among their own peers.

In EST, the following happens:

> *… here at school there is no daily uniform or other for special dates, because the community has not allowed it!, many think that it is like coming to take away some of their identity, they do not want their children to dress like cashlanes!.*[3] *More in women than in men !, they have typical clothes, but since it is extremely expensive, not everyone uses it, only the authorities of the community (…).Girls still keep the regional costume of the community, some come with jeans, blouses, which is also allowed, when they do not have physical education they can come as they want, only the days that have sport is when they wear the red uniform, pants and shorts so they can do the exercises on the school court. (Professor Yulibeth, EST)*

Similar comments are given in COBACH:

> *…there is no impediment in wearing traditional clothing, considering that parents have no possibilities, we have been flexible in wearing the uniform (…) except for Mondays and Fridays when they are asked to wear the shirt. (COBACH Principal)*

However, there is an imaginary position that suggests that in the school environment, the use of clothing other than everyday clothing is part of the school's enlightening work:

- Yes, they have brought their clothes and participate!, I do not exclude them because they bring their dress !, but if I approach them I say:
- next time if you can, bring trousers!, so you'll feel more comfortable and be able to participate

> *And if they do! It's how they feel, most of the girls bring the regional attire to school, meanwhile men are losing the tradition of bringing their blanket trousers. (Professor of Physical Education, COBACH)*

> *We ask them to wear the uniform, the T-shirt from Monday to Friday, women with blue skirt, most men wear blue jeans, from the social point of view, that is going through changes, we have the influence of television, we are in small cells, surrounded by fashions and different social behaviors, mass media, television magazines and all that is changing the identity here. (Professor Mario, COBACH)*

Teachers notice in other institutions or media a strong influence to change traditional elements such as clothing, but they hardly notice their own implicit and explicit interference in such changes. Principals and teachers are key elements of this transformation, because demands are pointed out in a space in which students attend most of the year, with adults whose authority is legitimized through the regulations and provisions that must be complied.

However, it must be said that the meanings that are presented regarding certain devices demanded by the school such as the use of uniform, are reasons to dispute, confluence, juxtaposition, or opposition, which is manifested in the appropriation or not of that device, which is managed in hegemony and subordination relations between the different educational agents involved, rejecting or assuming the provision or maintaining in this case forms of clothing legitimized by the community.

In some cases, this even culminates in rejecting the use of traditional clothing in events that can be considered as spectacle, since it has internalized a superfluous vision, external to its use, and not with the connotations that culture and community assign:

[3]Tsotsil word to name mixed race.

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There are occasions when we have events, and we want aides dressed with traditional clothing and they do not want to, they are asked to wear the typical blouse and jeans, now that they do not want to wear the skirt, the blouse, the belt, they themselves do not want it! Sometimes, when we have participated with the school band, students are asked to go with their traditional clothes and they have a hard time doing it, they themselves do not feel like doing it. Here we have tried to keep the culture in place, we have respected traditions or customs. (Professor of COBACH)

Nevertheless, there is a loss of tradition in the general population acknowledgment, especially in men, now that a few of them wear their traditional attire, while the use of women's pants is becoming more common.

A more pragmatic view of this situation is merged into the economic level:

> *Traditional attire is more expensive, and wearing cheaper clothing is more convenient for us, we can buy a lot more clothes instead of a suit. (Leticia, COBACH student)*

> *Handmade clothing rarely made by my mother, because it takes a long time to make it and she makes it only to sell it. (Guadalupe, COBACH student)*

In men, this situation is different:

> *…teens, it's not because they do not have the traditional attire, it's because they do not want to. (Leticia, COBACH student)*

> *They are embarrassed, it is good that they wear pants, but they should also wear suits. (María, COBACH student)*

Identity is one of the components that makes visible the tension between the local culture and the western culture, of someone's own and someone else's.

> *… sometimes they chose for fashions from other cities, when they leave for the migration to the United States, that causes them a little loss of their identity, sometimes they do not know how to behave, they behave in a way in front of us, like cashlanes; that is how they call us cashlanes, because we do not belong to their culture, to their indigenous area, but they, they sometimes do not know how to behave! They want to talk like cashlanes!, expressions like: what's up? How are you? Hi! What's up teacher?, but when they are not in the school they start talking in their native language. (Physical education professor, COBACH)*

The strengthening of cultural identity is not only aimed at preserving cultures but also to promote the unfolding of their potential, to allow the exercise of cultural rights, to establish fairer channels of dialogue and participation in decision making, and to avoid overwhelming processes of interaction between different cultures [27]. Attire is one of the elements that distinguish the community and consequently provide a cultural identity, is judged, valued, appreciated, or rejected by others, and even by its members, because as a dynamic process, it evolves by contact with other cultures.

In this process of appropriation and culture contrast, the student "reinvents his ethnicity, in order to adapt and respond to the changes and transformations of his environment (…) he turns the cultural reference points of indigenous modernity and tradition into malleable and dynamic identity attributes that enable the reinvention of their ethnicity and with it the political use of the cultural issues [10]."

Other behaviors and manifestations have become present among them. This refers to:

…There are many boys from Larráinzar who go to study in San Cristobal and bring another ideology, they come back with skateboards, they want to behave like city people, there is graffiti, when here in the community that is not allowed; this phenomena is happening as globalization increases, is the loss of their identity. (Professor of Physical Education, COBACH)

However, for many of them, their belonging to the group gives them a different meaning:

> *I think we should be proud of being indigenous (Laura, COBACH student, campus No. 60).*
>
> *I am still indigenous, even if I have a career I will not change that. (María, COBACH student, campus No. 60)*

3.3. Disruption of culture order

Regarding the relationship between students, it is common in the community to differentiate between men and women in festive and religious activities, as well as in family and social interaction. From school, they are encouraged to approach among them. This is why we look for forming mixed work teams, which is gradually achieved. This condition challenges and stresses two worlds: the one at home, including the community and customs, and the one demanded by the school.

Behaviors of men and women are clearly differentiated among students, which is a reflection of what happens in the community itself. In the case of women, some of these behaviors are:

> *They are very submissive! Although they pay attention, they do their homework! Women are the ones who work the most. (José, hall supervisor of EST)*
>
> *In the classroom, many of the girls are completely reserved, unfortunately the culture has made them not shine as much as boys, it is cultural!, they grab their rebozo (a long flat garment) and cover their face, some, very few come with pants to the hip and very awake, but there are other girls who do not and that isolation, that shyness, causes them to speak less and learn less in Spanish. (Prof. Yulibeth, EST)*

In the classroom, especially in secondary school, the spatial differentiation among them is still evident:

> *…in the classrooms on the right or left side only men sit together and on the other side all the women sit together. (Prof. Yulibeth, EST)*

The following work with them tries to approach a reality shared with other female students and male students.

> *I do not try to seek equality among them, because it does not exist! We talk about equity but it is never achieved either!; so the girls listen more Spanish and try to join with their fellow men or work with women who have a different vision, dress or behave differently from them. (Prof. Guadalupe, EST)*

This situation does not occur in the same way with men, where their relation with aspects such as clothes or objects they possess are not considered as nodal for their interaction:

> *…They show their friendship more, they buy their soda, their sabrita (chips), and they all sit down to take it and to talk to everyone, whether there is one who is well dressed and neat or someone who is not. (Prof. Yulibeth, EST)*

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It has even been promoted tasks assigned socially to men and women who are resignificant in the school environment

> *We have tried to tell them that everyone can serve oneself or we all help to serve, boys can also serve themselves, women do not have to pass the food where the sir (male student) is seated, he can stand up and take it. They do it inside the classroom, but not at home, neither outside the classroom! (…), I've tried the same thing many times when cleaning the classroom, men should also grab their broom and sweep!, and grab their little flannel and clean! (Prof. Guadalupe, EST)*

Even so, the results are not as expected:

> *In most cases in the classroom, they accept each other, get to work and integrate into the group!, they go out, and during the school break in the court or somewhere else we see the same phenomenon again, men on one side, women on the other side!. In events like student's day that is celebrated on May 17th. they all receive the same snack, we try to look for a space where they can all interact together; however, we end up with a line of men waiting for their chicharrines (pork rinds) and all the women make line for their drinks, then all the women run to the other side to get tamales (Mexican minced-beef pie) and all the men go for their drinks. (Prof. Yulibeth, EST)*

Certain behaviors in the case of men such as aggression, harassment, and loyalty, are interpreted to reaffirm their masculine identity [28].

The interaction and changes that take place are a sign of the process of elaboration of their own with what is established by the school in its socializing function.

…Now, there is more physical contact among them!, more confidence!, I do not know, the mental opening they are bringing is greater !, profitable for us as teachers, but a little harmful for their culture(…), I have always managed activities in pairs, before it was man with man, woman with woman, not anymore, I say:

– Get in pairs!

If you do not get a man, work with a woman, and if carrying her is necessary, then it is done. Even a woman can carry a man. (Physical Education Teacher, COBACH)

> *There are small groups of boys and girls, unlike secondary school, here they begin to spend time together a little bit longer, among men and women. (Observation 2, COBACH)*

This greater interaction is evident for both men and women, one student comments:

…It is no longer like middle school where men were on one side and women on the other side, now we are all together !, mixed !, we talk and take more. (Ana Laura, COBACH student)

> *In my class from the beginning they are told: here you are no longer a man, or you are not less for being a woman!, then here we are equal !, both men and women can participate in team and coexist, a man is a little rough, that is understandable, but they have to coexist. (Professor Edith, COBACH)*

There is a fundamental condition of mandate in the figure of male that is tried to be emphasized when teams participate, in groups, in the use of spaces, which can be constitutive of interaction rituals in order to affirm social function and roles. In such circumstances, situations arise in which games are presented with punches, or violence, which seems to occur only in front of others, as a representation scene. Even then, different forms of behavior are observed in the relationship between men with men (beatings) and between women (offensive messages). These changes during interaction amalgamate this confluence of tensions

You can notice in some classrooms men are on one side and women are on the other side, women are subordinated to men! The man commands! (Professor of EST)

Machismo (male chauvinism) is presented all the time! Men are more aggressive with girls, they hit them, and they annoy them! Girls do not say anything, because practically they are taught, that they should not raise their voice to man. I tell them:

"Punch the boys, so they do not bother you!"

Girls start to defend themselves and boys start to respect them (Professor Enrique, EST)

…boys pull the girls' notebooks, they do not want to give them their notebooks, they do not let them walk around, they pull their hair, they throw them water, and girls do not say anything! They can take their food away and girls say nothing! (Joseph, hall supervisor of the EST)

Some female students and male students stand out:

Some men are very aggressive with women. (Gabriela, EST student)

Men are rude to women, they bother them or touch them. (Faust, EST student)

From teachers' perspective, some changes are relevant for students. Some elements are pointed out such as machismo and alcohol consumption, regardless of how it impacts or not the community itself, changes are set out from the worldview of the western world, from the authority that legitimates them socially from the school:

…..indigenous communities are governed by customs and traditions, then it is not so easy to eradicate these issues of machismo and drug addiction because it is very rooted!, because they enforce their traditions and customs!, it is not easy to remove or overcome them! It is a slow process that has to start at secondary level, in order to change their roles, to change part of their culture. (Professor Carlos, EST No. 57)

From the elements presented, there is an agreement with the idea that school experience is not exhausted by official programs or teaching, but it is in the dynamics between the official norms and the daily reality where the school life contextuality is created among concrete actors, norms, practices, and scenarios [29].

3.4. Students outside the norm: alcohol, graffiti, and pornography

Consumption of alcohol begins and its consumption is exacerbated with secondary school students, a situation that tends to decrease in the context of high school

Some of them escape from school and take the streets, in our group there are only three!, but in other groups there are many!, these three students bring sometimes drugs. We do nothing, because if we say something they threaten us! (Marcela, EST student)

When they are high, they do not know what they do, also we fear them because they come very aggressive. (Gabriela, student of the EST)

Consumption of alcohol is closely associated with aspects such as community traditions in which this consumption is presented in celebration of festivities

…there are students who, even though they have no family problems, they adopt bad habits!, but there are also students who drink alcohol, they spend a lot of time smoking marijuana!, that does not mean others do it; but when someone has a family or dating problem, they go out for drinks! (Francisco, EST student)

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> *…consumption of alcohol is closely linked to the culture, customs and traditions (…), they use it as an excuse arguing that it is part of the tradition, culture, even though rituals are not about getting drunk, it happens (…); it is not promoted by the culture to drink alcohol in excess though. (COBACH Principal)*

> *… in their culture alcohol is immersed, they are not even aware of it!, they cannot quit it !, there are few who do not drink, or their parents do not drink !, because in their culture, in each religious event alcohol has to be presented. (Professor of Physical Education, COBACH)*

This situation is aggravated by the lack of recreational spaces for young people

> *…There is no place in the community that serves as a distraction or healthy entertainment for a student or classmate, because of this situation many opt for alcohol consumption. (Juan Carlos, COBACH student)*

The consumption of substances is not only alcohol but also marijuana, inhalable and even cocaine. This situation occurs in both men and women, although this is predominantly performed by men

> *We drink with my girlfriends, sometimes when we drank they had something else, they had marijuana, the first time they gave me it I rejected it! From then I began accepting it, I did it to feel good for a while, to forget problems, to feel life! (Student of EST)*

> *That white powder I have also seen it here in school, some guys consume it; I have seen some of my classmates bringing it, or weed as they call it, they make it into a cigarette or smoke it outside, sometimes during school break time, they smoke somewhere hidden. (Diego, student of the EST)*

In addition, some students show parasocial behaviors such as wall graffiti, or fights due to jealousy situations when a man companies a girl who is supposed to be another man's date and girlfriend

> *…graffiti, belongs to small groups that imitate the behavior of another group of young people, all this pervades indigenous communities that previously did not present any of that.(COBACH Principal)*

Emphasis is placed on teachers, in aspects related to sexuality and alcohol consumption, whose behaviors are considered excessive, because students "see pornographic films and they even have clubs in which they watch these films," or alcohol consumption which forms part of the customs and traditions, it constitutes an impediment for its adequate development. In this imaginary position, it is denied thinking that like indigenous school children, students from other communities also consume pornography, "sex," that alcohol consumption is part of other rituals, in quinceañeras parties (sweet 15 birthday parties) or weddings. Facing these issues, school wants to avoid tension and does not know how the teacher feels without resources to face this situation, which occurs with regret and discomfort. The indigenous schooler is assumed to be a "pure" person, who, unlike others, consumes information that affects him and does not extend his understanding of life.

Some other expressions are a clear reflection of other cultural manifestations such as tattoos or musical interests.

A student in one of her arms, at the height of her wrist, had drawn a skull with black eyes. (Observation 1, COBACH)

When criticizing the work of the school, it is maintained that there is a tradition that conceives schools as places where children and young people are formed in the so-called school

knowledge and that it is a basic mistake to think of them only as a space for teaching, because, "beyond the virtual world of scholastic knowledge, there is a set of real events, which constitutes the daily experience of people and at the same time, serves as a field for scientific research. To this set of events we call it reality [30]." In the same sense, experience in school is not exhausted by official programs or teaching "the whole school experience participates in this dynamic between the official norms and everyday reality [29]." "This everyday reality is built on the contextuality of school life between concrete actors, norms, practices and scenarios [29]." The research experience in schools shows concrete situations that go beyond the school institution as a normative and learning space.

3.5. Courtship and its reconfiguration

For teachers, there is a strong tension between the inspiring factors of an open school to the expression of a more egalitarian relationship between men and women and the tradition that indicates a strong distance in the coexistence and differentiation in the behavior of men and women. In this regard, if two students are observed to talk and get along with some assiduity, this for some parents has the meaning of prelude to a marriage relationship, or the interest of their children to initiate sexual intercourse, even if only a fluent communication is maintained with means of friendship.

In the field of sexuality, the delay of reproductive, labor, and paternity life is proposed contrary to the customs of the community in which marital couples are formed at a very early age.

In non-indigenous society, dating is conceived as part of the family evolution and is conceptualized as a stage for interaction and have fun with the couple. Such component, however, is not appreciated in the relationships established in the community, for whom marriages are agreed upon by adults. In this sense, the perception of teachers and students about courtship is surrounded by contradictions that emanate from a greater openness to social interaction between peers, men and women and their social acceptance; nevertheless, the pressure of parents—increases in secondary school—confronts such openness and demands the distance between students, a situation that places teachers in an ambiguous position and provides a little definition due to the consequences that this could have toward them.

> *…here in San Andres courtship is forbidden by the culture!, if people see a boy and a girl together, what is done here by custom is that they have to get married! (…), sometimes if the boy does not want to, he is taken and put him into prison!, or he goes to court! (Francisco, EST students)*

> *If we get close to a girlfriend who is trustworthy and we talk, and her father or my father see us, they think something else, that we are a couple!, that we are going to get married! (Fausto, Student of the EST)*

Dating is also a topic whose conception changes during the schooling process, aspect that is noticeable in parents of undergraduate students, as well as the presence of other religious groups different from the traditional ones.

> *…Now you can have a relationship!, some parents give permission, it's not like before!, when a girl was seen talking to a boy, she was forced to marry him!, now they can decide! (…) My religion is not traditional, it is sabbatical and my family is not so attached to traditions. (Laura, COBACH student)*

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Last year we had Victor and Martina, a couple, parents knew about the situation and agreed on it, but we're talking they were children of bilingual teachers! (Professor Yulibeth, EST)

Even when that does not happen in this way, students themselves are generating new forms of interaction in assuming relationships with others:

My father never agreed with my current boyfriend, he always told me no!, maybe he never knew, I did not tell him!, Only my mother knew because she is the one I trust the most. When my dad found it out, he scolded and beat me! And from there even my mom told me she had problems with my dad. He thought … he was afraid of me doing bad things with my boyfriend, having sex:

– What if you get pregnant, that's all the boyfriend wants.

And that's what my dad did not want. (Guillermina, EST student)

…we already see life in another way, even if our parents do not let us, because we do it on the sly, we believe that times have changed, it is not how they lived, now it is not like this. (Leticia, COBACH student)

…there are those who have dropped out of school, either because they have no money to continue studying or because they live far away, in the case of girls, some because they have gotten married or pregnant. (COBACH student Eneyda)

This behavior is a sign of a different meaning of sexuality, which is associated with the affirmation of one's own identity and greater social legitimacy for women [28]. Likewise, maintaining a friendly relationship, chatting with a male, even with the impediment of adults and parents, constitutes values of change in communities where women have little access to resources, in such a way that it introduced a new way of reinventing ethnicity beyond school and community walls.

Pregnancy in students inevitably leads them to drop out of school.

….if they are caught together, they are forced to get married and cannot attend school, if they can, the parent who gets them married has no longer responsibilities with them, if it is difficult for the boys to come to school without their wife, then with wife and even with children it is more than enough reason to drop out of school. (COBACH Principal, campus No. 60)

These situations emerge facing events that are not part of the course of the school; they demand new actions and forms of action from their parents, who must deal with this, with different forms of parenting and communication.

What we have observed is that the relationships of couples among young people are reconfiguring over time and between generations, probably due to the relationships established with the non-indigenous world, since cultural groups are not explained and understood only from their attire, rites, traditions, or the so-called "cultural traits," but also in a permanent dynamic with the others. The identity of social groups is not built in seclusion but in constant communication with others. "Identity as culture, cannot be delimited, described or explained because, simply, it is impossible to define it. In any case what we call identity is articulated through processes of interactions, encounters, and if something is characterized by its multiplicity, its constant movement. Its constitution is heterogeneous, unfinished and changing [31]."

3.6. School support: peer tutoring and teacher criticism

One of the most recurring forms of support for students given the difficulties they manifest in understanding instructions or activities to be developed in class is peer support, whose mastery of Spanish and Tsotsil allows them to better understanding of school work. This aspect is extremely important, considering that in secondary groups only five or six of its members speak Spanish perfectly, who are used as monitors in teamwork to facilitate the development of activities; however, the difficulties involved in understanding the topics addressed are recognized.

> *If there is something they do not understand or do not get, if I have an idea of what they need then I support them, I guide them or give them an explanation! (…) Sometimes I explain in Spanish, it depends how they understand you better, either in Tsotsil or in Spanish. (Francisco, EST student)*

> *In the process of learning, the smartest - intelligent - joins with another, students look for him, what I try to do is for him to help me with those who do not understand me. (COBACH teacher)*

> *…I understand very little Tsotsil, but I can get help from the translators, in the classrooms there are children who are very skilled and I ask them what their classmates say and they translate it. (Professor Yulibeth, EST)*

In this process of mediation, the use of the language is submitted not to students but to the mastery or ignorance of the students' mother tongue from teachers, which is the reason why peer supports must be done in Spanish.

> *I explain in Spanish so that teachers can understand, because if I speak in Tsotsil, they will not understand what I said! -to classmates-, so in Spanish - teachers - will get the information and explain it themselves. (Francisco, student of the EST)*

The use of the dominant language is assumed as the means of formation, which is joined with an expectation from parents and teachers; this is an essential part of the school's mission, because of its promotion to the mastery of the use of Spanish among students.

This aspect of the course of the school increases a criticism of some teachers.

> *…In the case of a teacher, who works with the same book he gives us to transcribe-copy-to the notebook, it is quickly noted that he has no interest!; also he does not review the homework content, he just signs it!, he does not have a higher interest rather than the work!, what he counts is the number of signatures, if he complies or not!, if a student learned or did not learn it is not reflected! (Francisco, EST 57 student)*

In addition, among teachers themselves, the difficulties that some have to interact and maintain a respectful relationship of trust with the students are set out.

> *…there is a lot to do with the person who is in front of them, because I consider myself an open minded person, very open !, I can have their trust, I speak to them with great sincerity, with much respect !, they do it too, I receive the same rapport!, but I have seen that they do not behave this way with the reading teacher, math teacher, history teacher, I feel that there is a lot to do with the leading figure that is in front of them, the degree of trust they can perceive, if they can perceive that they trust you, they open up and express, they say everything!, if they do not trust you, they just say hi and that it is. (Professor of Physical Education, COBACH)*

Consequences of pedagogical practices in Spanish, like students, teachers recognize that it constitutes a communication barrier that implies the emergence of learning problems, because many young people repeatedly ask the meaning of a given word, sentence, or class instruction.

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However, teachers feel overwhelmed by the culture shock, the activities they propose as alternatives to attend the learning difficulties of students, install them in a circle with no exit, they carry out actions of individual accompaniment to overcome the conflictive situations that result from being in the school, they teach remedial courses on curricular contents that students find difficult, they manage an indigenous-Spanish language dictionary, they request the support of parents to help their children at home. In the classroom, they carry out a pedagogical strategy of peer support, where boys who have a "fluent Spanish" form work team with the ones who have greater difficulty in understanding, with the expectation that among peers it is possible to express doubts and overcome the problems of understanding the language; however, students' learning is maintained with very poor results.

The conception of teachers about the students' learning problems agrees with the criticisms made [32], when it is said that, it seems to be repeated or updated, the same conception from the colonizers of America, who considered natives, was inferior and incapable of being interrogated as civilization, because they were savages. These situations are naturalized and show a veiled form of racism [33].

Schools, in a way of guiding their work, communicating and demanding, disappear the differences with the other and place them as students with learning problems (tutorial work is done and courses to strengthen Spanish are given); therefore, the indigenous condition continues to be a "problem" to meet the school's goals. Teachers express concern about the limitation of language, with consequent learning difficulties, which culminates in many cases, with student's school dropout; however, the tasks undertaken are far from the claim of indigenous culture with all its benefits that can bring in its formative process.

4. As a closing remark

All research work is by no means finished task, it always opens new paths and horizons to ask and start new directions. We recognize that this humanity is increasingly complex and diverse, and it is confronted by social, cultural, political, economic, and educational discourses and practices. What we have presented is only an approach to the reality of the indigenous school in a limited territory of the state of Chiapas, Mexico; however, it provides some information about the concrete reality and opens new perspectives in the study of subjects in schools of indigenous communities. Educational institutions that were studied embody a dynamic and construct a particular experience among subjects that make it possible; they are living scenarios, spaces of ruptures and tensions between the "universal" schools with the local culture.

School practices that we have noticed are aimed at the construction of subjects that can be inserted or participate in a liberal society, one that strives for individualism, competition with others and unequal distribution of real resources and opportunities, considered as the only and the best. The homogeneous curricular proposal presented by the Ministry of Education for indigenous education, the material and symbolic deficiencies of communities and schools, and the lack of knowledge of teachers of local language for pedagogical practice make them converge in the same space regarding both the structural power and the micro-social power.

The activities analyzed transcend classrooms and define ways of being and living the school process. During the course of the school, there is a set of real situations and practices that constitute the daily experience of students as a product of local cultural characteristics and processes. Students of the indigenous community live in situations of tension between cultural products and practices, norms, demands, scientific and technological contents that the school offers. The school is a silent institution that promotes a civilization thought and sustained outside the local context. School daily life is a symbolic reality, which alternates the local configuration, students become protagonists, main characters, not with academic activities, but with other activities that do not belong to the strict order of the transmission of knowledge such as contests, festivities, and shows. In this role, the pupil also shows to his culture the products that are created in the school environment, where he exhibits his achievements and not failures. In all this, school daily experience is a different experience from what is offered by the culture. It is an experience that provides the opportunity for the emergence of another actor, which is the student's presence in the indigenous context. It only remains to think how much tolerances toward the acts that transgress local norms such as living with people of the opposite sex, engaging in gambling, using other attire, acquiring another language, even foreign language, and respecting national symbols, are products of faith's trust and community expectations.

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Chapter 3

Landscape of Resistance: The Fronts of Economic Expansion and the Xavante Indigenous People—Brazil

Renan A.S. de Oliveira and Luciene C. Risso

Additional information is available at the end of the chapter

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Abstract

This article has the objective of identifying and reflecting upon the sociocultural strategies that allowed the Xavante Indians, after centuries of cultural spoliation and territory expropriation, the development of different adaptive mechanisms that guaranteed their reproduction. Here, the attempt is to show that those sociocultural strategies and mechanisms were decisive in the maintenance of its territory, social cohesion, and relative cultural autonomy. Likewise, as a specific objective of this article, one intends to identify which of those cultural changes are perceived in the landscape, seeking a deeper comprehension of the appropriation mechanisms developed by those people in the interface with the Brazilian contemporary society. The proposed methodology to reach the said objectives has been built upon extensive multidisciplinary bibliographical surveys, interviews, and field observations that made feasible, among other things, a more refined construction of the Xavante historiography and a more precise understanding of the social organization variation of those people. Finally, it is proposed here to view the Xavante people as the main subject of their decisions, capable of offering resistance to the progress of capitalist expansion fronts upon their territory and, above all, capable of maintaining their sociocultural cohesion deciding on the course of their own development.

Keywords: American Indians, Xavante, landscape, territory, culture, resistance

1. Introduction

The history of the colonizer is not the same as that of the colonized. The history of the native Americans throughout the centuries has been told under the "foreigner" point of view, under the point of view of one who needed to justify and legitimate his presence and his possession. The colonized history version, however, has been attenuated whenever possible to the point where fair voices have become small whispers and then silenced.

To tell the history through the colonized is to echo voices that were trimmed or forgotten, means to renovate the knowledge about a history that has been well grounded throughout time, but could not crystallize all the possibilities or the circumstances of every historical fact. Giving voice to the Indians means reviving their ancestors, renewing the hope in the present time, and stimulating their future blossom.

This article tries to echo those voices and values the tenacity of native American people who, even in front of cultural spoliation and territorial expropriation, lived on with ability and courage. Even though each contact and indigenous integration process has been unequal, multifaced, and full of specificities in time and space, such voices will be here spread through the dissemination of the Xavante people's history, who even in face of wars, diseases, and genocides, was able to elaborate political strategies which allowed, among other things, the maintenance of their social cohesion and relative cultural autonomy.

The Xavante Indians name themselves *A'uwe*, which means "authentic people"; they are genuine inhabitants of the Cerrado biome, which comprises a huge territorial extension in the Central Brazil Plateau. Among the Xavante, the group that will lead this research is concentrated in the São Marcos Indigenous Land, a reserve fully located in the city of Barra do Garças, in the state of Mato Grosso, Brazil. Through historiography and analysis of the adapting mechanisms developed by that group throughout their contact with the national Brazilian society, the nature of native Americans' resistance to advancements of the national states and the capitalist system itself will be shown.

This article, however, aims to investigate which sociocultural and spatial changes (voluntary or not) contributed to the adaptation, and at the same time, resistance of the Xavante before the national society and the economic advancements over their cultural territory and resources.

2. The landscape and the Xavante

The landscape encompasses both material and immaterial dimensions. It is the result of social relationships and cultural symbolisms that are materialized and piled up in space throughout time. From the mediation between the Xavante culture and its relationship with the natural world, complex, cultural landscapes full of symbologies have shown up, which can be hardly explained or understood in their totality and essence with a look formed in another cultural, historical, social, and spatial context.

The so proposed research is clearly limited, mainly concerning the contextual position of the researcher in relation to the matter being researched. Here, there is not an attempt to attenuate neither the liability nor the insecurity regarding the presented data. However, surely, there is a conscience that the scientific analysis that is to follow "suffers" of partiality, non-neutrality, and westernization.

The approach to the Xavante culture in a context external to its reproduction, according to scientific methods and philosophical-ideological matrices may lend to the objectives of this

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research; however, stripped of any illusion, this article does not intend to explain the Xavante culture in its totality, mainly because to the Xavante society, any effort in that direction would be useless.

The researcher, being a result of time-space in which he lives has, for example, limitations of language that, inevitably, derived from ideological symbolisms and power relationships he was "exposed to" during his intellectual development process [1]. Thus, any analysis performed by the researcher in an environment exotic to his formation environment should, admittedly, be made without aspirations to neutrality and his observations should be conscious of his ideological, social, and historical partiality.

The interpretation of the Xavante landscape thus cannot be restricted to observations of materiality or empirical works, but should contemplate, before anything, the historical, spatial, social, cultural, and political processes subscribed in that landscape. The intended landscape idea here does not consider the materiality or the visible as an end, but as one of the possible means of seizure of the cultural processes engendered by the landscape.

The creation of material or nonmaterial symbols, according to an ideological social organization, together with the power relationships and even the individual passions, represents other possible means of cultural appropriation of the space, which allows for a broader conception of the landscape formation process [2].

The point that divides this analysis is precisely that of interpreting the Xavante landscape under an external optics of ideological capitalist matrix and, cosmologically, trying to understand the importance of maintaining the millenarian symbols of that culture for the contemporary society. The first effort of that research will, therefore, be to lecture about the capitalism role in the formation of the Xavante cultural landscape, identifying its main mechanisms of action and its expansion activities.

3. The capitalist expansion fronts and the formation of the current Xavante landscape

The capitalist system is extremely dynamic during certain periods and inevitably expandable. The stationary state of capital reproduction is logically incompatible with the perpetuation of the capitalist mode of production [3]. The accumulation need sets up a dynamic characteristic to capitalism, causing the space and time barriers to be unlimitedly overcome for the sake of capital reproduction and its surpluses. The addition of new areas, in that context, caters to a vital demand of the capitalist system because, in its essence, the colonization brings in new resource sources, inaugurates new markets with manpower reserves, and creates potential consumers.

In that sense, larger profits mean growth in the capital mass that aims for cost-effective implementation and the trend for overaccumulation exacerbates, but then in an expandable geographical scale. The only escape lies in the continuous acceleration of the creation of new productive resources [3]. From that, one can deduct an impulse inside the capitalism to create

the world trade, to intensify the exchange volume, to create new needs and new types of products, to implant new productive resources in new regions, and to place all manpower, everywhere, under the capital domination.

The organic need for expansion of the capitalism produces significant space and social changes as the capitalist mode of production destabilizes and replaces the previous mode of production. The capitalist model, consequently, starts to create new symbols, to restructure social and power relationships and ends up imposing a new space organization. The materialization derived from that restructuring consolidates a new landscape and hegemonizes the new production mode. The resulting landscape responds to other signs, making any material or ideological remnant of the previous model devalued or stigmatized, becoming a "residual landscape" [2].

The nonappreciation of alternative landscapes to the capitalism or the self-stigmatization of those landscapes as "residuals" is part of the cultural and sociospatial weakening and breakdown necessary to the capitalist expansion. The nonrecognition of pre-existing space contexts and the steamroller effect of the expansion activities open the necessary path to insert a new production mode which, through a new appropriation of resources, deconstructs the previous relationship models.

The consolidation of that production mode is followed by a cultural landscape that rewrites and is rewritten by a new social economic dynamic. The hegemony, at last, arises from the thorough or an almost complete elimination of the previous cultural symbolisms and social relationships. Only a dilution that is carried out under a conditioned coexistence is left to the residual landscapes.

The Xavante landscape and territory, by that perspective, should not be recognized by the capitalism as a parallel force, but as an obstacle to the insertion of new areas, creation of markets, and, consequently, impediment to the reproduction of capital. It should be seen as a remnant of a past cultural and economic model, which was replaced due to its "inability" to cater to new social demands.

Everything previously constructed by the Xavante should be, inside the capitalism, relativized, or even distorted, in an attempt to downgrade the Indian way of relating to nature. Likewise, the symbols and marks given to the space by the Xavante must be perceived by the capitalists as remnant of a distant past and at present without the necessary strength to resist the inevitable capitalist headway. The possibility of profit, capitalism's main target, superposes any millenarian culture or its principles. The ancestral lands are, through a capitalist optics, underutilized available resources that sooner or later will give in to the market "needs."

At this point, a more detailed recognition about landscape appropriation and territory formation experienced by the Xavante in the interface with the national society becomes necessary. In this way, it is possible to identify the true circumstances of the change of the production mode paradigm to achieve a real spatial and temporal understanding of the capital movements and the changes in the Xavante landscape over the centuries of contact.

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In that sense, there are two relevant moments during that process: the first consists of a large period of territory expropriation and deconstruction of ancestral landscapes performed by the action of several capital expansion fronts in a row that ended up reducing that people to a rarefied mosaic of reserves; the second consists of a neocolonization process of those remaining lands through new harassments motivated by the metamorphosis and the new needs for accumulation and production of surpluses.

4. From the first contacts to the appearing of Xavante reserves

The main economic activities that vectorized and consolidated the implantation of a capitalist production mode in the ancestral Xavante territories, already from the XVIII century, derived from a mercantile and colonial matrix, having, for this, the function of subsisting the markets outside the Indian territory. Among those activities, it is possible to highlight the primary ones: agriculture, livestock, and mining.

Another important economic activity in the period were the *Bandeiras* and *Entradas* (military expeditions with the aim of imprisoning Indians to make them slaves, besides the search for precious metals and gems) which allowed the recognition and opening of paths in the colony hinterlands, as well as establishing contacts and "pacifying" several ethnic groups who inhabited those hinterlands. Although those pioneering activities did not consolidate the occupation, they enlarged the horizons and the economical possibilities of the colony.

The colonization internalization promoted by those activities were marked by two interconnected and subsequent movements. At the first moment, the livestock activity took on a prominent role through the sugar economy that, during the XVII century, promoted a large accumulation of surpluses for the sugar mill lords and, at the same time, stimulated the internalization of other activities, thus creating an economical synergy through the demand for other basic products.

Activities like livestock and the detention of Indians guaranteed the supply of meat, animal traction, leather goods, and the necessary manpower for the plantation, harvesting, and sugar cane processing in the sugar mills. Based on that, it is possible to affirm that the livestock and the Bandeiras represent, simultaneously, the mainstay of the coastal sugar activity and the vectorization of the mercantile capitalism in the colony backlands during that period.

The second moment is precisely marked by a consequence of the internalization of those support activities. The incessant search for the detention and enslavement of Indians guaranteed not only the manpower supply but also revealed important gold and other precious gems deposit in parts of the travelled backlands. The ascension of the mining activity creates a new economic synergy under which the livestock internalization deepens, generating new mineral discoveries, and taking with it the mixed farming agriculture.

Mining emerges circumstantially in that period as an articulating element of the precious metal discoveries that led to significant migratory movements toward the extraction sites in

the colony backlands. Those movements, in their turn, started demanding expressive amounts of food, clothes, tools, among other items. Therefore, mining behaved as a centrifugal activity during that period, which from a nucleus, it irradiated through space as a model of spatial, social, and ideological organization, embodying a form until then unknown of occupation and space organization in the colony backlands.

And that is how the Xavante territories began to be transformed as they started receiving indirect flows irradiated by the nucleus of colonial occupation. The XVII and XVIII centuries pastoral fronts reached lands surrounding the Xavante, who, without any desire for contact—by their own strategy or not—started their first large migratory movement beyond the Tocantins river, where contacts with new pioneering activity fronts only occurred between the XIX and XX centuries [4].

The discoveries of gold and diamonds in the territories, which nowadays belong to the states of Mato Grosso and Goiás, did not take long to happen, when, by 1720, alluvial deposits were discovered and promptly aroused the greed of many, stimulating the arrival of new expansion fronts in the valleys and interfluves of the Tocantins-Araguaia River Basin. The lands inhabited by the Xavante once more got in the way of the economic advances.

Contradictorily, the more pronounced expropriation of the Xavante lands guaranteed the maintenance of a part of its territory, once from there, a long process was initiated and culminated with the creation of their reserves. The reduction and delimitation of the Indian territory symbolized a vital "concession" for the capital expansion, as that mechanism simultaneously eliminated the "element of discord" and opened up the way for the settlement of the economic activities necessary for the accumulation and production of surpluses.

The "submissions" of the people belonging to the Akwen Group happened gradually and were conditioned to numerous conflicts that produced significant losses both for the Indians and the settlers. Those conflicts, above all, served as a purpose to show how dissatisfied those people were in relation to the attempts not only to insert them in the Indian village policy but also to exhibit the military power of those nations and their ability. The Xavante, after numerous conflicts, were reduced to the Indian villages of Mossâmedes and Pedro III (in the Carretão croft), near the rivers Carretão Grande (current São Patricio river) and Crixás, between the years 1784 and 1788.

Even so, the "submission," although it symbolizes an important victory over the gentio (pejorative way of referring to the Indian people by the settlers), would be the first step only of the pacification process, the second being to make the Xavante people "weaker" in order to discourage or even inhibit insurrections. In this sense, the first measure adopted was the fragmentation of the group in two distinct villages, dismantling the tribal orders and making it difficult to organize any type of offensive. The first Indian village created was the Pedro III, in the Carretão croft, on the border of the Carretão Grande River, and the second, near the Crixás River, named Mossâmedes.

Although the measure was vehemently opposed by the Xavante, it was implemented anyway due to the lack of structure of the first village to receive such a large number of Indians. Thus,

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the people fragmentation, besides being inevitable, efficiently attended the purposes idealized by the Crown of undoing the Xavante cohesion.

The process was concluded through hunger, mistreatment, and diseases that symbolized the fastest and more efficient ways of disaggregation and eradication of the Xavante people in the villages. A measles epidemic may have been the main cause for the death of a significant portion of the villagers, causing the few remnants to flee to hinterlands not yet occupied in the search of a new start.

The failure of the Indian villages brought back the political and territorial uncertainty in the Province of Goiás and reestablished ancient conflicts between settlers and Indians, which required the development of new Indian people control policies by the colonial government. As an answer to those new demands, the Crown invigorated the military force policy against the Indians through the May 13, 1808 regiment. The Goiás government, in its turn, abiding by the designated guidelines, created "military prisons" that were aimed at sheltering those who were captured in combat, be them Indian men, women, or children.

The imprisonment policy built around thirteen prisons in the Province of Goiás only, and one of those was especially constructed to shelter the groups Xavante and Xerente. The Santa Maria do Araguaia military prison had the objective of isolating those groups from the crescent colonization and navigation that was happening in the Araguaia River Region.

That prison represented an emblematic moment in the history of some people that inhabited the central Brazil region, in particular for the Xavante, because besides not submitting to the prison, they also banded together with the Xerentes and Carajás to form a coalition of Indian nations to attack the prison. At the end of conflict, in the year 1813, the Santa Maria do Araguaia prison was destroyed, thus sealing the destiny of those people who, in the face of such insult, would not be able to inhabit the land in the confluence of the Araguaia and Tocantins Rivers anymore.

The years after that episode were of intense persecution and conflicts which forced the allied ethnic groups to disperse while searching for new lands out of the colonial influence. In that period, several reports about the Xavante dispersion in the north of Goiás appeared, an attempt of isolation that failed due to the greed of the settlers who put down roots in that part of the territory.

The impossibility to remain in their ancestral territories made Xavantes and Xerentes go looking for new spots inward the hinterland, so they crossed the Araguaia River westbound. Between 1850 and 1890, large migratory movements of the Xavante ethnics group gradually happened toward the lands that these days encompass the Mato Grosso state. The Xavante groups by the end of the XIX century began their search for "redemption" in the Mato Grosso lands, first, crossing the Araguaia River (or *Öprè*) and second, the Cristalino River to, finally, cross the Mortes River (or *Owawe*).

Thereafter, a series of displacements and socio-spatial changes in the Xavante society took place, which culminated in the establishment of three distinct regions of occupation on the West bank of the Araguaia River, between the Cristalino and Mortes Rivers.

5. The New State, the Westbound March, and the come into being of the Xavante Indian Lands (or reserves)

As the Brazilian economy entered and deepened itself into the finance and industrial sectors in the second quarter of the XX century, the economic expansion fronts grew through the accumulation and appropriation of large areas in the country's backlands, providing the necessary resources for the economic and urban growth of the large industrial centers. Brazil, in that way, abandoned the structure based solely on the production of primary agricultural products meant for export and started diversifying its economy, urbanizing part of its territory and stimulating new investments (both national and international) in a growing domestic market.

The Midwest and Amazon lands, in that context, gradually start taking part in the national economy, their main function being that of subsisting the emerging urban-industrial economy through the supply of ore and agricultural and livestock products. However, the integration of those regions and their resources in the economy directly depended on policies, from the state or not, that would enable an effective occupation of the unexplored territories and the rationalization of production.

The New State, in that sense, was majorly responsible for taking measures and creating the adequate conditions for the movement of the economic expansion fronts in the backlands. The new-state government was characterized, among other things, by a totalitarian leadership, political centralization, and strong interference in the civil society, carrying out policies of developmental characteristic such as incentives and subsidies for the industrial economic growth and, above all, creating several mechanisms for the accumulation of capital.

In the core of the new-state's developmental policies, the "territorial integration" figured as an imperative and immediate demand due to a need for consolidation of the new urban-industrial production mode. The main state policy in that direction was the idealization and attainment of the "Westbound March" that consisted of opening paths through the cerrados of Central Brazil for the construction of landing strips and military bases at first and allowing large-scale economic occupations in another moment.

As per the official speech at that time, such a policy would make feasible the supply of staple food, amend regional economic injustices, protect the national frontiers, and determine a unified national identity under the sign of a single mode of production, the capitalist. The lands of the Midwest region and, consequently, the lands of the East Mato Grosso occupied by the Xavante started being trespassed by the state through institutes like the Fundação Brasil Central (FBC) which, in its turn, through initiatives such as the Expedição Roncador-Xingu (ERX), put into practice the Westbound March.

The New State, through its racial integration policy, sought to expand the capitalist mode of production by viewing the territory as a resources space with predefined vocations, ignoring the existence of "places" or "landscapes" with previous sociocultural dynamics. The selective and ideological view of the landscape contributes for a reductive and homogenizing

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interpretation of distinct Indian cultures. In that way, the lands the Xavante used for hunting, harvesting, and planting were viewed by the state according to their commercial potential for agriculture and livestock, for instance [5].

Lands that were considered as historical and cultural references were assigned by military strategists as national safety zones or as solutions for land ownership conflicts. Complex modes of production and kinship nets that structured communities were disregarded or simplified in the attempt to rationalize the production and the social organization of the Indians [5]. The political-economical context where the contacts with national Brazilian society and the Xavante are resumed in the middle of the XX century, produced intense territorial harassments, uncompromising, and, at a certain point, voracious.

The methods and the "characters" utilized to resume the contacts between white men and Indians were since then the most diverse and, although all had the same goal in essence—to appropriate the Xavante lands—many were the searched objectives. Starting by a couple of Salesian preaches Fuchs and Sacelotti, who, in the attempt to catechize and convert the Xavante to Christianism, were killed near the Mortes River in 1934.

Many contacts followed that, alternating between state bodies or representatives, like the Indian Protection Service (IPS), and civil organizations, through which deaths and murders kept on happening on both sides. An example of that was the case of an IPS team led by Genésio Pimentel Barbosa that was killed near the Mortes River by a group of Xavante while attempting to attract and condition them.

The situation begins to change only in 1946 when an IPS group of Indian culture supporters and backland specialists led by Francisco Meirelles was able to establish a pacific contact with one of the Xavante group on the west bank of the Mortes River. The group attracted by the IPS was led by the chief warrior Apowe who transferred the Indian village to the East bank of the river and installed it near the Indigenous Post of São Domingos.

In spite of the contact having been accepted by only one Xavante group, the news that the pacification had been finally reached was spread very fast through the official communication media, causing "The Westbound March" enthusiasts to feed their greed for the "new" lands. That greed did not take long to materialize as in the beginning of the 1950 decade the Xavante lands started being occupied, even with the promise of the state government to create reserves.

However, the continuity of those pacific contacts was conditioned to the promise by the state government of Mato Grosso to create those reserves. The state government guaranteed a temporary title of property to the Xavante (1950), due to expire in two years, during which period the SPI should inspect a large area on the left bank of the Mortes River and establish the reserves limits. But before the expiry date, the lands were already being cut up and sold by the state government itself, so after two years the left bank of the Mortes River was almost completely divided into lots.

The emerging of reserves, in that context, symbolizes an important milestone in the Xavante social and economic formation, as they are, at the same time, the mark of the territory expropriation

and the most striking feature of the conditioning imposed by the capital needs. To know the historical implementation process of those reserves is, therefore, an important stage to understand the current Xavante landscape.

The São Marcos Indigenous Land, main spatial slice of this research, in spite of its specificities, has its development thoroughly inserted in that paradigmatic change of subjection to the capitalist mode of production, attending to a single spatial restructure mechanism. Even so, taking to pieces the creation process of that reserve in special is an effort necessary to justify the option for that area.

The most striking episodes derived from this conditioning process and expropriation of the Xavante territory happened during the period of appearance of the TIs, and many of them were precisely linked to the appearance of the São Marcos TI. Between 1956 and 1957, populations from the Xavante villages, Parabubu and Wedetede, fleeing from persecutions of settlers and farmers, sought shelter with the Salesian missions of Sangradouro and Meruri, which already sheltered Indians from the Xavante and Bororo ethnics groups. That migration, however, meant death for a large number of that group, mainly through diseases like measles [6].

Later, other cases of persecution exploded, causing more Xavante groups to look for shelter in the missions, which led the Salesians, at a given time, to opt for the creation of a new mission, attached to Meruri, fully devoted to the Xavante. That is how the São Marcos was born [6].

By the end of the 1960s, the tension between Xavantes and farmers increased, leading the Federal Government to compromise to the creation of a series of reserves to guarantee the integrity of those people. The territory created by the capitalism, therefore, is a place of contradiction and tension, behaving like a permanent scenario of power disputes and, inevitably, produces numerous conflicts, either real or ideological. Thus, the reserves creation represents the momentary needs of the capitalism and not of the Indians in the villages.

The permanent characteristic of the disputes, supported by the contradiction and need for renovation of the capitalist activities, makes the reserves ephemeral symbols of cultural maintenance as its limits and resources are permanently subject to questioning and, consequently, reason for conflicts. Thus, the capital will be presented in the form of a physical landscape, created at its own image, created as value for use, accentuating the capital progressive accumulation in an expandable scale. The geographic landscape encompassed by the capital and fixed assets is as much a crowned glory of the development of the past capital, as an inhibiting prison of the additional progress of accumulation [3].

6. New economic expansion fronts and the "pacification" of white men by the Xavante

The West acts like a soulless, impersonal machine, henceforth lacking a master, that put mankind at its service. Free from any human interference that may want to refrain it, the insane machine goes on with its planetary uprooting work. Uprooting men from their soil, even in the furthest corners of the world, the machine throws them in the desert of the urbanized

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zones without integrating them into the industrialization, bureaucratization, or the unlimited technicality it propels [7].

Many times, in distinct time and places, indigenous groups announced that they had "pacified the white men," claiming for themselves the position of subjects, not victims. "To pacify the white men" has many meanings: pinpoint them before the white men and the objects in the world's vision, empty them of their aggressiveness, their malevolence, their deadly force, tame them, in short, but also to establish new relationships with them and reproduce in society not against this time, but through them, in short, recruit them for their own continued existence.

The Xavante firmly state that upon establishing "definitive" contact with the *waradzu* (Xavante word meaning "white men" or non-Indians), they accomplished their pacification, not the other way around. For them, the acceptance of the contact does not derive from the simple inevitability of the Brazilian society expansion, but from inner geographical strategies of maintenance of their territory and culture. In other words, the Xavante bent and partially adapted to the western habits; in contrast the Western society also had to adapt to the Xavante.

The more pessimistic ethnographers consequently started to place the Xavante into the group of those Indians who, through flexibilization of "fundamental" aspects of their culture to preserve life, entered a kind of "social limbo," where Indians "stop" being Indians and, at the same time paradoxically, they are not citizens in their own right in the core of the involving society either.

The idea of maintaining the "Indianness" through inflexible cultural distinctions and geographic and social isolation ends up underestimating the ability of the aboriginal people to preserve ethnical differences in spite of the social immersion in other sociocultural structures. Moreover, while viewing the inter-ethnical contact as a manicheaist relationship between Indian people and dominant powers instead of a complex inter-cultural zone, the observers failed to evaluate how the differences are settled through economical and political practices [5].

Many Xavante, however, were able to understand that the selective cultural adaptation offered them the best guarantee to defend their land and communities and to adjust their relationship to the dominant societies [5]. Therefore, the idea of pacification of the *waradzu* by the Xavante is not only a matter of point of view or ideological orientation, but of a feasible strategy of survival that justifies itself, for instance, in the increase of birth and demography rates among the Xavante in the last years.

The adaptive mechanisms developed by the Xavante culture throughout the contacts with the Brazilian society—main objective of this article—were first perceived when, in several moments, the Indians actually took the reins of the "negotiations" and outlined their course, even without the due control over the results. That leading role, free of any romanticism, was necessarily permeated by concessions that almost always changed significant elements of those people's culture.

In the Xavante case, the dominant forms imposed on the Indians merged, opposed, or superposed the indigenous practices. A clear example of that was the specificity lived by each Xavante group in contact with the Brazilian society, as, after the pacification, some groups remained under the direct "guardianship" of the state represented by the Indian Protection Service (IPS), whereas other groups kept contact with the involving society through the work of the Salesian Missionaries.

The role of both entities was initially one of guarding the physical integrity of the Xavante communities; however, that "protection" had its price of the cultural flexibilization. In order to protect themselves from armed conflicts with the expansion front landowners, those Xavante groups had to accept the confinement of the reserves, each one with its own set of rules and specific social constructions. On the one side, under the tutelage of the Salesian missionaries, the Indians were gradually deprived of their cosmology in favor of the Christian monotheism; on the other side, under the IPS guardianship, they were skilled under a nationalist manual to become "brazilindians."

What the different processes of acculturation lived by the several Xavante groups had in common was the sign of work. The Indians were "stimulated" to definitely abandon the seminomadism in favor of getting skilled in any job that might contribute to building a nation or a divine work. In that way, hunting expeditions, pickups, and seasonal planting of food that served to initiate the young Xavante in the culture ceased, deeply changing not only their diet but also the symbolic landscape and oral tradition of knowledge transmission.

The Indians became permanent growers, carpenters, tractor drivers, artisans, seamstresses, rendering services either to the IPS or the Salesians in exchange of a few industrialized products that little by little became daily "needs." On the other hand, they became low-skilled manpower. The end of that process would be, in a way, to convert the Xavante into low-income citizens devoid of possession and property of lands; however, it is in that dimension that the Indian protagonism begins to appear.

Even in the face of harsh and sudden cultural changes, the Xavante were able to maintain some practices that helped to perpetuate a feeling of belonging, creating a sensation of ethnical continuity. They maintained the communitarianism that molded and structured their lives and identities throughout generations, essentially keeping age structures, exogamous halves, performing rituals, and, mainly, dreaming of the ancestors so that the ancestral wisdom kept on nourishing their spirits.

On another plan, the Xavante sought to learn the Portuguese language as a means to understand not only what was being said but also to comprehend more deeply the sociocultural structures and the *waradzu's* way of thinking. Therefore, politically speaking their performance became more incisive and assertive when, through noncooperation, they were able to obtain concessions from the state as well as from the Church by playing one against the other on ideological conflicts.

Thus, the Indians began to realize that their Indianness happened even if they made some concessions like tossing aside some cultural aspects, and by doing it, they were able to better understand the outside social structure and, with a gentle touch and skill mark their ethnical differences and impose (covertly) their intransigence (here understood as something that decidedly should not be changed).

The *A'uwe*, however, quickly grasped the symbolic value of the indigenous identity after the pacification of the *waradzu*, even though culturally altered, the ownership of that identity would give them a concrete chance for political claims (territorial).

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7. Final considerations

Under the steamroller effect of the westernization, all seems to have been destroyed, leveled, and smashed, however, at the same time, the reefs are often submerged, sometimes resisting and ready to emerge to the surface [7]. Latouche's words are "surgical" when he lively qualifies the planet's westernization power, accomplished through the capitalist system and its economic expansion fronts. However, he is equally brilliant on his alert about the resistance inevitability.

The magmatic activity inside the inner lays of the earth is uninterrupted and silent; however, it is always in touch with the lithosphere, be it by influencing or devastating it, through quakes or volcanism. Equally unstable is the Xavante resistance because its essence is far from being outdone. Those people, like the magma, will certainly look for an escape if submitted to "rises in temperature and pressure."

These days, the reserves are either surrounded by pastures for cattle or soy plantations. Some are cut by federal or state highways, which means their ways are not for strolling anymore but for road transportation. Most of the time the houses are not placed in semi-circles, facing one another (traditional distribution of the Xavante houses); they are not made of straw either, which is not found in the reserve limits anymore.

The seeds for the subsistence plantation are not *criolas* (native seeds), that is to say they are primarily distributed by the Indian National Foundation (FUNAI, government agency that replaced the IPS) and almost no swap is made among villages. The meat that is consumed does not come from hunting activities, it is cattle actually (the same that destroyed the ancestral *cerrados*) and it is bought in the supermarkets along with the sodas, which have risen significantly the diabetes cases, and often the money comes from the elderlies' pension.

The young people still listens to stories, but the movies and soap operas that are broadcast through the TV sets of each house offer "new" perspectives. O *wai'a* (race between the clans carrying Buriti logs) still happens, but nothing calls more attention than the soccer games, be it on TV or in the field at the *warã* (center of the semicircle formed by the traditional villages where meetings of men and the elders happened to deliberate about important matters like wars or hunting). All of that however is surpassed by the attention and time devoted to Facebook).

Lastly, those same young people who have access to the youth of more consolidated capitalist centers are encouraged to marry before they are 15 years old, as a last resource to keep them in the villages and thus avoid a demographic emptying, in spite of a rise in that density. Let alone old issues like alcoholism and the use of other substances (illicit or not).

The presentation of the field collected information, mainly in the São Marcos Indigenous Land and at FUNAI may, at first, generate questioning about the nature and the success of the Xavante resistance related to cultural spoliation and territorial expropriation. However, the objective of this research still remains that of identifying changes that symbolize strategic adaptive factors which help to promote the Xavante culture, instead of stressing the pains suffered throughout the process.

Despite all those illnesses, part of those Indians have been able to graduate at public universities and have come back to teach in the villages, in their mother tongue and in Portuguese, discussing different cosmological and theological theories. There are still those who throughout the years have been elected for city, state, or federal posts, contributing to the greater autonomy of the Xavante people vis-à-vis external institutions.

Several nongovernment organizations (NGO's) have been created inside the villages to demand improvements ranging from infrastructure to water supply, garbage collection to communication, and culture devices. Many documentaries have been produced and ethnic group exchanges have happened in the Xavante lands. Some rituals still happen, and the women have conquered more space and conditions for their social and intellectual development.

Here, one intends to present the final considerations, not as a presentation of conclusions. Even so, that should not prevent the reader from reaching his own conclusions. Even because such conclusions may symbolize important reflexive instruments that are fundamental to the academic-scientific development and progress. The truth is that the Xavante pride does not lie on his being a hunter or his exhibition of warlike ferocity, but on his Xavante feeling and understanding, without being minimized.

More than that, any conclusion may contain a partiality that the author does not even perceive. In other words, any conclusion or judgment about the current Xavante modus vivendi, besides lacking a structural partiality and not embrace the whole sociocultural complexity of that people, may be irrelevant or of little contribution from the indigenous themselves point of view.

The capital, on its own need for accumulation, reduced the Xavante to a rarefied mosaic of reserves, eliminating their structure and restructuring almost all aspects of their lives, but did not annihilate them. Thus, it is possible to affirm that the capital, at a given time, had to expand its activities to areas with unexplored resources and, at the same time, had to maintain some elements of those areas, like the workforce that is, virtually, also a consuming market. As the capitalist system is dynamic and inevitably expandable, it is equally possible to say that the same reserves that were "necessary" in the past may have their importance revised in the future.

Soon, new expansion fronts will surely besiege the remnant of the Xavante land, but what is not possible to predict is what kind of resistance the Xavante will have to offer. Important is to perceive that the past changes, according to some points of view, even though they seem so negative, can in the future symbolize very important elements of dialogue between Indians and the situations presented. That being said, the so-called acculturation may truly be an element of adaptation that enabled or is enabling the Indians to deal with more complex issues that might show up in the future.

However, the wisdom of the native Americans is not in a static body of costumes but on their ability to learn and react to situations in accordance with a rationality built up throughout thousands of years mixed with a spiritual irrationality that was also created throughout thousands of years of balanced contact with the Earth and its resources.

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Section 2

Indigenous Environment

Chapter 4

Analysing Environment-Development Interventions Through the Lens of Indigenous People in Cameroon

Mbunya Francis Nkemnyi

Additional information is available at the end of the chapter

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Abstract

Ideally, both eenvironmental protection and human development policies should improve human well-being through the conservation of ecosystems that provide valuable services,. However, in practicallye, this rarely happen rarely. Settings for environment-development interactions are complex because they consist of diverse ecological systems as well as and human engineered knowledge systems. Using the pathways approach analytical framework to sustainability, this paper analysed how actors' understandings and scale of knowledge in environment-development interventions influence sustainable management. Data for this study used mix methods, includeing interviews, questionnaires, policy document texts and field observations. The main findings suggested that the diverse views and scales of knowledge mobilised by different actors in conservation-development interventions is a major challenge in producing sustainable outcomes. The inability of conservation practitioners to conveniently reconcile different narratives held by different actors leads to the domination of powerful actors narrations, on which policies are based. The major setback in attaining sustainable forest management does not necessarily lie in the conflicting interests of actors, but also in the social processes that guided the negotiation of these conflicting interests. This study argues that local people and traditional structures have the potential to contribute sustainable forest management processes if offered the space. Given that lLocal people are often not directly engaged in forest management planning, their actions are directly or indirectly influenced by other actors (elites). This makes it more complicated to achieve processes that might lead to sustainable forest management. There is a need to create Convenient space is needed to that enables conservation practitioners to sees and promotes conservation through the lens of the local people.

Keywords: indigenous knowledge, scales of knowledge, environmental conservation, local development, pathway approach, Cameroon

1. Introduction

"The rapid growth of human populations living in areas of endemic poverty and the rapid loss of natural habitats and the species within them have drawn international attention to interventions designed to effect positive socio-economic and environmental change" [1]. This is due to the belief that targeting conservation and poverty alleviation together can improve conservation effectiveness [2]. Poverty and environmental deterioration are argued to be among the gravest challenges faced in the developing world today [3]. The relationship between poverty and the environment is complex and highly influenced by the socio-economic factors of the locality. This warrants the need for multidisciplinary analyses of how interactions among a variety of factors affect outcomes in the socio-ecological system (SES) [4, 5]. This is supported by the argument that negotiating conservation-development actions requires greater emphasis on diverging values and diverging preferences for the scale of operation and action [6]. This study analysed how different actors in the proposed Tofala Hill Wildlife Sanctuary (THWS) understand and narrate wildlife conservation and how these difference narrations influence conservation strategies. Specific questions included (i) What understandings do individuals make of conservation initiatives? (ii) How do these narrations translate to conservation outcomes? (iii) What possible pathways could ensure sustainability in conservation management strategies?

The THWS is an important landscape for the conservation of biodiversity and is under consideration to be name a wildlife sanctuary [7]. It is one of the fragmented forest habitats harbouring the critically Cross River gorilla (*Gorilla gorilla diehli*), which has a population of less than 300, left in the wild [8]. This species is under high conservation priority given it vulnerability to human threat. This adds to the reasons why it is given high conservation preference [9]. On the other hand, the local people living adjacent to the THWS have continuously relied on the forest for livelihoods for several years without conservation interventions until 2004, following the discovery of the cross river gorilla in the forest. This new era of conservation put the local people into doubt, as they feel their forest rights may be taken away as conservation activities intensify in the area [7]. In this line, the local non-profit organisation working in this project area is implementing community-based conservation approaches to reconcile local livelihood needs and conservation. However, the diverse views held by the different actors involved in the project seem to be a main challenge to the success of the project as argued in this study.

The prospect of local people to sustain community-based natural resource management (CBNRM) for livelihood security and conservation needs is centred on how well programmes are embedded in sociocultural relations, politics, resource needs and uses [10]. In this line, establishing sustainable linkages between environmental conservation and local development actions require the consideration of how policies influence and are influenced by actors in CBNRM [11]. It is also argued that most often than not, actors hold diverse interests, motivated by their scale of knowledge, which together with scale politics, lead to conflict in forest resource management [6, 12]. Scale of knowledge as used in this study refers to the temporal and spatial extend and character of knowledge held by individuals and collectives [12]. These diverse framings form the dynamic and complex SES we live in [5, 13].

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As environmental conditions are changing rapidly, so too are social systems. Thus, there is a need for a robust conceptualisation of these constant changes if we need to attain sustainability in the SES. The pathway approach to sustainability questions how sustainability can be achieved in a complex and dynamic system and how contestation between alternative approaches and goals played out among actors [13]. This is based on the assumption that development drives social and ecological changes, which affect the SES. Thus, the dynamic SES raises some major policy and development challenges, which requires immediate attention. To cope with some of these challenges, efforts to regulate environment degradation focus on biodiversity (wildlife) conservation [14]. Yet, biodiversity conservation in most developing countries is at crossroad with local livelihoods. This warrant conservation projects to also consider local livelihood issues in their action plant (community-based natural resource management approach—CBNRM) [10]. CBNRMs have the vision to improve the livelihood of the local people by empowering them to manage natural resources in their community for their well-being [15, 16]. However, despite the hopes of the CBNRM approach, implementation is argued to be challenging given that powerful actors still play out CBNRM to marginalise the rights of the underprivileged [13, 17, 18].

2. Methods of study

2.1. Study area description

The study was conducted in the adjacent communities of the THWS, located in the Lebialem-highlands, Southwest Region of Cameroon (**Figure 1**). The THWS is located specifically between 5037′ and 5042′ latitude and 9053′–9058′ longitude covers approximately 15,000 ha. The area ranges from 230 to 2400 m above sea level. This forest area range is known to contain 84% of African primates, 64% of African passerine birds and 66% of known African butterflies [19]. The THWS forest is home to 26 species of large mammals including some of Africa's most threatened primates species; the critically endangered Cross River gorilla (*G. gorilla diehli*) and the endangered Nigeria-Cameroon chimpanzee (*Pan troglodytes vellerosus*) [20]. The forest equally harbours endemic birds including the Bannerman's turaco, Banded-wattled eye, Bangwa forest warbler and the Bannerman's weaver as well as many endemic plants [21]. The THWS is surrounded by 10 main communities (Fossimondi, M'mock mbin, Bamumbu, Folepi, Bechati, Banti, Igumbo, Besali, Bangang and Nkong). The population of the THWS is estimated to be about 7000 inhabitant [22].

2.2. Conceptual framework

The pathways approach is composed of two building blocks: a complex systems perspective and a normative emphasis on reductions in poverty and social injustice as defined by and for particular people and settings—strategies and dynamics [23]—see **Figure 2**. The complex system perspective is concern with 'framing', or the different ways in which different actors understand or represent a system. In this study, we capture this aspect of system framing by eliciting the narratives of wildlife conservation and local livelihood across different

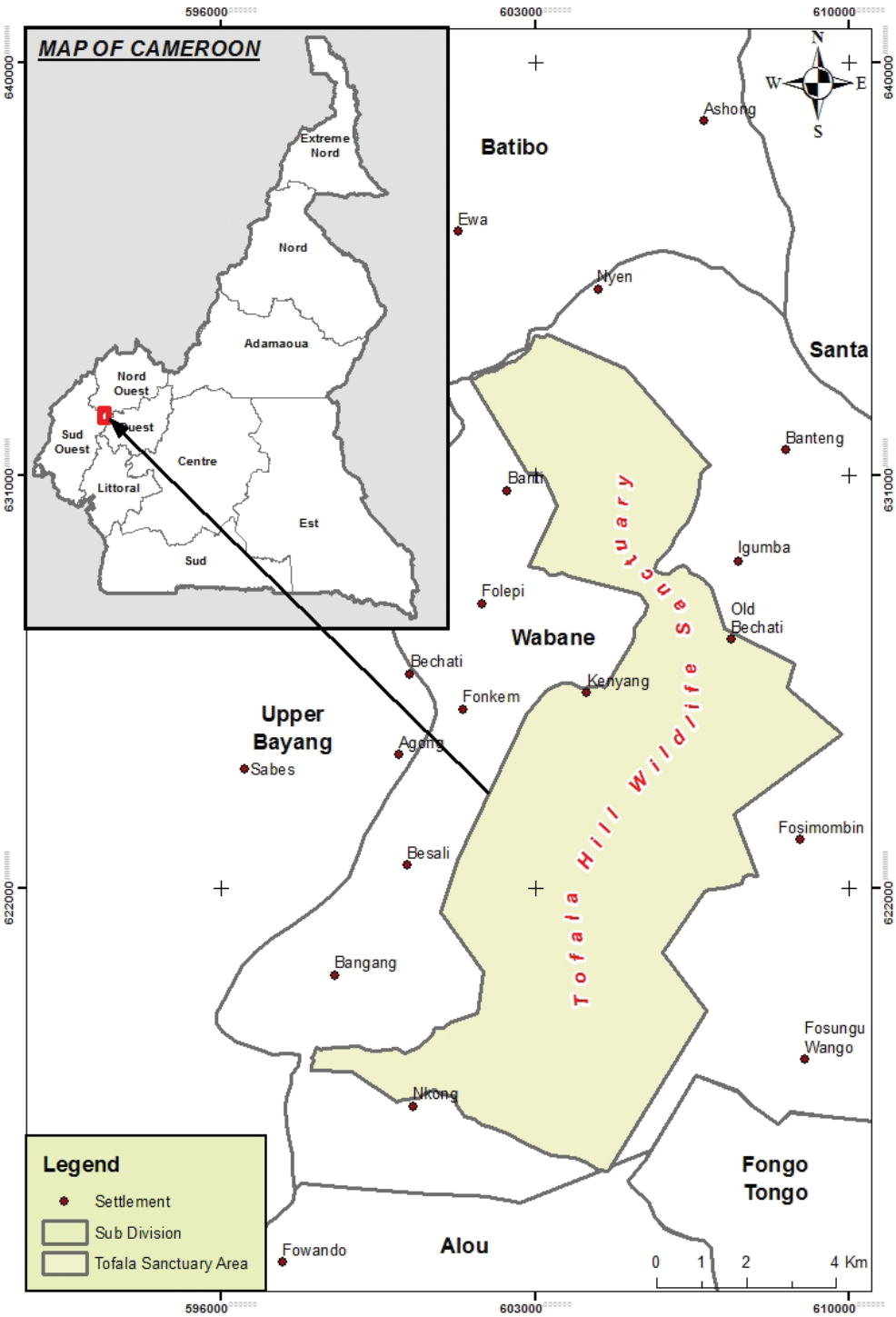

Figure 1. Location of study area within the Lebialem Highlands.

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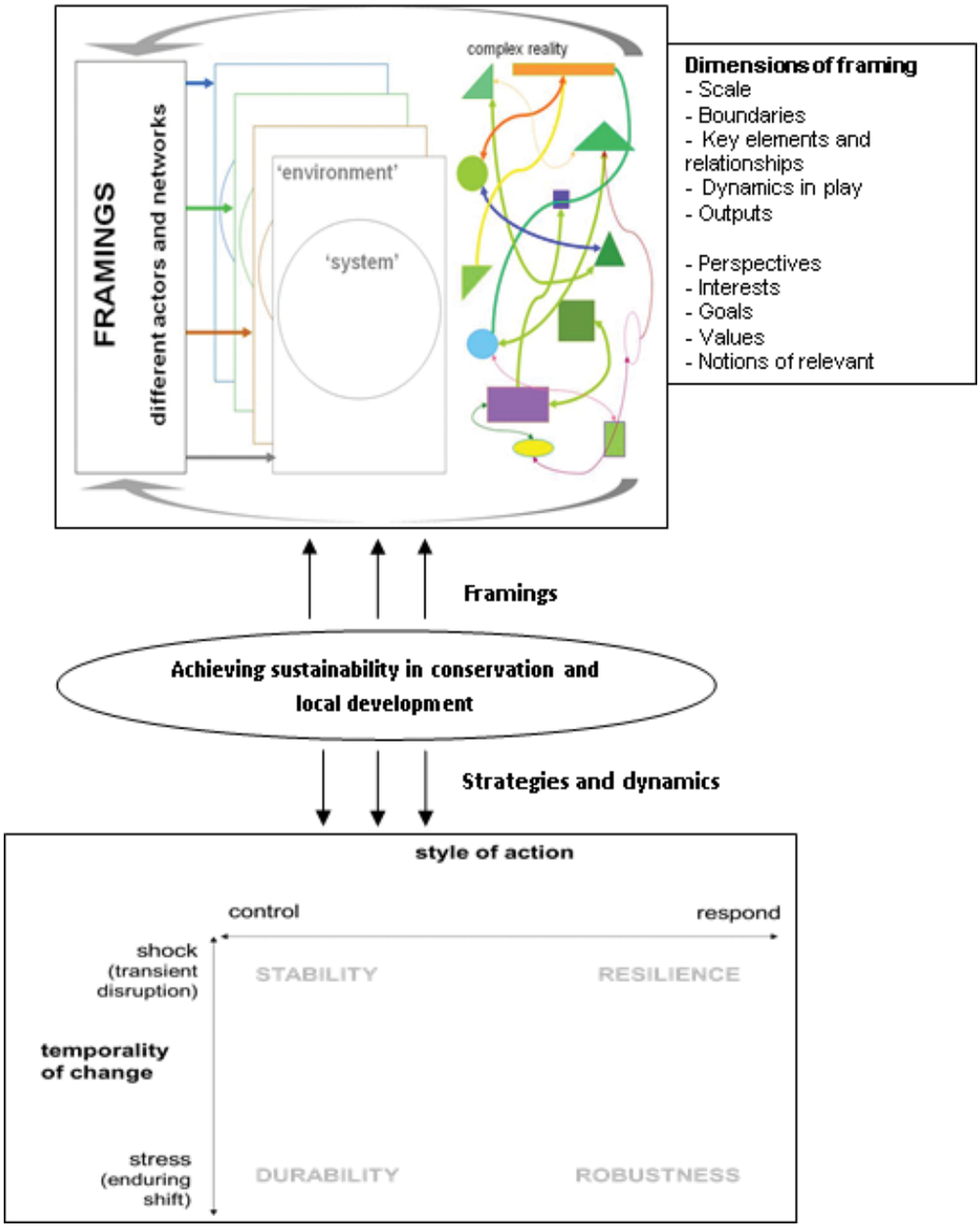

Figure 2. Representation of framing, strategies and dynamics in the pathways approach (adapted from Ref. [23]).

actors. The normative emphasis on reduction in poverty and social injustice as used in this study referred to strategies and dynamics in governing natural resources to meet both local needs and conservation needs. The strategies and dynamic aspect in the pathways approach

questioned if narratives within a given policy are intervention strategies aimed at exercising control in order to resist disturbance or shocks (stability); it also questioned if there exists an acknowledgement that they may be limit too control, and thus, the interventions should resist shocks in a more responsive fashion (resilience); furthermore, it questioned if interventions attempt to control the potential changes in the case where a system is subjected to important stresses (durability), and finally, if the interventions embraces both the limits to control and an openness to endure shift (robustness)? The above dynamic properties guided the analysis in this study to questions how the situation of the THWS can open up opportunities for sustainability. The framework as presented below also acknowledges that framings, strategies and dynamics are interconnected and play out simultaneously to determine the pathways to sustainability.

2.3. Data collection approach

Data collection for this study was mainly between the periods of January 2013 and July 2015. In order to capture how different actors in the THWS understand and frame conservation and local livelihood issues, we used a collective research approach [24]. The collective research identified the different strategic groups involved. The research questions were guided to elicit information on how each strategic group perceived conservation and livelihood challenges in the study area. Participants were asked to narrate how their perception and understanding of conservation and its ability to meet the need (livelihood) of the local people. They were also asked to narrate how they fell other actors understand conservation and local needs. The identified strategic groups included local government staffs, conservation practitioners (local non-profit organisations—NGO), farmers (men and women), hunters, youths, chiefs, elites, researchers and policy makers (represented by the Ministry of Forestry and Wildlife). The collective research involved the following steps: an individual inquiry on site by the principal investigator to prepare the subsequent teamwork by identifying in summary the main local issues and thus making it possible to predetermine the main strategic groups. This was followed by a preparatory seminar to familiarise the research team with the pre-identified problems and the methods that will be used to elicit information from the strategic groups. The research team included the principal investigator and two graduates from the University of Buea Cameroon, who were also familiarised with the settings of the research environment. Now acquainted with the strategic groups and the main problems, the research team did a tour of the study communities; spending 2 days in each community, meeting with strategic groups. This enabled the researchers to perceive issues through the perspective of the strategic groups and at the same time realising the variety and relativity of the strategic groups. The target of the research team was to talk to many people as possible across the defined strategic groups in each community. At the end of the participatory research phase, we spoke to 378 community members (Fossimondi-36, M'mock mbin-43, Bamumbu-37, Folepi-47, Bechati-54, Banti-27, Igumbo-21, Besali-49, Bangang-35 and Nkong-29), 6 elites, 4 local government representatives, 3 staff from the local non-profit organisation and 4 policy makers in the conservation sector. This gave a total of 395 participants.

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2.4. Data analysis

The data collected aimed to understand how different actors frame and perceive conservation and local livelihoods and how the strategies used in the implementation of the conservation programme offer opportunities for stability, resilience, durability and robustness as defined in the conceptual framework. Analysis on how different actors framed conservation and local livelihoods was guided by the following dimensions of framing: scale, boundaries, key elements and relationships, dynamics in play, outputs perspectives, interests, goals, values and notions of relevance.

3. Results

The problem narrations in this study revealed that conservation strategies in the THWS have not been participatory enough, and this presents the local people with a situation that do not permit them to clear judge if long-term conservation goals protect their interests or not. This has led to poor community support in conservation strategies. The implementing strategies do not also provide local people with sufficient incentives to engage in alternative livelihood options. All these challenges lead to forest degradation and loss of biodiversity as local people continuously and heavily rely on the forest for livelihood.

3.1. Defining actors dynamics, relationships and interests in the THWS

Two main conflicting interests were clearly visible in the THWS: the need to conserve the rich biodiversity of the forest area and the need for local community members to meet their livelihood need, which also depends on this forest. The narratives from this study also reveals that though the interest of the actors involved have not change over time, their perceptions and strategies to protect their interests are constantly changing. Most notably, the support of the local community member to the project has greatly depreciated from 2004 when they fully supported the project till present when they now hold different views on the project (**Table 1**). Couple to this, the collaboration of the Ngo with the local administration has also been challenging. The interests of the local government in the THWS are largely define by the administrators in charge and given that the persons in charge are constantly changing, new administrators often come in with their own agenda and personal demands, which often require the NGO to adapt it collaboration strategies to cope with the situations. Narratives from this study also revealed that elites and at time, the local government representatives have sometimes mobilised local community members to stand against conservation or demand rewards from the NGO for using their forest for conservation. These actions was analysed to be motivated by personal interests held by these stakeholders. These dynamic relationships and interest were observed to pose a major challenge to the sustainability of the THWS. On the other hand, this study also revealed that the NGO have been able to muddle through these challenges in one way or the other and continue pursuing its agenda in the THWS despite the shortcomings as we will discuss in Section 3.2.

Actors	Framing of conservation and local livelihood based on key words
Local government staffs	The NGO have a good agenda of conservation in the THWS as it is important to conserve biodiversity. However, the livelihoods of the local community members also need to be taking into account. We are always available to assist the NGO and the local community to find a common ground for cooperation
The NGO	The THWS is home to some the last species of the great apes among other important wildlife. The gazettement of this forest area will pose a major challenge to the livelihoods of the local community members but we are working with them to see how we can develop alternative livelihood options
Farmers	The forest is the only source of our livelihood. We have been depending on this forest for some many years. Now, our rights and feature livelihood are threatened by conservation. We do not see the possibilities of the NGO providing us with livelihoods alternatives that will equate what we get from the forest
Hunters	There is no way we can stop hunting completely. With income generated from hunting, we send our children to school. We do not yet see any viable alternative that can replaced our interests in the forest
Youths	It is through money from the forest that our parents are also to send us to school. Some of us who are not opportune to study earn our own living from the forest. We are aware that conservation is important but if the conservation goal is to take our forest away without alternatives provided, it will really affect the entire community
Chiefs	We have been working with the NGO to see how this conservation can work. As of now, they are no benefits that can encourage us to give our full supports. We all rely on this forest for livelihoods and cultural reasons. We need assurance beyond words of mouth to guarantee our full support to conservation
Elites	- The agenda of conservation as pursue by the NGO have less meaning to our people. The NGO received a lot of money for conservation but the local community members are not benefiting from this money - Conservation is very important but we do not see how conservation can succeed without adequately considering local livelihoods
Policy makers	We are aware that local people rely on the forest for livelihood and this makes it difficult for conservation objectives to be achieved without providing alternatives livelihood options. We are working to put in place and enforce policy that enable environmental protection and at the same time protect the rights of the local people to benefit from these resources
Researchers	Conservation and livelihood issues in the THWS are complex and need more than just a single answer to reconcile it. The absence of effective collaboration among stakeholders is already an early indication that the strategies in place will not be sustainable and need to be re-addressed

Table 1. Actors perceptions and framing of conservation and local livelihood.

3.2. Dimensions of conservation and livelihood framing in the THWS

The difference in actors' views in the framing of conservation and local livelihoods challenges in the THWS indicated they were no effective collaborative actions between stakeholders. The absence of a common ground for action explains why there is little or no overlapping in the way the different actors frame the issues as observed above.

3.3. Governance and strategies in the implementation of conservation and livelihood in the THWS

The NGO plays a lead rule in governance and the development of strategies in the implementation of the THWS project. The implementation strategies are supported by the local community members, local government and the Ministry of Forestry and Wildlife, Cameroon. However, we observed that these key stakeholders act more like service provider rather than as key actors as we will expect from an effective community-based conservation project. This can also be deduced from the way the difference stakeholders framed the project in relation to meeting the local people need (**Table 1**). Conservation strategies so far have aimed at reducing community dependence on forest resources by providing alternative livelihoods support to some community members in the form of small loans for off-forest livelihoods activities and offering in-kind donations (piglets) in some cases. Modern infrastructures for milling palm oil have also been installed in two communities to improve the palm oil production process. Despite these actions by the NGO, local members support to the project is till poor. Some local communities (Fossimondi and M'mock mbien) have pulled out the conservation project. Effort to resolve their differences with the conservation project have been unsuccessful. Conservation education has also been used as a strategy to win the support of local people. However, this study reveals that it has added little meaning to the local people understanding of conservation. The question we raise here is what is missing out, giving the above listed effort by the NGO?

4. Discussion

Based on the framings, governance and strategies presented in the results above, we questioned if the implementation of the THWS project at this stage is closing down or opening up opportunities for the local community members? With reference to the normative emphasis on reductions in poverty and social injustice as define by and for particular people and settings—strategies and dynamics [23]—see **Figure 2**, we also argue based on the results of this study that the strategies in the THWS are not been pursued in practice as a result of political, institutional and cognitive pressure and also because the strategies do not look beyond the immediate challenges. The complex nature of local institutions, involving elites, chiefs, hunters, farmers and youths who hold completely different agendas and interests in the conservation project, makes it more challenging for a single solution (mainly based on improving livelihood and community awareness) to work. The inability of the NGO to develop robust and resilience strategies for actions beyond the visible challenges enables them to embark on controlling the challenges (stability) rather than to responding to them as they evolve (durability, resilience and robustness). Actions aiming to promote sustainability should involve assumptions about the temporality of change and the style of action (**Figure 3**) [23].

The THWS project is observed to be more concern with the temporality of change (providing immediate solutions to the challenges and bring the situation under control). These types of strategies leave out important dynamic properties of sustainability and thus close up

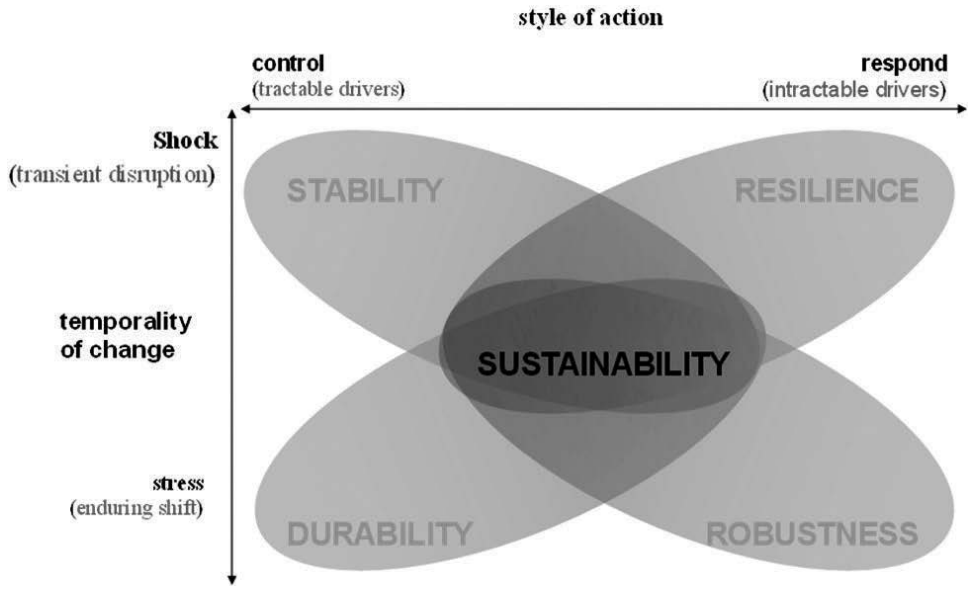

Figure 3. Combining dynamic properties of sustainability. Source: Ref. [13].

opportunities for the marginalised group (local community members). Given the complex settings of conservation and local livelihood interactions (SES), a sustainable system would consist not only measures to control the immediate challenges but also open up to respond adaptively to emergent challenges, resist shocks in a more responsive fashion (resilience) and at the same time, identify, track and response to long-term shift that may occur in the system (durability and robustness).

In line with the arguments above, we question a new agenda and strategies needed to ensure sustainability in the THWS conservation project. The goal of sustainability is in a SES is the need to develop a common language that cut across disciplines to analyse how interactions among a variety of factors affects outcomes [4, 5] as presented in **Figure 4**.

The analysis of a SES requires a range of expertise and approaches, which may be very expensive for grassroots institutions to afford as in this case study. Thus, the next questions at this point are how can such institutions achieve sustainability under constraint resources? What approach will best maximise resource usage and enable sustainability? And how can "a common language" as defined by Ostrom be developed for actors with diverse interest? The pathways approach [13] attempts to answer some of these questions by emphasising on collaborative actions in policy development and implementation. With the hint that meaningful actors' collaboration and participation can minimise implementation cost and at the same lead to sustainability, we will advocate this type of approach to the THWS project. However, for this to work, there is the need for the project to revisit the questions posed above on achieving sustainability. One method of paving the way to sustainability in the THWS will be the use of the participatory mapping approaches to define "a common ground" for actions and to allocate and manage resources.

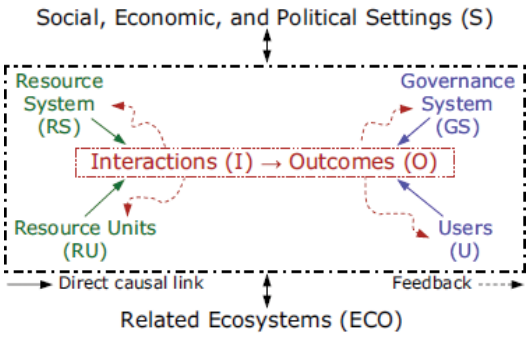

Figure 4. A multitier framework for analysing a SES. Source: Ref. [4].

5. Conclusion

Though wildlife conservation projects may have a genuine agenda, social, ecological and political settings often play out to make implementation complex and challenging. The expertise required in the integration of the diverse actors involved is most often left out due to poor strategies development or inadequate resources. The pathways approach informed us that sustainability in a SES can only be achieved if the system would consist not only measures to control the immediate challenges but also open up to respond adaptively to emergent challenges and response to long-term shift that may occur in the system. Enabling this idea setting for sustainability is challenging in practice. However, participatory approaches offer a starting point for engaging into sustainability. Notwithstanding, I also acknowledge the challenges of implementing participatory approaches in practice.

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Chapter 5

Indigenous Resource Management Practices and the Local Social-Cultural Context: An Insight towards Self-Directed Resource Management by People who 'Coexist' with Supernatural Agents

Masatoshi Sasaoka

Additional information is available at the end of the chapter

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Abstract

In recent arguments in the governance of natural resource management, effectiveness and desirability of collaborative management among various stakeholder including indigenous people has been recognized. In the context of Indonesia, the reformation movement has stimulated the growth of a new perception of indigenous people's rights to their land in the country. This recent transition presents a growing opportunity for indigenous people who live in nature-rich areas (national parks, etc.) to collaborate with 'outside stakeholders' such as governmental agencies, scholars and environmental NGOs in natural resource management. In such situations, it is necessary to deeply understand the value of indigenous resource management (IRM) practices to promote self-directed and effective resource management. This chapter focuses on local forest resource management and its suitability in the local social-cultural context in central Seram, east Indonesia. First, I describe how the well-structured forest resource use is constructed and maintained through the indigenous resource management practices based on 'supernatural enforce mechanism'. After that, I investigate what social-ecological roles the IRM in Amanioho has, and how IRM practices relate to the social-cultural context of an upland community in central Seram. Then, I discuss the possible future applications for achieving self-directed resource management by people who 'coexist' with supernatural agents.

Keywords: indigenous resource management, local social-cultural context, Seram, supernatural enforcement mechanism

1. Introduction

Many indigenous societies that directly depend on natural resources have developed norms (e.g. values, beliefs, customs and institutions) that control the use of resources. Such norms include various resource use regulations such as a temporal ban on access to a certain area, a ban on using certain resources, rules restricting the amount of resources that can be harvested and rules regarding harvesting methods. The roles of these norms that local people regard (i.e. roles of the norms in an emic sense) vary from site to site, and they include the prevention of resource degradation, enhancing efficiency in resource harvests, avoiding conflicts among resource users, and soothing and reposing supernatural agents such as ancestors' spirits, natural spirits and deities [1]. Mechanisms that enforce people to obey the norms are also diverse. Some resource management practices are based on a social enforcement mechanism, where people living in the real world monitor other peoples' conducts and apply sanctions (e.g. punishment and moral blame) against those who break the rules, and the others are based on a supernatural enforcement mechanism, whereby people believe that supernatural agents such as ancestor spirits and natural spirits monitor human conduct and impose punishments on violators, promoting compliance with the rules [1].

In this paper, we use the term 'indigenous resource management (IRM)' for practices based on indigenous norms for establishing and maintaining order in the relationships among resource users, as well as between humans and resources for certain purposes such as that mentioned earlier.

Environmental sociological and anthropological studies on natural resource management have thematized IRM practices based on supernatural enforcement mechanisms. For example, an extensive literature review by Colding and Folke about social taboos guiding human behaviour to the natural environment compared resource and habitat taboos (RHTs) in many places around the world to contemporary measures of conservation [2]. It shows that some RHTs supported by supernatural enforcement mechanisms have functions similar to those of formal institutions for nature conservation. Hamilton classifies the cases where forest areas and certain trees are protected because those are believed to be sacred or have evil powers, and discusses how supernatural restrictions are important in biodiversity and local culture conservation [3]. Bhagwat and Rutte also show examples of traditional conservation practices at natural sacred sites in various parts of the world, and suggest that incorporating natural sacred sites into existing protected area networks is needed, focusing on current threats to sacred sites including legal ownership denying customary rights, population growth, increasing immigration and so on [4]. Verschuuren et al. compiled case studies on sacred natural sites covering a wide spread of both iconic and lesser known examples in the various parts of the world to make the case that sacred natural sites support high biodiversity values, document the losses of sacred natural sites and draw attention to the threats and pressures that many still face [5].

Several case studies of local resource management supported by the supernatural enforcement mechanism have also been published. For example, Byers et al. examined the role of traditional religious beliefs in conserving remnant patches of a unique type of dry forest in the northern part of Zimbabwe [6]. Virtanen studies the social-cultural backgrounds of sacred

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forest institutions which are continuously functioning at the juncture of changing state laws and customary laws based on a case study in Mozambique [7]. Saj et al. investigated how local taboos against hunting on monkeys contribute to complementing the formal conservation agenda [8]. Etiendem et al. who investigated the local beliefs related to the Cross-River gorilla and taboos of hunting and eating the gorilla in Cameroon discussed how effective it is to integrate such beliefs and practices into the conservation of the species [9].

In Indonesia, some case studies focus on the interrelations between local belief in supernatural agents and wildlife and land protection such as given in Refs. [10, 11, 12].

In recent arguments in the governance of natural resource management, effectiveness and desirability of collaborative management among local people including indigenous people, state actors, NGOs, scholars and corporations has been recognized. In the context of Indonesia, the reformation movement, which has been taking place since the late 1998 after then-President Soeharto's fall, has stimulated the growth of a new perception of indigenous people's rights to their land in the country. Forestry Law 41/1999, which replaced the Basic Forestry Law in 1999, created a new forest category, hutan Adat or customary forests, defined as 'state forests located in traditional jurisdiction areas' [13]. This made an advance for recognition of indigenous rights to forest lands but Indonesian NGOs and indigenous communities have challenged the law, arguing that it failed to adequately recognize, secure and protect indigenous land rights, as required by articles in the Indonesian constitution.[1] Reflecting on the arguments, in May 2013, the Indonesian Constitutional Court issued Decision 35/PUU-X/2012 which invalidated provisions of the Forestry Law under which the Indonesian central government had assumed ownership over forest land that indigenous communities had occupied and used for generations. Following the Constitutional Court Decision, governmental agencies issued regulations for resolving land claims and recognizing community land rights.[2]

Even though the land handed back to indigenous communities is still very small, and there are several challenges for promoting the recognition and protection of indigenous land rights, the recent transition presents a growing opportunity for indigenous people who live in nature-rich areas (national parks, etc.) to collaborate with 'outside stakeholders' such as governmental agencies, scholars and environmental NGOs in natural resource management.

In such situations, it is necessary to deeply understand the value of indigenous resource management practices to promote self-directed and effective resource management.

This chapter focuses on local forest resource management and its suitability in the local social-cultural context in central Seram, east Indonesia. Indigenous resource management practises

[1]For example, article 18B (2) in the constitution (the second amendment) states that 'The state recognizes and respects indigenous people and their traditional rights providing these still exist and are in accordance with the development of the people and the principles of the Unitary State of the Republic of Indonesia, which shall be regulated by law' [14].
[2]The minister of environment and forestry (KLHK) signed a Joint Ministerial Regulation 79/2014 which spells out the procedures Indonesian National land agency and several related ministries including KLHK will use in a joint effort to resolve land claims and provide secure forms within the forest zone. The minister of agrarian affaires and spatial planning and the head of the national land agency signed Regulation 9/2015 on Procedure for the Determination of Communal Rights on Customary Land and the Land of Communities in Special Regions, which is regarded as an important legal breakthrough in putting indigenous communities in a position to secure collective legal rights over their territories [14].

are closely related to and embedded in the social-cultural context of local communities [15]. However, few intensive case studies in Indonesia have addressed the relationship between the indigenous resource management practices based on supernatural enforce mechanism and the social-cultural context.

Therefore, we illustrate how the well-structured use of forest resources (wild games) is established and maintained through the indigenous resource management practices based on supernatural enforce mechanism. After that, we investigate what social-ecological roles the IRM in Amanioho has, and how IRM practices relate to the social-cultural context of an upland community in central Seram. Then, we discuss the possible future applications for achieving self-directed resource management by people who 'coexist' with supernatural agents.

There are a few precedent ethnographic studies referring to the indigenous resource use of the Seramese. Ellen carried out a descriptive analysis of land use and settlement patterns, seeking to uncover their socio-ecological processes and decision-making sequences [16]. He also analysed the relationship between animal words and animal categories, how these categories were constructed and the language of the classification [17]. Valeri re-examined the anthropological interpretation of taboo based on his intensive study of customary prohibition, makquwoli, in the Huaulu language of central Seram [18]. These studies, however, did not address the issue related to natural resource management. This chapter also aims to fill the current gap in the ethnographic literature on indigenous forest resource management in Seram.

2. Methods: study site and data collection

Seram island is the largest island in the Moluccas (18,410 km^2), east Indonesia. The island is located at the north of Ambon, the provincial capital. This study was conducted in an upland community (given the fictitious name of Amanioho) in the interior mountain area on central Seram (**Figure 1**). In 2012, the population of Amanioho was approximately 320 (60 households).

There is no navigable roadway connecting the village to the coastal areas. Therefore, the villagers need to walk to the coastal areas where markets are situated. It takes 2–3 days to go to the north coast from Amanioho on foot, whereas it takes 1 day to go to the south coast.

The main economic activities include sago (starch extracted from the sago palm, *Metroxylon sagu*) extraction [19], banana and root crop cultivation, collecting non-timber forest products (edible wild plants, honey, etc.), hunting and trapping. The villagers engage in these activities for mainly subsistence purpose. The Amanioho people also engage in money-earning activities such as seasonal migrant work (clove harvest) and selling parrots and honey in coastal villages [20].

The staple food of Amanioho people is sago. It is rich in carbohydrate but contains little protein.[3] Therefore, forest game resources are essential sources of protein. The main games that local people hunt and trap are cuscus (*Phalanger orientalis, Spilocuscus maculatus)*, Timor deer (*Cervus timorensis*) and Celebes wild boar (*Sus celebensis*) [21].

[3]Field research conducted by Sasaoka suggests that the energy gained from sago is over 70% of the total energy derived from staple foods (sago, banana, sweet potato, yam and taro) [19, 20].

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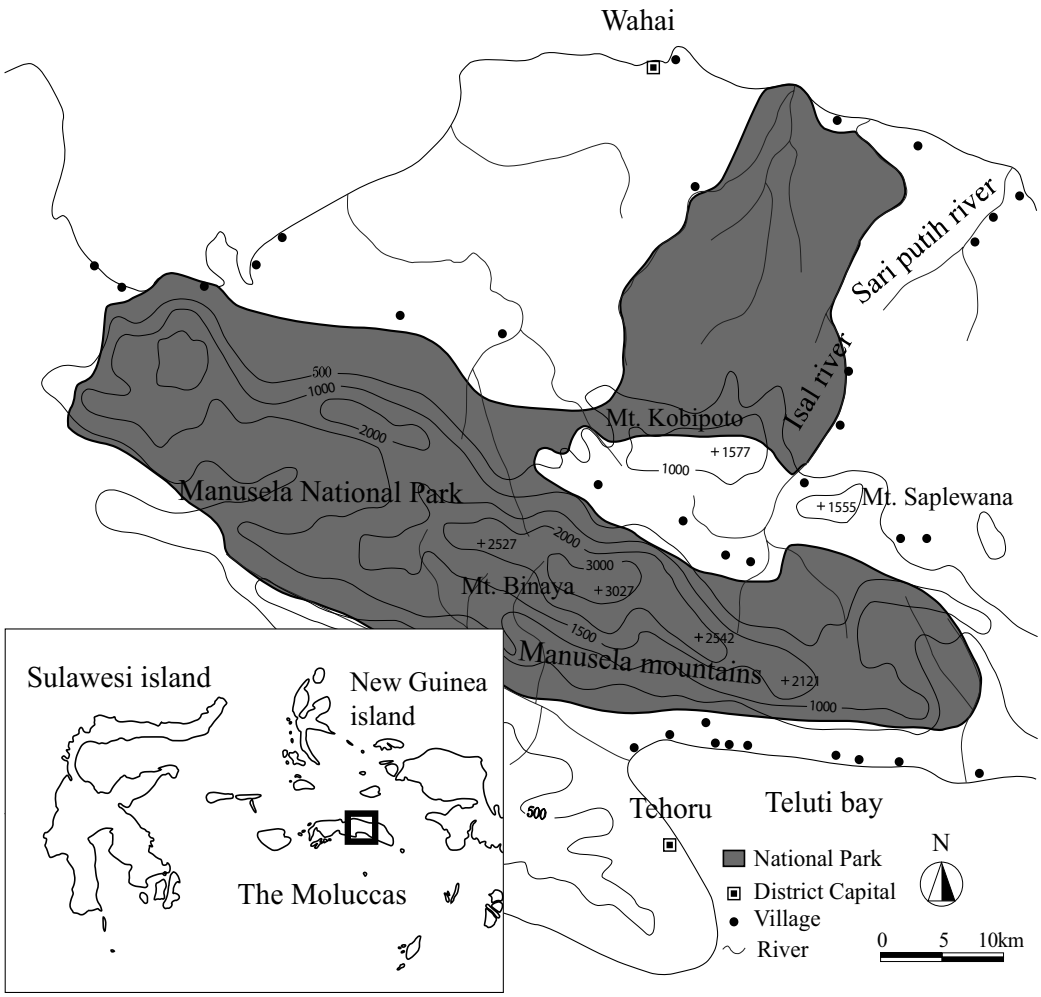

Figure 1. Study area.

The village settlement of Amanioho is situated approximately 2–3 km from the nearest boundary of the Manusela National Park which was formally established in 1997 to conserve an area of 1890 km^2, covering about 11% of the terrestrial area of Seram island.

Several upland communities are situated in a peninsula-shaped enclave in the Manusela valley on central Seram. Amanioho is one of those communities. Almost half of the village territory of Amanioho and most of their hunting and trapping grounds are situated inside the park. Existing Indonesian laws forbid hunting and trapping inside national parks. However, the law enforcement is very weak. The local people continue hunting and trapping the game animals inside the park.

The data collection methods I used are (1) key informant interviews on norms relating forest tenure and use, (2) participatory forest mapping, (3) focus group interviews on historical

trajectory of forest right inheritance and transfer, and (4) household interviews on forest use and tenure, and imposition of temporary forest use ban. All interviews were conducted by Masatoshi Sasaoka using Bahasa (a common Indonesian language) mixed with the local language, *Sou upa*.

In the key informant interviews, I conducted in-depth interviews intermittently during 2003–2010 with the village head, the village council members and customary law leaders to gather data about forest tenure system, norms for controlling forest use and local people's view of the supernatural world.

In the participatory forest mapping, 34 villagers draw a forest map by marking the location of each forest lot in 2003 (as I explain later, forest area in Amanioho is divided into more than 250 forest lots).

In the focus group interviews, I interviewed with village elders from 10 of the 11 soa (patrilineal descent groups) in 2003 and 2004 to clarify the tenure status of all forest lots and historical trajectory of forest right inheritance and transfer.

In the household interviews, in 2004, I asked all heads of households in Amanioho about the tenure status of each forest lot, temporary hunting and trapping bans, actual forest use and its historical trajectories.

3. Forest use and interactions between humans and supernatural agents

3.1. Hunting and trapping methods

Cuscus, Celebes wild boar and Timor deer are very important to Amanioho, accounting for almost 90% of the wild animal food resources consumed by villagers in terms of the amount of protein (**Figure 2**). Hunters sometimes use dogs for hunting wild boar and deer, but in many cases, these animals are caught by using a spear trap, *hus pana*. On the other hand, local people hunt cuscus by spear hunting when cuscus are resting in a tree hollow or a lair made inside the accumulated moss on a branch. However, these arboreal marsupials are primarily trapped using a weighted noose made of rattan, *sohe* [21] (**Figure 3**).

Trapping is usually conducted in *kaitahu*, a primary and mature secondary forest situated far from the village settlement and thought of as a ground primarily used for hunting and trapping. As mentioned earlier, *kaitahu* area has been divided into many small forest lots based on trails and natural landmarks such as rivers, ridges and large stones. Each forest lot (*kaitahu*) belongs to a specified individual or a group called the *kaitahu kua*. The villagers set *hus pana* or *sohe* in one forest lot of *kaitahu* or two adjoining lots of *kaitahu* and regularly check their traps approximately two times a week. They continue trapping in this manner in a certain *kaitahu* until the number of animal decreases. If the number of caught game animals decreases, the *kaitahu kua* imposes a temporary prohibition on forest use, *seli kaitahu*, as we will mention later.

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Figure 2. Cuscus (*Phalanger orientalis*).

Figure 3. Left: a weighted noose trap, *sohe*. Right: a spear trap, *hus pana*.

3.2. Interactions with supernatural agents

Amanioho people think of primary forest as a hunting and trapping ground (locally called *kaitahu*) as a place where supernatural agencies such as spirits of ancestors and various natural spirits live. They believe there are natural spirits called *sira tana* that raise and protect the Celebes wild boar and Timor deer. The natural spirits that bring up and protect cuscus are called *awa*. Each forest lot has these natural spirits. It is also believed that ancestor spirits, *mutuaila*, dwell the *kaitahu* where they used before.

After practicing the ritual to remove *seli kaitahu*, the trapper usually remains in the forest for several days and sets traps intensively. Each forest lot has a *liakika*, a camping site usually formed at the foot of a protruding precipice, for the trapper to stay when he comes to a forest that is far from the village to check traps and to produce smoked meat if numerous games are caught (**Figure 4**).

Trappers and hunters offer jewels or/and ornaments such as earrings, rings, beads, gold necklaces and dolls as offerings to *sira tana* and *awa* at *liakika* (**Figure 5**). Then they pray to them for success in their trapping or hunting endeavours. In the local people's perceptions, obtaining game animals means receiving a gift (game animals) from *sira tana* and *awa*. They believe that *mutuaila* delivers these offerings to the natural spirits and then receives game animals given by *sira tana* and/or *awa* in return for the offerings. Next, *mutuaila* bring the game animals to the villagers (*mutuaila* make the animals be caught in the traps).

Some of the *awa* or *sira tana* are good spirits (*alowa oho*), while others are evil (*alowa kina*). Natural spirits who inform the villagers of their names in their dreams are good. The villagers

Figure 4. A man who cuts a Timor deer at his *liakika*.

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Figure 5. Offerings to *sira tana* and *awa*.

believe that if a trapper intones the names when offering or setting traps, he or she succeeds in trapping. On the other hand, there are evil natural spirits such as the *awa kina*, who try to make hunters fall from trees or get injured by machetes. Then there is the evil *sira tana* that makes villagers get lost in the forest. A forest where a villager once disappeared or a villager lost his/her way is considered as a place in which evil natural spirits have been dwelling. These forests have not been used for a long time by the imposition of *seli kaitahu*.

4. Norms in regulating forest use and their social-ecological functions

4.1. Forest tenure

In central and southeast Maluku, the customary land traditionally occupied by the *negeri* (*adat* community[4] in Maluku) is called the *petuanan negeri* [22]. According to the group interviews conducted with 34 villagers from 10 of the total 11 *soa*s (patrilineal descent group) in Amanioho[5] and participatory mapping, the forest area in Amanioho which covers most of the *petuanan*, is divided into more than 257 forest lots (*kaitahu*).

Each lot has a specific name based on its topographic characteristics and belongs to a certain individual or a group as shown in **Table 1**. 'Ownership' here does not mean absolute and exclusive total rights, but non-exclusive ones (I will explain later).The forest land ownership is inherited through the paternal line.

Forest lots can be classified into four categories as shown in **Table 2**. In collective forest such as *lohuno*, *soa* and kin-group forest, members of the ownership group can use their forests by turn with an interval of several years while the forest is closed by the imposition of *seli kaitahu* for hunting and trapping.

[4]The *adat* community is a traditional community bound together in an association, having *adat* institutions, a customary law that is still adhered to, a territory defined by the customary law, and existence affirmed by the community itself, together with the government.

[5]Villagers from a *soa* (*Ilela poto*), where there is a total of 11 *soa*s, who recently immigrated from the neighbouring community do not own *kaitahu* within the territory of Amanioho. Therefore, these people were not involved in the group interviews.

Code	Name	TS[2]	HN[3]	ITH[4]	Code	Name[5]	TS	HN	ITH	Code	Name	TS	HN	ITH
Etalo					A33	Mamuhona	KP	1	KH	Ms4	Sotitai	KP	1	KNN
E1	Halulohu	KK	6	KH	A34	Teneha	KK	5	KM	Ms5	Anania	KP	1	KM
E2	Kukutotui	KS	16	KM	A35	Sinuhapoto	KK	5	KM	Ms6	Masalaikesu	KK	2	KNN
E3	Aimusunuhata	KK	6	KH	A36	Topokosu	KS	3	KTu	Ms7	Marilakahata	KP	1	KM
E4	Kaipu	KK	6	KH	A37	Omasu	KS	11	KTu	Ms8	Omakopa	KK	3	KM
E5	Haluhari	KS	16	KM	A38	Ulenokawa	KK	2	KM	Ms9	Hathuni	KK	3	KM
E6	Liapoto	KS	16	KM	A39	Lialaitu	KP	1	KM	Ms11	Wekela	KK	3	KM
E7	Sahua	KP	1	KF	A40	Lehahari	KK	4	KM	Ms12	Silahutu	KK	3	KM
E8	Kasife	KK	2	KH	A41	Aiumehari	KK	8	KM	Ms13	Kokania (2)	KK	3	KM
E9	Silahata	KS	16	KF	A42	Wae Uhu Uhue†	KK	5	KKa	Ms14	Haluhata	KK	3	KM
E10	Mapaue	KS	16	KM	A43	Ulihari	KK	2	KM	Ms15	Atamana Sana	KK	3	KM
E11	Liamumusi	KP	1	KM	A44	Aimakata	KK	2	KM	Ms16	Malilu Mata Sesu Meleka	KK	3	KM
E12	Liapihitan	KS	16	KT	A45	Malaka Sisa	KK	3	KM	Ms17	Foutihua	KK	3	KM
E13	Salapika	KP	1	KM	A46	Mutula (1)	KP	1	KNN	Ms18	Hatu Totoloe	KK	4	KM
E14	Patate	KP	1	KH	A47	Akalou Totua	KK	3	KM	Ms19	Limilohu (Panaula)	KP	1	KM
E15	Halulohu Tapu	KP	1	KH	A48	Selwolina	KK	2	KT	Ms20	Haturaohi†	KP	1	KM
E16	Liahaulu Ana	Dis	?	Dis	A49	Aimoto	KK	4	KM	Ms21	Hiauana†	KP	1	KM
E17	Lehae	KK	3	KM	A50	Lia Fali-fali†	KK	5	KM	Ms22	Iteli	KK	2	KM
E18	Halule	KK	3	KM	A51	Ilawa Haha†	KK	5	KM	Ms23	Mananeu Haha	KP	1	KM
E19	Enamasaie	KK	3	KM	A52	Wasa (2)†	KK	5	KM	Ms24	Pulatamu	KK	4	KM
E20	Manusela Ana	KS	16	KM	A53	Tiapohuhu	KK	5	KM	Ms25	Milisoi	KK	4	KM

Code	Name	TS[2]	HN[3]	ITH[4]	Code	Name[5]	TS	HN	ITH	Code	Name	TS	HN	ITH
E21	Manusela Potoa	KL	7	KM	A54	Hatuoto	KK	5	KR	Ms26	Lohie Paki Paki	KP	1	KM
E22	Ailulahari	KS	1	KM	A55	Mulua Haha	KK	5	KM	Ms27	Wana Lailai	KP	1	KM
E23	Awoua	KS	16	KM	A56	Utalohu	KK	5	KM	Ms28	Malilu Hakika (1)	KP	1	KM
E24	Hoale Ana†	KL	41	KM	A57	Atauhata	KK	5	KR	Ms29	Tala (1)	KP	1	KM
E25	Pahohi	KS	16	KM	A58	Lilihalahari	KK	5	KM	Ms30	Sautapu	KS	4	KM
E26	Totunie Paki-paki	KK	5	KM	A59	Ramauhena†	KK	3	KM	Ms31	Ena Masaie	KL	7	KM
E27	Makalasina	KP	1	KM	A60	Nisaispateia†	KK	3	KM	Ms32	Seina Haha	KK	4	KM
E28	Lusilala	KS	16	KM	A61	Waeula†	KK	3	KM	Ms33	Sehito	KK	4	KM
E29	Awausana	KK	2	KM	A62	Malilukola	KK	3	KM	Ms34	Ulai Katale†	KL	7	KM
E30	Katouhata	KS	16	KM	A63	Suhula Sana Kete Kete†	KK	3	KM	Ms35	Omapaka (2)	KK	4	KM
E31	Kasusu Mau Hata	KK	2	KT	A64	Koriwahatae†	KK	3	KM	Ilela				
E32	Tepio†	KS	14	KM	A65	Hatutuhu†	KK	3	KM	I1	Wae Hataue	KK	2	KT
E33	Seipaki Tai	KS	16	KM	A66	Kohaha†	KK	3	KM	I2	Sonihasa	KP	1	KNN
E34	Wae Musunu Ulu	KS	16	KM	A67	Matakaitupa†	KK	3	KM	I3	Wae Wasa	KP	1	KNN
E35	Soiya	KP	1	KF	A68	Lumu Panu Panu†	KK	4	KM	I4	Aiwaya	KP	1	KM
E36	Sauanae	KP	1	KF	A69	Kahupe Hatukesu†	KK	4	KM	I5	Hunasiulu	KP	1	KM
E37	Ihulae	KS	16	KM	A70	Uwaela†	KK	4	KM	I6	Ulaipoto (2)	KP	1	KM
E38	Mutula (2)	KS	16	KM	A71	Kaulata Rahe Koria†	KK	3	KM	I7	Atauhari	KP	1	KM
E39	?†	KS	16	KM	A72	Lianahu Hatu†	KK	3	KM	I8	Pasaleli	KP	1	KM

Code	Name	TS[2]	HN[3]	ITH[4]	Code	Name[5]	TS	HN	ITH	Code	Name	TS	HN	ITH
E40	?†	KS	16	KM	A73	Hatusuha	KK	3	?	I9	Ihisi Poto	KP	1	KM
E41	?†	KS	16	KM	A74	Kalae Pola-pola	KK	8	KM	I10	Makola Hutu†	KP	1	KM
E42	Matapulaue†	KK	2	KM	A75	Taumusunue	KS	11	KM	I11	Tanahai	KP	1	KM
E43	Pupuhutu	KK	2	KM	A76	Korie Waihitu	KS	11	KM	I12	Lekamahua (2)	KP	1	KM
E44	Lumsiwa	KK	2	KM	A77	Aimakasana†	KS	3	KM	I13	Funasi Limanani	KP	1	KM
E45	Lekamahua	KK	2	KM	A78	Keilekesana Kete-kete†	KS	3	KM	I14	Manu Wai Hora†	KP	1	KM
E46	Manualo	KK	2	KM	A79	Wekela (1)	KP	1	KM	Latumutuany				
E47	Sinapulounia	KK	2	KM	A80	Mileu Kori Tupe	KK	5	KH	La1	Koatotu	KL	6	KT
E48	Luku Luku Humani	KK	2	KM	A81	Kesitamu	KK	3	KM	La2	Asauhari	KS	3	KM
E49	Kileke	KK	2	KM	A82	Kinuehata	KK	3	KM	La3	Holu	KS	3	KF
E50	Manuolea	KK	2	KM	A83	Uamota Hata	KK	3	KM	La4	Mosohaa	KP	1	KM
E51	Kailoloula	KK	2	KM	A84	Mileu Poto	KP	1	KM	La5	Mahuaininue	KP	1	KM
E52	Pahuhi Tapu	KK	2	KM	A85	Hakialelohu	KK	3	KM	La6	Hinehali	KS	3	KM
E53	Walala Ana	KK	2	KM	A86	Palaloha	KK	8	KM	La7	Totulai	KS	3	KM
E54	Makalasina	KK	2	KM	A87	Likino Hata	KK	8	KM	La8	Haimama (2)	KP	1	KM
E55	Sama Sama Lea	KK	2	KM	A88	Hatu Koho	KK	4	KF	La9	Malilihu	KP	1	KM
Amanukuany					A89	Wae Kasusu Hata	KK	3	KM	La10	Liaholu	KP	1	KNN
A1	Wasa (1)	KP	1	KM	A90	Alaina Hari	KP	1	KNN	La11	Tululuti†	KS	3	KM
A2	Soa	KP	1	KM	A91	Kakopi Hari	KK	3	KM	Eyale				

Code	Name	TS[2]	HN[3]	ITH[4]	Code	Name[5]	TS	HN	ITH	Code	Name	TS	HN	ITH
A3	Sewatinueni	KP	1	KH	A92	Omapaka (1)	KK	5	KM	Ey1	Wasale	KS	3	KT
A4	Hilili Kule Kule	KK	4	KNN	Lilihata					Ey2	Leuhe	KK	2	KM
A5	Koaoku	KK	4	KT	Li1	Wasiahari	KP	1	KH	Ey3	Malilusole	KK	2	KM
A6	Pakalula	KK	4	KT	Li2	Liahaulu	KK	2	KNN	Ey4	Tala (2)	KP	1	KR
A7	Sufeli	KK	4	KR	Li3	Hinehari	KK	2	KKa	Ey5	Alasia†	KK	2	KM
A8	Kasisu Haha	KK	4	KM	Li4	Kokania (1)	KK	3	KT	Ey6	Kenena	KK	2	KM
A9	Tomoe†	KK	4	KM	Li5	Kailelea	KK	2	KT	Ey7	Haila	KS	3	KM
A10	Sisoy Hata	KK	8	KM	Li6	Hoitakesu	KK	2	KT	Ey8	Fouhata	Dis	?	Dis
A11	Sesehutu	KK	8	KM	Li7	Laheulu	KP	1	KNN	Ey9	Malilu Hakika (2)	KP	1	KM
A12	Hanahata	KK	8	KM	Li8	Hisahata	KK	2	KT	Ey10	Hererue	KP	1	KM
A13	Ahahae	KS	11	KNN	Li9	Nasa Hata Hatae (2)	KL	13	KT	Ey11	Muraleana	KP	1	KM
A14	Ulaipoto (1)	KK	4	KM	Li10	Masehi	Dis	?	KT	Ey12	Suluie	KP	1	KH
A15	Pahita Sia Tue tue (1)	KK	4	KR	Li11	Kaiyofilekea	KL	13	KNN	Ey13	Loaharie	KK	3	KM
A16	Manuelala	KP	1	KM	Li12	Tapianarue	KP	1	KNN	Mahua				
A17	Kopa Hata Hata	KK	2	KM	Li13	Lialelohu	KK	2	KT	Mh1	Aimakasana	KS	2	KM
A18	Lumah Ulai	KK	2	KM	Li14	Melute	KK	2	KT	Mh2	Silisanae	KS	2	KNN
A19	Liolepe Hani	KK	2	KKa	Li15	Tuahatan	Dis	?	Dis	Mh3	Pahuhi	KP	1	KM
A20	Kutulisa	KK	2	KM	Li16	Kahiyama	KP	1	KNN	Mh4	Leia	KP	1	KM
A21	Unenehutu	KK	2	KM	Maloy					Mh5	Malaloaki	KP	1	KM
A22	Lulakala	KK	2	KM	My1	Kikulihata	KS	7	KT	Mh6	Wae Lakaulu	KP	1	KM
A23	Sapatue	KK	2	KNN	My2	Tapuana	KS	7	Un	Mh7	Mihehata	KP	1	KM

Code	Name	TS[2]	HN[3]	ITH[4]	Code	Name[5]	TS	HN	ITH	Code	Name	TS	HN	ITH
A24	Maliluhata	KK	2	KM	My3	Atauhu	KS	7	KT	Mh8	Hatu Koho	KS	2	KM
A25	Aipaki	KK	2	KNN	My4	Marohata	KS	7	KM	Paai				
A26	Tehio	KK	8	KF	My5	Mamara	KL	13	KNN	P1	Luhehata	KS	1	KNN
A27	Kasusumauhata (2)	KK	2	KM	My6	Tifu	Dis	?	Dis	P2	Kahaka	KS	1	KNN
A28	Nasa Hata Hatae (1)	KK	8	KM	My7	Lemai	KK	4	KT	P3	Masilah	KS	1	KNN
A29	Nasae	KK	5	KM	Masauna					P4	Sihite	KS	1	KM
A30	Notaharie	KK	4	KT	Ms1	Amanihaha	KK	2	KM	P5	Wahau Potoa	KS	1	KM
A31	Tihulatan	KK	5	KT	Ms2	Waeseina	KK	2	KNN	P6	Mararoi Haha†	KS	1	KM
A32	Pahita Sia Tue tue (2)	KK	5	KKa	Ms3	Haimama (1)	KP	1	KM					

Source: Field research (July 2003).

Note 1: This list is based on the results of four group interviews (total number of participants was 34 persons) held in July 2003. The *kaitahu* owned by villagers who immigrated temporarily to the coastal areas is not listed in the Table 1. indicates lack of data.

Note 2: TS is a category of the *kaitahu* according to the scale of the *kaitahu kua* and their numbers. The meanings of the abbreviations are as follows: KL: *Lohuno* forest, KS: *soa* forest, KK: kin-group forest, KP: private forest, Dis: the forest lots, the recognition of whose tenure status was discrepant, and Un: Forest, whose tenure status is unclear because I could not interview the *kaitahu kua*.

Note 3: HN is the number of households composing the *kaitahu kua*.

Note 4: ITH is a forest lot category according to forest rights inheritance and transfer history. The meanings of the abbreviations are as follows: KM: *kaitahu mutuani*, KNN: *kaitahu nahunahui*, Kka: *kaitahu katupeu*, KH: *kaitahu helia*, KF: *kaitahu fununui*, KT: *kaitahu tohutohu*, KR: *kaitahu rela*, KTu: *kaitahu tukar* (for information on folk category of the *kaitahu*, see Table 3). 'Dis' and 'Un' stand for the forest whose recognition of tenure status is discrepant and the forest whose tenure status is unclear because I could not interview the *kaitahu kua*.

Note 5: Forest lots with the mark "†" have been not used for more than 20 years because these forests were thought of as a place in which evil natural spirits have been dwelling or the person who imposed *seli kaitahu* on the forest immigrated outside the village without removing the ban.

Table 1. List of *Kaitahus* in Amanioho[1].

Type of forest lot	*Lohuno* forest (*kaitahu lohuno*)	*Soa* forest (*kaitahu soa*)	Kin-group forest (*kaitahu keluarga*)	Private forest (*kaitahu perorangan*)	Discrepant	Total
Number of forest lots	8	48	133	63	5	**257**
Percentage	3.1	18.7	51.8	24.5	1.9	**100**

Source: Field research.

Note 1: Besides forest lots listed up in the table, there were three village forests owned communally by all the villagers and a village Church forest owned by village church. These forests are *Agathis damara*—dominated forest which have been maintained for the resin extraction.

Note 2: 'Discrepant' stands for the forest lots are those with disputed tenure status.

Table 2. Forest lot categories.

Each collective forest has a custodian, *maka saka*. *Maka saka* is a person who is expected to coordinate forest use. He is also regarded as a person who has deep understanding of the history of forest rights inheritance and transfer and is eligible to talk about the history. Others strongly avoid talking about the history of inheritance and transfer of forest rights since the locals believe that if their account is not correct, it will arouse the anger of ancestor spirits and hasten their death.

As **Table 3** illustrates, the forest is classified into eight categories based on the history of forest rights inheritance and transfer.

The *maka saka* (custodian of *kaitahu*) and *kaitahu kua* of a private forest leave *itinau*, a message concerning how the *kaitahu* should be inherited and who should inherit it when they become

Type of forest lot	Description	Number of forest lots
Kaitahu mutuani	Forest inherited through patrilineal lines from generation to generation	180
Kaitahu nahunahui	Forest given gratuitously by the right-holding individual or a group that obtained some support or aid in return for it	22
Kaitahu katupeu	Forest given by a person who was injured or came down with an illness in a forest, or by the relatives of a person who died in the forest to the person or people who carried the injured or sick person or the dead body to the village	4
Kaitahu helia	Forest gifted by the bride's side to the groom's side as a return gift for a majority of the bride's price	10
Kaitahu fununui	Forest given gratuitously by the bride's father, brother or relatives to the bride	7
Kaitahu tohutohu	Forest purchased with old ceramic dishes, textiles and money	21
Kaitahu alasihata/rela	Forest confiscated from a man who commits adultery with a married woman, or from his father, brother or relatives, as a fine. The confiscated forest right is granted to the husband of the women.	5
Kaitahu tukar	Forest exchanged between two forest ownership groups	2
		251

Source: Field research.

Note: Of the 257 forest lots that were listed in the field research, the tenure of 1 remained unclear because we were not able to interview the ownership group, and five forest lots had disputed status.

Table 3. Forest lot categories according to forest rights inheritance and transfer history.

	Number	Percentage
Households using only their own forest		
Kin-group forest	10	
Soa forest	7	
Private forest	6	
Kin-group forest and private forest	1	
Lohuno forest and *soa* forest	1	
Soa forest and kin-group forest	1	
Subtotal	26	59
Households using only the forest of others		
Private forest	5	
Kin-group forest	4	
Soa forest	3	
Subtotal	12	27
Households using their own forest and the forest of others		
Their own kin-group forest and the *soa* forest of others	1	
Their own *soa* forest and the private forest of others	1	
Subtotal	2	5
Total	**40**	

Source: Field research.

Table 4. Nonexclusive forest use.

aware that they are approaching their time of death. In the case that the *maka saka* or the *kaitahu kua* of a private forest cannot leave an *itinau* because of sudden death, it is regarded as appropriate that the *kaitahu* is inherited by the owner's male descendants (son or nephews). *Itinau* is not only a message to people who live in the real world but also a message or declaration to the ancestors (*mutuaila*). When forest rights are transferred from one *kaitahu kua* to another for reasons such as the forest is gifted or offered as *kaitahu nahuhahui* or *kaitahu helia*, the *maka saka* or *kaitahu kua* announce to *mutuaila* in a ritual who the *kaitahu* is transferred to and for what reason.

4.2. Non-exclusive forest use

Villagers can conduct hunting or trapping in the forest they do not own if they obtain permission from the owner. If a forest owner is asked to allow someone to use his forest, he seldom rejects such requests because such rejection is considered shameful. Such feeling is locally called *mukae*. Furthermore, the owner may receive retributive misfortunes from the ancestor spirits, such as causing his hunting and trapping to fail, or making him or his family to fall ill [21]. If the forest is under *seli kaitahu*, however, the owner can ask the requester to refrain from using the forest for the time being; this gentle rejection is socially acceptable. Rights to forests thus do not involve exclusive total ownership restricted to non-right holders.

Table 4 shows the results of the one-to-one interviews on forest use. Among 59 households I interviewed, 40 households (68%) engaged in hunting and trapping in their own forests, and 14 households (35%) used the forest of others. The results of the research on the history of forest use indicate that most people frequently used the forest of others because they did not have their own forest (**Table 5**). Among14 households who used the forest of others, three households conducted hunting and trapping in forests owned by distantly related relatives or nonrelatives. The others (11 households) used forest owned by relatives who were tied by blood relationships to the maternal line or other conjugal relationships.

4.3. *Seli kaitahu*: a temporary ban on hunting and trapping

When the number of cuscus, Celebes wild boar and Timor deer trapped or hunted declines, a temporary ban on hunting and trapping, *seli kaitahu*, is imposed to make the numbers recover. All traps are removed from the forest, and a sign is set up made of stakes of wood. This is locally called *seli amu holu holu*. It is an object that supernatural argents such as *sira tana*, *awa* and ancestors' spirits, *mutuaila*, are drawn or summoned to temporarily.

After setting up the *seli amu holu holu*, the person who imposes the *seli kaitahu* lays tobacco as offerings at the base of the sign and calls the spirits by murmuring their names. He informs them of the imposition of *seli kaitahu* and asks them not to give game animals to anyone who enters the forest to hunt in violation of the *seli kaitahu* (**Figure 6**). In this ritual, he also prays for any violator to receive misfortune and for the game populations to recover.

Household	Forest Tenure Index[1]	Use of the forest of others[2]
A. E	8.8	+
Ym. A.	7.9	−
D. A.	6.6	+
P. A.	6.4	−
T. Mh.	5.5	−
Yp. A.	3.7	−
M. E.	3.3	+
Y. Li.	2.8	+
E. Li.	2.7	+
B. La.	2.3	−
F. E.	2.0	+
A. My.	1.5	+
D. My.	1.3	+
L. Li.	1.3	+
F. Li.	1.0	+

Source: Field research.

Note 1: Forest tenure index is defined as Σ(1/number of households composing a forest ownership group).

Note 2: Households that had used others' forest for the past 10 years (+); households that had never used others' forest (-).

Table 5. Differences in the scale of forest tenure.

Figure 6. A man who conducts a ritual to impose *seli kaitahu*.

After the ritual is completed, nobody including the person who imposed the *seli kaitahu* and the forest owner can trap or hunt in that area until the populations of forest games recover. That if one violates *seli kaitahu*, he or his family members will surely meet with misfortune such as falling from a tree, getting injured with a machete, suffering from illness, and so on, because of the sanctions imposed by the spirits.

Several years later, the person who wants to use the forest for trapping or hunting and/or imposed the *seli kaitahu* visits the area to judge if the game resources have recovered based on the number of animal tracks, droppings and feeding marks. If the number of game animals

Tenure form	***Lohuno* forest**	***Soa* forest**	**Kin-group forest**	**Private forest**	**Discrepant**	**Total**	
Forest under ban	7	32	111	48	5	203	79%
Forest used as a trapping/hunting site	1	12	13	14	0	40	16%
Forest not used and not subject to the ban	0	3	0	0	0	3	1%
Unknown	0	1	9	1	0	11	4%
Total	**8**	**48**	**133**	**63**	**5**	**257**	**100%**

Source: Field research.

Note: 'Discrepant' stands for the forest lots that are those with disputed tenure status.

Table 6. Forest lots closed by the imposition of *seli kaitahu*.

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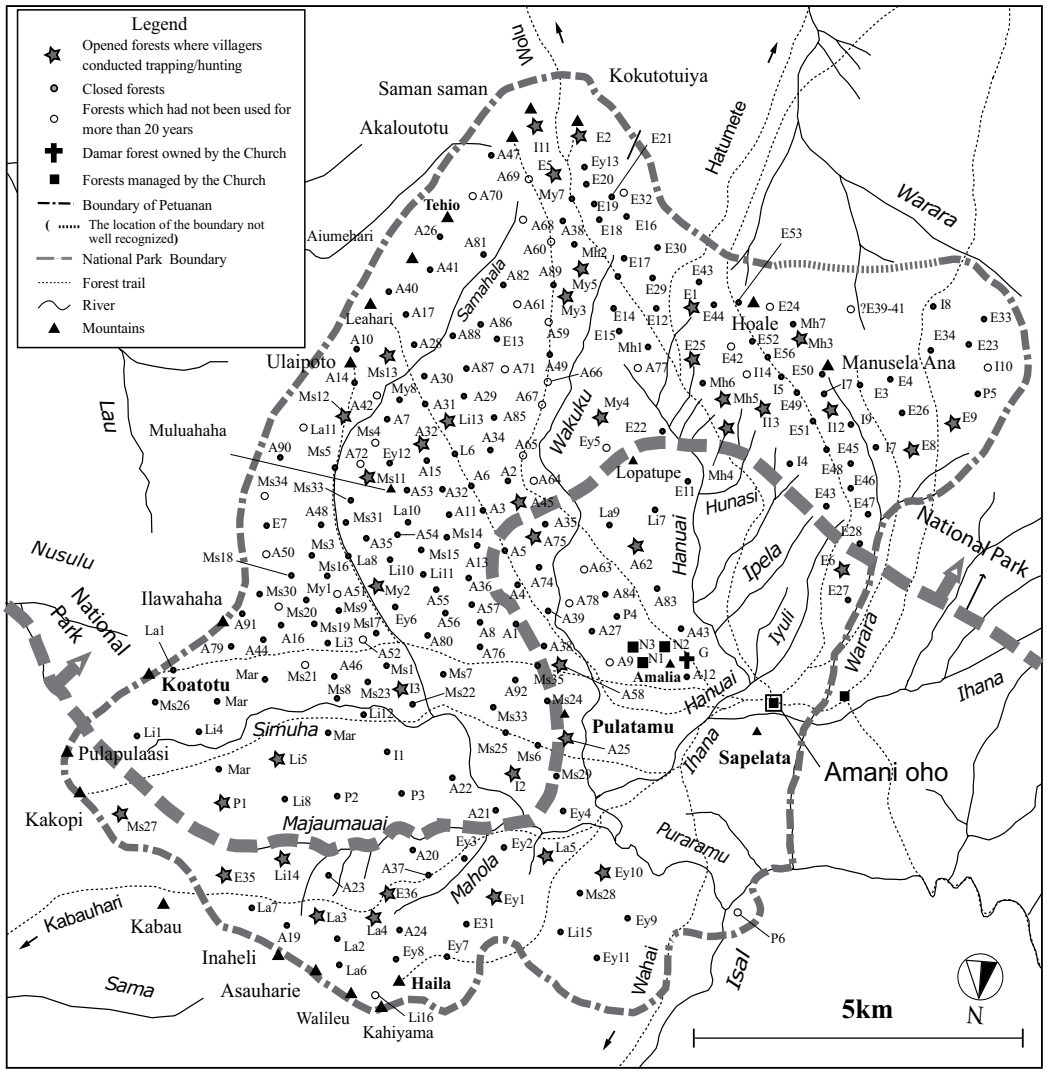

Figure 7. Forest lots used for hunting and trapping in Amanioho territory. Source: Field research. Note 1: The map of *kaitahu* was drawn through participatory mapping (number of participants: 34 persons) in July 2003. In this study, Sasaoka prepared large blank maps in which the locations of mountains and rivers were written based on the original map created by the Nederland's (Schtskaart van Ceram Blad VIII, Topografische Inrichting, Batavia 1922). In the participatory mapping, informants wrote the location of each *kaitahu* on a blank map through a group discussion. *Kaitahu* owned by villagers who immigrated temporarily to the coastal areas were not written on the map. Note 2: Alphabets in the codes on the map (e.g. A27) represent soas (patrilineal descent groups) to which *kaitahu kua* (owners/right holder groups) belongs (E: Etalo, A: Amanukuany, Li: Lilihata, My: Maloy, Ms: Masauna, I: Ilela, La: Latumutuany, Ey: Eyale, Mh: Mahua, P: Paai). Mar stands for *kaitahu* owned by the villagers of the adjoining village. Note 3: N is *kaitahu* owned by the village. N1 and N2 are forests having old graveyards. N3 is regarded as a tabooed forest where the villagers are prohibited to enter, because there was a hamlet and many people died there a long time ago. N2 are forests having old graveyards. N3 is regarded as a tabooed forest where the villagers are prohibited to enter, because there was a hamlet and many people died there a long time ago.

seems to have recovered, the *seli kaitahu* is lifted through praying to the spirits in front of *seli amu holu holu*, and trapping/hunting is reopened.

As **Table 6** and **Figure 7** indicate, almost 80% of total forest lots (203 out of 257 lots) were closed by the prohibition of *seli kaitahu* at the time I collected the data. Forty forest lots were used as hunting and/or trapping grounds at that time. Among the forest lots under *seli kaitahu* ban, 34 lots had been closed entirely for more than 20 years. These areas appear to be functioning as de facto sanctuaries. In most cases, these long prohibitions were based on the belief that there are evil spirits who try to bring misfortune to hunters in the forest.

5. Supernatural enforcement mechanisms and its transition

5.1. Narratives concerning violations of *seli kaitahu*

We now focus on the supernatural enforcement mechanism of *seli kaitahu*. Through narratives about *seli kaitahu* violation, we explore how the reality of supernatural agents and their power is socially constructed.

Judging from the results of informal interviews and field observations, most villagers seem to have a strong belief in the power of supernatural agent (ancestor spirits and natural spirits). They have complied with the regulation of *seli kaitahu*. As illustrated in the following case stories, however, these beliefs do not mean that the ban of *seli kaitahu* was never violated.

> Case 1: One day in 2006, D. A. (initials of the informant) set *sohe* in a forest after lifting the ban of *seli kaitahu* on the forest. The forest was a collectively owned forest, owned by D. A. and his two cousins (sons of his father's brother). They closed the forest for about 5 years by imposing *seli kaitahu*. While setting *sohe*, D. A. found many new *totoi*—incisions made in a trunk of a tree used as steps to climb the tree—in several trees with a tree hollow or a lair made inside the accumulated moss on a branch used by the cuscus as a shelter and/or a nest. This apparently indicated that there was someone who conducted spear hunting, thus violating *seli kaitahu*. Half a year before lifting the ban of *seli kaitahu*, a male villager (D. A. declined to state his name) had engaged in hunting in a forest adjoining the forest. D. A. assumed that the man crossed the forest border and stole forest game animals in the forest. D. A. did not report the infringement to the head of the adat law organization (*tua tua adat*), responsible for the resolution of adat law infringement, with the reasons that no one can identify the poacher and if we try to find out the infringer, relationships among villagers will worsen. D. A. said that 'even though we don't know when it will happen, the time (when supernatural agencies bring about the infringer a misfortune) will surely come, so we should only wait for it'. About 6 months later, the wife of that man had extremely hard labour when she gave birth to a baby. D. A. thought of it as *akeake*, a sanction imposed by *mutuaila*, *awa* and *sira tana*.[6]

This case illustrates that in Amanioho the agents expected to monitor forest use and punish the violators of *seli kaitahu* ban are not people but supernatural agents such as ancestor and forest spirits.

[6]Interview with D. A., a 33-year-old male, in February 2007.

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I heard from the villagers other narratives about violations of *seli kaitahu* having a similar structure in which the violation of *seli kaitahu* was connected to misfortune experienced by the violator or his families. Among those narratives, the following story was frequently told by the villagers as an example of severe consequence of the violation of the ban.

> Case 2: One day, in 1986, A. Li and Z. A. (a brother of A. Li's wife) went hunting together to Akalautotu, a forest collectively owned by the sub-clan of Amanukuany (Amanukuany Susataun) that Z. A. belonged to. After hunting in the forest, they entered Aimoto, another forest collectively owned by the Amanukuany Susataun, to spear hunt cuscus. However, *seli kaitahu* had been imposed on the forest. A. Li found cuscus hiding in a deep tree hollow. To catch the cuscus, he cut down the tree at the root. Since arboreal vines were twined around the trunk of the tree as well as the next tree, just as the tree was cut down, the next tree was pulled by the vines and fell to the ground. A. Li was crushed to death under it. Concerning this accident, the village head of Amanioho, Ym. A., and a village elder (a member of the adat council, tua tua adat), F. Li., said that if they had asked *maka kohoi seli* to remove *seli kaitahu* in Aimoto, he would have never met with such an accident.[7]

In the local interpretation of the causes of misfortune, the conducts of supernatural agents play a crucial role. Every time someone encountered a misfortune such as machete injuries, sickness, the sudden death of a young man, the villages constructed a narrative about the conduct of him/her or his/her families that would have incurred the displeasure or anger of supernatural agents. In this way, the reality of the supernatural agencies for the villagers appears to be socially constructed and reinforced.

5.2. Recent transformation in indigenous forest resource management

Judging by the fact that infringement of *seli kaitahu* has rarely happened, the locals strongly believe the power of supernatural agents, and that belief heavily influences on forest resource management in Amanioho. However, we observed recent transformations in forest resource management such as the application of *sasi gereja* (church prohibitions) on forest resource use.

Sasi is a customary ban for regulating land and resource use in east Indonesia. It includes spatial and temporal prohibitions on harvesting crops, cutting wood and gathering other products from the forest, tidal zone or marine territory of a village [23]. In *sasi gereja*, the church plays the most important role in imposing the prohibition. A village clergyman publicly declares the closing and opening of a certain area or a resource. In Maluku, this type of sasi has become widespread among the local communities of Christians [23–25].

Christianity (Protestantism) was introduced to the mountain areas of the Central Seram at the end of the nineteenth century. In Amanioho, almost all the villagers embrace Christianity. Their animistic belief, however, was not extinguished and it coexists with their Christian beliefs.

[7]Interviews with Ym. A., a 63-year-old male; F. Li., a 71-year-old male; and Ad. Li, a 50-year-old male, in January 2004.

In Amanioho, around the year 2000, some villagers started to ask the village church council to implement *sasi gereja* to protect their agricultural crops (coconuts, sago palm, betel nuts, etc.) from other villagers who might harvest them. The person who wants to implement *sasi gereja* must request its implementation from the council with donation to the church, and inform the crops subject to the sasi and their location. The preacher announces the imposition of *sasi gereja* and prays for a good harvest at Sunday worship. He also counsels the villagers not to violate the sasi and prays that the Christian God will inflict a punishment on the violator.

The local people believe that the Christian God will punish the persons who infringe upon the *seli kaitahu* ban. *Sasi gereja* is supported by such faith of the local people. In regard to resource management based on a supernatural enforcement mechanism, both *seli kaitahu* and *sasi gereja* have a common characteristic.

Recently, instead of *seli kaitahu*, a few villagers started to impose *sasi gereja* for prohibiting forest resource use as shown in Case 3.

> Case 3: Sewatinueni is a private forest owned by Ym. A. Its adjoining forest, the Ahahae, is soa forest collectively owned by all members of the soa Amanukuany that Ym. A belonged to. Both Sewatinueni and Ahahae had been used and managed by Ym. A. Both forest lots had been closed under *seli kaitahu* by Ym. A. However, it has been recognized that someone is engaging in trapping/hunting in these forests for several years. Therefore, Ym. A. imposed a *sasi gereja* on these forests and put up a notice board stating that both forests are under *sasi gereja*. This board was placed at the side of the forest trail near these forests in October 2005. It was the first *sasi gereja* against forest use (trapping and hunting) placed in Amanioho.

The imposition of *sasi gereja* on the forest use was not because Ym. A. no longer believed in the effectiveness of the supernatural power of *seli kaitahu*. According to the explanations by Ym. A., *mutuaila* and natural spirits (*awa* and *sira tana*) sometimes inflict *akeake* (punishment) on the offender shortly after *seli kaitahu* is broken, but sometimes they inflict the *akeake* long afterwards. However, in the case of *sasi gereja*, the Christian God punishes the sasi breaker shortly after the infringement. Ym. A. imposed *sasi gereja* on these forests because he wanted to have the poachers meet with some punishment (misfortune) as soon as possible.

In December 2006, a half year after placing the *sasi gereja*, Ym. A. requested opening the sasi in Sewatinueni and Ahahae to the village church council. After the announcement of the removal of the sasi in the Sunday service, his son-in-law (his daughter's husband), living with him, went trapping in the forest. The son-in-law found several new *totoi* (incisions made by machete in a tree trunk to climb the tree). This indicated that someone had conducted spear hunting for cuscus, thus violating the *sasi gereja*. The son-in-law returned to the village and reported it to his father-in-law.

Ym. A. suspected X, who was known as the master of tree climbing, of poaching in the forests, since many *totoi* had been made in huge trees, which ordinary people hesitated to climb. In addition, X had caught many cuscuses and had sold them in the village. X had also suffered from terrible malaria and hovered closely between life and death in October 2006. In addition,

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X's wife also had suffered from serious malaria, and a brother of X had been seriously wounded in his knee by his machete a while before the sasi was opened. The villagers interpreted all misfortunes of X and X's family members as punishments brought by the Christian God because of his violation of the *sasi gereja*.[8]

6. Discussion

6.1. Social-ecological roles of IRM in Amanioho

Seli kaitahu is a customary ban to temporarily prohibit forest use (hunting/trapping) in certain forest lots, where supernatural agencies such as ancestors' and natural spirits play important roles in monitoring resource use and imposing sanctions on the violator. In Amanioho, hunters/trappers usually distribute the meat of animals to their relatives and neighbours. However, most village men intend to engage in hunting/trapping themselves, rather than continuing to only depend on the distribution of meat from others, because gifting some part of the game animal's meat that they caught themselves is a socially and culturally valued practice for them. Consequently, they prefer not to continue receiving gifts of meat from others unilaterally, but intend to build mutual reciprocal relationships with others. If they catch their own game, they obtain more meat, even though some of their catch must be shared with others when they succeed in hunting/trapping. Furthermore, a dinner in the forest is usually held shortly after chopping down the carcasses of Timor deer and wild boar, and this is of great enjoyment to them [21].

Considering these points, it can be thought that if there was no temporal ban of *seli kaitahu*, forest use without the permission of *kaitahu kua* (poaching) would increase, and such situations, consequently, could lead to the collapse of the well-structured rotational forest use, where people alternate concentrated trapping with the imposition of temporal prohibition on forest use. The increase in poaching is likely to give rise to an incentive to catch before others do, and to cause the intensification of hunting/trapping before the numbers of forest game animals sufficiently recover. In addition, such competition in hunting/trapping and its consequent increase in the harvesting pressure have a risk of occurrence of resource conflicts and discord in the community. In Amanioho, these situations appear to have been avoided since the ban of *seli kaitahu* has been effectively enforced through the supernatural enforcement mechanism.

Although more detailed data on the hunting pressure and dynamics of the resources would be needed to specify something more precise, it seems reasonable to suppose that, to some extent, the norms to control forest use in Amanioho, characterized by gently opened territoriality of the forest and the temporal prohibition of forest use, have contributed to levelling access to the forest, the increase in harvesting pressure caused by competition in catching and avoiding resource conflicts within the community.

[8]Interviews with Ym. A., a 63-year-old male; Hs. Li., a 28-year-old male; and Yh. Li., a 36-year-old male, in February 2007.

6.2. Suitability to the local social-cultural contexts

As seen till now, supernatural agents, rather than people, are expected to monitor resource use and inflict punishment on violators, which is the essential characteristic of the local forest resource management practiced in Amanioho.

As commons studies have suggested, the cost of monitoring behaviour of resource user and enforcing rules have significant effects on the sustainability of resource use [26]. Formal institutions for resource management depend on a third-party legal structure where a regulatory agency often hires its own monitors (e.g. forest wardens, police and park guards) and mediators (e.g. lawyers). Thus, such a regulatory structure may require high costs charged to the society [2].

By contrast, the forest resource management in Amanioho does not burden the community with the high cost of monitoring human conducts and enforcing the rules. In Amanioho, as described in the previous section, there are more than 250 forest lots in the village territory. Thus, it would be difficult to monitor resource user's behaviour in huge forested areas. Under such situations, the resource management based on a supernatural enforcement mechanism is very practical.

Furthermore, this resource management system is suitable to the local socio-cultural context. As I illustrate in another paper, in Amanioho, the locals have a strong fear of sorcery. Sorcery is regarded as an expression of the jealousy and discontent of others. Consequently, they avoid social discord and friction within the village [21]. 'The fear of sorcery' here means not only the fear that someone put a curse on him/her but also the fear that someone suspect him/her of casting sorcery on them. If some friction and discord happen among villagers, they are tormented with a fear of sorcery. This is one of the main reasons for them to be inclined to detest friction and discord with others. Thus, the local people dislike pointing out errors of other people such as violations of *seli kaitahu* in face-to-face situations and avoid directly inflicting punishment on those who break the rules.

This disposition was also observed when I conducted household interview about forest tenure. Through the interviews, it turned out that several villagers have contradictory accounts of the history of forest rights inheritance and transfer. Where such differing accounts arose, they bitterly resented those who have the contradictory understanding of the forest tenure status to their own version. However, they showed no intention to resolve the discrepancy through direct dialogue and negotiation. All they can do is complain to their families and relatives. By no means do they try to assert the legitimacy of the recognition to the opponent under a face-to-face situation. Such a conduct must be accompanied with *mukae* (strong shame).

Under the social-cultural context I described earlier, if there is an infringement of *seli kaitahu*, it is unlikely that the forest owner tries to find out and punishes the violator. The IRM, which is based on the supernatural enforcement mechanism, can prevent friction and discord among the villagers which may be caused by a social enforcement process. Thus, the IRM based on supernatural enforcement mechanism in Amanioho is a high suitability for the social-cultural context in which people have a strong disposition towards avoiding social friction and discord.

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As described in the previous section, a few villagers started to apply *sasi gereja* to forest management in the mid-2000s. Ym. A. was the first villager to impose a *sasi gereja* on a forest in Amanioho. As the head of the village, he was in a position to take the initiative in formulating a new forest resource management action against a series of *seli kaitahu* violations. However, he did not try to identify the violator. He did not try to make a new forest resource management system based on social enforcement mechanism. In *sasi gereja*, the Christian God took the place of the ancestor and forest spirits. Despite such a change, this management method is similar to *seli kaitahu* because supernatural agents are expected to monitor people's forest use and inflict punishments on the rule breakers. Ym. A. made an effort to reinstate the orderly, well-structured forest use by applying a new management system, *sasi gereja*, which is based on a supernatural enforcement mechanism instead of creating a more 'rational' management system with a social enforcement mechanism. The imposition of *sasi gereja* did not require the locals to be directly involved in the enforcement process. Therefore, it was quite suitable to the local social-cultural context.

The idea that if one violates *seli kaitahu*, then the violator and/or his/her family members will surely meet with misfortune, is widely shared in Amanioho. Thus, it is still uncertain that *seli kaitahu* will be replaced by the *sasi gereja*. However, if this system is not degraded by outsiders who have different social-cultural backgrounds, the local people are likely to maintain their orderly forest use depending on supernatural agencies, even as the management system transforms. The case of Ym. A. appears to imply their tendencies to establish and maintain the order in forest resource use depending on the forces of supernatural agencies.

7. Conclusion

Supernatural agents (e.g. *mutuaila*, *awa* and *sira tana*) are certainly realities in the lived world of the local people in Amanioho. The local faith in these agents has had a significant influence in the arena where the norms to control local forest use have worked. The indigenous resource management based on the supernatural enforcement mechanism appears to contribute, to some extent, to the levelling of accesses to the forest, the prevention of the increase in harvesting pressure and the avoidance of resource conflicts. In addition, it is also heavily suitable to the local socio-cultural context where the local people have a strong tendency to avoid accusing someone's errors in face-to-face situation and directly inflicting punishment on violators. Therefore, to promote self-directed resource management by people who 'coexist' with supernatural agents, it is necessary to not only reconsider the intervention of outside agencies (NGOs and governments), which may break up the interrelationships between people and supernatural agents, but also construct a new model for resource management compatible with the local people's view of the supernatural world, taking cultural resilience into consideration.

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Chapter 6

Empowering Namibian Indigenous People through Entrepreneurship: The Case from the Nama People

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Additional information is available at the end of the chapter

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Abstract

The challenge emanating from the colonial and apartheid regimes on the Nama people of Namibia have not only resulted in them losing nearly half of its population, but they also appeared to have lost their social identity. To that end we continually find convergences and divergences in clothing and accessories, food, traditional dances, homes, and traditional beauty cosmetics, between the past and present. This chapter seeks to explore whether the Nama people have always used money to acquire the aforementioned past? If not, what have they done right in the past to acquire all these items? These are one of the few questions this chapter seeks to explore and understand, and the role Nama entrepreneurial activities play for their own socio-economic advancement. Critical discourse can lead to a better understanding and appreciation of entrepreneurship among indigenous people in Namibia. This will in turn result in an enhanced understanding of the role entrepreneurship and culture can play in both a local and international context. After a brief introduction to Namibia and the Nama people, the cultural values and entrepreneurial initiatives of the Nama people are discussed, followed by discussions, recommendations and conclusions. Research methods employed were in-depth interviews and participant observation.

Keywords: indigenous people, Nama, self-determination, culture, values and Namibia

1. Introduction

1.1. Introduction to the Republic of Namibia and Nama people

Namibia, formerly known as Sűd West Africa, is situated in the South Western corner of Africa, in sub-Saharan Africa. This young vibrant nation gained independence on 21st March 1990, following decades of colonial rule under the Germans and subsequently South African apartheid regime.

According to ILO [1], the Nama language is the only surviving Khoe language in Northern South Africa and Southern Namibia. The word "Khoe" means a person. In their own language the Nama people refer to themselves as Khoenkhoen (people's person). It is interesting to note that up until 1994, the Government of South Africa was not aware of the presence of people who were Nama speaking. From a historical perspective the Nama communities managed to maintain communal land for grazing, which extended into Richtersveld National Park with limited hunting and planting. Nama's were in constant conflict with the white settlers, and Basters. The Basters maintained their identity and moved from Cape Town to Namibia. The primary purpose was to find safer land. Namibian Nama people spoke Nama and Afrikaans and practiced pastoralism. The Nama people in Southern Namibia on which this chapter is based is subdivided into the following clans namely (see **Table 1** below):

During the colonial period, the Nama people were thought and seen as a threat and barbaric in nature. The colonizers were constantly seeking new ways and efforts to ensure that they are completely wiped out. This attempt was also done to ensure that they convert to Christianity or die. Under the apartheid law, Nama people that were not already assimilated into other native groups were forced to be registered as colored. Failure to comply with this rule was unavoidable and illegal. Nama elders were forced to hide their identities or misinterpret them

- *Khai‖khaun (Red Nation)*
- *!Gami‡nun (Bondelswarts)*
- *Aonin (Southern Topnaars)*
- *!Gomen (Northern Topnaars)*
- *!Kharakhoen (Fransman Nama)*
- *‖Hawoben (Veldschoendragers)*
- *!Aman*
- *‖Ogain (Groot Doden)*
- *‖Khau|goan (Swartbooi Nama)*
- *The Kharo!oan (Keetmanshoop Nama)*

Table 1. The Nama clans.

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from their neighbors and sometimes even their children. This use of indigenous language bibles, including Nama was prohibited in Namibia.

Jacobs [2] narrated the pre-dominance of this tribe (Nama) in socio-economics and politics of South West Africa, today known as Namibia. The Nama people conquered, discovered, marauder and fierce resistance to colonial occupation of their land. The colonial forces reacted to fierce opposition from this tribe with mounted reprisal. The colonizers had strong weapons and ammunition and they killed, raped, maimed, drowned, fed to sharks, beheaded, departed and more than half of the Nama people were lost. Precious lives were lost including land, possessions and property in the hands of the German occupation forces. These latter mentioned painful experiences were told by the ancestors to their children. The Nama's were the most feared tribe by the Germans, not because of their military strengths, but because of their intellectual intelligence. This fear that the Germans had led to the establishment and foundation of concentration camps on which Drechsler [3] narrated as the "transfer of the Witbooi and the Bethanie people to Shark Island marked the beginning of a harrowing ordeal on what was referred to as the Death Island". The Nama's could not cope with the humidity and chilling prevailing climate and most of them died like flies. Although many Nama people lost their lives, their persistence, perseverance and determination can still be seen among todays' generation in the twenty-first century.

This chapter comes at a very crucial and critical time in the Namibia history of the Nama people as the underperformance of the people impact the positive economy of Namibia as a nation. In addition the Nama young people in Namibia started the *"Landless Peoples' Movement"* recently. The Nama people in the Southern//Kharas region constitutes approximately 11,226 poor people, meaning that they are unable to access basic needs. The poorest areas in//Kharas are Berseba, Keetmanshoop rural and Karasburg.

2. Nama traditional culture, identity and values

2.1. How do we identify a Nama person and tradition?

Malan [4] described Nama people as people of medium height, has high cheekbones, a flat face, dark almond eyes and the Nama tribes and clans are defined by territory. Looking back into the nineteenth century establishment of centers where the chief resided and tribal government was establishment, each tribe had independent governments consisting of chief and elected council. Family life includes the practice of children living at home until they get marriage. Social gatherings are very frequent and usually happen at night around fire. Man and women usually start playing music which usually results into a dance.

As in many cultures, Nama traditions are passed down through generations and are critical in order to fully understand the ethnic group and Nama elders today narrates that, they know what they know, because of what has been carried on to them by the ancestors and that is the knowledge that enables them to distinguish between right and wrong as Nama's. Not just the term Nama, but the cultural practices they follow.

2.2. Gender roles

Nama women in the colonial days had important roles such as gathering and collecting food for the entire community, whether they are close knit family or not. The roles of men as hunters were irregular, thus it was important for women to ensure that the family is well taken care of. As revealed by Deacon and Deacon [5], Nama communities attribute women to good happenings; for example – a clear distinction can be made between female and male rain. Female rain is usually gentle and helps plants grow. Male rain is usually destructive and harsh. Another significant celebration on the Nama calendar is the woman's first menstrual cycle. During this celebration which last up to two weeks, in a traditional grass and reed mat house and the youngsters usually sit on an animal skin (see **Figure 1**). Elderly women guide the youngsters about what she is going through and the ceremony concludes with a dance out ceremony attended by local indigenous people.

2.3. The Nama dance

As stated by Jones [6], despite the colonial influences, the Nama people have declared these performances, known as Namastap (a step dance) which is a symbol of the Nama identity. The Namastap dance is performed at most significant events of the calendar. Social gathering, weddings, birthday parties' forms part of the list. Wedding preparations can last up to 1 year. The couple normally only gets married 6 months or sometimes more after engagement. From an anthropological perspective, issues such as gender relations, the impact of Christianity on the Nama people and the power of colonial influences can be observed in the dance. It is important to mention that during the dance when the foot is lifted away from the central axis,

Figure 1. Traditional Nama mat made from Springbok Skin and usual for girls when undergoing womanhood as well as bedding: Photo by: JP Van der Westhuizen.

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Figure 2. Nama learners at a school started as a missionary school by Rhenish and AME Churches in Maltahöhe/Daweb!gaos (Namibia): Photo by: JP Van der Westhuizen.

instead of lifting it away from the ground; they keep contact with it by sliding across its surface. This sliding action is what differentiates the Nama of !Khubus from other Nama groups.

2.4. Church and education

Church and education are the two major topics most Nama communities are eager to discuss (see **Figure 2**). These issues impacts their daily lives. Although most Nama's are not professionally trained and highly qualified, going to school and becoming a teacher or nurse is important. Teaching and nursing are one of the most highly respected professions in the Nama culture. Many elders had grown up in a time when church and education were the only ideas transferred to them by the missionaries.

3. Review of entrepreneurship literature

Leff [7] defined entrepreneurship from the Schumpeterian perspective as a combination of already existing endowments to produce something which is novel, innovative or original. He further had the notion that entrepreneurship is increasingly viewed as essential to economic growth and social development. Societies are not static and the entrepreneurs of today are not identical to the ones which existed before. In any country, some regions produce more entrepreneurial activities than others, because entrepreneurship cultural bound. When we

look at entrepreneurial activities of the Nama, Maori, First Nations or Aboriginal people, we usually talk about "indigenous entrepreneurship."

Hindle and Lansdowne [8] argued that indigenous entrepreneurship is the creation, management, and development of new ventures by indigenous people for their own benefit. The desired benefits that are ultimately achieved can range from the narrow view of economic profit for an individual to the broad view of multiple people. Thereto, indigenous entrepreneurship creates socio-economic advantages for communities, and the outcomes derived from indigenous enterprise which extends to non-indigenous enterprise partnerships and stakeholders.

As claimed in Ref. [9], the common perception of indigenous business as a community-run venture is inadequate and renders indigenous entrepreneurs invisible, missing the fact that most indigenous people live in urban areas. It is also the argument of the researchers in Ref. [10, p. 6] that there is cultural legitimacy to some extend and indigenous identity and the desire to positively reflect indigenous values in the surrounding mainstream community.

According to the authors in Ref. [11], indigenous entrepreneurship refers to the entrepreneurial process of an enterprise which encompasses the desire of an indigenous person to become more self-reliant and socially cohesive. Also, as stated in Ref. [12], discussions around indigenous entrepreneurship in the academic literature is prominent in the Canadian and Australian literature, as scholars have done research pertaining to issues of indigenous people and how they sustain their livelihoods through self-employment based on indigenous knowledge. When looking at the academic literature and the definitions from various scholars indigenous entrepreneurship also looks into people's own traditional customs, knowledge and values.

It is noted in Ref. [8] that people who are indigenous see themselves as a collective group working together on the basis of their common ancestry, history, language and, at times, religion. This observation came to light from a study which was conducted with the Aboriginals of Australia and Torres Strait Islanders. The primary motive behind this latter mentioned study was to search new paths to interpret indigenous entrepreneurship in the context of the indigenous people of Australia.

Indigenous entrepreneurship domain has two main areas which it strives to achieve name: (i) the essence of reconciling tradition with innovation; and (ii) the importance of understanding values and worldviews which are not necessarily part of the mainstream views.

- *The essence of reconciling tradition with innovation:* Generally, modern entrepreneurship is revenue driven and based on innovation. With culture being an identity, indigenous people are driven fundamentally to restore and preserve their own cultural heritage. The aim is to create an understanding of the language and cultural values so it may not be lost, but serve as a means to revenue creation as well ensuring the cultural heritage is not lost.
- Values and worldviews are usually not part of the mainstream but understanding these two aspects are important. Worldviews are regarded as backward; the benefits indigenous people can offer are sometimes missed out on by mainstream society.

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It is also confirmed in Ref. [8] that indigenous entrepreneurs can offer many benefits to the mainstream society and the global village. Furthermore, if indigenous people intend to pursue a successful indigenous business activity, cultural heritage must not be lost as that is the good and service that is placed on the market, unique and innovative, a niche on any market.

Ref. [13, p. 563] reported that as part of the migration settlement of the Polynesian peoples in the Pacific the last 500 years indigenous people of Aotearoa New Zealand were viewed as indigenous to the land. Entrepreneurial activities of the Maori people in New Zealand were viewed as "Kaupapa Maori entrepreneurship." This relates to the specific ways Maori people practice, think and feel toward activities related to the improvement of their livelihoods. Kaupapa Maori Entrepreneurial activities are focused on the development community rather than individual development and it is that aspect that drives the enterprise.

To the Maori, indigenous to New Zealand, the *whanau, hapu and iwi* play a very essential role in their survival. The Maori establish businesses for both profit and non-profit, this enhances their *whanau, hapu and iwi*, and also creates robust strategic organizations that impact the development of the Maori communities [13, p. 547].

An indigenous group of people are defined by the following characteristics as per the World Bank:

1. Attached to ancestral territories and natural resources;
2. Customary, social and political institutions are noticeable;
3. Systems of economic activity which are mostly geared toward subsistence production;
4. An indigenous language different from the language spoken by indigenous people in a particular country;
5. Individuals who view themselves as indigenous and are defined or are identified by other members of a distinct cultural group as indigenous.

As cited in Refs. [11, 14] also acknowledged that the aforementioned clearly places "indigenous people" to be distinct. Indigenous people around the world range between 300 and 500 million people and they constitute at least 80% of the cultural diversity on this planet. Five thousand (5000) different groups of indigenous people are recognized by the United Nations (UN). It is important that the rich diversity of cultural heritage is recognized by these institutions to both restore and protect the identity of these groups.

Drawing from the diverse insights and writings of the scholars above, and for the purpose of this chapter, indigenous people are defined as "the first inhabitants of a particular nation. Indigenous People worldwide still maintain their social cultural norms, language and institutions [11]." The next section will look at Entrepreneurship in a Nama cultural context.

3.1. Entrepreneurship in the Nama cultural context

Entrepreneurial activities among the Nama people were from the early days about trading goods (barter) rather than that which involved currency. The community would usually exchange tea for sugar or Holsum fat (see **Figure 3**).

In addition in the early days they also traded their land for guns. Other items which were traded included shoes, accessories, livestock. Namas' traded items with one another depending on what they don't have. It is important to mention that the principle of sharing did not warrant Nama people to be involved in entrepreneurial activities till their time of trading with goods ended sometime in the twentieth century as goods became expensive and acquiring them would mean they must have money. Indigenous enterprises among Nama people which requires money is relatively very new and there is a lot of untapped potential for sustainable growth. Key entrepreneurial activities which the Nama people are involved in are Clothing and Accessories, Traditional Medicine, Perfumes and make up, Dances and Food.

- *Clothing and Accessories:* The Germans would cut of one leg of the trousers of the laborers, so that they would easily know that it is a Nama person. The dresses are designed with printed fabric material and the cut is very unique and distinctive (see **Figure 4**).
- *Traditional Medicine*: The Hoodia plant natural plant has now became a protected plant, which has been used by the Nama people since the olden days. Currently some Nama people hold licenses and sold this plant to create revenue. Other medicine and food products that has now become commercial from which the Nama people generate relative revenue is the !nara root and fruit that is used for medicine, oil and skin products as well as products which are eatable.
- *Perfumes and make up:* Although not sold in large quantity or to other tribes, the Nama people still use and sell their powder perfume made from trees and stones and are stored in small tortoise shells with small animal skin with fur is used as a brush, this perfume is known as Sa and its storage of the shell is known as !uros.

Figure 3. Holsum fat very useful for cooking porridge and Karakul Lamb: Photo by: JP Van der Westhuizen.

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Figure 4. Traditional Nama dresses and accessories: Photo by: JP Van der Westhuizen.

- *Nama Stap Traditional Dance:* Nama people in this twenty-first century perform the Nama Stap and Langarm at festivities to generate extra income and to sustain their livelihood.
- *Food/Delicacies:* As pastoral farmers the Nama people usually did not sell their livestock to generate revenue, but livestock was sold when necessary to put food on the table for family. Other food items which the Nama people use to do for business includes meat (donkey, cow, sheep etc.), rooster brood, goat and sheep intestines, goat and sheep head, ash bread, bread baked in black pot and butter made from cow milk (see **Figures 5**, **6**, **7**, **8**) for Nama food delicacies and drinks).

Except for the monetary benefits these above entrepreneurial activities are meant to generate and also sustain cultural identities of the Nama people and livestock. Numerous studies have looked into the indigenous community based enterprises and these businesses usually have a more communal purpose and not focussed on profit for the individual. According to Ref. [15],

Figure 5. Traditional Nama Potjiekos: Photo by: JP Van der Westhuizen.

Figure 6. Famous Nama delicacy known as "Jom" made from bread flower and cooked in black pot: Photo by: JP Van der Westhuizen.

Figure 7. Traditional Nama lamp for light in evening and calabash to keep sour milk creamy: Photo by: JP Van der Westhuizen.

although these businesses embrace the basic business functions, they differ from most conventional businesses as they are not operating on the business doctrine models used by everyone else but have a much broader political, social, cultural, environmental and economic goal in which they resolve pressing social problems.

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Figure 8. Traditional Nama bread baked in a black pot: Photo by: JP Van der Westhuizen.

Although the indigenous entrepreneurial activities of the Nama people are evident when the researchers drove through Namibia, these indigenous entrepreneurial activities are under researched.

4. Methodology

This chapter made use of primary and secondary data. Primary research was done among the Nama people, to capture the rich cultural experiences from the respondents. Twenty people from the Nama community took part in the in-depth-interviews. Oral storytelling was also used to capture meanings from the Nama people in terms of the daily battles they face and oral story forms part of the night ritual around the fire in Nama people. The authors also observed the behavior and the interactions of the Nama people on a daily basis. Secondary sources ranged from scientific journals, books, theses, conferences papers and internet sources. This chapter made use of the purposive sampling technique whereby the authors interviewed people which were very familiar with the Nama culture and identity.

5. Discussions and findings

The findings of this research gave the readers a clear direction of entrepreneurial activities among the Nama people of Southern Namibia. This study is one of the first of its kind to be conducted by Namibians from both an insider and outsider research perspective: The chapter in particular wish to answer the following key research questions:

- Have Nama people always used money as a form of exchange?
- Did Nama people have well-paying employment in colonial area?

- How did the Nama people use indigenous knowledge to make a living?
- How can indigenous entrepreneurship be defined in a Nama cultural context?

To answer these questions above it becomes important at this point in time to explore some of the responses from the interviewees.

It was interesting to note that one of the interviewees see the Nama people as very lazy and they have no work ethic. This is evident from the quotes below:

Sara not her real name noted that: *"We are from broken homes, substance abuse, poverty and peoplewho are very inferior."*

Thomas not his real name noted: "As a Nama I avoid risk at all cost as I do not want to fail."

Box 1. SARA and THOMAS.

These two excerpts in Box 1 from Sara and Thomas are just one of the many challenges the Nama people in southern Namibia has to face with on a daily basis. Entrepreneurial success in the mainstream academic literature considers risk, tenacity and confidence as a major driving force for any entrepreneurial venture to succeed.

Another respondent Saul on the other hand felt that success in entrepreneurship is not guaranteed and they as a family will try by all means possible to run away from challenges and problems. For him personally he feels that there are simply no aspirations among the community, but he loves the culture and still has hope that there is a possibility to find something entrepreneurial in it

Box 2. SAUL.

A church leader (Bonja not his real name) amongst the local community has the notion that most of the young ladies become victims of teenage pregnancy (even at times from the same pastors) and alcoholism is king amongst the communities. The Nama youth look old, they appeared to be 70 years of age at 20.

Box 3. BONJA.

"Monica (not her real name) noted that Nama people are very judgemental people, they assume that they are always better than the next person. They will at times view their own teacher as intellectually challenged and give off that sense that nobody can teach them anything, while they are unable to do anything. This can also be regarded as self-destructive behaviour."

Box 4. MONICA.

"Absalom a local youth activist said that 27 years into Namibian independence a lot of effort has been made by the government to preserve employment for the Nama people, but people simply do not show up for work and most job opportunities are given to other tribes (e.g.: Oshiwambo). The work ethic of my people is relatively very low."

Box 5. ABSALOM.

"Tukulan (not his real name) noted that staying in school is very difficult for me as a young person, as my parents never had proper education. What can possibly change for me differently compared to their times? I have no father figure and whenever he visits he beats up my mom. As a Nama man we were mostly regarded as hunters. We would haunt wild animals and use the skin after the animal is killed to make clothing. Any clothing we received from the white settlers were usually torn, so we have to make patches and that is what created our own clothing identity."

Box 6. TUKULAN.

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This expression from Tukulan relates to the issue of social identity. The way he was raised and that change can be at times beyond his personal reach. One thing Tukulan is certain that his ability to make clothing from animal skin, which is entrepreneurial in itself, it we go back to the initial definition of entrepreneurship in the thirteenth century.

From the research methods used for this study it became clear that in the olden days currencies were use namely Shillings and Tikkies. These currencies could buy a lot of commodities. So the Nama people were aware of currency used by the settlers, but the barter system was also very prominent during those days, when they were trading with the Germans and among one another. The Nama people did not necessarily have well-paying employment as they were mostly shepherds and hunter gatherers. They were working mostly for the white settlers, but because the employment was in line with what they have normally been familiar with most of their lives, it was easier to integrate it into their daily lifestyle.

It is clear that the Nama people used their indigenous knowledge to make a living during the olden days. They could use their intellect, and they lived in extended families where they could learn and share ideas in a team. This later created an appreciation for each other among them as a unit.

Indigenous entrepreneurship according to the Namibian Nama people is what they are able to do with their hands regardless of the limited resources they possess. The entrepreneurial spirit and drive of the Nama people is strongly rooted in their cultural values and believe systems. It is more about what they believe in strongly and what they have been raised with.

6. Conclusions and recommendations

This chapter explored how the Namibian Nama people can be empowered through entrepreneurship. This research revealed that entrepreneurship was prominent among the Namibia Nama people, if we reflect back to the original definition of entrepreneurship to take your hand and do something. Research revealed that in the olden days when the Nama people of Namibia came into conflict with the colonisers or settlers they were constantly seeking new ways to defeat them. This certainly showed their tenacity, perseverance, persistence and patience. These latter mentioned qualities are very critical for any successful entrepreneur. The lifestyle of the Namibian Nama people is deeply rooted in culture and tradition. The uniqueness of the people lies in their strong ability to survive from hunting which is both a means to feed the family and also a very prominent. It became clear that indigenous entrepreneurship as defined by most prominent scholars refers to the use of indigenous knowledge by a certain tribe or group for their personal development or economic advance. This research forms part of the very few exploratory experiments which has been conducted in Namibia in terms of indigenous entrepreneurship. It is important to reiterate that the Nama people do not operate within isolation and that they are part of the bigger Namibian population. They have got a very unique yet significant role to make the economy better. It became clear from this study that the Nama people first need to develop a sense of trust and become more socially

and economically intelligent. Stumbling blocks to creativity and innovation can be the colonial psychological mind-set which is still evident among the Nama people. Since Namibian independence in 1990, numerous entrepreneurial development projects and job opportunities were brought forth for the people, but they are simply not interesting to the extent that they see their lives any different than it is today. For any entrepreneurial program to flourish or make a significant change to the lives of the Nama people, they have to buy into it. They must want it more than anything.

This research has shown that the Nama people used both currency and barter as a form of exchange in the early days. For indigenous entrepreneurship to prosper new programs which encouraged a change of mind-set and harmony is required. The entrepreneurial values of the Nama people need to be in alignment with their culture. New development frameworks which understand and accepts that the Nama have stagnated, mentally, physically and at times emotionally needs to be developed for the future advancement of the people. It is important to make the Nama people aware that they have to deal with the traumatic past, regardless of how difficult it is. Nama people need to be reassured that their uniqueness and perseverance brings something special to the country. Mentoring and role modeling programs of Nama people whom have succeeded against all odds needs to be showcased.

Nama people feel that they have no sense of meaning, because their parents are or were not educated. It will be good to teach character development interventions in schools. Nama people should be educated about the importance of technical skills such as farming, technical subjects. In addition is important that the land of the Nama people be restored as that is a very critical component for any Nama person. The ability to have land of one's own. It became clear from this research that the sense of and cultural identity of the Nama people to impart knowledge to other tribes and clans needs to be restored, by reassuring the Nama people that they can achieve great things. Self-awareness is a major component which needs to be addressed also that the Nama people develop an appreciation of their culture and develop a strong drive and motivation.

The Namibian National Policy of entrepreneurship development with particular reference to indigenous people needs be developed. Once people have a policy document that guides their existence and the role they are able to play in the community, taking ownership becomes much easier. In New Zealand and Australia there are specific programs for indigenous people and how they can take pride of their culture, which also making a significant contribution to the economy. In New Zealand the Maori people also talks about Maoripreneurship. This gives the researchers great hope that the possibility of "Namapreneurship" is feasible. It could be a relatively new dimension, but a possibility of exploring a new theory cannot be ruled out. Once Namibian policymakers understand the importance of indigenous entrepreneurship and implement policies which are cultural sensitive entrepreneurial activity will certainly thrive among the Namibia Nama people. Currently there are no successful entrepreneurship programs based on indigenous people from the Nama people. An entrepreneurial mind-set, spirit and culture need to be established first. Each tribe or clan in Namibia

needs to be reassured that they all have something very unique yet distinctive to offer. This study taught us that we must not only give food and money to beggars, as they will be forced to return and beg for more. However, if we teach them to be more self-sufficient, they will no longer be dependent, but they could help others too.

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Section 3

Indigenous Knowledge

Chapter 7

Indigenous Knowledge Systems for Appropriate Technology Development

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Abstract

Indigenous knowledge systems (IKS) comprises knowledge developed within indigenous societies, independent of, and prior to, the advent of the modern scientific knowledge system (MSKS). Examples of IKS such as Ayurveda from India and Acupuncture from China are well known. IK covers diverse areas of importance for society, spanning issues concerned with the quality of life - from agriculture and water to health. The IK resident in India and China have high relevance to rural life, especially given the level of engagement with agricultural and health technologies. The goal is to establish a heuristic whereby IK can be reviewed and evaluated within particular contexts to determine if the IKS can lead to the development of appropriate technology (AT) addressing that need sustainably. Although much work on cataloguing and documenting IKS has been completed in these two countries, a paucity of attention has been paid to the scientific rationale and technological content of these IKS. Evaluation of many indigenous technologies reveal that many of these technologies can be classified as 'appropriate', focused on basic needs of water, sanitation and agriculture, and many have origins in IKS that survived. Thus, IKS must be validated, exploited and integrated into AT innovation and development.

Keywords: indigenous knowledge systems, modern scientific knowledge, appropriate technology, sustainable development

1. Introduction to indigenous knowledge and systems

Indigenous knowledge (IK) and indigenous knowledge systems (IKS) refer to knowledge and knowledge systems that are unique to a given culture [1]. Indigenous knowledge can be differentiated from the modern scientific knowledge system (MSKS) and international knowledge systems. The roots of MSKS rest on scientific research conducted and generated in institutions of higher learning such as universities and research institutions. MSKS can be seen as a component of society, part of the scientific and technological advancements of humanity; this knowledge cannot be orally garnered or obtained through anything but rigourous academic study. It is propagated through advanced study's institutes, graduate research and education, including internships and training workshops and modules. What should be understood most clearly about the MSKS is that it is self-perpetuating, where the models for training and development and career advancement all involve the reinforcement of existing systems of research and knowledge propagation and development. Nevertheless, there are examples of indigenous knowledge systems that have survived and even thrived despite the challenges brought up through the MSKS such as *Ayurveda* [2] and *Unani* [3] and even acupuncture, which is basically an indigenous Chinese medical knowledge system. The strength of IKS can be seen in how these three systems have gained acceptance in various contexts, including the National Institute of Health establishing centres of research and study for both acupuncture and *Ayurveda* in the United States, as well as various governmental research centres that have been established by the Indian government, for example, to research *Unani*.

At its most elemental level, IKS can be considered the foundation upon which local communities make determinations about local issues. These decisions pertain to various areas of endeavour, including water and other resource use, conservation and management, agriculture, health care issues, as well as providing information and public outreach and education within a local community.

The major problem with indigenous knowledge and indigenous knowledge systems reside in the difficulty encountered in establishing what constitutes 'indigenous' in particular social, geographical and cultural contexts. The difficulty for a society to come to agreement on what and who is indigenous can be quite high, especially because of establishing a socially and culturally accepted identification of what constitutes the indigenous groupings within a given country or region. The conflict can range from groups that desire to be recognized as indigenous to groups that find paternalistic offense in that identification. Global transcontinental migration drives the mix of peoples of different backgrounds and ethnicities towards greater complexity and the discourse has to dissect whether only communities that are native, aboriginal or tribal should be included or the scope expanded to include other types of residents or migrants. The process of classifying and providing tangible examples of indigenous knowledge systems, researchers, educators and practitioners have developed a plethora of terms that can be linked closely to IKS [4]. These include such labels as traditional knowledge (TK), indigenous technical knowledge (ITK), folk and local knowledge, environmental or ecological knowledge (EK), and sometimes it has also been called people's science.

Despite the multitude of terms used to identify IKS, there are generally accepted and received notions of what IKS comprise, specifically around the space of traditional knowledge in

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diverse cultural surroundings and geographical spaces. Thus, what is helpful is developing operational and characterizing ideas of what IK is, how it is developed, and how it grows as a knowledge system within a particular cultural space.

The main characterizing feature of an IKS is that it is locally based, grounded in a particular culture and geography. The oral tradition is strong in IKS, most of the knowledge being passed on orally, and through mimicry and practical application. In general, IK can be considered the cultural and technological product, or knowledge product, from a society or culture's interaction and engagement with daily living. Theoretical grounding is not IKS's hallmark—that is, the foundation of the MSKS. On the other hand, IKS is developed through daily engagement and through trial and error to see what meets a particular community's needs.

The notion of the static nature of IK has been disproved through numerous examples showing how IK can be changing continuously, especially as a culture or a community develops and grows, and is subject to changing environmental, cultural, physical and economic stressors. Because of its oral traditions, IKS tend to be more transparent and openly accessible to communities. Intellectual property is not a strong point in the IKS ecosystem—knowledge is supposed to be shared for the benefit of the community and not for private gain. As described earlier, IKS are grounded in a specific local culture and as such tend to be distributed through a given community according to different bases; IK can be quite asymmetrical dispersed in a given community. The bases can be age, seniority, gender, or sometimes based within a particular community sub-group or segment that focuses on the particular activity the IKS is integral to—such as, for example, river keepers and water masters clustered around rapine communities focused on water treatment and conservation.

IKS is often maintained and propagated through community members who are experts recognized and accepted as such by the community. This standing may obtain from political authority, particular ritualistic standing an individual may possess, or simply from being the most respected authority with the most experience and acknowledged as such within a particular community. In terms of knowledge organization and management, indigenous knowledge is broadly seen as based in its function, which may include both technical and non-technical aspects within a particular field of application [5].

An excellent illustrative example of IKS being employed in decision-making at the local level is the *panchayathi raj* form of local government that involves all stakeholders at the grass roots level in governance decisions at the village level [6].

To summarize, indigenous knowledge and indigenous knowledge systems are based in communities at the very grass roots level; this knowledge provides the critical socio-cultural capital that is essential for communities to not only survive but also to go beyond and flourish within the given contexts of that community's geography, environment, culture and economy. At the same time, IKS is not static—it changes as is required and in response to the various stressors that a community faces, including environmental, social, public health and safety; IKS is also informed through external interchanges and interactions that any community undergoes through trade, exchange and other cross-boundary type interactions.

Given the importance of IKS to a community's survival and flourishing, these knowledge bases and systems are critically important for capacity building within a community. This

capacity building takes the form of development of appropriate technologies (ATs) to sustainably address the challenges that a community may be faced with [7-9].

2. Appropriate technology

Before being able to relate indigenous knowledge and IKS to appropriate technology (AT), it is important to clearly define what an 'appropriate' technology is, something that has been quite difficult to do and has been the source of much controversy [10]. There is some consensus that has emerged from the various discourses, however, on the operations and manifestations of technologies that have been deemed appropriate, despite many accepted notions of AT being brought into question [11]. Perhaps most important for AT is the underlying philosophy and ethic that focuses on empowerment of communities at the grassroots through the development and implementation of appropriate technologies that address basic needs of clean air, water, shelter, safe and nutritious food, relevant education, and pertinent information and communication technologies among other needs. Some of the tenets generally applicable to ATs include: require little capital, utilize local materials and resources, be relatively labour intensive, be small scale and be affordable. Nevertheless, there has recently emerged the notion of micro-AT and macro-AT, challenging some of the previously mentioned tenets of AT. It is clear that many long held presumptions about AT are now being debated and questioned. AT philosophy does emphasize grounding in specific communities, implementation within the constraints of local community-specific socio-cultural and geographical contexts. Perhaps most important, the end result of development and implementation of ATs within communities must result in building community capacity and empowering the community at the local grass roots level [12–14].

The most critical feature of the appropriate technology ethic speaks to the holistic inclusion of the local targeted community in the entire development process. This has to begin with the actual technology conceptualization stage, going on right through to technology innovation, development, implementation and execution, followed by monitoring and evaluation. Any technology that claims the mantle of 'appropriate' should also be adaptable and flexible, while eliminating adverse environmental impacts [12, 13]. An earlier paper [13] provided a broad over view of appropriate technologies available for water collection, treatment and storage in the context of land reform and a more recent version [14] updated appropriate water technologies in the context of public health.

3. Indigenous knowledge and appropriate technology

For a community to survive and flourish, elementary community necessities for survival such as clean water and air, safe and healthy food, renewable energy, accessible and affordable healthcare, relevant and topical education as well as information and technology needs, must be satisfactorily met. The focus of appropriate technologies being developed across the

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planet is the development of sustainable technologies to satisfy these fundamental needs. Communities focus on the development of the technologies appropriate to the satisfaction of these community needs. Often, it is the indigenous knowledge of these communities that was the basis for the community's technological development.

A launching point for the analysis of how indigenous knowledge and IKS might contribute to the development of appropriate technologies would be to address these identified needs. More importantly, after identifying relevant and applicable needs, IKS that include appropriate technologies for these targeted efforts must be identified through engagement of the local community. A broad and diverse spectrum of appropriate technologies can be called upon as a resource base, allowing communities to self-select and focus on those areas that are of critical immediate need for the community. This drawing from IKS for the development of ATs will promote and enhance sustainability practices and principles within the community.

Numerous and diverse examples exist of appropriate technologies that are being implemented and practiced that originate in indigenous knowledge. The application of the prolific and multifaceted neem tree in a broad array of rural sustainability practices such as health and agriculture is an excellent and pertinent example [15]. The spice turmeric has been utilized for centuries by indigenous communities in agriculture, animal husbandry and in health and medicinal applications [16]. Turmeric is also widely employed in the Ayurvedic medical practices, as well; indeed, medical systems for health management such as acupuncture and Unani [17] are examples of IKS on a much larger and deeper social milieu.

Among the rich resources that emanate from IKS, agricultural knowledge and management systems also abound. An example that has particular relevance in the age of synthetic fertilizers and large-scale pesticide inputs into industrial scale agriculture and the various problems that ensue is *vrikshaturveda*. This is an old IKS that focuses on agricultural practices that only call for organic and natural interventions into the farming process and cycle. Thus, in *vrikshaturveda*, traditional agricultural outputs such as cow dung and biomass waste are manipulated to create sustainable and naturally and organically renewable input. Thus, a spray for plants is created out of cow urine, yogurt, milk and *ghee* (clarified butter), and this can displace synthetic pesticide and foliar sprays that might have large negative impacts on the environment [18].

Alongside food and agriculture, water is a critical natural resource that needs to be managed sustainably for the community. Various indigenous knowledge systems have developed water sourcing, conservation, storage and treatment techniques and practices that are sustainable in the context of that local community. As part of the natural hydrological cycle and the seasonal variations in rainfall, indigenous knowledge systems developed such as the various water tank systems of India [19], including the *ery, kere and cheruva* water tank systems of Tamil Nadu, Karnataka and Andhra Pradesh, respectively.

Indigenous knowledge systems are being supported by some governments such as those of India (*Ayurveda and Unani*) and China (*Accupuncture*), with the aim of undergirding the IKS with scientific backing and support. Turmeric, as utilized and implemented in indigenous knowledge practices, lends itself to more fundamental scientific and clinical study in

order to be able to develop an understanding of the mechanisms and processes by which turmeric might be affecting various health outcomes. As something that has widespread use in *Ayurvedic* practices as well as in traditional Chinese medicine (TCM) for numerous ailments. Turmeric has been indicated for use to treat wounds, skin diseases and liver problems. It has also been used extensively as an anti-inflammatory agent, not just in human medicine but in animal husbandry as well. Turmeric's anti-bacterial properties are well known; nevertheless, it is also being investigated for beneficial therapeutic effects in the treatment of atherosclerosis, stomach ulcers, ulcerative colitis and cancer. It has also been employed as an anti-viral agent [20]. The tremendous breadth of research that is now on-going and being initiated to explore the diverse therapeutic potential of turmeric is what can drive the engagement of appropriate technologists with local medical technologies to develop sustainable solutions to public health issues.

Acupuncture is perhaps the most widely known traditional Chinese medical practice that is being reflective of a tradition of indigenous knowledge that has a history of over thousands of years [21]. Although there is broad awareness of TCM, the need to develop a more fundamental understanding of what happens in TCM from a biomedical perspective is great [22]. This need has been addressed by the Chinese government, which has thrown a great deal of resources behind establishment of institutes devoted to the systematic and scientific study of these traditional medical practices. In the west, government research institutes such as the National Institute of Health, have established departments and centres for the study of acupuncture and other non-traditional or non-conventional medical practices. The realization that these traditional medical practices have led to positive health outcomes for diseased individuals who have been so treated underscores the great need for thorough scientific investigation and understanding of indigenous medical practices, ranging from Ayurveda to acupuncture [22].

Although much of the world's attention has been focused on Asia, many African Indigenous Knowledge systems (AIKS) are now being documented and described and are becoming the focus of study, especially as these indigenous practices pertain to development in the African context [23]. Indigenous knowledge from Africa can be a central vehicle by which education for all (EFA) target and goals can be met. It has been argued [24] that formal schooling and regular school education may not be the appropriate vehicle for delivery of the outcomes that are being visualized in the EFA context [24]. Formal schooling, with more traditional educational practices, may need to be integrated with and into these practices to enhance their impact and expand their reach.

Another critical area that needs to be paid attention to is the issue of 'intellectual property (IP)', as it impacts the articulation, development and implementation of indigenous knowledge system-based technologies. It is important to be able to protect the IKS as well as the knowledge bearers and practitioners. To do this, it may be critical to grant legal effect to existing indigenous protocols for the preservation, as well as protection, of indigenous knowledge possessed by native healers. A good first step is to identify indigenous knowledge and to ensure that indigenous knowledge practices must be researched and given due credit when reviewing and considering IP and patents that have their origins in that indigenous understanding [8].

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It is clear that support for indigenous knowledge and systems must emanate from the state. This has been the case in both India and China, and is also emerging as a model that is being employed in other countries such as Ghana, Sudan and Guyana. In India, for instance, there is the National Mission for Manuscripts that seeks to document and catalogue a rich trove of indigenous knowledge that spans the diverse country [25]. The issues that need to be addressed by such institutions include access, documentation and sharing and the incorporation of appropriate digital technologies for the knowledge management, sharing and dissemination [26].

The underlying philosophical approach that most indigenous knowledge systems take is a holistic one. The 'disciplinary' approach, which seeks to break everything down to some elemental constitutive components and study these individually, is the opposite of the indigenous approach, which takes a systemic perspective in its approach to developing solutions to particular problems. The developing world does not lack for this creativity, as Goonatilake [27, 28] has so clearly described: in fact, creative and innovative solutions that were sophisticated in their complexity, integration and effectiveness have been implemented across the centuries in various areas of human endeavour and need, from agriculture and food to health and the environment.

4. Institutionalizing IKS for appropriate technology development

A number of earlier papers investigated the resource-potential of IKS to serve as a repertoire of appropriate technologies [29] as well as the ability to integrate IKS into the conceptualization, research and development of appropriate technologies [30, 31]. These papers provided lessons that will facilitate the integration of best practices for appropriate technology conceptualization, research, development and implementation such as sets of integrated strategies for the management of various resources such as water. The practices are more subject to failure when the civil institutions that may be the vehicle for a technologies development and implementation do not reflect the needs of all stakeholders equitably. Thus, focusing on only agriculture and farmers as the primary water extractors, while not paying attention to water-heavy users such as commerce and industry, would contribute to failure. Nevertheless, the major reason for failure in the development sector is because of the lack of attention that would have been paid to the indigenous knowledge that may have been resident in the community and that could easily have been harnessed to address the problem.

In order for indigenous knowledge systems to be successfully integrated into the development of appropriate technologies, many questions need to be asked and various issues need to be raised and addressed. Has the problem been tackled before? What are the existing institutions that have been addressing this problem before? What are the technologies that are available to address the problems? Are there indigenous knowledge systems of practices that have any relevance to the situation? Is it necessary to bring in an outside-community expert? What are the equity and justice issues that need to be addressed? Will the IKS be able to handle this? Is outside mediation necessary? Who will be benefiting from the technology development and implementation? Who will be bearing the burden? Of cost? Of resources?

These and other questions underscore the importance of a thorough understanding of, and appreciation for indigenous knowledge and indigenous knowledge systems, and how these can contribute holistically and sustainably to the development of communities in a participatory, just, equitable and environmentally non-impactful manner.

5. Conclusion

Modern scientific knowledge is a part of the top-down model of development that is the hallmark of multilateral development agencies that promote MSKS as the only solution to development problems. These agencies' claims for success in terms of improvement of the quality of life across the planet are risible, given the state of human civilization today, where, in most of the developing world, basic community needs remain unmet, despite more than half a century of 'development' engagement on the part of the multilateral agencies, including the World Bank, the International Monetary Fund and United Nations Development Program. This is especially true of rural areas and in the bulk of the overburdened and degraded urban centres. Slums and informal settlements are the urban habitat of rural folk who have been displaced from their environments and thrown into the city. These displacements occur because of infrastructural development projects that are usually state-sponsored, of a large-scale and focused on resource extraction, energy production, transportation and communication. Very little of the infrastructural development is focused locally and hence local needs remain unmet.

This is especially true in the need areas that are critical for survival and flourishing. Clean air and water, adequate clothing and shelter, safe and healthy food, renewable energy, accessible and affordable healthcare, accessible, affordable and quality education, as well as information and communication technologies are the minimum that need to be provided to a society in order for that society to not just survive, but to prevail and flourish. The fact that adequately meeting these needs remains a pipe dream for most developing country inhabitants, especially those in rural areas and congested urban cores, is reflective of the failure of traditional development paradigms and models.

The AT movement from its start, going as far back to the colonial era when Gandhi was in the midst of his non-violent struggle for Indian independence, and continuing on through ATs actual articulation in the 1970s with Shumaker and *Small is Beautiful* has as a rationale for its existence the failures of the traditional development models.

The importance of IKS in this context becomes even more critical and significant. IKS provide tremendous knowledge and technology resource bases that tend to be sustainable, and which also focus on addressing needs in appropriate cultural contexts. IKS already have a head start in terms of sustainability. This recognition has led to proposals for the establishment of Institutes for Indigenous Science and Technology (IIKS, 2012 [17]), and work on the fusion and integration of MSKS with IKS. Anamuah-Mensah and Asabere-Ameyaw [31] promulgate the notion of fusing indigenous knowledge systems education with the regular school curriculum. They have convincingly argued for indigenous knowledge systems and the study

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of IKS, demonstrating how various impacts and outcomes of such engagement. Outcomes include the engagement of teachers, who are community members, in curriculum development that does not devalue indigenous knowledge but focuses on integrating these into the curricula. Using indigenous knowledge can have tremendous benefits in terms of the being able to link disparate disciplines with its intrinsic multi-disciplinarity and interdisciplinary approach. The potential to deal with linkages with the environment, with culture and how these engage with development objectives is there and should be taken advantage of. In this way, IKS and the modern scientific knowledge system are also brought closer together, further strengthening the thematic and disciplinary linkages between IKS and appropriate technology development. This also enables the articulation of the complementarity of IKS and MSKS, even while employing MSKS to validate IKS; the balance between the informal of IKS and the rigour and formality of MSKS is not envisioned as contradictory.

An approach to the integration of indigenous knowledge into the development paradigm, which has been suggested in other forms before [30], is diagrammed in **Figure 1**.

Alongside the use of MSKS to validate IKS, developing country governments serious about sustainable development must engage their institutional and academic scientists and researchers with informal science practitioners. Academic administrators, as well as educational curriculum and program developers have to buy into a new vision, which elevates indigenous knowledge to a position and level where it becomes part of the knowledge resource base available to the field. Building an effective interface between modern scientific knowledge and indigenous knowledge will substantively enhance capacity building capabilities and potential for successful and sustainable appropriate technology development and deployment.

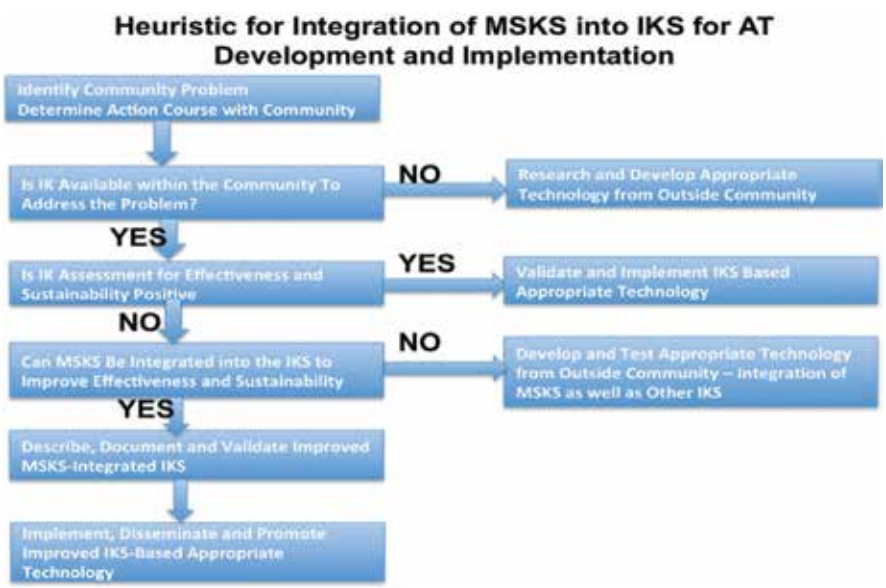

Figure 1. Heuristic for integration of MSKS into IKS for AT development and implementation. (Adapted from Aluma [32].)

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Chapter 8

Revisiting Indigenous Biotic and Abiotic Weather Forecasting for Possible Integration with Scientific Weather Prediction: A Case from the Borana People of South Ethiopia

Desalegn Yayeh Ayal

Additional information is available at the end of the chapter

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Abstract

This study assesses how Borana herders make weather forecast using abiotic and biotic indicators. Survey questionnaire, observations, focus group discussions, and key informant interview were employed to obtain data. Field data were analyzed and interpreted using appropriate analytical tools and procedures. The result revealed that the Borana herders have time-tested weather forecasting experience of using astrological, intestinal, plant, and animal body language indicators. Astrological and intestinal readings that need special training and local expertise are known as *Urgii Elaltus* and *Uchuu*, respectively. Forecast information is disseminated using the Borana sociocultural institutions. Based on the disseminated forecast information, the Borana herders take measures such as strengthening enclosure, storing hay, migrating with animals, destocking, and changing schedules of social and cultural festivities such as wedding. The precision and credibility of traditional weather forecast steadily declined and led to repeated faulty predictions. Poor documentation and knowledge transfer system, influence of religion and modern education, premature death of forecast experts, and expansion of alcoholism were identified as causes undermining the vitality of Borana indigenous weather forecast. It is high time that the tenets of indigenous weather forecasting be assessed scientifically and be integrated into the modern science of weather forecasting before they vanish.

Keywords: weather forecasting, indigenous knowledge, abiotic, biotic

1. Introduction

Indigenous weather forecasting system is dynamic and is built on observation and long years of experience [1]. The importance of indigenous knowledge transcends the culture from which it is born and offer exciting insights to scientists and others who seek to assist the development of local people [2]. Agricultural decisions, such as the timing of planting, indigenous ranch management, herd composition, and number, are highly interlinked with anticipated weather phenomenon [3, 4]. Hence, the capacity of people to be drought resistant is highly related to the precision and credibility of their indigenous weather forecasting systems [5–8].

Different cultures make use of biotic and/or abiotic indicators to forecast about the future weather conditions. For example, atmospheric conditions and astronomic, plant, human, and animal indicators are used in Zimbabwe for weather forecasting [9, 10]. Besides, traditionally, the behavioral changes of some animals and birds, change of wind directions, and phonological changes in plant species are used to make weather forecast in Ethiopia, Nigeria, and Kenya [1, 3, 11, 12]. Astrology is also cited in Kenya. The ritual observation of the Pleiades alignment is used for weather forecast in Peru and Bolivia [13]. Cultural and ritual specialists in Burkina Faso observe plant and animal behaviors for the same purpose [14]. In Uganda indigenous weather forecasting is made based on cloud color, features of vegetation, the cycle and shape of the moon, and seasonal calendar [15], while in Swaziland, reading animal behavior and environmental clues are the sources of weather forecasting indicators. In western Ethiopia indigenous experts have a sophisticated indigenous knowledge of weather forecasting by way of reading and interpreting astrological phenomena [16]. The list goes on and is too much to mention all, and much commonality is shared in different cultures. History shows that over the last 400 years, the Peruvian and Bolivian Andes people were able to forecast El Nino years based on indigenous weather forecasting.

However, studies show that in recent years the vitality of indigenous weather forecasting mechanisms is declining. Among many factors the disappearance of biotic indicators and the influence of religion and modern education [10, 17], poor documentation and knowledge transfer mechanism [9, 18], generation gap, poor finance, and passing away of skilled persons [15] are identified as causes for the gradual weakening of the precision and acceptance of indigenous knowledge of weather forecasting. In addition to examining how the reality of the study area feeds into the short survey made above, this study extends the discussion to forecast dissemination systems and reaction of the herders to the forecast information.

Most related studies are highly descriptive (of the view of indigenous people) and lack critical appraisal on how to determine the validity of indigenous weather forecasting system. In a bid to address that lacuna, this book chapter assesses the relative merits and demerits of different indigenous weather forecasting systems and their level of acceptance by the people. It is hoped that it would make significant contribution as to what policy directions should be followed vis-à-vis agricultural development programs. Attempt is made to distinguish aspects of indigenous weather forecasting that could be readily dismissed as superstitious from those that merit appreciation for scientific validation.

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2. Study area and research methodology

2.1. Study area

Borana zone is found in Oromia Regional State of Ethiopia between 3°36'–6°38' N and 36°43'–41°40' E [20]. The zone covers a total area of 35,000 km^2 [19]. The study site experienced semiarid climatic condition and has four distinct seasons. These are small rainy season, hot dry season, main rainy season, and cool dry season that roughly cover from September to November, December to January, March to May, and June to August, respectively. The rainfall amount decreases toward south, and annual rainfall amount ranges between 400 and 600 mm. The study site receives 59 and 27% of its rainfall during the main rainy season and small rainy season, respectively. There is no perennial river which crosses the study site [20]. In the study site, pastoralism is the dominant way of life. This study was conducted in Yabello and Arero *woredas* (districts) of CCAFS 30 × 30 block learning site.

2.2. Research methodology

2.2.1. Study site, sample size, and sampling technique

Dida Hara PA in Yabello and Alona PA in Arero of CCAFS learning site were purposefully selected for the study. For questionnaire survey 200 herders were selected using simple random sampling technique. A total of four focus group discussions (FDG) having 12 participants in each session were organized. Eight indigenous astrologists, eight indigenous intestinal readers, four veterinarians, four botanists, and two astrologists were also interviewed.

2.2.2. Sources and data collection methods

In this research flexible and eclectic research approaches which combine participatory rural appraisal (PRA) (as a tool in overt observation, FGD), key informant interview and survey questionnaire were used to collect data from different stakeholders. Overt observation and diagnostic approach were used as a complementary approach to understand how technical skills of indicators sign interpretation. Data was also gathered through in-depth interviews and questionnaire. The quantitative method deals mainly with herders' socioeconomic preparations following the forecast and perceptions on the status of the Borana weather forecast. Metrological data was also collected at National Meteorological Agency.

2.2.3. Data analysis technique

For the qualitative data which was collected using observation, interview, and focus group discussions, thematic content analysis was applied. Paraphrasing, identification, and characterization of the recurring themes were carried out in the analytical procedure. The household survey was analyzed using simple descriptive technique, i.e., percentage. Drought assessment method which was developed by [21] was adopted to identify drought and normal years within the last 27 years.

3. Results and discussions

3.1. Participants' background information

Table 1 provides background information of herders who were approached to gather data for this research. Illiteracy is rampant, and attendances of primary school's first- and second-cycle education were 3.5 and 0.5%, respectively. Predominant majority of them (80%) adhere to the indigenous religion called Wake Feta followed by Islam and Christianity. Indigenous weather forecast system was the source of weather information for 96.5% of the respondents, while the rest had access to modern meteorological weather information. Herders have limited modern mass media weather information.

3.2. Mode of acquiring the skill of weather forecast among the Borana herders

Not all Borana herders possess the skill of different modes of indigenous weather forecasting, and there are different ways of acquiring the skill. Those who make astrology-based weather forecasting, known as *Urgii Elaltu*, teach the skill to their eldest son as they received it from their fathers, and the process goes on. A trainee masters the skill at about adolescent age and starts to read the alignment of celestial bodies for weather forecast. Thereafter, the title of *Urgii Elaltu* will be bestowed to him. The skill being highly guarded with secrecy, the possibility for others to acquire it is closed, although there are few individuals who reported to have acquired the skill from friends. In most cases, however, the skill of astrology-based weather forecasting is inherited from their own fathers.

Item		**Participants (N = 200)**			
Educational level	Illiterate	M	F	Total	%
	1–4	167	25	192	96
	5–8	7	0	7	3.5
	9–10	0	0	0	0
Religion	Wake Feta	142	17	159	79.5
	Christian	10	0	10	5
	Muslim	23	8	31	15.5
	Others	0	0	0	0
Source of weather information	Indigenous	168	25	193	93.5
	Development agent	52	0	52	26
	Relatives/friends	165	21	186	93
	Radio	21	0	21	10.5
	TV	0	0	0	0

Table 1. Participants' education, religion, and access to weather information.

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Learning the technique of weather forecasting based on reading of animal intestine takes up to 2 years of training. A person who completed the training and started to make weather forecast based on intestinal reading is known as *Uchuu*. Intestinal exploration is used to forecast about the timing and intensity of drought, peace, conflict, the time of livestock mass death, and the timing and the place where good pasture will be available. In the study site, there were no female experts in astronomy and intestine reading. The result is cognate with previous findings in other parts of the world, i.e., indigenous knowledge is gendered and obscured the contribution and interest of women [22]. Weather forecasting based on a reading of the behavior and body language of animals and plants or observation of weather conditions is largely known by many people and is almost a tradition. For that reason, no special title is used to designate a person who makes weather forecast from the observation of weather conditions and the body conditions and behavior of the cattle. The same applies to the skill of weather forecasting based on observation of plant conditions. As is the case in some other cultures, vertical and horizontal skill transmission takes place orally which impedes seamless transfer of indigenous knowledge from generation to generation especially when experts die untimely [23]. The accurate transmission of oral indigenous knowledge of weather forecasting across generation is also influenced by both the teacher and capability skill receiver.

3.3. Types of indigenous weather forecasting

Among the Borana herders, indigenous weather forecasting was made based on (1) a reading of alignment of celestial bodies, (2) a reading of the conditions of animal intestine, (3) a reading of plant and animal body languages, and (4) observation of local weather phenomena and shape and color of celestial bodies. How such traditional mechanisms and technical know-hows are used are discussed below.

3.3.1. Reading of celestial body alignment

In Borana, some stars' alignment with the moon, stars' apparent movement and location, and decent and cessation of some stars were used for weather forecasting purposes. Like other indicators of weather forecasting, there was no special ritual activity or any food or sexual restrictions. Celestial bodies, indigenous astrol *Urgii Elaltus* were able to forecast the upcoming rainfall onset, cessation, and volume at different time scales, i.e., ranging from a week to 3 years. The detailed techniques of the know-how are presented as follows.

3.3.1.1. Reading of the alignment of celestial bodies using the Geda calendar

Based on the alignment of celestial body reading, *Urgii Elaltus* claim to be able to make weather forecasts 6 months or more in advance of the timing, duration, and amount of rainfall or drought. Weather forecast based on stars' position and their alignment with the moon is considered to be the most effective method for weather forecasting. *Urgii Elaltus* reported that there are seven stars (individual or in groups) known locally as *Lemi* (believed to be the mother of all and very important for forecasting), *Busan*, *Soresa*, *Algajama*, *Arba-Gadu*, *Walla*, and *Bassa*. The different alignments of such stars in relation to the position of the moon provide data for weather forecasts. There are a maximum of seven star-moon alignments,

but observing only the Lemi-moon alignment is enough for weather forecasting. Unlike the claims of [10], this study found that astrological features are used for long-term weather prediction.

Among the Borana herders, observation of star-moon alignment for weather forecast is made partly in reference to the lunar Borana calendar. The association is partial in the sense that *Urgii Elaltus* use months of the Borana calendar to choose the timing of observing star-moon alignment. The Borana calendar divides the year into 12 months. The first and the last months of the year in Borana calendar are *Amajjii and Abrassa*, respectively. For the purpose of weather forecasting, *Urgii Elaltus* divide months of the year in the Geda calendar into two groups each comprising 6 months. The first group comprises the months of *Birra, Ciqqa'a, Sadassa, Abrassa, Amajjii*, and *Gurandhala*. The first 3 months represent the short rainy season, while the last 3 months are the hot dry season. It is only during *Birra* that *Urgii Elaltus* calculate star-moon alignment for weather forecast. The second group of months comprises *Biouttessa, Chamissa, Buufa, Waxxabaji, Obora-Gudda, and Obra-Teka.* The first 3 months represent the main rainy season, while the last three are months of the cold dry season. Of the 6 months, it is only during *Biouttessa* which *Urgii Elaltus* can calculate in terms of star-moon alignment for weather forecasts.

In Borana observation of the constellation of celestial bodies takes place in the month of *Birra* (September) on the fourteenth and fifteenth moon day at 9:00 p.m. in order to predict the weather for the main rainy season (*Biouttessa, Chamissa, Buufa*). The small rainy season weather forecast is made in the month of Biouttessa (March) on the first and second day of the moon at 09:00 p.m. When asked to elaborate the rationale behind the specific date for forecasting, the *Elaltus* were unable to justify their choice.

Weather forecasting for the main and small rainy season is made through observation of star-moon alignment in the months of *Birra* (September) and Biouttessa (March), respectively. However, it is not clear why *Urgii Elaltus* use *Birra* and *Biouttessa* even the date and time to forecast the prospect of rainfall. They were asked to elaborate the rationale behind, but they were unable to justify their choice. *Urgii Elaltu* makes forecast for the small and main rainy seasons as follows.

Figures 1 and **2** show the seven star-moon alignments as described by *Urgii Elaltus*, which they used for observation during the months of *Birra* and *Biouttessa*:

I. If the first alignment (moon and *Lemi*) is observed in the month of *Birra*, it signifies that 14 days have elapsed since the first appearance of the moon. This *Ayana* (year) is known locally as *Gonchera.* The alignment is interpreted as an indicator of a delay in the onset and early cessation for the next main rainy season.

II. The second moon-*Lemi* constellation is referred to as *Gobana* and predicts that the next main rainy season will be normal and be a time of abundance, peace, and love.

III. If the first moon-Lemi alignment, known locally as *Bita-Dura* or *Kera,* is observed in the month of *Biouttessa*, it is considered to be a sign of a coming season of drought and famine during the small rainy season.

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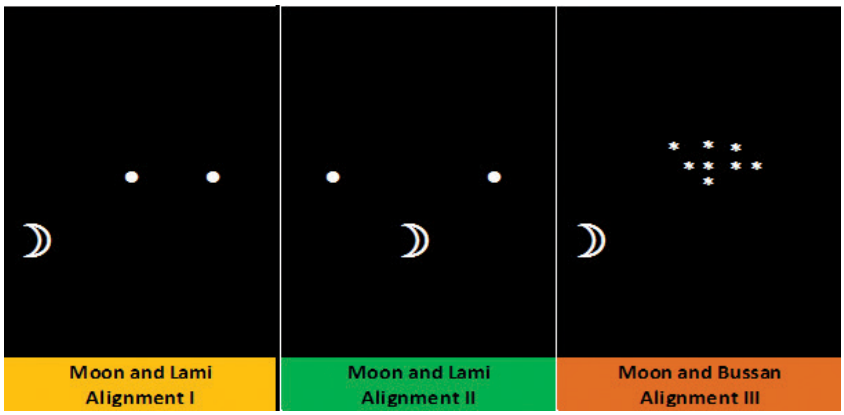

Figure 1. The first three moon-star alignments. Sources: Diagram sketched based on the description of *Urgii Elaltu*.

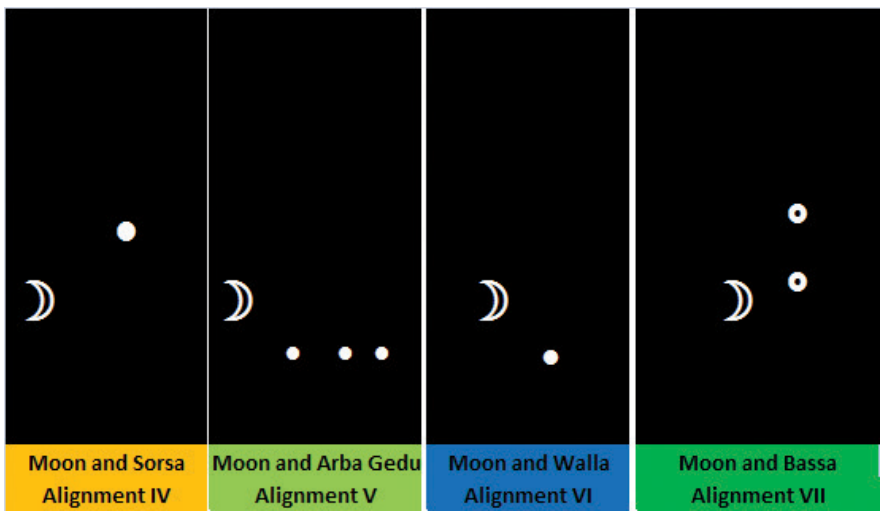

Figure 2. The four moon-star alignments. Sources: Diagram sketched based on the description of *Urgii Elaltu*.

IV. On the other hand, the second moon-Lemi alignment signifies that the next season would be Beta-*Bella*, in which a timely and optimal rainfall is expected.

Whether the reported moon-star alignments actually occur in reality during the specific months, informant mentioned is not of interest to this study. Equally, the meteorological consequence of those alignments on earth is difficult to negate or confirm. However, modern science has reached a stage where the movement, position, and speed of celestial bodies in different times and ages are certainly known. It is established beyond a shadow of doubt that the alternating constellations of celestial bodies caused by their differential rotation and movement are very regular. If *Urgii Elaltus*' perception about the impact of moon-star alignment were true, then we would naturally expect to experience drought and normal year in

a very regular succession, and if changes to that regularity are to happen, it would only be possible in thousands of years. Hence, the actually experienced drought seasons being very erratic than regular, and knowing that the alignment changes are very regular, indigenous experts' claim does not tally with the reality. This must account for the discrepancy between their forecasting and the actual phenomena.

3.3.1.2. The apparent movement duration of Bekalcha Bari or Bekalcha Gulchu

The morning star known locally as *Bekalcha Bari* (star at dawn east direction) and *Bekalcha Gulchu* or *Ahiha* (in the west) is used to forecast extreme drought conditions. If it is seen in the west 70 days after it has been observed in the east, and if it is seen in the east 7 days after its appearance in the west, it assumed that the prospective season will be normal. However, if it is not observed in the east on the seventh day after its appearance in the west and is observed again in the west after 140 days, it is regarded as an indicator of future extreme drought.

3.3.1.3. Geometrical alignment of celestial bodies

In Borana the alignment of the moon with the *Busan* is also used to forecast the upcoming weather. If the *Busan* is observed in the west by a man milking a cow at 08:00 p.m. under the cow belly, then it is regarded as an indicator of the arrival of the main rainy season. On the other hand, if it is seen in the east to a person milking a cow at night at 08:00 p.m. under the cow belly, it indicates the arrival of the small rainy season. The informants could not explain why the observer should be in a milking position with a cow in such a way that he/she should observe *Busan* in the east or west. If it is supposed to imply any geometrical value, for example, to calculate the impact of that constellation on earth, unfortunately that is out of the scope of this study to prove. Here, it is interesting only to say that this observation is not made to forecast the likelihood of normal rainfall or drought, but to simply know the arrival of the main and small rainy seasons.

3.3.1.4. The apparent size of the stars

A star locally known as *Kormi Mado* is located in the southern hemisphere. It moves in a clockwise direction and never moves to the north of a perceived line of the equator (see **Figure 3**). The position of *Kormi Mado* is used to make forecasts both for the long and short rainy seasons. The forecasting is based on the size of the star at the time of observation. If it is observed in the month of *Birra* and seemingly smaller in size at the 14th day of the moon at 09:00 p.m., the forecast for the upcoming main rainy season would be drought. On the other hand, if the star is observed, on the same month, day, and time, with a seemingly greater size to normal, a rainy season is expected. The star is also used to make weather forecasts for the small rainy season. While the interpretation of the size of the star is the same, for the small rainy season, the timing of observation is in the month of *Biouttessa* on the 1st day of the moon and at 09:00 p.m. local time.

3.3.1.5. Apparent movement of the star

Turban is located only in the northern hemisphere moving in a clockwise direction. The position of *Turban* is not used to forecast the starting and cessation time of rainfall as well as the

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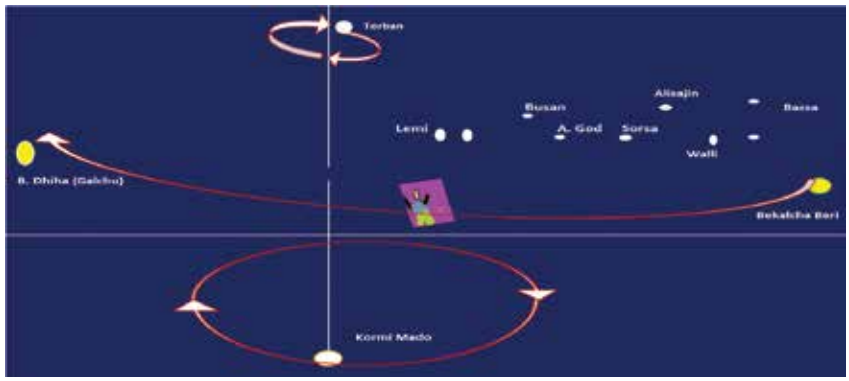

Figure 3. Significant moon positions used for weather forecast. Sources: Diagram sketched based on the description of *Urgii Elaltu*.

volume of the rain. When it is observed on the position shown in **Figure 3**, experts realize that the rainy season is approaching. When *Turban* is observed near to the extreme North Pole, *Urgii Elaltus* believe that the small rainy season is approaching. Conversely, when *Turban* moves from its southern path into the northern path of rotation, it is believed that the main rainy season will arrive within 2 weeks.

3.3.1.6. Other indicators used to validate star-moon alignment weather forecasting

The Borana herders use data from the condition of weather and climate elements such as sunlight, cloud cover, temperature, and wind necessary not only to forecast weather but also to strengthen forecasts based on other biotic and abiotic indigenous weather forecasting systems. If, at the time of star observation, the sun is surrounded with what is locally called *Muna Garti*, herders conclude that drought will occur in the next season. If, on the same day, a solar radiant with reddish color is observed at sunrise, experts believe that the next season will have normal rainfall. A dull and white sky at sunrise is equated to the future drought. When people notice that their locality experiences a strong and fast wind blowing from east to west, they expect that drought is forthcoming. However, if the wind blows slowly raising the dust upward, people expect normal rainfall at the right time. The appearance of a whitish feather-like column of cloud (in a vertical position) in the sky is regarded as indicative of rainfall which is about to fall. If the sky is dominantly covered by light cloud, herders do not expect rainfall shortly.

3.3.2. Reading of animal intestines

Uchuus claim that intestinal features that are used for weather forecast are mirrors of the future weather conditions. This stems from a dictum that the future weather and sociopolitical conditions of an area are encoded in animals' intestines where the sex and age of the animal do not matter, although an informant indicated the females and older ones preferably. The intestines of cattle, sheep, and goats are used to forecast about the magnitude, severity, and duration of drought, drought-affected places, disease outbreak, the prospect of peace, and/or conflict.

Like astrological weather forecasting, intestinal forecasting system is full of secrecy. *Uchuus* read and interpret slaughtered animal organs such as the large intestine (*Kechuma*), small intestine, lymph node (*Kabello*), and blood vessels (veins) to forecast the upcoming season (see **Figure 4**). *Uchuus* infer the amount of food substance in the intestine, color and amount of blood, and lymph node size to forecast the small and main rainy season drought condition. For instance, the more the amount of food substance in the small intestine and large intestine, the forecast translates into normal rainfall season. But, the drought season will be expected if they observe small amount of food substance in the digestion process in the small intestine and large intestine. The intestinal weather forecasting system also used to predict the magnitude of drought. Mild, moderate, severe, and extreme drought conditions are forecasted when *Uchuus* see small, smaller, and very small food subsistence in both the small intestine and large intestine

When *Uchuus* observe uniform lymph node thickness entirely and the node is covered by darker color tissues, normal rainfall season is forecasted, and rainfall onset will begin on the right time. Forecast for drought is made if a thin and very thin lymph node is observed. A very thick lymph node and large intestine are signs to predict that rainfall will commence in 2 weeks time and 2 months, respectively. Regardless of its thickness, if a marked protrudes is observed at the end of the lymph node that is regarded as the right sign to forecast an outbreak of livestock disease. In Borana, intestinal reading of weather forecasting system is used only for short-term weather forecasting, i.e., from 2 to 3 months. This system of forecasting enables to identify the village and peasant's association level of drought severity. These help herders to send scout to areas which will not affect by drought.

The amount and color of blood in the blood vessel on different parts of the intestine are also indicators for weather forecasting (see **Figure 4**). If the blood filled tauten the vessel and its color

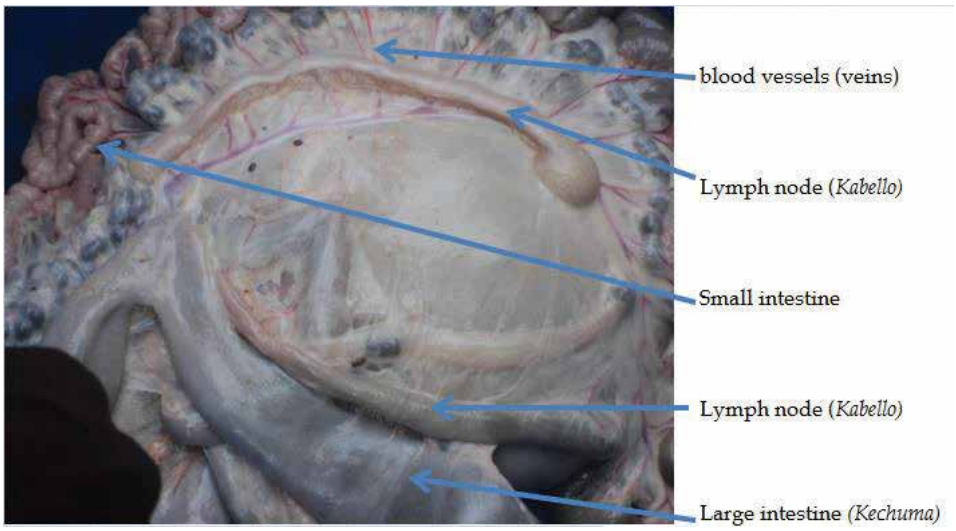

Figure 4. Parts of the intestine used for weather forecasting. Source: Photo taken during data collection when *Uchuu* interprets the intestine.

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is darker, *Uchuus* forecast drought for both small rainy season and main rainy season. But if the blood is smaller and yellowish in color at the junction of blood vessel in the small intestine and large intestine, the forecast for the next season would be normal rainy season. The severity of the drought is inferred in indirect proportion to the amount of blood contained in the vessel; if the amount of blood in the blood vessels is small and yellowish in color, normal year is predicted. However, the absence of blood in the vessels is an indication of extreme drought condition.

In the diagnostic data collection sessions, the researcher confirmed that *Uchuus* used the same signs and sign interpretation procedure and made similar forecast. In three diagnostic sessions, six of *Uchuus* forecasted accurately the 2015 main rainy season. Likewise, all weather forecasting systems made accurate forecast for the 2014 main rainfall season. However, faulty weather forecast was made for the 2015 small rainy season. The timely onset of rainfall was forecasted by *Uchuus* and *Urgii Elaltu*, which foresaw drought. The *Urgii Elaltus* rightly forecasted the 2014 small rainy season. It may mislead to comment the reliability of intestinal weather forecasting system by single right forecast and faulty forecast. Hence, I argue that since meteorological forecast has its own limitations, repeated diagnostic and astrological observation is compulsory to reach a conclusion on the precision of Borana indigenous forecasting system.

The researcher tried to substantiate *Uchuu* signs and interpretations with the experience of veterinarians. Veterinarians have different positions on the intestinal indigenous weather forecasting signs and interpretations. Those who have research experience on indigenous knowledge have positive attitude to indigenous weather forecasting system, whereas others connect the amount of food substance in the small intestine and large intestine with the amount of food taken, laying position of the animal at the time of slaughtered and the color of the blood with the effect of disease or toxic grass. They emphasized that the blood color variation might be the effect of disease or toxic grass that is mostly encountered during times of environmental stress. Proper red color simply reflects the good health status of the animal rather than to be a code for the future of rainfall.

The view of veterinarians holds that the inequality in the amount of waste found in the right and left blood vessel of intestines could vary depending on the age, sex, pregnancy, and health conditions of animals and is not necessarily linked with future climatic events, peace/war, conflict, etc. However, the researcher observed the similarity of interpretations made on the intestine of three goats by different readers. In both cases, normal year was forecasted, and the amount of waste, color blood, and shape of the blood vessel are found similar. However, this could be attributed to the similarity and harmony with which fathers train their sons and does not necessarily lend the craft of intestinal reading a force of scientific truth, and we know myths told even in distant cultures show high degree of consistency.

It suffices here to point out that indigenous intestine observation is not impure to superstition. Hence, it may make too big claims in forecasting the range from the fate of the animal owner to that of local weather information and world peace and conflict. It looks as if the practice is an archaic form of early warning system for socioeconomic, political, and security threats of the people. At any rate, it is very difficult and misleading to entirely disregard the craft as it might risk perpetual loss of valuable cultural heritage, and rigorously thus scientific validation should take place.

The same assumptions apply to forecast about the prospect of peace, conflict, starvation, mass death of livestock, etc., from a reading of the intestine. The prospect of conflict (including at the global level) can be deciphered if the section of the intestine that bears "the map" is observable beneath the matter that envelops it. Intestinal reading is also used as to who would come to visit them or even where guests would park their car, not only the belief that intestinal feature give clue to forecast the rain time but also when the owner of the animal would die.

3.3.3. Reading of animal behaviors and body conditions

The informants believed that particular body conditions and behaviors of cattle during abundant resources are signals for future weather condition. Cattle behaviors that are interpreted as signs of a future drought are calmness, sleeping in the zoo very close to one another, being unwillingness to go to the nearby pasture, reluctance to go away from water points after drinking, and poor appetite for grass and salt. Besides, the bull would isolate himself from the herd, goes to forest, and refuses to return to the zoo. Cattle body conditions that are considered as indicators of a future drought are loss of body weight, erection of skin hair, and swollen bellies, which do not get raised even when they have eaten much, urinating and defecating while sleeping and diminishing of dung amount even when they eat enough and lack of desire for mating.

On the other hand, informants believe that in view of a prospective normal rainy season, cattle lick each other's body, roam around villages, eat any bone found, leave water points immediately after drinking, show a relaxed mood, and amuse them with frenzy wriggling around. Besides, the bull mounts on any cows in a short period of time. In other words, they think that the future weather conditions of the area find expression in animals' external behavior to a degree that warrants weather forecasts. Such views are endorsed by scholars who said that animals detect the incoming weather conditions, and that is an essential component of their survival strategy. Veterinarians also agreed with the view of herders in that animals have natural ability to sense the future precisely than human-made technology. They believed that sensing the future and making behavioral changes are essential features of their instinctual knowledge. Behaviors such as reduced appetite for food and mating prepare cattle to withstand incoming harsh condition. Some of the cattle body conditions and behaviors mentioned by study participants such as looking hungry is similar with a study result in Kenya but contradicts with the assertion that cattle fight over food [12].

Some of the above body conditions and behaviors of cattle used by herders as harbingers of the future weather conditions could lead to misinterpretation. In science, things like lack of appetite for mating and food are caused by sickness than the influence of the future weather phenomenon. The cattle behaviors that are said to be indicators of a future drought are in fact typical conditions of animals during actual drought time and may not necessarily be indicators of a future drought. Likewise, the cattle behaviors interpreted as indicators of normal rainy season are actually conditions that can be seen in time of abundant resources rather than the effects of what would happen during the next season.

Of course, it is not difficult to explain some of the cattle behaviors and body conditions. Forecasts of rainfall are made during the dry season where resources are scarce. By then cattle have very little to eat, and their bellies would not rise up and hence would have defected

diminished dung. In fact, this is indirectly admitted by informants who said that if the future is to be drought, the palatability of grass decreases which reduces the amount of grass consumption of animals below the normal years. On the other hand, if animals show behaviors and body conditions that are believed to be indicators of good rainy season, it could be because they are not hard-hit during the dry season for various reasons such as herders have had stored enough forage. Moreover, it is odd to believe that cattle would demonstrate behaviors and body conditions that are typically observed during the time of resource abundance while living during the dry season. Hence, without disregarding a possibility that specific body languages and behaviors could be signs of future weather conditions, it would be difficult to distinguish those signs from those caused by sickness and hunger.

In addition to cattle, in Borana weather forecast is made using the behavior of other wild animals. If ground squirrels (*Tuka*) are busy digging holes, the ants' movement along a course of nearly a straight line, a normal rainy season is expected and vice versa, while drought is forecasted if squirrels are passive and ants are dispersed in search of food. The migration of bees during the time of resource abundance season in their locality from north to south is regarded as a signal for a future drought, while normal rainfall will be forecasted if they migrate in the reverse direction. In Kenya the same activity of ants and bee migration are interpreted similarly for weather forecast [12]. The termites' activity 2 months before the small and main rainy season commence is also other indicator for the forthcoming season. When termites are actively engaged in gathering and storing of food, building hills is regarded as normal rainy season. In the contrary, if termites did not show any activity to gather and store food and build their home, drought will be expected. It seems clear that the above behaviors and activities of animals confirm that the forecast is derived from a belief that those animals act in a way that ensure their survival in the face of forthcoming season. Among the Borana herders, the varying screaming hyenas' tones and songs of birds are employed to make forecasts about different things. But it is a daunting task to describe the musical or vocal scale of different voices of hyenas and birds here. This result is in line with previous study in Borana [24].

3.3.4. Reading of plant body languages

In Borana, the phonology of Tedecha (acacia flowering tree with narrow leaves and black fruit pods, *Acacia tortilis*) (see **Figure 5**) and Ret (aloe tree, a plant with fleshy-toothed leaves) (see **Figure 6**) is used to forecast the main and small rainy season rainfall situation. In both cases, herders expect rainfall a month after the date of flowering of these trees. If the trees have small amount of flower and shed it early, that is regarded as a sign for a future drought. Botanists corroborate the claims of herders. They elaborated that to survive or withstand the incoming harsh conditions, plants respond through different ways: by restricting their growth (which can be observed at the tree ring), shading their flower before pollination to minimize their fruit, and minimizing their flower to reduce the food intake. All such strategy helps them minimize the loss of energy in times of scarcity. Otherwise, the plant would perish (see also similar scientific arguments from [12, 25]. Shukurat et al. [12] discovered partially conflicting result with the Borana plant observations and botanists in that forecasting is made busing same tree spices fruits. In the contrary, other botanists claimed that plant body conditions are reflections of the conditions they live in rather than the future weather phenomenon.

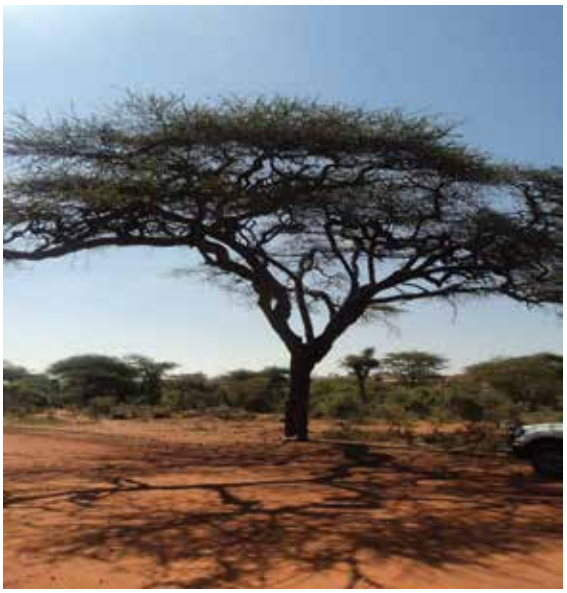

Figure 5. *Tedecha*/acacia tree. Source: Photo taken during data collection.

If herders observe a less number of locally growing green leaf plants such as *Hamesa* (*Commiphora africana*), Agarsu (*Commiphora erythraea*), *Dakkara* (*Boswellia neglecta*), and *Sukela* (*Delonix elata*) during *Obra-Teka* (August) and *Amajjii* (January), the forthcoming small rainy season and main rainy season are forecasted as drought. In the contrary

Figure 6. *Ret*/aloe tree. Source: Photo taken during data collection.

when the density of the aforementioned tree leaves increased, normal year is predicated. *Bisduga* (*Kirkia burgeri*) tree provides more precise forecast information than the above tree types. However, the observation and interpretation system is the same with the rest of the plants. Unlikely, our finding [9] observed plants that are used for long-term weather forecast. The variation could be due to biophysical (e.g., climate, topography, soil, tree type) differences.

On the other hand, there is something discomforting about herders' explanations. They say that the tree flowers and leaves before the onset of the rainy season and the flowering and lavishness by itself are not sufficient to make weather forecasts; it is the amount of the flowers and leaves as well as its early fall. If the flowers and/or the leaves are small and drop early, it could be because of the actual moisture stress felt by plants rather than in anticipation of drought. Like cattle behaviors, it is hard to distinguish plant body conditions that are caused by actual drought, disease, etc. from those natural signs caused by the perceived drought. To make a conclusive argument about the true cause for the smallness of the flowers and leaves and their early fall, it is imperative to make experimental research such that a group of trees would be continuously watered since the time of flowering while leaving the other group with no water. If both groups shed their flowers and leaves early than the usual time and then drought follows, herders claim would make good sense. But that is not the scope of this study. Herders expect that rain follows a month after the starting date of flowering and lavishness of the leaves. If their analogy is correct, their ability to make weather forecast depends on how early or late the trees drop their flowers and leaves. At any rate, they do not seem to be able to make forecast for drought before about 2 weeks, a time too small to make adequate preparation. In summary, scientists have not reached consensus about the implication of plant body conditions, and it is very difficult to downplay the claims of tradition. A more conclusive answer awaits for in-depth scientific investigation.

3.4. System of disseminating weather information

The *Uchuu*, *Urgii Elaltu*, and Ayantu (Borana calendar experts) are in charge of forecasting weather and disseminating information, but do not have obligation to do so and are not paid. The *Uchuu*, *Urgii Elaltu*, and Ayantu communicate their weather forecast information to community elders and heads of Geda who would then disseminate it by summoning the people for urgent meetings. Alternatively, the information is provided to people in market places, water points, and village settlements. Moreover, interested people could go to the houses of weather forecasters and personally ask for weather information. Individuals who receive weather information also inform others. The development agents, local administrators, and NGOs participate in the dissemination of forecasted information by *Uchuu*, *Elaltu*, and Ayantu. Besides, they are responsible for disseminating modern weather information by translating it to local language to influence herders to make appropriate preparations. In Alona *kebele*, an NGO called Action for Development (AFD) provides early warning and preparation service by registering the observation of *Uchuu* and *Urgii Elaltu* every 15 days. AFD also disseminates the information to concerned government and nongovernment authorities.

3.5. Public attitude about the vitality of indigenous weather forecasting

Table 2 illustrates that only *Wake Feta* religion followers believe that the traditional weather forecasting systems are not contradictory to the belief in God and contend that God himself has given them the wisdom of weather forecasting, and, hence, they are happy to share their information. They emphasized that their herd management and other cultural activities are guided by forecast information. In general, they think that devoid of traditional weather forecasting systems and their livelihood would collapse. Muslims believe in traditional weather forecasting practices as the right way to cope with the changing weather condition. This could be the fact that Islam is old in the area and followers may not comply with the tradition. Hence, Muslims in Borana consider indigenous weather forecasting as a source of weather information. In the contrary, the traditional practices of weather forecasting are repudiated by Christians who deem it incongruent with the rules of God. For them, the traditional practices are nothing more than magic in which evil spirits are involved. Christians stick to a view that the fortune in every season is determined by God and is blasphemous to consult alternative authorities' information. Borana, which observed in Zimbabwe the expansion of Christianity religion, had a negative impact on the acceptance of indigenous weather forecast practices in the study area [10].

Religion	Wrong practices against God		Right practices	
	No. of replies	%	No. of replies	%
Wake Feta	2	1.25	157	89.75
Christian	10	100	0	0
Muslim	7	22.5	24	77.4

Table 2. Herders' belief on indigenous weather forecasting practices by religion.

Different indigenous weather forecasting systems have varying level of acceptance depending on their reliability [12]. This also applies to the Borana experience where the perceived reliability and acceptance of abiotic and biotic weather forecasting depends on precision of the forecasting system. Astrology-based forecasts are the most reliable indicators followed by intestine reading, animal body language, plant body language, and temperature and wind conditions (see **Table 3**). Astrological indicators also enable them to make weather forecast as long as 3 years, while other methods are effective only to make weather forecast no longer than 3 months. In Kenya weather conditions are found to be the most reliable indicators [12]. However, it should be stressed that all indigenous astrologists are not equally respected and only a person called *Kalicha Qoncher* commands high respect, possibly for his spiritual authority since the *Kalicha Qoncher* was mostly a spirit medium whom people visit for many reasons. Informants also reported that the number of indigenous astrological and *Uchuu* experts has decreased over time in their localities. Key informants and FGD participants stressed that herders are increasingly losing confidence in all methods of indigenous weather forecasting which has led to the decline in the number of *Urgii Elaltu* and *Uchuu*. The precision and popularity of indigenous weather forecasting have declined particularly for

Indicators	Most reliable indicator	
	Total no. of participants = 200	
	No. of replies	%
Astrology reading	150	75
Intestinal reading	60	30
Animal body language reading	46	23
Plant body language reading	20	10
Temperature and wind condition observation	4	2

Table 3. Herders' response on the most reliable traditional weather forecasting indicator.

the past one decade. However, it is reported that few individuals with exceptional weather forecast skill indicate the timing and nature of rainfall more accurately. There has been a strong public reaction to the negative consequences people suffered due to the faulty indigenous weather forecasting. Most importantly, people are frequently affected when forecasting shows a normal rainy season, but drought comes without preparation. The Borana indigenous experts repeatedly failed to tell the exact timing and intensity of rainfall and drought. Since the last one decade, it is not uncommon to experience abundant rainfall while the forecast indicated drought and vice versa. They also said that there are occasions when they do not receive rainfall although they could see clouds. The people are usually caught unprepared in situations when the weather forecast shows normal rainy seasonal, while the actual weather condition turned out to be drought.

The decline in accuracy of indigenous weather forecasting systems, reported by informants above, is also corroborated by comparative historical analysis. Comparisons of the forecasting made over the last 27 years using all modes of indigenous weather forecasting were compared with Standardized Precipitation Index (SPI) as an indicator. For the purpose of comparison, the instrumental record was computed using Standardized Precipitation Index where results below zero were taken to represent a condition of drought. Besides the inconsistency of forecasts within different modes of indigenous weather forecasting systems, glaring discrepancy exists with the actual instrumental record. For instance, there is about 79% mismatch within the four main types of indigenous weather forecasting systems which means that in most cases herders received contradictory weather forecasts. The degree of mismatch between the forecasts of indigenous experts on the one hand and instrumental records on the other is about 60% (see **Table 4**). Even in the case of astrology-based weather forecast, which is believed by the people as the most reliable indicator, the degree of mismatch with instrumental records is 50% which means that no system of indigenous weather forecasting is reliable enough as to advise herders to base their decision on indigenous weather forecasts. What accounts for the decreasing vitality of indigenous weather forecast systems?

Given that plants and animals naturally undergo behavioral transformation parallel with the global weather change, it is highly possible that indigenous experts may not be able to observe body languages and behaviors that had been used hitherto. In the absence of the commonly

Year	Astrology		Intestinal		Plant body language		Animal body language		Standardized precipitation anomalies		Count of match and mismatch between different forecasts		
	No. of replies	%	No. of replies	%	No. of replies	%	No. of replies	%	SPA	Drought level	Mach/ mismatch	Mach/ mismatch	Mach/ mismatch
1985	15	7.5	51	26	23	12	19	9.5	0.42	Normal	*	***	x
1986	6	3	134	67	169	85	23	12	1.59	Normal	**	****	x
1987	85	43	74	37	58	29	93	47	1.01	Normal	*	***	x
1988	173	87	42	21	25	13	86	43	1.14	Normal	**	****	xx
1989	161	81	51	26	36	18	103	52	1.22	Normal	**	****	xx
1990	16	8	51	26	39	20	27	14	0.35	Normal	*	***	x
1991	144	72	124	62	150	75	164	82	−1.2	Moderate	**	***	x
1992	129	65	123	62	168	84	170	85	0.23	Normal	**	****	xx
1993	23	12	65	33	37	19	32	16	0.08	Normal	*	***	x
1994	190	95	119	60	33	17	186	93	−1.7	Extreme	**	****	x
1995	13	6.5	72	36	22	11	18	9	−0.8	Mild	**	***	xx
1996	178	89	109	55	45	23	166	83	−0.3	Mild	**	****	x
1997	17	8.5	81	41	41	21	29	15	1.37	Normal	*	***	x
1998	150	75	63	32	33	17	102	51	−0.6	Normal	**	****	x
1999	11	5.5	52	26	26	13	24	12	−1.6	Moderate	**	***	xx
2000	182	91	38	19	22	11	77	39	−1	Moderate	**	****	x
2001	7	3.5	158	79	173	87	83	42	−0.5	Mild	**	****	xx
2002	22	11	53	27	15	7.5	100	50	−0.7	Mild	**	****	xx
2003	11	5.5	8	4	11	5.5	11	5.5	−0.2	Mild	**	***	xx
2004	164	82	121	61	50	25	150	75	0	Normal	**	****	x
2005	6	3	32	16	178	89	137	69	0.44	Normal	*	****	x

Year	Astrology		Intestinal		Plant body language		Animal body language		Standardized precipitation anomalies		Count of match and mismatch between different forecasts		
	No. of replies	%	No. of replies	%	No. of replies	%	No. of replies	%	SPA	Drought level	Mach/ mismatch	Mach/ mismatch	Mach/ mismatch
2006	176	88	103	52	24	12	176	88	1.2	Normal	**	****	XX
2007	188	94	4	2	91	46	122	61	0.1	Normal	**	****	XX
2008	14	7	114	57	0	0	0	0	−0.8	Mild	**	****	XX
2009	8	4	13	65	0	0	0	0	−1.2	Moderate	**	***	XX
2010	190	95	164	82	102	51	148	74	1.94	Normal	**	***	X
2011	92	46	123	62	164	82	112	56	0.47	Normal	**	****	X
2012	29	15	29	115	113	57	29	15	−0.9	Moderate	**	****	XX
Count of mismatch											22	17	14
Percentage of mismatch											78.5	60.5	50

*Mach of forecast b/n traditional methods and instrumental records of drought condition.

**Mismatch of forecast b/n traditional methods and instrumental records of drought condition.

***Match of forecast within traditional methods.

****Mismatch of forecast within traditional methods.

XMatch of forecast b/n astrology and instrumental record value of drought condition.

XXMismatch of forecast b/n astrology and instrumental record value of drought condition.

Table 4. Comparison of forecasting and the level of mismatches within indigenous methods and instrumental records.

used signs, indigenous weather forecasters can hazard misinterpretation. Hence, indigenous experts are unable to update their science in view of changed environmental and ecological conditions that directly impact the stimulus-reaction pattern displayed for ages. On the other hand, it is very difficult to excuse the ever dwindling efficiency of astrology-based forecasts since the movement of celestial bodies and their constellations hardly change over brief span of time. Two possible explanations may be forwarded. First, in the past, the occurrence of drought had a more or less regular pattern, recurring once in a decade. Working on understanding of the observed regular pattern of the occurrence of drought might have deluded indigenous astrologists as having been correct in their forecasts. In recent years, however, global weather change has considerably distorted the old pattern of climate conditions with the effect that the forecasts of astrologists would not match with the reality. This means that from the outset, the knowledge claims of astrologists are found on pseudo-epistemology. This seems to be the reason for the failure/unwillingness of astrologist to explain why they read and interpret certain celestial alignments and constellations the way they do.

Secondly, the younger generation seems to have lacked fascination with the wisdom of forefathers, thereby undermining curiosity to learn the difficult technique of weather forecasting. As pointed out above, the expansion of alien ideas through education and monotheistic religions would stand negatively to the prestige and acceptability of indigenous experts, thereby inducing them to shy away from their indigenous practice. The bottom line is that people are no longer ready to seriously subscribe to indigenous forecasts. It would be impudent to argue that people should abandon their tradition at a time when science cannot provide a viable substitute. The best suggestion seems that indigenous experts should disclose their secrets to scientists so that a hybrid of climate forecasting system could be designed in ways that would make consideration of new biologist and animist signs as valid indicators of future weather phenomenon. It should not be difficult for indigenous experts to disclose their secrets as it would not represent any material lose since they are not paid for their service in the first place. They should be convinced that harmonious blend of indigenous and innovation has been inalienable prerequisites for survival and prosperity, as the history of human civilization attests.

3.6. Socioeconomic preparations in view of expected drought

Indigenous knowledge-based weather forecasting is the main source of weather information in Borana where access to modern weather information is limited. In Borana weather forecast is disseminated using well-organized cultural network. In view of drought forecast, herders take different preparations: they stop sawing crops for a while, strengthening enclosure through community bylaw, saving water and grass, preparing livestock medicine, storing hay, migrating with animals, destocking, and changing schedules of social and cultural festivities such as wedding. In Borana, indigenous weather forecasting is becoming unreliable, and herders were victimized by incorrect prediction. However, still herders prefer indigenous weather forecast information than modern forecast information. They were reluctant to heed development agents' advice about modern weather information. This shows that integration of herders' skill and knowledge with the modern weather forecasting system and dissemination should be a topical issue.

Migrating with animals where water and pasture are available areas is widely practiced as a coping strategy to drought. However, in the event of seasonal migration caused by drought,

people suffer from many problems. There is a high risk of attack on cattle by wild animals, and many incidents of cattle raiding occur that would lead to conflict. They may be exposed to conflict over water and pasture. En route, they have to endure the effects of cold and hot temperature due to problems of shelter which exposes them to health risks such as diarrhea and malaria and other animal contagious diseases that mainly affect the foot and mouths of cattle. Socioeconomic complications breed clan conflict that may lead to the loss of human and animal lives. People often find it difficult to maintain contact with their family members who stay behind and suffer from extreme food shortage. Sustaining the livestock resources in drought times requires heavy workload since owners need to treat their ailing cattle extensively which among other things requires fetching water from long distances, cutting and carrying cattle feed, etc. These complications in turn lead to school dropout for children and inability to fulfill basic needs such as clothing for the family.

4. Conclusion

The study shows that indigenous weather forecasting has its own merits and demerits. The main quality of indigenous weather forecasting lies in the longer temporal horizon it covers. Whereas modern meteorology could offer a probable weather scenario for weeks and a few months, traditional weather forecasting offers probable weather scenario for a longer period. The degree of accuracy of traditional weather forecasting varies depending on the quality of experts, the base of the forecasting, and the complexities caused by climate change. Currently, the acceptance of indigenous weather forecasting is decreasing because of cultural assault perpetrated by the expansion of Islam, Christianity, and modern education. The intrinsic merits of traditional weather forecasting have not been a subject of serious scientific scrutiny. It is a high time that the tenets of indigenous weather forecasting be assessed scientifically and be integrated into the modern science before they vanish. This could improve the performance of weather forecasting for a better climate change adaptation.

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Chapter 9

Role of Traditional Ethnobotanical Knowledge and Indigenous Institutions in Sustainable Land Management in Western Highlands of Kenya

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Additional information is available at the end of the chapter

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Abstract

The objective of this chapter is to elucidate the relevance of indigenous knowledge and institutions in natural resource management using western highlands of Kenya as a case study. The research design was a mixed method, combining qualitative and quantitative methods. A total of 350 individuals (comprising farmers, herbalists and charcoal burners) from households were interviewed using a structured questionnaire, 50 in-depth interviews and 35 focus group discussions. The results show that indigenous knowledge and institutions play a significant role in conserving natural resources in the study area. There was gender differentiation in knowledge attitude and practice (KAP) of indigenous knowledge as applied to sustainable land management. It is recommended that deliberate efforts should be put in place by the County Governments to scale up the roles of indigenous institutions in managing natural resources in the study area.

Keywords: indigenous institutions, Kakamega forest, Kenya, natural resources management

1. Introduction

At a global scale, available evidence points toward a direction of increasing relevance of Traditional Ethnobotanical Knowledge (TEK) as an invaluable, underutilized and underdocumented knowledge pool [1]. This presents developing countries, particularly in Africa, with a powerful tool to address plant resource conservation challenges [2]. In 1992, the

Convention on Biological Diversity (CBD) was the first to develop measures for use and protection of traditional knowledge related to the conservation and sustainable use of biodiversity. Abiding countries are expected to (1) promote the use of indigenous knowledge (IK) systems in natural resource management (NRM), (2) embrace and scale up utilization of indigenous knowledge and (3) promote equity and access in benefit sharing accruing from utilization of indigenous knowledge systems [3]. For example, Chapter 26 of Agenda 21 reiterates the "involvement of indigenous people and their communities at the national and local levels in resource management and conservation strategies to support and review sustainable development strategies" ([4], 26.3c). The United Nations Scientific Conference Organisation (UNESCO) and the International Council for Science Union (ICSU) in their blueprint documents appreciate the role played by IK and plead for its application in all forms of humanity engagements [5]. In defining TEK, various authors focus on the attributes of perception, management and utilization of plant resource by local communities [6, 7]. In specific terms, research on TEK focuses on "*how people classify, identify and relate to plant resources, examining the interactions of plants and people, taxonomic identification of selected plants and biological as well as chemical analysis of their ingredients*" [6]. Put differently therefore, TEK encompasses the investigation of plants as used in indigenous cultures for food, medicine, rituals, building, household implements, firewood, pesticides, clothing, shelter and other beneficial purposes [8, 9].

Indigenous knowledge, defined by Masango [10], as "*the totality of all knowledge and practices established on past experiences and observations that is held and used by people*," is the main reservoir of ethnobotanical investigations and is commonly referred to as TEK. However, changes in lifestyle brought about by globalization, particularly in Africa, have led to the negation of TEK in ongoing efforts to ensure sustainable management of resources with a concurrent loss of related knowledge [11, 12]. In particular, transmission of this knowledge between the older and younger generation is no longer connected [13].

In Kenya, for example, there is an apparent lack of practical recognition that indigenous technical knowledge is pivotal for sustainable utilization of environmental resources [6]. Further, TEK remains underdocumented in Kenya, particularly western Kenya [6]. Instead, there seems to be much focus on the "modern scientific knowledge." In western Kenya, for example, researchers do not seem to have paid much attention to TEK and its role in sustainable plant resource utilization. For this reason, this study sorts to answer the following questions: (1) Which plant resources are perceived as resources in western highlands of Kenya? (2) What degree of knowledge do people of varied socioeconomic status living in different ecological zones in western Kenya have about indigenous plant resources? (3) How are indigenous plant resources defined and conserved in western highlands of Kenya? and (4) To what extent do traditional knowledge and indigenous institutions for natural resource governance remain relevant in resolving current land degradation issues and how are they integrated in formal policy process in western highlands of Kenya? This study attempts to fill these gaps in knowledge by using people within western highlands of Kenya as the micro-level unit of analysis examining how they exploit indigenous plant resources. We postulate that people's management and utilization of plant resources are based on the knowledge, priorities and perceptions of the natural environmental resources and ecological processes involved. The study identifies the plant resources that are perceived by people as

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resources and undertakes an evaluation of these resources. It documents and assesses the TEK associated with the utilization of plant resources and examines how the resources are defined by use and culture.

2. Literature review

2.1. Traditional ethnobotanical/ecological knowledge

There is a general consensus in the arena of NRM that traditional ethnobotanical/ecological knowledge of indigenous communities can positively influence sustainable land management (SLM) practices [14–17]. Further, TEK can widen the manner in which environmental challenges are conceptualized and addressed by communities, hence enhancing a socioecological system's resilience [18].

TEK has received much attention from several researchers, hence the myriad of definitions. Raymond et al. defined TEK as "a subset of indigenous knowledge that includes knowledge and beliefs handed down through generations by cultural transmission and which is related to human environment interactions" [19]. Fernandez-Gimenez describes TEK as "a system of experiential knowledge gained by continual observation, and transmitted among members of a community" [20]. In this study, we use a definition from [16]: "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about relationship of living beings (including humans) with one another and with their environment."

TEK is an important component of a number of concepts within community-based natural resource management (CBNRM) realm and related concepts, including resilience, community participation and stakeholder collaboration [16, 21, 22]. Sustainable land management more often than not requires sufficient collection, retention and transmission of knowledge gained through years of interacting with a landscape [23]. TEK transmission is the transfer of traditional knowledge between individuals of a particular indigenous group. The primary modes of transmission are dynamic, varying with place and across time, though it commonly occurs through direct interaction with one's environment [24, 25]. TEK is also often conferred during normal social interaction and by oral transmission through storytelling [16, 26].

Loss of TEK has been attributed in part to Western influences including formal education, medicine, political systems, religion and technology [12, 27–29]. These factors have been corroborated by the United Nations Environment Programme (UNEP) in 2006, which presented a list of 23 barriers to traditional knowledge in Africa, including loss of or dramatic change to ecosystems, poverty, climate change, emigrations, schools, urbanization, among others [26].

2.2. Empirical studies on determinants of sustainable utilization of plant resources

Many factors determine whether or not indigenous plant resources are to be used in a sustainable manner. **Table 1** summarizes the findings of empirical studies on determinants of sustainable utilization of plant resources.

Author	Objective	Method	Setting	Main findings
[17]	Examine the different species and uses of plant genetic resources	Literature review	South Africa	South Africa is a hot spot for biodiversity with more than 22,000 plant species that form 10% of the world species on only 1% of the earth. Plant genetic resources are used for four main purposes: (1) medicinal by 60% of people who engage in informal trade with threats of depletion of many indigenous species. (2) Few species are used as food: leaves and trees have high nutritional value and, hence, could play an important role in preventing malnutrition in rural areas. (3) Ornamental industry based on a plant kingdom called *flora capensus* with 8600 species that were collected by many European explorers to develop new horticultural products. The indigenous flower industry supports 20,000 people in South Africa. (4) Economic exploitation of aloe and the devil's claw that are exported for medicinal use
[56]	Explore the role of gender in sustainable utilization of environmental resources	Literature review	Mayan communities, Mexico, Africa and Bangladesh	Although women have always played a major role as food providers and plant domesticators, they were considered as ecologically naïve until the last decade when they were recognized as embodying environmental knowledge that could lead to sustainability since it is local, traditional, subsistence-oriented, contextual, communal and uncorrupted by the influence of the commercial market. However, gendered knowledge varies with the environment. For instance, out migration in Mexico pushes women into decision-making positions while in Bangladesh, women do not play a public role in agriculture but only preserve indigenous crops
	Assess the effect of ecotourism on retention of knowledge on wild medicinal plants	Literature review	Brazil-Bahia State	Knowledge of medicinal plants is declining in the face of habitat alteration and cultural decay. However, women are the primary health care providers in the family and older women know more medicinal plants than men do; elderly women constitute cognitive repositories of traditional ethnomedical knowledge. Younger women and men, especially those with the most education and travel experiences, show little interest in learning the identities and use of local plants, albeit having a strong general commitment to environmental conservation
[50]	Dependent on substance production of maize and b squash	Literature review	Mayan community in the Yucatan	Home gardens and agricultural field are complementary gendered domains for varietal maintenance for both maize and squash, while a new space of family allocated plots (terrenos) is a joint agricultural domain where both genders make decisions about crop diversity. Mayan women select maize based on factors such as processing, food preparation and preservation methods, while men select squash cultivars for the market value of their seeds
[15]	Examine the role of gender in conservation of plant resources	Field surveys	Central Mexico	Gender differences in knowledge of varieties of maize are related to divisions of labor, farming of separate plots and men's out migration for long periods. Women could remember a greater number of varieties of maize that were no longer grown and that they often grew small plots of traditional maize varieties for special dishes or to maintain a variety passed on to them by a parent or grandparent

Author	Objective	Method	Setting	Main findings
[69]	Assess the relationship between gender and the naming of plant resources	Field survey	West Africa-Ghana	Gender division of labor is extended to labeling certain crops as male or female depending on their role in the perfect meal. Stable root crops are considered to be "male," while the seasoning used with these stable roots are grown and collected by women. The introduction of soybean changes the gendered relationships with food crops. Soybeans are associated with female soup items and their introduction allows women to overcome the shortage of the traditional soup item, wild "dawadawa" seed, due to deforestation. Women are able to cultivate, process and market soybeans, but pesticides are considered. Male and women are not only excluded but refrain from the technology of plant protection for fear of being accused of witchcraft
	Identify the role of women in food conservation	Literature review	Uganda	Although women are sorghums' exclusive custodians, their lack of decision-making authority over allocation of productive resources, plus a labor shortage precipitated by HIV/AIDS, is making it hard for them to maintain crop biodiversity. Nevertheless, women's role in seed selection and seed conservation ensures the survival of many local varieties
[64]	Assess women's attitudes toward varieties of rice grown in Bangladesh	Field survey	Bangladesh	Seed management is an extension of women's domestic duties: women are responsible for all seed processing, storage and exchange for both field and home garden crops. Women are reservoirs of detailed and complex knowledge of seed selection, processing and storage that is vital for the survival of households and local culinary cultures and is a source of pride among women. Although rural women accept the necessity for growing hybrid rice in order to "fill the stomach," they regret the loss of traditional varieties that were used in special dishes and in ceremonies
[45]	Examine farmers' ethnobotanical knowledge and rural change	Field survey with 90 respondents	Bungoma, Kenya	Some farmers have started to domesticate some of the traditional plants and new crops which have been introduced associated with corresponding innovations in local agricultural systems. It is important to combine and intertwine modern and indigenous knowledge to produce a more realistic and sensitive understanding and management of natural environmental resources for sustainable development
[62]	Explores the dynamics of the production and marketing process of rooibos tea and the key variables involved	Field research 2004–2006	South Africa	Success in tea production has been achieved through active NGO support which focuses on the use of local skills and social capital. This has led to significant social and economic improvement among participating communities. The experience illustrates how, given the right conditions, poor communities in the South might participate successfully in global alternative food networks
[11]	Analyses of key decision points and critical emerging legal and policy issues that have an impact on utilization of plant resources	Literature review	Global documents	There are major issues that influence the use of plant resources such as the farmers' rights, the rights and interests of indigenous and local communities, benefit-sharing, access to genetic resources, patenting and industry trends and protection of plant varieties

Author	Objective	Method	Setting	Main findings
[75]	Assessment of the use of biotechnology in conservation of plant generic resources	Literature review	Kenya	Conservation and sustainable use of genetic resources is essential to meet the demand for future food security. Advances in biotechnology have generated new opportunities for genetic resource conservation and utilization. Techniques like in vitro culture and cry preservation have made it easy to collect and conserve genetic resources, especially of species that are difficult to conserve as seeds. While technologies like enzyme-linked immunosorbent assay (ELISA) and polymerase chain reaction (PCR) have provided tools that are more sensitive and pathogen specific for seed health testing, tissue culture methods are now widely applied for elimination of systematic diseases such as viruses for safe exchange of germplasm

Source: Author's synthesis of literature.

Table 1. Empirical studies on determinants of sustainable utilization of plant resources.

2.3. Land degradation and sustainable land management in western highlands of Kenya

An overwhelming number of smallholder farmers in western Kenya rely on subsistence farming as their main source of food and livelihood support. However, this resource base has experienced continuous widespread declining land productivity due to various forms of land degradation that include but not limited to: soil erosion, soil nutrient depletion, deforestation and biodiversity loss [30, 31]. This directly has concomitant negative effects on household food security, particularly for the resource-poor farmers. In a wider sense, this adversely affects the supply of a range of ecosystem services from the existing natural resources [32]. For instance, ecosystem services provided by tropical forests are becoming scarcer due to continued deforestation as demand for forest benefits increases with the growing population [33, 34], whereas land degradation is acknowledged as a key contributor to poverty and food insecurity [35]. SLM strategies have in recent years been a focus of the Government of Kenya, and numerous development partners, due to their potential to minimize degradation, rehabilitate degraded lands and increase food production (**Table 2**). Studies elsewhere have found that proper application of SLM practices reduces land degradation and improves productivity of ecosystem services within the targeted ecosystems [36, 37].

According to Ref. [39], SLM is "*a knowledge-based [process] that helps integrate land,…, biodiversity and environmental management … to meet rising food and fibre demands while sustaining ecosystem services and livelihoods*." SLM is necessary to meet the requirements of a growing population. Improper land management can lead to land degradation and a significant reduction in the productive and service functions.[1] For operational definition purposes, we considered SLM as the "*application of a set of improved technologies and or better practices to enhance land productivity, increase on-farm returns and forest benefits than what is currently achieved*" [40].

[1]Numerous definitions of sustainable agriculture and natural resource management exist [54–56] that are equally applicable to land management. This chapter draws upon these in the definition provided *inter alia*.

Selected projects	Lead implementing agency	Location of implementation
1. Nitrogen to Africa—N2Africa	Centre for Tropical Agriculture—CIAT	Kakamega
2. Kenya Agricultural Production and Agribusiness Programme—KAPAP	Ministry of Agriculture	Kakamega, Siaya
3. Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa—SIMLESAs	Kenya Agricultural and Livestock Research Organization—KALRO	Bungoma, Siaya
4. Sustainable Community-based Input Credit Scheme	Kenya Forestry Research Institute—KEFRI	Siaya
5. Kenya Agricultural Carbon Project—KACP	Vi Agroforestry	Bungoma, Kakamega, Siaya
6. Strengthening Rural Institutions—SRI	World Agroforestry Centre—ICRAF	Bungoma

Source: Ref. [38].

Table 2. Some selected SLM projects implemented in western Kenya.

In the study area, the following SLM practices are ubiquitous: application of farm yard and compost manure, use of inorganic fertilizers and improved crop varieties, incorporation of crop residues and intercropping with legumes [41–44].

2.4. Conceptualizing indigenous institutions in soil land management

Institutions have been defined in various ways such as "rules of game in a society" [45], "regularized patterns of behaviour between individuals and groups in society" [46] and "structures of power" [47]. However, institutions can be simply understood as rules and norms framed by people, helping them in deciding what actions are required, permitted, or forbidden in society [48]. Institutions reflect power relations in community, which shape the ways in which differentiated actors access, use and derive well-being from environmental resources and services. They play a critical role in sustainable management of resources through defining property rights. For example, institutions ascertain who can graze cattle on a particular pasture and who cannot and also define one's share [49]. Institutions promote stability of expectations ex ante, and consistency in actions, ex post, from different actors [50]. Hence, it is increasingly believed that "getting institutions right" is as important as and inextricable from "getting incentives right," if sustainable resource development is to be achieved [48].

Like institutions, the term "indigenous institutions" has also been defined in many ways, which makes it difficult to understand what does it involve and what does it mean. Here for the sake of simplicity and clarity, a definition can be borrowed from [47], who defines indigenous institutions as "those institutions that have emerged in a particular situation or that are practiced or constituted by people who have had a degree of continuity of living in, and using resource of an area." These indigenous institutions can be traditional and nontraditional, and formal and informal. Indigenous institutions have a number of positive characteristics, which

lead to successful natural resource management. Some of their characteristics are [50]: social embeddedness, flexibility, cost-effectiveness and ability to promote inclusive and holistic development.

3. Research methodology

3.1. Study area

The study area covered Vihiga County and subcounties and areas adjacent to Kakamega tropical rainforest in western Kenya (**Figure 1**). Subsistence agriculture is the mainstay of the inhabitants of the area. The Kakamega forest ecosystem is a major source of charcoal and firewood, livestock grazing, medicinal extracts and wild honey and provides ground for the local community to practice their cultural activities such as circumcision [51]. The prominent SLM practices include: planting of improved seed varieties, timely implementation of agronomic practices, mulching, contouring on slopes, planting multipurpose farm trees and livestock integration [43, 44]. The SLM strategies for conservation of Kakamega forest ecosystem include: the promotion of farm forestry, sustainable planting and harvesting regimes for plantations, rehabilitation of natural forest stands and protection of riparian vegetation [52].

3.2. Conceptual framework for the study

A synthesis of literature and theories led to the development of a conceptual model for the study as shown in **Figure 2**. The model emphasizes the pivotal role that ecological and socioeconomic factors play in the utilization of plant resources. The relationships in the model are complex but linear. As shown in **Figure 2**, the level of TEK and utilization of plant resources are not arbitrary but instead, specific factors determine where, who, when and how plant resources are utilized by varied cultural identities, resulting into either sustainable or unsustainable utilization of plant resources and/or land management.

3.3. Sources of data

The study used both qualitative and quantitative data collection techniques. The data collection tools included:

3.3.1. Social surveys

In order to generate data about people's experiences of TEK, the first task was to investigate and analyze the socioeconomic/cultural and demographic profile of the respondents. To achieve this, a social survey was conducted on household basis, using mainly structured questionnaires. The questionnaires included both closed- and open-ended questions. Prior to the design of survey instruments, 2 weeks of reconnaissance were carried out in the study area to ascertain the population from which a sample would be drawn for data collection. Using a simplified formula for determining a sample size, $n = 1 + N(e)^2$, the sample size was

http://dx.doi.org/10.5772/intechopen.69890

Figure 1. Map of Kenya (inset) showing the location of Vihiga District and Kakamega Forest that constitute the study area in the western highlands of Kenya (source: Ref. [53]).

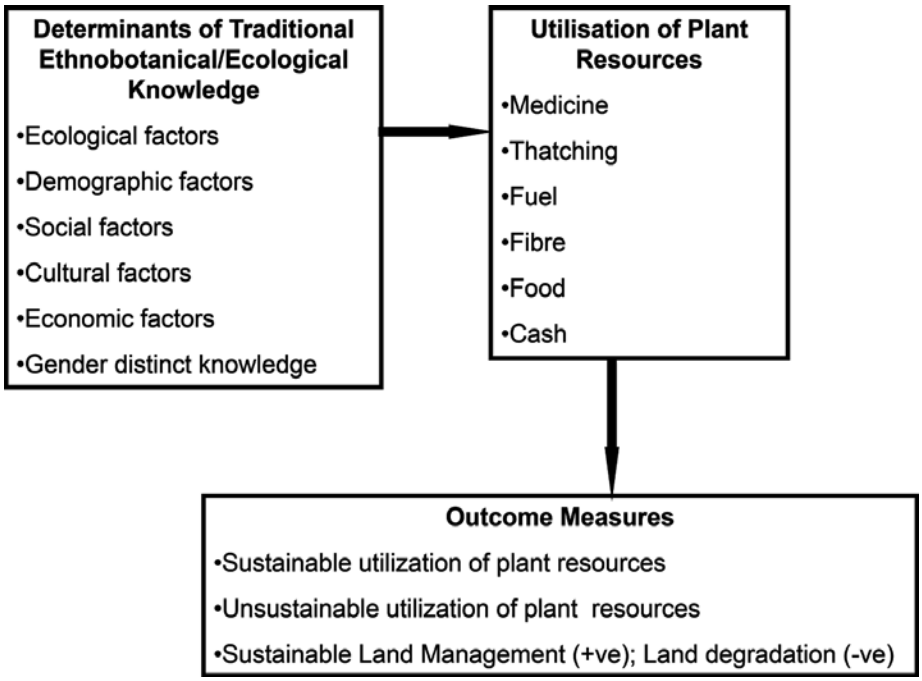

Figure 2. Conceptual model of the study (source: author's own conceptualization).

calculated from the target population with a 5% margin error [57, 58]. In the formula, n = the desired sample size, N = the target population and e = margin of error.

A reconnaissance visit was prudent to help gain basic understanding of the potential respondents for the study, and this helped in deciding what to include in the survey instruments. After the initial visit, a week was spent preparing questionnaires for the survey, and another week for training of research assistants on how to effectively administer the questionnaires and also iron out any challenges regarding translation of questions and responses (from English to the local languages and vice versa where applicable). The services of a translator were employed where necessary. A total of 30 questionnaires were piloted. The results of the pilot were used to improve the efficiency of the data collection instruments for the main survey. The study also employed ethnographic approaches such as participant observation, transect walks, key informant interviews and focus group discussions.

3.3.2. Participant observation

Participant observation is considered a primary method in anthropological research, especially for ethnographic studies. One of the first instances of its use is in the work of Frank Hamilton Cushing who spent four and a half years as a participant observer with the Zuni Pueblo people (northwestern New Mexico) around 1879 [59]. The aim of participant observation was to understand the social world from the subjects under investigation's point of view [60].

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3.3.3. Key informant interviews

This is a qualitative and in-depth method of data collection with people who know at first-hand what is going on in a specific area of an activity [60]. It is carried out in the form of a loosely structured conversation with selected (nonrandom) group/individuals that have specialized knowledge about a topic one wishes to understand [61]. Key informants for this study were selected from Kakamega County based on consultations with other key informants as well as references from scholarly literature and official documents. Key informants outside the study area were also interviewed where necessary.

3.3.4. Focus group discussion

This is a research method in which a small group of participants gather to discuss a specified topic or an issue to generate data [62]. Focus groups can reveal a wealth of detailed information and deep insight. The discussion capitalizes on communication between the researcher and participants to generate data [63]. Participants for the focus group discussion (FGD) were drawn from the following groups: youths, women, men, traditional health practitioners, county officials, among others. The FGD participants were identified from prior data survey data collection. The discussions were recorded (audio and video) with consent from participants, and at the end of each FGD session, they were required to fill out an evaluation questionnaire.

3.4. Data analysis

Data analysis comprised both quantitative and qualitative techniques. Quantitative data on the one hand were cleaned, coded and entered into the Epidata 3 software prior to exporting it into the Statistical Package for Social Science (SPSS) version 16 for analysis. Descriptive and cross tabulations were carried out. On the other hand, qualitative data followed a four-point data analysis schema involving reading, coding, displaying and data reduction. The transcripts were entered into Nvivo 10 program (Scolari Inc., SAGE Publications) based on the template of topical categories drawn from questions and issues covered in the field guide and from the themes emerging from the interviews themselves. The program facilitated easy coding, displaying and data reduction.

3.5. Ethical considerations

Prior to participation in the study, an informed consent of all participants was sought. The researcher acknowledges that many of the cultures from which traditional knowledge is collected are more endangered than the ecosystems in which they reside. When their local knowledge and information is published or supplied to databases, industry or the general public, a unique opportunity exists for these communities to receive economic or nonmonetary benefits from its use. If this opportunity is missed, their knowledge, once published, becomes part of the public domain and it is no longer their own to monitor and control. Yet, ethnobotanical information is often recorded without fully explaining to communities how it will be used or how local rights to control its use might be affected. Similarly, biological samples are

sometimes collected from indigenous reserves without local communities' full consent. The ethical issues that were addressed by the researcher in consultation with Kenyatta University Directorate of Intellectual Property Rights (IPR) included:

1. Identifying the communities living in the study area.
2. Consultation with the communities to ascertain interest in the project in allowing access to their resources.
3. Negotiating agreement with potential users.
4. Providing copies of the report.
5. Third-party use of information.
6. Access to their genetic resources embodying their traditional knowledge.
7. Issues related to equitable benefit sharing.
8. Community intellectual property rights.

While systematic documentation captures and preserves orally transmitted knowledge for present and future generations, it exposes local farmers to the risk of losing their IPR through piracy and commercial exploitation. Cognizant of this, the research team strived to use creative ways of documenting oral ethnobotanical knowledge while protecting the IPRs of the community right at the beginning of the study. The provision of an explanation on the objective of the study hopefully led to a relaxed and positive attitude from the respondents to facilitate data collection. Additionally, field observations, photography, participatory resource mapping and transect walks were employed in data collection.

The inclusion of the community in the study by giving local people a chance to coordinate the study process enabled the research team to build linkages and ensured that the local community owned the work. The local community benefited in three ways:

1. The local steering committee that mobilized people were recognized as key people who had interacted with senior scientists and obtained knowledge on some aspects of indigenous ethnobotanical resources that they could cascade to other members in the community.
2. The youth who participated in the study as research assistants were not only remunerated for their services but also gained insight into ethnobotanical knowledge that they did not have previously.
3. Members of the research team were given seedlings by some herbalists who had preserved pivotal plant species in nurseries to plant in their homesteads for future use.

Such collaboration through an exchange of seedlings between the community and researchers as well as empowerment of the research team to cascade the gained knowledge about ethnobotanical resources enhanced the buy-in of study results and recommendations to improve the current environmental policy with a view to integrating indigenous ethnobotanical knowledge in development programs for sustainability.

4. Results and discussions

4.1. Awareness of traditional knowledge and practices

The results shown in **Table 3** indicate that most respondents (95%) were aware of these practices, whereas the remaining 5% were not aware. To establish the levels of understanding of TEK on SLM, respondents in the study subcounties were asked to state whether they were aware of the various TEK and practices related to SLM. Majority of the respondents (95%) were aware of these practices, whereas the remaining 5% were not aware (**Table 3**).

The level of awareness of traditional knowledge and listed practices of SLM was not significantly different among respondents across levels of education. Significant differences emerged between gender categories. Majority of male respondents (73%) were aware of the different traditional methods and practices of SLM compared to 27% among female respondents. This difference was statistically significant ($\chi^2 = 9.75$, $df = 2$, $p < 0.017$). Similar findings have been reported elsewhere [59]. This difference can be attributed to the fact that customarily, men are inheritors of ancestral land among communities inhabiting this region and hence are keener on conserving land than women. This was summarized as follows:

> *Women can never inherit ancestral land in this region. Land is inherited by sons of the home. Girls are expected to get married elsewhere when they become of age (in-depth interview).*

Young respondents aged 18–25 years had limited knowledge about traditional methods and practices of SLM. Respondents aged 45 years and above appeared to be more aware of these methods and practices. Chi-square test confirmed that these differences observed were statistically significant ($\chi^2 = 14.143$, $df = 5$, $p < 0.001$). The differences in levels of awareness about traditional methods and practices of SLM between young and elderly were further emphasized by respondents in a FGD, thus:

Sub-county	Number of respondents	Aware of TEK of SLM	
		Yes	No
Luanda	50	100	0
Emuhaya	50	90	10
Hamisi	50	100	0
Sabatia	50	80	20
Ikolomani	50	100	0
Shinyalu	50	92	8
Malava	50	100	0
Total	350	94.6	5.4

Source: Field data, 2016 ($\chi^2 = 34.456$, $df = 12$, $p < 0.021$).

Table 3. Respondents' awareness of soil land management in the study area.

> *Only old men and women have same knowledge about indigenous plant resources and how they are used. As for young people, only few who go to the forest to harvest some species for use as medicine have some knowledge about indigenous plant resources. The reason that the youth lack such knowledge is that the elderly withhold a lot of information from the former so that they can continue reaping economic benefits from their knowledge of indigenous medicinal plants. (Male FGD, Malava Sub-county).*

These above results corroborate results of other studies that younger people are less knowledgeable about indigenous plant resources. In Bahia State of Brazil for example, younger women and men, especially those with the most education and travel experiences, show little interest in learning the identities and uses of local plants, albeit having a strong general commitment to environmental conservation [64].

4.2. Current traditional knowledge and SLM practices in western highlands of Kenya

Some of the identified practices that address the myriad soil land management challenges (**Plate 1**) in the study area are elaborated here below.

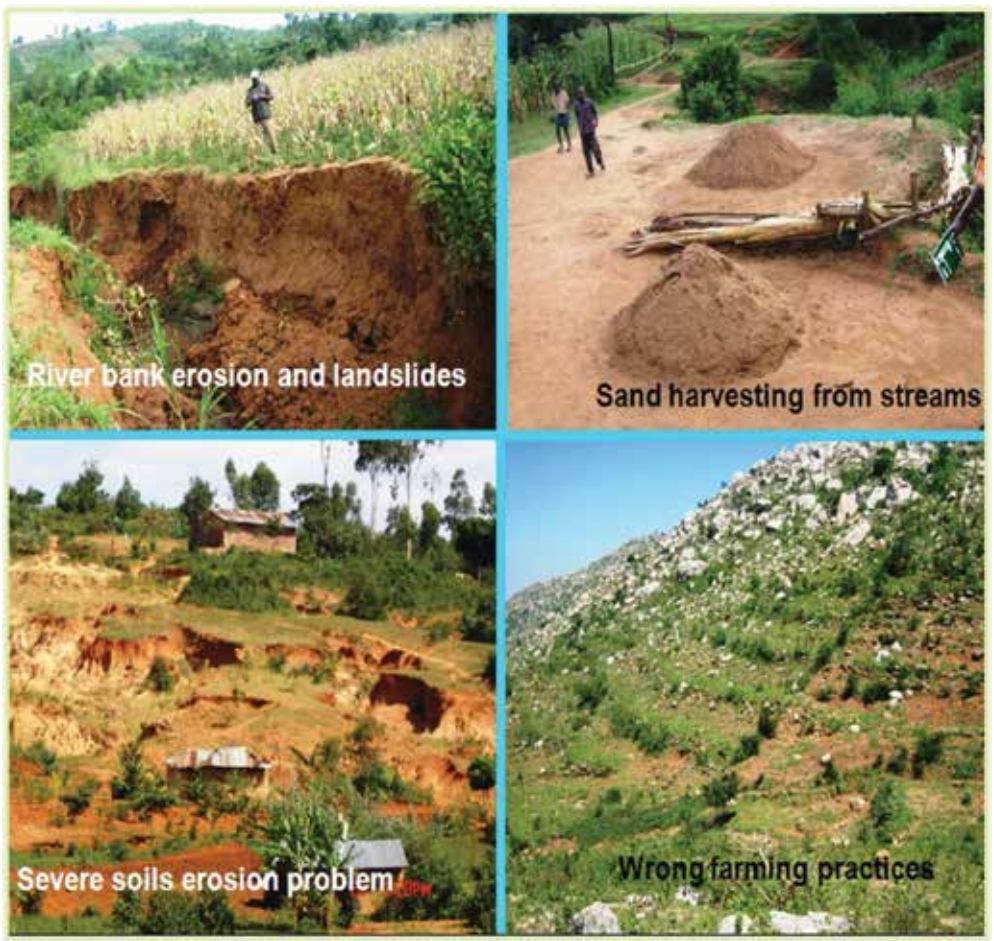

Plate 1. Environmental challenges facing the people of western highlands of Kenya (source: Author, 2016).

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Cultivation of ridges

The most popular practice used in the study area is the "*fanya-juu*" terracing. *Fanya-juu* terraces have had the positive effect of increasing crop yields in East Africa by about 25%, hence the high adoption rate by smallholder farmers (**Figure 3**) [65].

On the importance of *fanya-juu* terraces, respondents during in-depth interview were unanimous that:

> *Fanya-juu terraces help preserve valuable topsoil rich in soil organic matter, thus promoting the use of fewer chemical inputs to sustain yields, which have positive economic and ecological consequences for both farmers' livelihoods and the environment.*

Use of organic farmyard manure

This practice of using farm yard manure (FYM) (*imbolea*) in crop farming enterprises is common in the study area. Cattle manure is an integral component of soil fertility management in western highlands of Kenya, and its importance as a source of nutrients for crop production is widely recognized [66–68]. Field interviews showed that respondents rely on organic manures as low cost and easily available alternatives to inorganic fertilizers. The quantity and quality of manures available are the major factors limiting its contribution to increased crop yields.

The use of FYM requires that farmers own livestock as the market for it is thin because of inadequate amounts available partly because of inadequate knowledge on its benefits [69]. Respondents during FGD reported that they make their farm yard manure from a wide range

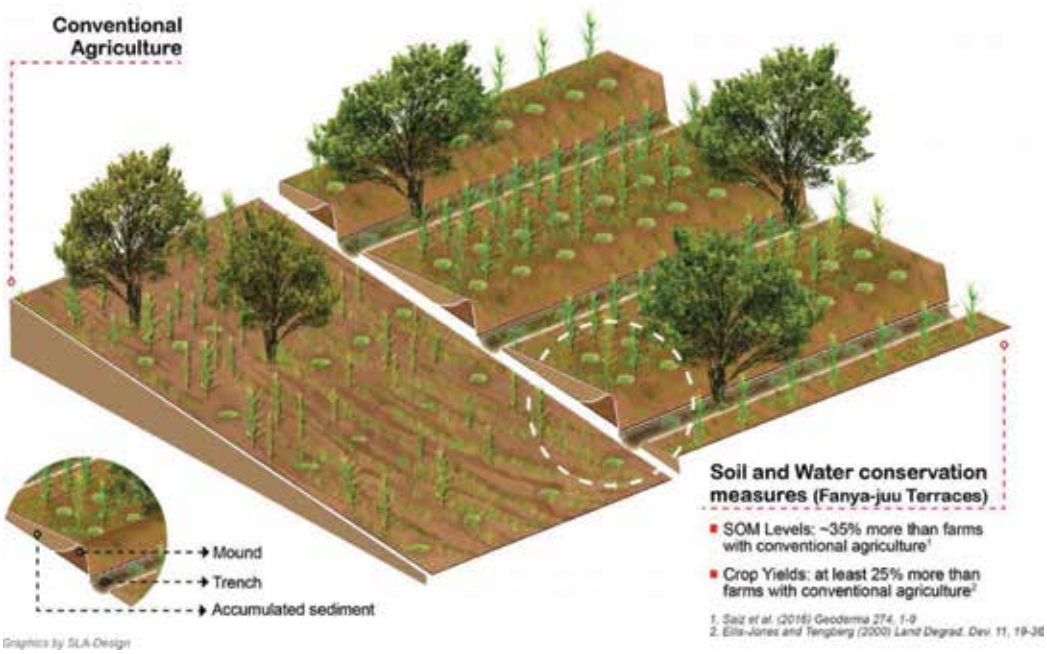

Figure 3. The architecture of *fanya-juu* terraces (source: Ref. [65]).

of organic materials including plant residues (maize stover, bean straw, grass trash, tree/hedge cuttings and banana pseudostems), animal manures and kitchen waste.

Mulching

Mulching is an effective method of manipulating crop-growing environment to increase yield and improve product quality by controlling weed growths, ameliorating soil temperature, conserving soil moisture, reducing soil erosion, improving soil structure and enhancing organic matter content [70]. Over 95% of respondents interviewed reported practicing mulching on their crop fields.

Protection of indigenous plant resources through religio-cultural beliefs and rituals

A herb called ***Euphorbia tirucalli*** (*ingoi*) was mostly used during rites of passage. Other ethnobotanical species that were mostly mentioned by respondents as instrumental in rites of passage include: ***Musa acuminate*** (*amakomia*) or bananas (315 respondents, 90%), ***Trichilia emetica*** (*munyama*) (315 respondents, 90%), ***Tamarindus indica*** (*mukumu*) (315 respondents, 90%) and ***Ficus thonningii*** (*mutoto*) (300 respondents, 85.7%).

FGD participants observed that an herb called ***Euphorbia tirucalli*** (*ingoi*) acts as a disinfectant/antibiotic and facilitates faster healing of wounds. This explains why the herb was applied on fresh wounds after circumcision of boys in the western highlands of Kenya. According to respondents:

> *When we were circumcised, there was something that was crushed called **Euphorbia tirucalli** (nyingwa or ingoi), mixed with water and applied on our fresh bleeding wounds to facilitate faster healing. (Male, FGD, Malava Sub-county)*

The value of trees was equally mentioned during rituals related to child birth. According to a respondent, "*the leaves of Dioscorea **villosa** (induma) or yams were boiled in water and used to bathe new born babies in order to neutralize their bad smell and wade off evil eyes of some people who could cause harm to the baby.*" (Female, FGD with herbalists in Shinyalu subcounty). A species of a tree called ***Markhamia lutea*** (*lusiola*) was used during rites of passage, starting with birth, initiation, marriage and death. "*Leaves of **Markhamia lutea*** (*lusiola*) *and another tree called **Plectranthus barbatus*** (*shiroko*) *were used with warm water to massage a child's knees to enable them to walk faster.*" (Female, FGD with farmers in Luanda subcounty).

The ***Markhamia lutea*** (*lusiola*) tree was also utilized during marriage rituals. According to a respondent, "*during marriage arrangements, branches from **Markhamia lutea*** (*lusiola*) *tree were customarily used to shepherd cows during dowry delivery. This is because the tree was perceived to link the living dead and future generations.*" (Male, FDG with farmers in Shinyalu subcounty). "*A species of a creeping plant, **Cussonia arborea*** (*lirande*), *was used to determine whether or not a marriage deal would be successful.*" (Male, FGD with herbalists, Ikolomani subcounty). When emphasizing how the success of a marriage was determined, a respondent noted that:

> *There is a root of a plant called **Cussonia arborea** (lirande). The **Cussonia arborea** (lirande) could be extracted and had to come out whole so as to give the expected result. If successful, a man went ahead to approach the girl. The girl could simply follow the man and accept all his wishes. (Male, FGD with farmers in Shinyalu Sub-county)*

When death occurred, ***Markhamia lutea*** (*lusiola*) tree was used to light mandatory fires that were believed to unite the dead and living members of the community in the former Kakamega district. A respondent noted:

> *"**Markhamia lutea** (lusiola) tree was used to light mandatory sacred fires that are believed to link the living and the dead." (Male, FGD with charcoal burners, Shinyalu Sub-county)*

The results also demonstrate that some indigenous tree species were used to demarcate sacred space such as graves of elderly and other respected people in the highlands of western Kenya. According to a respondent:

> *"**Markhamia lutea** (lusiola), **Tamarindus indica** (mukumu) and **Croton macrostachyus** (musutsi) trees were planted on graves of prominent people in the community." (Man, FGD with farmers, Ikolomani Sub-county)*

Study participants mentioned that some trees such as ***Markhamia lutea*** (*lusiola*), ***Mimusops bagshawei*** (*lutori*) *and* ***Diospyros abyssinica*** (*lusuyi*) are perceived as symbols of power and authority in the western highlands of Kenya. This explains why "*walking sticks for respected elderly people are made from trees called* ***Mimusops bagshawei*** (*lutori*), ***Markhamia lutea*** (*lusiola*) *or* ***Diospyros abyssinica*** (*luswi*). *Again, circumcision clubs for identifying initiates were derived from* ***Markhamia lutea*** (*lusiola*) *tree."* (Male oral interviewee, Malava subcounty).

Some participants mentioned the value of indigenous plant resources to exorcize demonic forces from haunted people. A respondent observed that "*the bark from* ***Vangueria apiculata*** (*mukhaa*) *is used to exorcise demons and evil spirits from a possessed individual."* (Male, FGD with farmers in Ikolomani subcounty). ***Spathodea campanulata*** (*luviru*) is also used to exorcize demons and evil spirits. According to a respondent, "***Spathodea campanulata*** (*luviru*), is burnt over fire and its ash licked by the affected person to neutralize demonic forces in him/her." (Male, FGD with herbalists, Ikolomani subcounty). A female herbalist reiterated, "*the leaves and bark of* ***Rubia cordifolia*** (*mulonda musala*) *herb also block evil spirits and demons from attacking people."* (Female, FGD with herbalists, Ikolomani subcounty). Results also revealed that some indigenous plant species were used to bind oaths. Such plant species were planted by participants after making oaths to seal intentions of keeping promises. According to a respondent, "***Tamarindus indica*** (*mukumu*) *and* ***Sesbania sesban*** (*lukhuvu*) *trees were used in administering oaths*. A shrub species called ***Sesbania sesban*** (*lukhuvu*) was mostly utilized to seal oaths" (Male, FGD with herbalist in Shinyalu subcounty).

5. Recent changes in the use and conservation of indigenous plant resources

Distinct gender roles exist in western highlands of Kenya which have influenced utilization of indigenous plant resources over time. However, the onset of colonialism, missionaries, education and modernization introduced changes in the use of indigenous plant resources as shown in the succeeding section.

5.1. Enculturation, gender dynamics, utilization and conservation of plant resources

Field results show a change in the use of indigenous plant resources due to societal changes in the former western highlands of Kenya. They include cultural changes and gender roles as discussed below.

5.1.1. Changing culture and gender roles

Unlike in the ancient days when culture prohibited women from cultivating and utilizing some plant resources such as indigenous trees and banana fibers, there is a change in modern times because culture is no longer strictly upheld. The introduction of exotic plant resources such as ***Cupressus lusitanica*** (*mutarakwa*) or Cyprus trees and genetically improved ***Musa acuminata*** (*amakomia*) or banana fibers has benefited illiterate women who feel free to handle the new plant species unlike indigenous species that culture prohibits women from cultivating and caring for. A respondent reiterated this fact in the following excerpt:

> *Beliefs and traditions used to demean women and prohibit them from planting trees and* ***Musa acuminate*** *(amakhola) banana fibres. However, times have changed leading to relaxation of stringent traditions and customs. Nowadays women do plant exotic trees and improved* ***Musa acuminate*** *(amakomia) banana fibres in women groups: something that was considered as a taboo in the olden days. (Female, FGD with farmers in Malava Sub-county)*

These changes have enabled women to play an important role in agro-biodiversity by cultivating, caring for and conserving plant resources by borrowing from traditional indigenous knowledge where women are well endowed as seen earlier. Women provide required food for households because they live in rural areas as spouses live in urban centers due to urbanization. Our findings corroborate with other studies [34]. The vital role played by women in the western Kenya resonates with the emphasis of the Rio Earth Summit that recognized and fostered the traditional methods and the knowledge of indigenous people and communities by emphasizing the particular role of women that is relevant to the conservation of biological diversity and sustainable use of biological resources [71]. Despite the engendered use of plant resources that has been enhanced by modernization and urbanization, there are specific indigenous plant resources that some illiterate women feel uncomfortable to plant due to cultural prohibitions. These include planting indigenous species of ***Musa acuminata*** (*amakomia*) or bananas, trees and fences, fearing that their spouses could die as elaborated by a respondent in **Box 1**.

There are some traditions that are still upheld, and these discourage women from planting indigenous plant resources such as *Musa acuminate* (banana) fibers and indigenous trees. Tradition demands that these crops be planted by men only. It is believed that men can die if women plant trees and bananas fibers. To this end, woman must rely on men to plant bananas fibers. If spouses are away, women request brothers-in-law to plant these species on their behalf. But in case the men decline, then bananas fibers and indigenous trees are not planted until when spouses return to villages to play their appropriate roles in homesteads. (Female oral interviewee, Shinyalu Sub-county)

Box 1. Some women not free to plant bananas and some indigenous trees.

5.1.2. New technology, utilization and conservation of indigenous plant resources

Agricultural technology could be perceived as both destroyer and conserver of indigenous plant resources. On the one hand, the introduction of technology has led to destruction of indigenous herbs/weeds that were resourceful to people. A case in point is where wastes from factories pollute rivers, leading to destruction of plant resources. When referring to this trend, a respondent noted, "*Long ago, we had different varieties of indigenous plant resources in our river basin that served many purposes. But with the introduction of factories in this area, the waste is dumped in rivers leading to extinction of most indigenous plant resources along river valleys.*" (Male, Oral interviewee, Ikolomani subcounty)

Pollution of the environment negates Act 87 of the Environmental Management and Co-ordination Act [72] that prohibits discharge of wastes that pollute the environment. The Act expects owners of factories to minimize wastes through treatment, reclaiming and recycling: failure to which such individuals are guilty of an offence liable to imprisonment for a term of not more than 2 years or to a fine of not more than 1 million Kenya shillings or to both such imprisonment and fine. To this end, local people ought to be made aware of their rights under this Act so as to put pressure on factory owners to minimize wastes prior to discharging water into local rivers. On the other hand, the introduction of technology has enabled people to conserve some species such as ***Aloe kedongensis*** (*likakha*) or *aloe vera* whose economic value was unknown. These trends are further discussed below.

5.1.3. Modern technology as destroyer of indigenous plant resources and soil nutrients

The onset of modern agricultural practices such as tractors and power saws led to clearing of indigenous herbs/weeds thereby threatening their future existence. For instance, a species called ***Mondia whitei*** (*mukombero*) for increasing sexual libido and other weeds/herbs used to be found in bushes but are extinct because farms were cleared using modern technology to plant food crops as revealed in the following excerpt from the field:

> ***Mondia whyttei*** *(mukombero) used to be found everywhere when we [people in the western highlands of Kenya] had fallow land full of indigenous bushes and forests. But nowadays people use their land mainly for agriculture. Tractors or bulls are used to plough thereby destroying many indigenous weeds/herbs that existed in the past. If someone needs* ***Mondia whytei*** *(mukombero,) these days, he/she must travel to Kakamega Forest to look for the species therein. (Male, FGD with charcoal burners in Malava Sub-county)*

The results from FGD further show that the use of modern fertilizers is believed to have introduced new species of stubborn weeds/herbs that never existed in western highlands of Kenya before. All FGD participants mentioned a weed called ***Tithonia diversifolia*** (*kayongo*) as one of the stubborn new weeds that have been introduced by the use of modern fertilizers. The challenge of nuisance and invasive species that cause harm to the environment is increasing along with the increase in international trade. In order to address this challenge, the people in the highlands of western Kenya need to establish teams to research on such invasive species and advice the government on how to eradicate them as is the practice in the United States of America [60].

Again, modern fertilizers have led to extinction of some indigenous species as shown in the excerpt below:

> *The use of new farm inputs such as pesticides and fertilizers have led to the disappearance of* ***Cupressus lusitanica*** *(inarutsaka) and even the leaves of that plant that was used to chase away birds in* ***Albizia coriaria*** *(mavere) or sorghum plantations. (Male, FGD with farmers in Ikolomani Sub-county).*

Key respondents further emphasized the role of technology in the extinction of indigenous herbs/weeds and vegetables as seen in **Boxes 2** and **3**, respectively.

People in this area have acquired knowledge regarding best practices in planting exotic species such as ***Zea mays*** (*amatuma*) or maize. They have knowledge about how and when to use varied forms of organic manure to plant ***Zea mays*** (*amatuma*). However, the people also know that continued use of modern fertilizers cause soil infertility and nothing can germinate unless the chemicals are added to the soil. This has led to reduced food production in this area and extinction of some valuable indigenous plant resources such as ***Albizia coriaria*** (*shivembe or obusinde*), ***Ricinus cummunis*** (*amabono*), ***Cupressus lusitanica*** (*inabutsaka*) and ***Biden pilosa*** (*olukoye*) or black jack that used to be common prior to introduction of modern fertilizers. Since many people lack cash to purchase the expensive fertilizers, they prepare composite manure in their homesteads to mix with modern chemicals to enhance productivity on their farms. (Male oral interviewee, Ileho Sub-county)

Box 2. Modern fertilizers' role in extinction of indigenous herbs/weeds.

Modern manure is responsible for loss of traditional vegetables. These vegetables cannot grow on the modern fertilizer. If an attempt is made, they merely wither away. For example, ***Solanum nigrum*** (*lisutsa*) and ***Gynandropsis gynandra*** (*tsisaka*) used to grow on uncultivated land. But these days, these vegetables together with ***Amaranthus*** (*tsimboka*) and ***Portulaca oleracea*** (*inderema*) are getting extinct due to the use of modern fertilizers. Whereas modern fertilizers increase the yield of ***Zea Mays*** (*amatuma*), the crop is very seasonal and very few people can afford the cost of fertilizer. On the contrary, indigenous food species such as ***Ipomoea batatas*** (*lipwoni*) or sweet potatoes were available throughout and enabled people to have food all the time. But the indigenous species of many crops are not available any more. (Female, oral interviewee in Shinyalu Sub-county)

Box 3. Modern fertilizers' role in extinction of indigenous vegetables.

FGD participants pointed out that agricultural inputs such as pesticides and fertilizers destroy nutrients in their farms. Farmers are forced to incur high costs to purchase farm inputs to improve ever-diminishing crop yields. One respondent stated that:

> *The use of fertilizer makes the soil very acidic and infertile. Previously, we just used organic manure for cultivating crops. We used to apply manure once for a whole season resulting to very good yields. But nowadays, our soils have changed. When you plant crops, with modern fertilizer, you must apply it again or top dress with ammonia before harvesting. Failure to constantly apply manure to food crops results to poor harvest. Again, nowadays, if you plant crops without fertilizer, you should not expect to harvest any crops. (Female, FGD with herbalists in Ileho Sub-county)*

In order to improve the soil nutrients, FGD participants observed that agricultural officers encourage them to interplant ***Grevillea robusta*** (*amapipilia*) trees with food crops because the trees are friendly to the environment and to other crops. According to one participant:

> *Nowadays, agricultural officers advice us to intercrop our food crops with* ***Grevillea robusta*** *(amapipilia)* **or** *gravellier trees to improve the fertility of our farms. Even long time ago, we used to inter crop* ***Tamarindus indica*** *(mukumu) tree, and* ***Olea capensis*** *(mukavakava), which shed their seeds and*

leaves to improve soil fertility. That is why we desire to have our indigenous plants to be returned to farmers so that we can bring back [revitalize] the soil fertility (Male, oral interviewee in Ikolomani Sub-county)

This finding shows that lack of adequate knowledge on ethnobotanical plant resources could lead to unsustainable utilization of the environment. Farmers who are unaware of how intercropping indigenous trees with food crops improve soil fertility are unlikely to plant indigenous trees on their farms. Fortunately, agricultural extension workers are sharing such information with farmers as they promote planting of ***Grevillea robusta*** (*amapipilia*) trees. In addition, agricultural extension workers disseminate information about the need to conserve genetic resources to meet the demand for future food security [73]. Our finding on the need to preserve indigenous plant species for sustainable use of the environment resonates with findings of other studies that new technology could be used to preserve indigenous plant resources and eliminate viruses for safe exchange of germ plasm using enzyme-linked immune sorbent assay (ELISA) and polymerase chain reaction (PCR) [73]. Ultimately, an integration of indigenous ethnobotanical knowledge with modern agricultural development will ensure sustainable use of the environment.

6. Importance of indigenous local institutions for natural resource management

Key informants were identified in consideration of gender balance, resource endowment and location in the landscape in order to examine the role of indigenous institutions for natural resource management in the study area. Diversity of indigenous local institutions identified is shown in **Table 4**.

The changes in importance for some of the local institutions shown in **Table 4** were also assessed. For example, rainmakers, devil cleansing, fortune-tellers and sacred areas for rituals are all becoming less important due to modern religion (Christianity and Islam),

Functional-based local institutions	Role in community
Land	Contracting and renting
Livestock	Regulating communal grazing
Labor	Collective action
Mutual assistance	Merry-go round "*Chamas*"
Health	Traditional midwives, traditional healers, devil cleansing
Traditional beliefs	Conservation of sacred trees/forests
Traditional leaders	Prescribing traditional community norms
Recreation	Traditional sports (wrestling, bull-fighting)
Conflict resolution	Council of elders

Source: Field data, 2016.

Table 4. Typology of indigenous local institutions for natural resource management in the highlands of western Kenya.

influx of outside cultures and government policies. The above changes do not significantly across the study sites. Traditional leadership structures have been replaced by a formal system under the devolved County government structure, where leaders are democratically elected. Form the foregoing, it can be seen that a variety of institutions in the study area are involved in natural resource management. For successful engagement of local communities, there is need to recognize and work with local institutions. This is because their role as custodians of local knowledge [20], mobilizing collective action [74, 75] and connecting members of different communities [76] are all fundamental to effective natural resource management.

7. Conclusion

This study has demonstrated that inhabitants of western highlands of Kenya perceive most indigenous plant species as resourceful. For this reason, the inventory generated by this study ought to be printed and used to educate the younger generation about the varied types of plant resources and their uses. Such knowledge will empower local people to avoid unwanted destruction of resourceful resources out of ignorance. Indigenous institutions are evidently strong and effective in sustaining plant resources in the region. In order for the indigenous traditional knowledge to be better appreciated by the youth, the curriculum should be revised to integrate TEK. The possibility of being examined on indigenous plant resources will motivate the youth to be keen and even plant some of the species during agriculture lessons to better familiarize themselves with indigenous plant resources. Additionally, the study has shown that integrating new scientific knowledge with TEK can yield greater results in terms of sustainable development. A case in point is the ***Jatropha curcus*** (*amabono*) and ***Aloe kedongensis*** (*amakakha*) species that are now being conserved by some people in western highlands of Kenya for economic benefits. To this end, participatory research needs to be encouraged because it enables local people to benefit from their indigenous plant resources. Current trends of modernization of agriculture, land use and resource management systems have interfered with TEK through weakening the role of intergenerational experiences related to traditional SLM practices. The government has put a policy in place prohibiting cutting of trees. For this reason, someone needs authorization from the government prior to cutting down his/her trees. According to the permit, two trees should be planted to replace the one that is cut down. Although the policy is good, the government does not provide free seedlings to replenish the trees that are cut down. It is important for the government to provide necessary support in terms of seedlings to encourage sustainable utilization of plant resources. If seedlings are provided free of charge, many people will plant indigenous plant resources for use by future generations. Otherwise, there are many cases whereby the policy that requires replenishing of cut trees is not implemented due to lack of resources. Availability of seedlings could lead to a greener environment and conservation of indigenous plant resources in people's homes for future use. This practice will reduce the current pressure on forests to provide all required indigenous plant species. Government of Kenya also needs to address legal issues related to use of indigenous plant resources. As

mentioned earlier, the government needs to enforce laws that protect indigenous plant species in western highlands of Kenya to prevent overexploitation of indigenous plant resources for economic gains at the expense of conservation.

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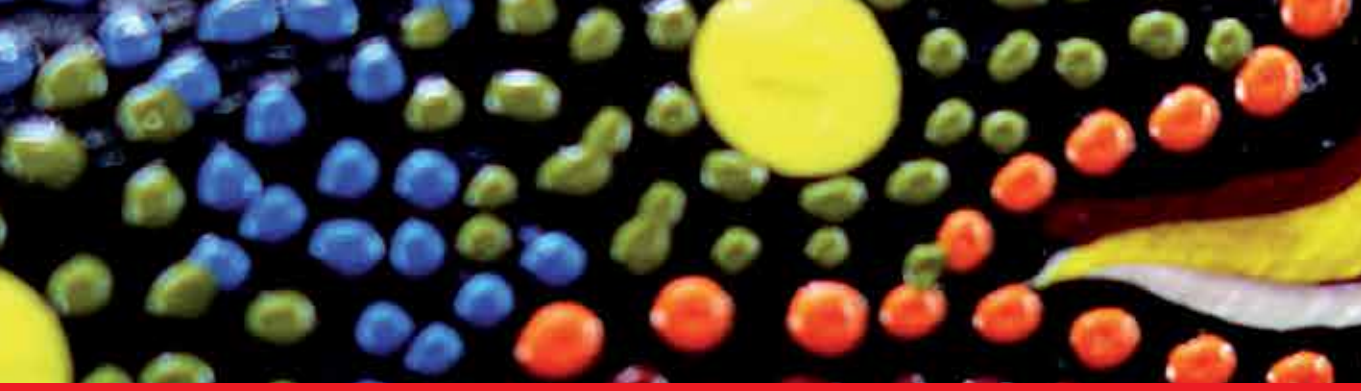

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Indigenous peoples are the native ethnic groups, who are descended from and identified with the original inhabitants of a region, in contrast to groups that have settled, occupied, or colonized the area more recently. This book entitled Indigenous People is an attempt to bring out the analysis of indigenous environment, indigenous technical knowledge, indigenous resource governance, and indigenous entrepreneurship and empowerment. This book contains selected chapters from renowned personalities from across the globe who have rich knowledge on sovereignty, economic well-being, and resource access of the indigenous people, on which their cultures depend. This book will certainly be an asset or a boon, not only to the extension fraternity but also to all those who are really thirsty of information and knowledge on indigenous people.

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