

The Initiative of “Farshaha Smart Village”: Context Evaluation

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Abstract— Background: To implement an initiative of “Farshaha Smart Village”, it is of paramount importance to have the necessary information about the village, its inhabitants’ characteristics, the strengths/weaknesses and opportunities/threats that face such a rural development project. Reference to that it was planned to conduct a context evaluation for Farshaha village, in Sheikan Locality, North Kordofan State, Sudan. The aims were to identify the socio-demographic characteristics of Farshaha village population and identify the village potential and development opportunities with full participation of its community. The ultimate goal was to use innovative solutions based on Information and communication technology (ICT) to improve village community resilience, building on local Strengths and opportunities, to have smart agriculture, economy, education, environment, infrastructure, technology, governance and society. **Methods:** This is an ex-post facto cross sectional study in Farshaha village. Four methods were used to collect the information, three for primary data: Observation, a predetermined questionnaire and Focus Group Discussions (FGDs). The secondary data was obtained from relevant published papers, relevant books, and authenticated web sites. The study sample was determined using Yamane formula for sample size calculation when population size is known. The sample size obtained accordingly was 222 households (HHs). A systematic random sampling technique was used to collect the data. Quantitative data was analyzed using Statistical Package for Social Sciences SPSS software (version 22), while qualitative data was analyzed using SOWT analysis. **Results:** More than half of the respondents were males, majority married (80%), and more than a third in the age group 15-45. More than two thirds were peasants and a third of them illiterate. The main field of work is agriculture, half of them owned land tenure, and the main crops are millet, sorghum, peanut and Gum Arabic. The majority with low income and more than two thirds possess animals mainly goats and hens. Regarding the home environment, majority of houses (92%) were built from local materials (mud and grass), water is available, no electricity but few HHs (13%) use solar energy. Half of the HHs lack latrines. Health care is deficient as well as education with most burden mainly on women, who suffer also from lack of energy and distant water source. Youth problems were mainly unemployment, high cost of wedding, farming and internal migration. Banking services were lacking, more than two thirds possess basic phones, but few possess smart phones. More than a third use “Sudani” as their communication Network Company and little use “Zain” company. The ecosystem was to some extent preserved. The village is administered and managed by Shaikh supported by public committee and the newly formed “Farshaha Smart Village” society. **Conclusion:** Farshaha village community depends mainly on agriculture with low income and the main crops are millet, sorghum and peanut, while some produce Gum Arabic. Water is available but there was no electricity and half of the HHs has no latrines. Both health care and education were deficient. Youth suffer from unemployment, internal migration and high cost of wedding and farming. There is no bank service and the communication network is weak. On the road to smart village a lot of work is needed, establishing a primary school for girls, building a health center, and helping people built latrines. Cross breeding to improve local goats to get better production of milk. Use of appropriate technology to improve farming and production. Use the newly built training center to introduce new income generating activities for youth and women. Support use of solar energy and improve the communication networks in the area.

Keywords— Initiative, Farshaha village, smart village, context evaluation, rural development, Sudan.

I. INTRODUCTION

1.1 The concept of smart village

A smart village concept was defined by the European Network of Rural Development (ENRD) as “Smart villages are communities in rural areas that use innovative solutions to improve their resilience, building on local strengths and opportunities”. They rely on participatory approach to develop and implement their strategy to improve their economic, social and environmental conditions in particular by mobilizing solutions offered by digital technologies” [1]. The concept of smart villages should be people centered approach covering different but interconnected fields. In 1664 the English Gardner

John Evelyn had written a book on forestry in which he clearly stated” We had better be without gold than without timber” [1]. A knowledge-based, community-led, and human centric rural society is the core of a smart village ecosystem [2]. According to Marsden a broader approach of sustainable rural development includes three aspects: economic, environmental and social [1]. Why following a smart village concept? This is to reduce the inequality between rural and urban life, to improve rural residence lives, to apply ICT to the agricultural sector which is the most important in rural areas and to use the internet of things (IoT) to improve the rural living standard. Furthermore, smart village aims to improve the quality of life and living standard, rethinking general public services and

considering environmental aspects in every action [1]. Through the use of digital technology to have a smart village that means to have: smart agriculture, smart education, smart environment and smart infrastructure [3]. Benefits of investing in smart villages development can be said to be two-fold: First they benefit the inhabitants making their life more comfortable and straightforward, and secondly they also make a community more empowered, resilient, independent and connected. Furthermore, smart villages are also contributing to the more efficient use of available resources [1].

Terry van Gevelt and John Holmes (2015) expect very broad social and economic effects from the concept. They treat smart villages as a strategy that can improve the quality of life and give younger generation's good reasons to stay in villages rather than migrate and seek their place in the city [4].

1.2 The Initiative of "Farshaha smart village": This initiative started on the 14th of October 2022 by a talk by Dr. Sayed Halalyto Farshaha village inhabitants at the mosque of the village after Friday Prayer in which both the concept of smart village and the steps needed to implement it were explained [5]. The initiative got agreement of the village population and two days later they established a local action group to start working and gave the green light to propose a plan for the context evaluation, which was then prepared by a combined team from both the Ahfad University for Women (AUW) and the University of Kordofan. The aim of the evaluation was to have baseline data about the village population and its priority problems. The ultimate goal was to plan for Farshaha village to be a "SMART" village, considering the five factors involved in the model of smart village: The inhabitants needs, resources, governance, technology (innovation) and public services [6]. The context evaluation was a step of paramount importance in developing a strategic plan of "FarshahaSMART" village [7].

1.3 Farshaha village (See Fig 1 and 2): Farshaha village lies in the Savannah zone in the north-west of Sheikan locality in North Kordofan State in Sudan. It is about 70 km west to El Obeid, the capital of the state. The village community as the rest of the area's population depends on agriculture as the main field of work and source of income. Some of the village society raise animals, mainly sheep and goats; and some have fields of "Hashab" trees that produce Gum Arabic. Farshaha village has a population of about 4000 inhabitants. It has one elementary (mixed) school and a primary health care unit run by a community health care worker. It has an approved health center plan that needs to be built. There is one mosque, one Zawyia (smaller place than mosque) and a Khalwa (a place for teaching Holy QurAan. There is good water supply from one "Haffir" and 16 borehole wells "Donki". There is no general electricity supply in the village. However, some forms of digital transformation are seen in the use of mobile/smart phones in effective communication and banking services. Renewable solar energy is used to light few houses and to operate pumping water from one Donki (borehole well). In the village 23 households have solar energy, each operating between 4-11 electric lamps, nine of them operate TVs and 3 operate refrigerators. The other donkis (=15) depend on Gasoline to operate their pumps. Four of these "Donki" belong to Gum

Arabic Society, "Zakat" Fund, Development Fund and a Charity Organization respectively. During dry season some nomads settle around the village with their animals to get water from these "Donki". There are two small oil plants in the village. The village is about 10 km north Umm Sumeima village which holds a weekly Monday market and has an intermediate and secondary schools. Umm Sumeima lies 60km from El Obeid on the main asphalt road joining El Obeid with Ennhud town and El Fashir City in Dar Fur on the west of Sudan. New technology in agriculture was introduced (workshop) last year in the harvest of peanut by a pulling machine that can harvest up to 30 "Mukhamus" /day (One Mukhamus= 1.73Feddan).

1.4 The context evaluation (Situational analysis): This was planned to identify the socio-demographic characteristics of the village population and clearly identifying the potential and development opportunities. With regard to the latter, the following were investigated: migration, climate change and environmental services, change in the production and diversification of village economy, infrastructure and basic services, digital transformation and bridging the rural-urban gap, and the social aspects of living.

II. OBJECTIVES

2.1 General Objective: To conduct a situational analysis of Farshaha village during Jan 2023.

2.2 Specific Objectives:

Quantitative study:

- 2.2.1 To determine the socio-demographic characteristics of the respondents.
- 2.2.2 To identify the income and land possession of the respondents.
- 2.2.3 To describe the home environment in the village households (HHs).
- 2.2.4 To identify the water supply and energy for the HHs.
- 2.2.5 To identify the types of animals possessed by the HHs.
- 2.2.6 To determine the banking and communication services in the village.

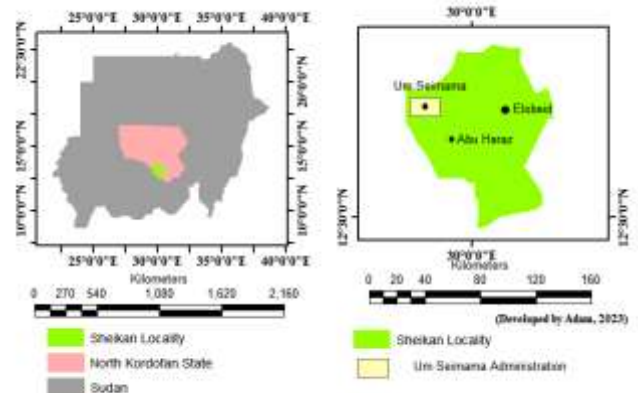


Figure 1: Sudan and North Kordofan state [8].

Qualitative Study:

2.2.7 To describe the following attributes and sectors in the village and identify related problems and challenges: The economic system and agricultural investment opportunities, the

social system and services, religious services, health care, education, bank services, communication services, electricity,

the echo-system, the administrative system, and the youth and women.



Figure 2: Farshaha Village (West to El Obeid, Capital of North Kordofan State) [8].

III. METHODS

3.1 Research design, Population and Sampling procedures

Ex-post facto research design was used via a cross sectional survey, using naturally occurring treatments on subjects having a self-selected level of independent variables [9]. This study was conducted in Sheikan locality, one of the nine localities of North Kordofan Sate in which lies EL Obeid City, the Capital of the State. The target population was the inhabitants of Farshaha village, which has a population of about 4000 inhabitants (Approximately about 666 HHs).

Sampling and sample size: The study sample was determined using Yamane formula for sample size calculation when population size is known. The calculated sample size was 222HHs and they were drawn from the village population using systematic random sampling technique [10]. The Focus Group Discussions (FGDs) involved five groups and each group included 10-15 people from the different sites of the village, with different backgrounds focusing on key informants including village leaders and knowledgeable individuals and considering gender representation.

3.2 Data collection:

3.2.1 Primary data:

3.2.1.1 The Questionnaire: A structured questionnaire was used to collect the information. It consisted of three parts. First: the socio-demographic profile of the village inhabitants (e.g. their ages, marital status, education, employment, income, water supply, energy, banking and communication services etc.). Second: Key problems/challenges. Third: Main assets and opportunities.

3.2.1.2 The Participatory Rural Appraisal (PRA): Qualitative data was collected through the Participatory Rural Appraisal

(PRA) for family households in Farshaha village. It included Focus Group Discussion (FGD) of five groups, guided by a dialogue with "pre-determined set of questions" investigating the following four systems in Farshaha village: the economic, the social, the ecological and the administrative system [4,11].

3.2.1.3 Direct observation: Direct observation was used to gather data from what was seen and carried out as cross-checking tool to find out whether all responses reflect the reality.

3.2.2 Secondary Data: Secondary data was obtained from relevant published papers, relevant books, and authenticated web sites.

4. Data analysis: Based on the nature of the data; quantitative and qualitative analysis was applied. SWOT analysis and the Statistical Package for Social Sciences SPSS software (version 22) were used to analyze the data. Descriptive statistics was used to compute frequency distributions, and percentages and the results were presented in tables. Qualitative data from FGDs, key informants and Knowledgeable inhabitants was presented in a narrative form.

Ethical approval: This was obtained from: The Ethical research committee University of Kordofan, the Ethical research committee Ahfad University for Women, Sheikan locality and the residents of Farshaha village.

IV. RESULTS AND DISCUSSION

5.1 Results of Descriptive analysis:

5.1.1 Socio-demographic characteristics of the respondents: 222 HHs were interviewed with a response rate of 100%. More than half (54%) were males and 46% females, 71% in the age group 15- 45yrs, majority (80%) married, 71%

peasants, more than a third (36%) were illiterate and nearly two thirds (64%) of the HHs had 4-9 members (Table 1).

TABLE 1: Socio-demographic profile of the respondents (n=222 HHs)

Item	Sub item	Frequency	Percent
1. Gender	Male	119	53.6
	Female	103	46.4
2. Age	15 – 30	73	32.9
	31 – 45	84	37.8
	46 - 60	49	22.1
	> 60	16	7.2
3. Marital status	Married	178	80.2
	Not married	27	12.2
	Widow	9	4.0
	Divorce	8	3.6
4. Education	Illiterate	79	35.6
	Primary and 2dry	122	55.0
	Graduate	21	9.4
5. Family members	1 – 3	38	17.1
	4 – 6	60	27.0
	7 – 9	81	36.5
	10+	43	19.4
6. Occupation	Peasant	157	70.5
	Trader	16	7.2
	Grazing	17	7.7
	Industrial	11	5.0
	Gov. employee	7	3.2
	Other	14	6.4

5.1.2 *Income and land possession of the respondents:* The father was responsible to the livelihood in more than three quarters (79%) of the HHs. The yearly income of the HH was less than 100,000 SDGs (1SDGs = 0.0017 US Dollar) in more than half (55%) of the HHs. Agriculture was the main source of income in the majority (81%) of the HHs, half (50%) of them owned land to cultivate which was 1-10 Mukhamus (1 Mukhamus = 1.73 Feddan) in three quarters (76%) of the HHs. One third of the HHs rented land for agriculture (Table 2).

TABLE 2: Income and land Possession of the Respondents (n=222 HHs)

Item	Sub -item	Frequency	Percent
1. Person responsible to Livelihood	Father	175	78.8
	Mother	29	13.1
	Brother/ sister	16	7.2
	Relative	2	0.9
2. Income	< 100,000 SDG*	123	55.4
	100,000 – 300,000 SDG	53	23.9
	> 300,000 SDG	46	20.7
3. Source of income	Agriculture	180	81.1
	Gov employment	4	1.8
	Industrial	2	0.9
	Grazing	3	1.4
	More than one source	33	14.8
4. Land possession	Owner	111	50.0
	Rent	73	32.9
	Grant	37	16.6
	None	1	0.5
5. Size of land	1 – 10 Mukhamus**	168	75.7
	11 – 20 Mukh.	35	15.8
	21 – 30 Mukh.	10	4.5
	31 + Mukh.	8	3.5
	None	1	0.5

* 1 SDG = 0.0017 US Dollar. ** 1 Mukhamus = 1.73 Feddan

5.1.3 *Home environment:* Houses were built by local materials (mud and grass) in the majority (92%) of the HHs, with three quarters (74%) of the HHs having 1-2 rooms, majority (95%)

had bathrooms while half (51%) of the HHs had no latrines, majority of them use neighbor latrines and few use open space. This may have a negative effect on the health status of the village community regarding fecal transmitted diseases (Table 3).

TABLE 3: Home environment (n=222 HHs)

Item	Sub-item	Frequency	Percent
1. House building Material	Local material	205	92.3
	Steady material	17	7.7
2. Status of wall	Excellent	23	10.4
	Good	114	51.4
	Poor	85	38.2
3. Number of rooms in house	One room	85	38.3
	Two rooms	79	35.6
	Three rooms	49	22.1
	Four rooms	9	4.0
4. Building material of Kitchen	Local material	198	89.2
	Steady material	12	5.4
	Lack separate kitchen	12	5.4
5. Status of kitchen	Excellent	7	3.2
	Good	138	62.2
	Poor	65	29.2
	NA	12	5.4
6. Presence of bathroom	Present	210	94.6
	Not present	12	5.4
7. Building material of Bathroom	Local material	200	90.1
	Steady material	10	4.5
	NA	12	5.4
8. Status of bathroom	Excellent	29	13.0
	Good	126	56.8
	Poor	55	24.8
	NA	12	5.4
9. Presence of latrine	Present	109	49.1
	Not present	113	50.9
10. Status of latrine	Excellent	15	6.8
	Good	78	35.1
	Poor	16	7.2
	NA	113	50.9
11. Presence of trees	Inside house	146	65.8
	Outside house	38	17.1
	None	38	17.1
12. Types of trees	Fruit trees	77	34.7
	Non fruit trees	109	48.3
	NA	38	17.0

NA= Not applicable.

5.1.4 *Water supply and energy:* The village has no pipe water supply, but they have good sources of water, 69% from Donki (borehole wells) and Hafir (an excavation in which surface water is collected during rainy season). There is no public electricity but few HHs (13%) had solar energy (Table 4). However solar energy is the trend now (as globally) in the village and expected to increase in the near future (Table 4).

5.1.5 *Animal raising:* Nearly two thirds (72%) of the HHs reported to possess animals, mainly goats (40%), hens (16%) and donkeys (6%), and 27% of these animals are kept inside the house. There may be a risk of the occurrence of zoonotic diseases (diseases transmitted from man to animals and vice versa). Goats are used mainly to produce milk and sometimes used for meat. Hens are used to produce eggs and meat. Both goats and hens can be sold in the nearby market to increase the income of the HH (Table 5).

5.1.6 *Banking and Communication:* The majority (96%) of the respondents had neither bank accounts nor automated teller

machine (ATM) cards. Those who possess mobile phones were 84% and only 8% of them were smart phones. Only 4% of the respondents use mobile phones in banking services (money transfer and payment). The main communication network companies in the village were (Sudani) 37% and (Zain) 9%. Generally, people experience weakness in the communication provided by both companies (Table 6).

TABLE 4: Water supply and Energy

Item	Sub-item	Frequency	Percent
1. Source of water	Donki* and Hafir**	130	58.6
	Donki	18	8.1
	Water pump	12	5.4
	Girba***	12	5.4
	Hafir	6	2.7
	More than one source	44	19.8
2. Way for water access	By animal	10	4.5
	Human	73	32.9
	Both	134	60.4
	Car	5	2.2
Source of energy	Solar energy	29	13.1
	Generator	2	0.9
	None	191	86.0

*Donki: a bore hole well. **Hafir: an excavation of land to store surface water. ***Girba: a plastic container in which water is kept and sold, usually supplied by tankers that bring water from Donki.

5.1.5 Animal raising:

TABLE 5: Possession of animals

Item	Sub-item	Frequency	Percent
1. Possession of animal	Having animal	159	71.7
	Not having animal	63	28.3
2. Type of animal	Goats	88	39.6
	Hens	35	15.8
	Donkeys	14	6.3
	All animals above	10	4.5
	Other animals	12	5.5
	None	63	28.3
3. Place of animal	Inside house	59	26.5
	Outside house	100	45.2
	NA	63	28.3

TABLE 6: Banking and Communication services

Item	Sub-item	Frequency	Percent
1. Having bank account	Having bank account	10	4.5
	Not having bank account	212	95.5
2. Possess ATM Card	Possess ATM	8	3.6
	No ATM	214	96.4
3. Possess mobile	Having mobile	187	84.2
	Not having mobile	35	15.8
4. Type of mobile	Basic phone	154	69.4
	Smart phone	17	7.6
	Both	16	7.2
	NA*	35	15.8
5. Mobile use in Bank Services	Used in banking	8	3.6
	Not used	179	80.6
	NA	35	15.8
6. Communication Network company	Sudani	82	36.9
	Zain	19	8.6
	Both	86	38.7
	NA	35	15.8

*NA: not applicable.

5.2 Results of Focus Group Discussions (FGDs):

The Economic system and agricultural investment opportunities: The community of Farshaha village depends on

agricultural activities as primary occupation due to the scarcity of work chances and income as well as the low level of living. One of the main problems of Farshaha village is the absence of local marketing for their products. Therefore, the provision of a local market and capital are very essential requirements. For land tenure, all agricultural areas are owned and inherited, while only few areas are rented, no registration system is found concerning land tenure. The range land is scarce, land under agriculture is prevailed. Conflicts between farmers, and animal owners sometimes occur, which lead to decrease animal population. Therefore, increase in rangeland is required. In addition to increase agricultural production, some interventions especially in technical know-how and innovation are necessary. The main crops are millet, sorghum, and groundnut, while the forest resources are siddir and Gum Arabic.

The Social system and Services: The social solidarity among the community is very strong especially regarding positive norms, culture and tradition as well as nafir (working together to help someone build a house, cultivating or harvesting a crop, etc.). The village community omitted the negative traditions such as female genital mutilation (FGM) and wedding of teenagers. The main social problems are: Unemployment and internal migration, due to economic pressing and lack of work opportunities especially among the productive age groups i.e. the youth. There are no clubs and recreation areas for families and youth.

Religious services: There is one mosque, one Zawyia (a place for prayer smaller than a mosque) and one Khalwa (a place for teaching Holy Qur'Aann). The mosque is sometimes used to hold meetings for the village population after prayers to discuss necessary rising community issues or problems.

Health care: is very limited. There is no building for the primary health care unit (PHU) although there is a primary health care worker (PHW), who runs the work in a room at his home. He is the only one available to care for the Farshaha village population and the neighborhood villages. In the village there are three trained midwives and a female vaccination technician. The nearest health center is in Um Sumeima village 9 km to the south on the main highway road El Obeid-Ennuhud- El Fashir.

Education: is also not sufficient. There is only one primary school and mixed. There is shortage in the educational cadre (teachers). A separate primary school for girls is underway.

Bank services: No bank services are available at the village. Money exchange and transfer occur in Um Sumeima village.

The communication services: The communication companies working in the village and the area are Sudani, Zain, and Areeba, but the signal is very weak. The village community restricts the ownership of mobile phones by non-married women before wedding.

Electricity: Public electricity is not available, but few houses use private solar energy units for lighting and to operate TVs and refrigerators.

The Eco-system: Some trees are available in the village (mainly Neem) and are used as location for ceremony, recreation and a place for children to play. Some trees are fruitful (Lemon and Mango) inside the houses. The main trees in the area surrounding the village are Hashab trees, which produce Gum

Arabic, which is an important economic product that increases the income of the owners in addition to agriculture. Certain trees are not available in the areas (Habil, Korsan, Sayal, Gibbaish and Abanos). There are some features and symptoms of desertification occurring in the area e.g. land creeping.

The Administration System: Farshaha village lies in the administrative unit of Umm Sumeima in Sheikan Locality one of the seven localities which form North Kordofan State. The Shaikh helped by a public committee and the Gum Arabic Association manages the village. The Society of “Farshaha Smart Village” was newly formed and registered as a governance body to lead the work and activities of the Initiative of “Farshaha Smart Village”. It cooperates with and complements the Shaikh activities. Four women societies are now underway for registration. There are no social conflicts in the village and all live in harmony.

The Youth: The main problems of the youth are: Unemployment, migration, absence of clubs, high cost of wedding and farming. Their main activities are: Agriculture, bricks manufacturing and participation in Nafir. They started a nafir to build a training center as part of the initiative of “Farshaha Smart village” to have training in new income generating activities (IGAs) for youth and women during dry season. The building of the training center is totally community funded.

Women: Main problems are lack of education opportunities, deficient health care, energy and distant water sources. Special training is needed for women to obtain new IGAs in addition to agriculture.

V. CONCLUSION

222 HHs were surveyed and five FGDs conducted. More than half of the respondents were males, majority married, more than a third in the age group 15-45, more than two thirds were peasants and a third of them illiterate. The main field of work is agriculture, half of them owned land tenure, and the main crops are millet, sorghum and peanut. The majority with low income and more than two thirds possess animals mainly goats and hens. Regarding the home environment, majority of houses were built from local materials (mud and grass), Water is available, no electricity but few HHs use solar energy. Half of the HHs lack latrines. Health care is deficient as well as education with most burden mainly on women, who suffer also from lack of energy and distant water source. Youth problems were mainly unemployment, high cost of wedding, farming and internal migration. Banking services were lacking, more than two thirds possess basic phones, but few possess smart phones. More than a third use “Sudani” as their communication network company and few uses “Zain” company. The ecosystem was to some extent preserved, the main trees in the area are ” Hashab” trees which produce Gum Arabic an important economic cash product in dry season. The village is administered by Shaikh and supported by a public committee and the newly formed “Farshaha Smart Village “Society. On the road to smart village a lot of work is needed, establishing a primary school for girls, building a health center, help people built latrines. Cross breeding to improve local goats to get better production of milk. Use of appropriate innovative technology to improve farming

and production and to add value to the local agricultural products. Use the new training center to introduce new income generating activities for youth and women. Support use of solar energy and improve the communication networks in the area. Increase land coverage with more “Hashab” trees with a dual aim of both increasing income and combating desertification on the road to sustainable rural development.

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Conflict of interest:

The authors declare no conflict of interest.

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