



# **Community's Perception towards Adoption of Information, Communication and Technology (ICT) in Artisanal Gold Mining within Nandi and West Pokot Counties, Kenya**

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## **Authors' contributions**

*This work was carried out in collaboration between all authors. All the authors managed the analyses of the study and literature searches. Also, the authors read and approved the final manuscript.*

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## **ABSTRACT**

Use of ICT in artisanal gold mining provides information on new improved gold mining technologies which are environmentally friendly with a higher recovery rate of gold hence better income to the miners while conserving the environment. For the mining communities to decide whether or not to adopt ICT, they must first perceive it. Therefore, perception is a necessary prerequisite for adoption. Therefore, the present study sought to assess perceptions of the mining communities towards the adoption of ICT in artisanal gold mining within Nandi and West Pokot Counties, Kenya. The study adopted a descriptive survey design that incorporated both quantitative and qualitative approaches. Simple random sampling was used to establish respondents for household survey. Structured questionnaires were randomly distributed to 279 household heads. Findings from the study showed that ICT could be used to mitigate structural challenges and serve many functions in

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artisanal gold mining only if it is designed to serve them. ICT has a variety of applications in artisanal gold mining activities and will serve as an enabler to business processes changing the situation in artisanal gold mining. The respondents affirmed that ICT holds the key to new production technologies to be used in mining such as geo-mapping systems. Unavailable geo-mapping systems make miners to engage in Trial and era methods leading to unnecessary land destruction. Therefore, for improved gold mining technologies in the study areas, ICT should be adopted.

*Keywords: Perception; adoption; ICT; artisanal gold mining.*

## 1. INTRODUCTION

Mining is a fundamental human development activity which creates wealth [1]. [2] defined the term artisanal gold mining as the use of rudimentary processes to extract valuable minerals from primary and secondary ore bodies, and is characterised by the lack of long-term mine planning. It is seen an economic mainstay activity providing direct employment to over two million people in rural sub-Saharan Africa [3]. Artisanal and Small-Scale Mining (ASM) is an important and increasingly popular livelihood for tens of millions of people around the world. [4] reported that ASM produces some 10% of the world's mined gold. Many artisanal-mined minerals are part of developing countries export economies, bringing in much needed foreign exchange; others are used for the local market, for example, salt, aggregates and stones. Despite their large numbers, the role artisanal mines play in the global minerals market is not always fully understood [5]. Furthermore, artisanal and small-scale miners, regardless of their exact size, level of mechanisation faces the same marginalisation as other small-scale sectors. Many miners operate in remote regions with poor transport and market access, suffering geographical marginalisation that makes them less able to access information, key technologies and inputs. The lack of information on alternative technologies is one of the essential reasons why artisanal gold miners continue to use mercury in their operations. Artisanal gold miners comprise of individuals struggling to earn a daily wage with no information on better technologies used in gold mining. Therefore, use of ICT will provide information on new improved gold mining technologies which are environmentally friendly with a higher recovery rate of gold hence better income to the miners while conserving the environment.

Perception refers to the process of acquisition and understanding of information from one's environment [6]. The community has to perceive the first ICT positively and then identifies the

importance of adoption and implement it. For the community to decide whether or not to adopt a particular measure they must first perceive. Therefore, perception is a necessary prerequisite for adoption. Thus, to enhance policy towards tackling the challenges that ASM poses to the community, it is necessary to have full knowledge of community's perception of ICT adoption. To the best of researcher's knowledge, no earlier study has been conducted on the perception of the local towards adoption ICT in ASM. It is against this background that this paper seeks to understand local community perceptions of ICT adoption in ASM.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted in Nandi and West Pokot Counties, Kenya. West Pokot County has a bimodal type of rainfall. The long rains fall between April and August while the short rains fall between October and February. There is, however, great variation in the total amount and distribution of the rainfall received in the county. The lowlands receive 600 mm per annum while the highlands receive 1,600 mm per annum.

The county also experiences great variations in temperature with the lowlands experiencing temperatures of up to 30°C and the highlands experiencing moderate temperatures of 15°C. On the other hand, Nandi County coincides with a spatial distribution of ecological zones that define the agricultural and overall economic development potential of the area. The Northern parts receive rainfall ranging from 1,300 mm to 1,600 mm per annum. The Southern half is affected by the lake basin atmospheric conditions receiving as high as 2,000 mm per annum.

The County receives an average rainfall of about 1200 mm to 2000 mm per annum. The long rains

start in early March and continue up to end of June while short rains start in mid-September and end in November. Only rarely is there a month without some rainfall. The dry spell is usually experienced from end of December to mid-March.

## 2.2 Research Design

A research design is an essential plan that made it possible and valid to conclude. The study employed descriptive research design. The research design portrays an accurate profile of persons, events or situations. It involved collections of quantitative information that was tabulated along a continuum in numerical form as scores on a test. The use of description in the study explained a phenomenon of interest [7]. This study was carried out using the sociological survey undertaken in two counties in North rift region.

## 2.3 Study Population and Sample Size

The study population was composed 1021 individuals from Kapsaos ward, Nandi County and Sekker ward in West Pokot county. The sample size of 279 respondents was obtained using the modified Cochran formula.

## 2.4 Sampling Design

Random sampling was used for individuals in two locations in each ward for the study. They are namely Kapsaos, and Kaborogin in Nandi County and West Pokot are Sostin and Takar locations for the study. The two locations in each ward were reflective of artisanal gold mining communities and were selected for the study as clusters. The selected locations both in Nandi and West Pokot counties were taken to be clusters and samples of a household for study were picked from them. Samples were calculated proportionately according to each clusters population.

## 2.5 Research Instrument

Primary data on perception of ICT in ASM were collected using structured questionnaires which were administered to 279 household heads randomly selected. According to [8], structured questionnaires permit the researcher to achieve a substantial sample inside a constrained time. The questionnaire concentrated on issues including demographic information of the

respondents and perception of ICT adoption in ASM.

## 2.6 Reliability and Validity of the Research Instruments

Reliability is the extent to which the measure of a construct is predictable or consistent [9]. To check the internal consistency, the questionnaire was pre-tried through pilot study to find out dependability in requesting data from the households and to distinguish any challenges that the respondents were prone to face when reacting to the items.

Validity is the extent to which a test measures what should quantify, its precision and weightiness of deductions, which depend on exploration results [10]. Is the degree to which results acquired from the investigation of the information really speak to the issues under study? Content validity was controlled by making coherent connections amongst inquiries and the targets of the study. The exploration instruments were additionally introduced to the supervisors for their recommendation and fitting changes made before the study.

## 2.7 Data Analysis

The data gathered was both subjective and quantitative. The returned questionnaires were checked for consistency, cleaned and the valuable ones coded and analyzed using descriptive statistics by applying the Statistical Package for Social Sciences (SPSS) database form 20. Categorical variables were presented using frequency tables.

## 3. RESULTS AND DISCUSSION

### 3.1 Demographic Information of the Respondents

Gender and Education level formed the demographic information of the respondents in the study areas.

In Nandi county, a majority of the respondents (70.2%) were males 42.2% were females. In West Pokot, 58.8% and 29.8% were females and males respectively. This result implies that males dominate mining in Nandi County while in West Pokot County, both genders participate in mining. Male domination in Nandi County is attributed to

**Table 1. Gender of the respondents**

Gender of the respondent	County of origin		Total
	Nandi	West Pokot	
Male	101(70.2%)	43(29.8%)	144(67.9%)
Female	28(42.2%)	40(58.8%)	68(32.1%)
Total	129(60.9%)	83(39.2%)	212(100.0%)

Chi-Square test			
Pearson $\chi^2$	Value	Df	p-value
	14.923	1	.000

patriarchal nature of Nandi community in terms of land ownership and the type of mining activity which was gender oriented demanding males than females hence gender insensitive.

The educational levels among the mining communities in both Nandi and West Pokot counties are shown in Table 2. The results indicate that respondents who had no formal education were 36%, primary level was 49.1%, secondary level were 11.8%, technical level was 1.4% and tertiary level 1.4%.

This result implies that those who participated in artisanal gold mining in both counties had either no formal education or had primary education. This agrees with [11] who describes many Ghanaian artisanal gold miners as having low educational levels and low technical know-how. This result further implies that artisanal mining communities lack critical capacity levels to grow their mining activities. With low education levels they usually lack knowledge on the policy requirements on environmental conservation, on occupational health and safety in mining.

**3.2 Perception of ICT Adoption in ASM Mining**

Respondents perceived that there are various ways through which ICT can be used as indicated in Fig. 1. ICT can be used to mitigate structural challenges and serve many functions in ASM only if it is designed to serve them. Results shown in Fig. 1 indicates that 34.8% would prefer use of the ICT to get access to new technologies in artisanal mining, 25.6% would use it for exchange platform, 21.7% for information flow while 16.9% would use it for pricing decision and 1% for marketing. ICT has a variety of uses in any economic activity as it serves as an enabler to business processes.

With affordable new communication techniques smartphones and improved telecommunication infrastructure in Kenya, a situation in artisanal gold mining can be changed. Young people are becoming increasingly accessible to smartphones which are becoming more and more popular in rural areas and by extension those in artisanal mining. [12] alluded that in well-connected rural centres with many gold buyers use of mobile phone coverage has enabled the upstream actors to keep track of world market price of gold and thus they are enabled to estimate reasonable prices.

There are various ways through which ICT can be used as indicated in Table 3. For example, integration into current technologies that may be used in artisanal mining activities for example in the area of geological mapping which is lacking regarding new technologies in the sector. The mining community also affirmed that ICT holds the key to new production technologies to be used in mining (Mean = 4.51, SD = 0.92) and used in geo-mapping systems similar to the geographical information systems (Mean = 4.50, SD = 0.93).

This result implies that Artisanal gold miners do not have access to appropriate geological data therefore they are unable to locate viable deposits rather than use trial and error methods. Artisanal mining exploitations are not efficient based on luck taking long periods due to lack of geological data. Trial and error methods lead to unnecessary land destruction due to unavailable geological information to guide mining activity on the right places. Basic geological surveys will be enhanced and more accessible to the miners with the use of ICT. These would increase returns to the miners by enabling them to excavate the right areas with minerals transforming their livelihoods and avoiding

degradation of land. Lack of use of new cleaner of information and limited access to alternative gold processing technologies is attributed to lack technologies.

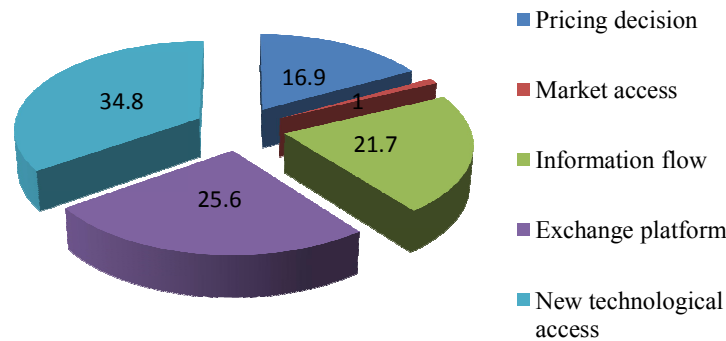
**Table 2. Educational levels of the respondents**

Level of education attained	County of origin		Total (F/%)
	Nandi (F/%)	West Pokot (F/%)	
No formal education	11(14.3%)	66(85.7%)	77(36.3%)
Primary level	86(82.7%)	18(17.3%)	104(49.1%)
Secondary level	25(100.0%)	0(0.0%)	25(11.8%)
Technical level	3(100.0%)	0(0.0%)	3(1.4%)
Tertiary level	4(100.0%)	0(0.0%)	4(1.8%)
Total	129(60.1%)	83 (39.9%)	212(100.0%)

Chi-Square test			
Pearson $\chi^2$	Value	Df	p-value
	106.826	4	.000

**ICT use in ASM mining**



**Fig. 1. ICT use in ASM mining**

**Table 3. ICT adoption in ASM mining**

	N	Mean	Std. Dev.
ICT adoption can contribute to better prices	212	4.6368	.87361
ICT adoption can contribute to market access	212	4.5802	.83648
ICT adoption can contribute to new markets	212	4.5708	.89744
ICT adoption can contribute to market information	212	4.5498	.91085
ICT adoption can disseminate information on environmental conservation	212	4.5094	.92101
ICT adoption can disseminate information on new product technologies	212	4.5094	.92614
ICT adoption can be used in geo-mapping information	212	4.5047	.93635
ICT adoption can develop new exchange platform	212	4.5283	.92575

The lack of information on alternative technologies is one of the important reasons why artisanal gold miners continue to use mercury in their operations. Artisanal gold miners comprise of individuals struggling to earn a daily wage with no information on better technologies used in gold mining. Therefore, use of ICT will provide information on new improved gold mining technologies which are environmentally friendly with a higher recovery rate of gold hence better income to the miners while conserving the environment.

The respondents would use ICT in improving pricing (Mean = 4.6368, SD = 0.87). This implies that miners can be informed on the prices of gold in international market and would serve to improve on the pricing offered to the mining communities. It will offer market going rates influencing local prices towards international market prices which are always higher, translating to improved earnings to miners.

Results further indicated that ICT would contribute to the dissemination of market prices (Mean = 4.55, SD = 0.91) as shown in Table 3. This implies that through this endeavour the mining community will be able to obtain and compare the real market prices with the prices with which they sell their gold produced to the middlemen which majority of them sell to. Findings indicated that ICT would also contribute to market access (Mean = 4.58, SD = 0.83) by providing a platform for which buyers and sellers of the gold can meet and interact. ICT would offer the participants new markets (Mean = 4.57, SD = 0.89) a market which is different from the normal physical market where individuals interact electronically and anonymously. It will serve as a trading and exchange platform for the gold and its associated products (Mean = 4.52, SD = 0.93). This finding concurs with the report by Bannock consulting ltd in 2008 that in order to make Artisanal gold miners less reliant on intermediaries for the sale of their products and to enable them to obtain better prices they need to have access to information on mineral prices and support in accessing markets directly.

As indicated in Table 3, ICT can be used as a reverse channel (Mean = 4.51, SD = 0.92) to disseminate environmental information and policies by government designated agencies to the mining community. Lack of appropriate interaction between artisanal gold miners and the authorities to inform of information flow contribute to environmental degradation. Mining

communities can be mobilized to actively participate in environmental conservation and understanding mining policies through the use of ICT enabling mechanisms. Information flow and interaction between authorities and gold miners will contribute enormous benefits. These include increase profits for small miners; investment in cleaner equipment and the avoidance of environmental degrading practice [13].

Results in Table 3 further indicate the use of ICT as an exchange flat form. This implies that there will be networking of miners to work together, to share information and to coordinate activities among themselves. Knowledge exchange between different groups of miners' organizations is an important strategy in generating lessons and sharing insights about organizational development, technologies, business practices, and livelihood challenges and solutions [14].

#### **4. CONCLUSION**

Findings from the study showed that ICT can be used to mitigate structural challenges and serve many functions in artisanal gold mining only if it is designed to serve them. ICT has a variety of applications in artisanal gold mining activities and will serve as an enabler to business processes changing the situation in artisanal gold mining. The respondents affirmed that ICT holds key to new production technologies to be used in mining such as geo – mapping systems. Unavailable geo – mapping systems makes miners to engage in Trial and error methods leading to unnecessary land destruction.

#### **ETHICAL APPROVAL**

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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