Socio-Environmental damage, a looming facet of illegal gold panning: a case study of the illegal gold panners of Gwanda District, Zimbabwe

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Abstract
Illegal gold panning is alleged to generate serious health hazards associated with lack of proper hygiene standards. Gold panning also has negative socio – environmental effects on the land, the ecosystem and on other aspects of human life, like the spread of infectious diseases and HIV/AIDS. The research methods applied was qualitative and quantitative. Face-to-face interviews, questionnaires and observations managed to provide an in built triangulation for the study. Purposive sampling techniques were used and a total sample of 94 respondents was drawn from gold panners, non-panners and relevant stakeholders. The stakeholders comprised local government officials, Environmental Management Authorities and officials from local mining organisations while non-panners included those people living with panners along the river banks and neighbouring communal settlers. The study established that gold panning activities, which are poverty driven, have immensely contributed to environmental damages such as deforestation, river siltation, soil erosion,water pollution and the destruction of aquatic based food chains as a result of disposing waste materials and the use of chemicals such as mercury and cyanide. In light of these findings the study recommends that a coordinated approach should be provided to panners to provide them with some basic training in environmental management and the disaster risk reduction management skills. This will assist in reducing the environmental damages and other related disasters emanating from gold panning.

Keywords: Socio-Environment, gold-panning, disaster risk-reduction

Introduction

Illegal gold panning has been the worst enemy of the environment and has become a widespread problem that is found throughout Zimbabwe. This problem is mostly due to the need for income, food, employment, asset ownership and decent living conditions. Zimbabwe is an agricultural and mineral backed economy and the rural population tries whatever means possible to pursue existence in gold panning as a source of employment. It is one of the survival options for them especially for the people that live along rivers, disused mines and dams. Whilst this is a local problem, it is one with very clear regional links as some of the rivers are also taking water to the neighbouring countries. The focus of the study was to to assess the impact of illegal gold panning on the environment and the people of Gwanda District. The methods used to extract gold and chemicals used in gold panning were investigated. It also investigates the level of training and awareness of panners in terms of legislations that govern such activities and disastrous impacts emanating from the gold panning. Illegal gold panning is a looming crisis, which has brought about many other crisis events associated with it. This article should raise awareness of the urgent need to prevent and mitigate the negative impacts associated with illegal gold panning.

Description of the study area

Gwanda is the district capital city of Matabeleland South Province with an estimated population of 18 000 people. The district is located in agro ecological zones, region 4 and 5 with an annual rainfall of 450mm and high annual evaporation (Sunga & Marinda, 1998). Agriculture and mining are the main economic activities with the latter gaining momentum, particularly the small-scale gold mining (Marinda, 1998). There are 24 wards in Gwanda district and the research focused on areas along Umzingwane and Mtshabezi rivers and communal areas of Matshetshe, Winhock and Maphane.

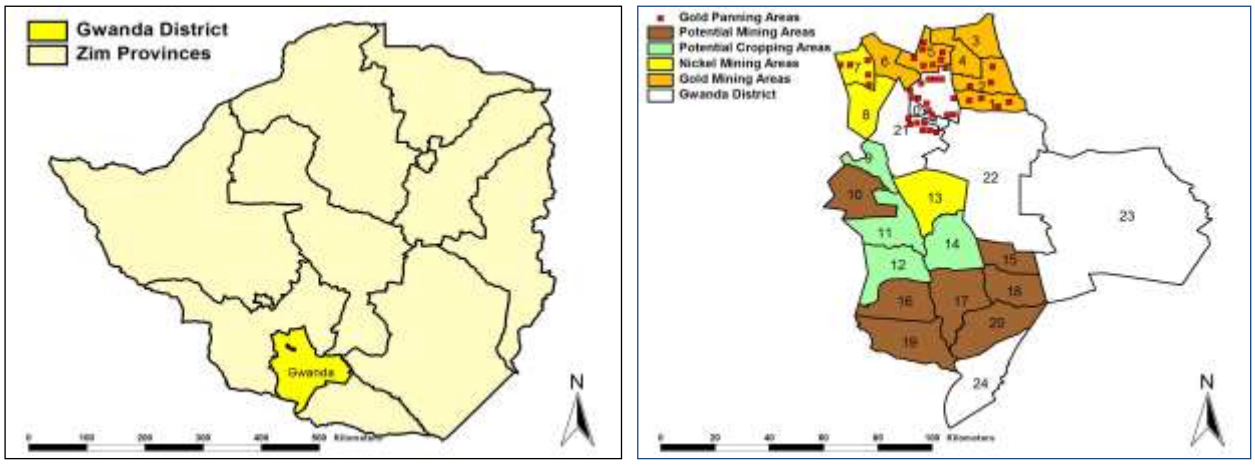

Figure 1&2: Map of Zimbabwe illustrating the geographical location of Gwanda District

Source:

In figure 1illustrates the location of Gwanda in Zimbabwe and the 24 wards in the Gwanda District. It also shows the wards which have a high concentration of gold panning activities

and other areas of interest like nickel mining, potential mining and cropping areas. The land degradation is very pronounced in areas shaded red in the district.

Research methodology

The researcher explored the issues of gold panning through the adaptation of a purely qualitative approach well suited to a case study. Some quantitative aspects were also used to broaden the scope of data collected for the study. A sample survey of 94 participants was drawn from the policy makers, local authorities, the district or regional body and government bodies in charge of the environmental affairs, these stakeholders were a total of 10 participants and from the gold panners they made a total of 49 and then a total of 35 non gold-panners. In the data collection phase the researcher visited the areas where the gold panning is prevalent to observe and experience first hand the social and economic hardships these people experience which are the key causes that push them to pan for gold. Data collection was also done through the use of detailed face to face interviews, questionnaire, and focus group discussions. The data collection methods entailed questions which probed on health hazards, environmental effects, economic effects and legal implications. A study of documents that show the trends for this issue past and present was also done. The use of multiple methods of data collection helped to reflect an in built attempt to cater for triangulation and secure an in depth understanding of the phenomenon in question.

Legislative framework on mining activities

The Ministry of Mines, Environment and Tourism, Act [165] provides the main legislative framework for all mining activities in Zimbabwe. The Act does not inhibit the development of small-scale mining and it is not seen as promotional either. The Act is complemented by 18 pieces of legislation administered by eight other ministries, which cover the usage and management of natural resources, a situation that sometimes lead to conflicts. This Act has made it possible for all interested parties to extensively explore the mineral potential of the country. There are other supporting regulations enacted to assist the Act and these are: The Mining Regulations (Health and Sanitation Act, 1977), which regulate the provision of adequate health and sanitation facilities on a mine, The Mining Regulations (Management and Safety, 1990), which seek to control health and safety in and about a mine and The Mining Regulations (Alluvial Gold and Public Streams, 1991) which seek to deal with small-scale gold panning activities in the country. Panning activities need a lot of water for the extraction of gold and other minerals and this impacted on water use. The water Act [1998] provides for the development and utilization of water resources, including the granting of permits to use water for mining purposes, protection of environment and control of water pollution and granting of permits to discharge the effluent and toxic work. The Act prohibits any person and industrialists and even mines to discharge any toxic or obstructing matter, radioactive waste or other pollution or allow any person to dump or discharge such matter into the aquatic environment in contravention of water pollution control standards. However, all these have been uncared for by illegal gold panners who could pose a threat to the ecosystem – the focus of this research.

Gold mining methods

The mining methods are used interchangeably and are open pit, riverbank and bed panning. These operations are characterised by shallow diggings, which follow the reefs. Whilst open cast mining practised by most miners is cheap initially; it is not sustainable and usually leads to the abandonment of the operation at an average depth not exceeding 20m because of hoisting problems and inability to de-water the mine workings. Most of these open cast workings end up with sharp or near vertical high walls or dangerous undercutting (Sunga, 1998). In terms of processing, panners can be grouped into three broad categories according to the types of ore being treated which are *Alluvial*, *Free mining* or *sulphidic* and *Refractory ore*.

In most countries, miners use nitric acid (30%) to dissolve the mercury in the amalgam. It is dangerous and an expensive procedure as it is difficult to precipitate all the mercury from the nitric solution. The process is usually done by introducing pieces of metal such as aluminium, copper, or zinc in the solution. In this way the remaining nitric solution cannot be discarded because it is extremely corrosive and still contains residual mercury (Huidobro, 2006). The most common process to separate mercury from gold is the decomposition (i.e., *"roasting"* or *"burning"*) of the amalgam by heating above 360˚. Most mercury compounds evaporate at temperatures above 460˚ and gold must reach almost 3000˚ to evaporate. When heated, mercury becomes volatile leaving the gold in solid state. Figure 3 illustrates a picture of gold panners in Gwanda, busy with a dangerous way of gold extraction, with two men pulling out a bucket with raw material while underground there is a person digging and loading the stones in the bucket.

Figure 3. Method of gold extraction in Gwanda

Negative and positive impacts of illegal gold panning

Illegal gold panning has been propelled into the world as an environmental threat and less as an acknowledgement of its economic potential. This is a post independence phenomenon,

fuelled by amongst other factors such as the harsh economic conditions, retrenchments and poor agricultural yields due to severe droughts (Sunga, 1998).

People: the social cost

Mining leaves openings both on the surface and underground and as a result, fractures can develop leading to collapse of the ground. Needless to say the impact is disastrous if subsidence leads to trapping and subsequently loss of human life underground. The impact is high during the operational stage, especially during blasting and during wet periods. The cost of treating panners who are involved in accidents is high where serious injuries require extensive hospitalization. Water from mining operation has the potential to contaminate surface water in quality and quantity because of the cyanide and mercury used in gold extraction which leads to increased incidence of illness. The risk is very high especially where explosives are used leading to fire which can cost people's lives.

Very often women burn their gold in the kitchen and children are the main victims of this lack of understanding of mercury vapour inhalation that causes intoxication. In Central Kalimantan, Indonesia, amalgam is burned in the open pans everywhere, including the kitchens and restaurants. A similar situation is observed in the Mekong River in Lao PDR, where a large audience of women and children observe the *"fascinating"* colour transformation when amalgam is burned and gold is obtained. At higher temperatures more vapour from metallic mercury is released and is more hazardous. Inhalation of mercury vapour is also most significant for miners and gold shop workers who are directly involved in the handling and processing of gold as it is an occupational hazard and needs proper precautionary measures. The skin or the alimentary tract does not absorb metallic mercury efficiently, but vapours are highly absorbed through the membrane of the lungs and the complexes in the blood and tissues before reacting with biologically important sites. Kidneys are the most affected organs in exposures of moderate duration to considerate levels, while the brain is the dominant receptor in long-term exposure to moderate levels. Since mercury vapour poisoning affects liver and kidneys, high mercury in the urine can indicate the levels of exposure. Total elimination of mercury in the blood and urine can take years and urine cannot be expected to correlate with neurology findings once exposure has stopped (Ditri, 1991). When methyl-mercury is used along rivers, it easily bio-accumulates in the fish species and people are also affected when they consume the fish. The lack of clean sanitation facilities by most gold panners and their families means that the river itself is the ultimate source for some human waste. Many families also do their washing and laundry directly in the river and these pollutants affect downstream users. Another social cost is the lack of education for many of the children and teenagers who are involved in gold panning. Long-term employment and income opportunities would be more limited without proper education for these young people.

Environment

Mining activities by nature are extractive and involve the removal of soil from underground on to the surface (Huidobro, 2006). The trenches then lead to soil erosion and increased siltation during heavy rains. This then has significant impact on modification of the soil profile as the topsoil is eroded and if not properly mitigated the effect can affect plant growth. Alluvial and riverbed gold panning leads to river siltation and affects the quantity of water flowing downstream to domestic and agricultural users. There is also deforestation along the

river banks which accelerates run-off, washing away sifted material piled loosely on the river bank leading to the collapse of river banks. Siltation of rivers from gold panning can reduce the storage capacity and hence the operational life of small dams downstream from the panning sites. A badly degraded riverbed can also slow down the rate, at which the river recharges and develops a surface flow after the rains come. This problem is due to the myriad of excavated tunnels, trenches and holes, which must fill up first.

Economic

Milne and Marongwe (1993) carried out a costs and benefits analysis of gold panning in Zimbabwe and they mentioned that natural resource stocks exhibit scarcity. The concept of resource scarcity can be viewed both from a geophysical and an economic perspective. Gold is a non-renewable natural resource with a fixed stock of ore deposits. Hence, gold deposits will become exhausted at some point in the future, depending on the rate of extraction and technology. In most cases, the reserves that are economic to extract are lower than the total identified mineral reserves (Howe, 1997). The general economic problem facing Zimbabwe is how to use these scarce, non-renewable resources to address long-term social, economic and environmental development goals. Gold sales outside Zimbabwe can earn foreign currency as with any other export. If dealers legally, through the Reserve Bank agents, market the gold, foreign exchange will normally be brought into the country once the gold is eventually exported. However illegal gold panners preferred selling their gold on the black market than selling to the Reserve Bank as it does not pay. Gold panning has become a form of employment otherwise those unemployed would subsist on informal work in cities or in the rural areas. The cost of living in panning areas appeared to be very low. Thus, panners who are successful in finding gold might have a small cash surplus after meeting normal living expenses.

Table 2.1 Summary of estimated costs and benefits from gold panning, Mashonaland Central Province, 1993

BENEFITS	**COSTS**		
Income from gold sales	**a) Economic Costs**	**b) Social Costs**	**c) Environmental Costs**
Foreign exchange	Labour (opportunity cost)	Water and sanitation	Siltation
Employment	Capital (Shovels, pans)	Children not in school	River Bank Rehabilitation
Panning permit fees		Monitoring/enforcement	Deforestation
			Chemical deposition
			Water pollution

Source, Marongwe, 1993, Environmental Management

The list of costs is much larger as compared to the benefits of gold panning. A comparison of benefits and costs suggests that gold panning in Mashonaland central is not desirable. The range in estimated net benefits for the province of Mashonaland Central shows that gold panning is uneconomic.

Data presentation and analysis

The findings of the study were based on the information provided by panners, non-panners and stakeholders in Gwanda District. The main findings were on environmental damages caused, social problems encountered awareness of these and training.

Social problems: the living conditions in gold pan areas

Development of respiratory diseases due to inhalation of irrespirable dust has been shown to be in direct proportion to the total load inhaled over a period of time. There were cases of people being trapped in disused mines or dug pits and a sad incident happened during the research when three men in a disused mine made fire for light and cooking. They were overcome by gases suspected to be carbon monoxide and died in the pit. Stakeholders stated that there was loss of life every year at the sites. Either people were being trapped in disused mines or in trenches. The rescue operations for such incidences are difficult and costly as there is no equipment or manpower to undertake such undertakings because of economic hardships.

Full time panners resided along the river banks in dilapidated infrastructure made from mud, plastics and wooden poles without access to proper sanitation facilities. They use small pit latrines very close to their sleeping huts and these latrines were often inadequate in number, resulting in high utilization rates. Both the huts and latrines emitted offensive smells and were very dirty. This posed significant health hazards to the panners and their families, since full-time panners had their families along with them. There is no access to clean water within a walking distance, they fetch water from rivers. The huts are constructed without any ventilation, with daylight being the only source of illumination.

One of the panners interviewed noted that she was not concerned with accommodation; all she wanted was to get the gold. She also noted that she would not abandon gold panning for an alternative job. Her condition depicted that she was either ill or hungry, wearing very dirty clothing, an indication that she does not have time to wash her body and prepare her meals, as most of her time is spent digging for gold. The high risk of the HIV/AIDS pandemic is mainly due to prostitution. There are so many people who are single and even children of about 15 years roaming the camps. The economic situation in Zimbabwe has hit hard across generations leading to all ages assisting to provide for the family.

Environmental damage in Gwanda

For full time panners a week's activity produced 50g of gold, while part time panners produced another 10g of gold. Assuming that these panners are constantly producing, this means serious damage to the environment since their focus is to get as much gold with little attention paid to the impact on the physical environment. Lack of sanitation facilities in most campsites for their families means that the river itself is the ultimate source of human waste, with most of the families doing their laundry directly in the river. All these have some effect on downstream users who may be users of the stream for their drinking water. This is typical in rural areas that people may fetch water directly from a flowing stream for their home consumption.

As a result of gold panning, especially in the Mzingwane River, there is increased siltation which occurs during heavy rains. This is mainly in places where there is improper gold panning. The study established that due to gold panning in the Mzingwane area, there is serious soil compaction and deforestation along the river banks, which results in accelerated run off and the washing away of sifted material piled up loosely on the riverbank and in the riverbeds, resulting in most cases, the collapse of the river beds. The study established that most of the dams in Gwanda are already 70% silted and in most of the rivers it was so bad that it is no longer economic to construct new dams along the rivers where gold panning takes place, due to the high levels of rapid siltation. The study established that the ecosystem was at risk due to gold panning which has resulted in dangerous open pits all over and siltation of major rivers and pollution of dams. The study found that 71% of all trees in the panning sites were damaged, although there is no way to estimate the proportion of damage due to gold panners alone. Another survey would need to be done in the future to quantify the change in woodland cover over time. Most of the dried rivers showed extensive riverbed damage due to previous gold panning activities. In most cases they do not bother to close the dangerous pits created on the riverbeds.

Nearly 75% of the panners interviewed indicated that they did not know or realize the impact of gold panning to the physical environment and their health status. Some panners and non-panners acknowledged that siltation arises as a result of gold panning while other stakeholders agrees on the impact of gold panning as a source of siltation but also blame factors such as stream bank cultivation, poor crop production practices, over grazing and deforestation as major causes of siltation.

The concentration of gold panners that make use of chemicals such as cyanide and mercury which may pollute water was also evident. This has disastrous impacts on the aquatic environment as the pollution kills aquatic life. The effect depends on the size of the mining operations, Out of the 49 panners interviewed almost 70% of them indicated that they used mercury and cyanide to concentrate gold. It is now common knowledge that the use of such chemicals and other waste materials from the panning sites are washed into the streams, rivers and dams. Mtshabezi is one river that was noted and it is evident that the pollution is high. When panners were asked whether they were aware of the danger caused by the chemicals in the water, the majority expressed ignorance as to what effect the chemicals have on water.

Training in gold panning

The environmental damage being created is due to lack of knowledge and formal training in gold panning. All respondents from local authorities, officials for Environmental Management and mining organizations received training in gold mining and processing. Twelve percent of non – panners were trained and only eight percent of panners received formal training in gold panning.

Most of the panners and non-panners expressed ignorance of the existence of the statutory rules and regulations and only knew it was illegal to pan. They were not aware of the environmental management and disaster management policies. Even campsite leaders did not have any training and some claimed they were making efforts to come up with small mining associations so that they could lobby for funding through the Ministry on Small Businesses

and Indigenization. One of the camp leaders interviewed said that he had never participated in the training and did not need one as it would take too much of his time and expose him to the authorities who would want to know his operations, such as how and where he was marketing his gold. Probed further he indicated that he had heard that if he joined or registered with mines they would assess his production and ask him to sell through the Reserve Bank which pays very low prices. He also boasted of vast experience he had acquired through panning without formal training. A majority of the panners interviewed had a negative attitude towards training programmes, the reason being that they did not want to be limited to one area of operation or site, but to dig anywhere they wanted to without following formal and organized procedures. Organized procedures are safe but they claim that it will reduce their yield as they will be required to adhere to systematic and organized systems of production. The study established that some of the gold panners have more than 12 years of gold panning experience. One of the panners noted that he was a senior "*Gwecha/ Tsheketsha*" panner and had he been employed at a mine, he would have been awarded medals for long service. It was interesting to note that most of them had indicated that they liked their jobs and would not wish to take any employment elsewhere other than gold panning. When asked whether they were aware that they were causing serious damage to the environment, most of them responded by indicating that they were so much experienced, such that they were no longer a threat to the physical and social environment, given their vast experience as illegal gold panners.

Recommendations

On the basis of the findings some recommendations are presented to provide guidelines to policy makers, environmental management authorities and potential stakeholders in disaster risk management.

Mining methods

A solution to this problem is to use blowtorches or "*mvuto* a fire blow used by blacksmiths' bellows to increase heat and reduce residual mercury and vaporize all the mercury.

Economic solution

It should be realised that gold panning is classified under small scale gold mining and is largely poverty driven due to the harsh economic demands. This would require a coordinated and collaborative approach from all stakeholders that are geared towards poverty alleviation in the region. These are all interested parties like Ministries of Tourism and Environment, Water Resources, Rural Development, local Government, Agriculture, Health, Economic Development and the Mines Authority. They should come together and draft an operational document governing mining operations. For example specific rules and regulations governing the operations of mining in the district.

Mining permits should be issued by the local authorities to train people in the district. Such people should be given claims or permits after the area has undergone impact assessment. The claim owners should also be trained in disaster risk reduction strategies.

To help assess current government policy regarding gold panning and formulate more effective strategies, a socio economic analysis is usually required. In most cases, a cost benefit analysis is part of the evaluation. In short, Zimbabwe must maximize the net benefit to society from the extraction and marketing of economically accessible gold reserves. The

analysis should consider how the flow and distribution of costs and benefits might change over time. One problem, which always arises in environmental economics, is the difficulty on applying monetary values to many costs and benefits.

Carrying out a cost benefit analysis

Alternative approaches for the estimation of siltation from gold panning are required. The replacement cost approach could be used to provide rough estimates of the cost of putting the excavated material back into the riverbed, filling holes and tunnels. Another approach would be to estimate the cost of moving the excavated material well away from the river to prevent deposition back into the river and resulting siltation. This approach lends itself to increasing the flow capacity of rivers. Additional costs of terracing, protecting high risk river banks with rocks and planting vetiver grass for soil stability could be added as part of a comprehensive programme to prevent siltation. This approach fits the preventative expenditure model of Wipenny (1991) if carried out during mining by the panners, or the replacement cost model if carried out after mining by government. Using the latter approach assumes manual labour is used to move the excavated pay gravel well away from the river. Rea (1994) estimated the tonnage of river bed material that must be mined to produce average gold yields through several seismic surveys of gold-bearing rivers in the province. These costs only include labour for moving material out of the river and distributing it. Other costs for a more complete rehabilitation programme would be incurred for example, to rebuild riverbanks, protect high-risk banks with rocks, terrace slopes and plant vetiver grass and trees.

Training

The coordination efforts should provide training and development programmes. This is based on the assumption that gold panning in Zimbabwe is a viable economic activity and a potential source of income for most rural families. It is therefore necessary to provide capacity building for people involved in gold panning. There is a need for educationalist, environmentalist and other interested stakeholders to have a keen interest in the operations of gold panning so as to address the problems created by such operations. This could be done through the press and project assessments and seminars to alert gold panners to the need and importance of protecting the physical environment. Where possible, gold panners and non-panners living in camps at the sites should be made responsible for the rehabilitation of the environmental damage they cause.

Environmental

All responsible government departments should be allocated responsibilities so that they are able to monitor the gold extraction activities. Unfortunately negative impacts outnumber the positive impacts and it is clear that to bring about sustainable development of the mining industry a commitment has to be made by both the miners and the stakeholders. Regulations that control blasting and any other related noises and vibrations at night as they disturb people and animals. To reduce the noise and protect ear damage appropriate sound proof devices should be used. All archaeology/cultural artefacts discovered should be reported to the National Museums and Monuments. All working areas must be fenced off to prevent animals and unauthorised people from entering the sight. Mining spoil piles should be placed outside the mining area and this should be in controlled erosion spots with sediment around all spoil

piles to preclude sedimentation discharge to surface water. All plastic and glass material must be recycled and taken off site (Huidobro, 2006).

Social problems

Dust inhalation must be eliminated to prevent respiratory and adverse effects to workers and people staying adjacent to the mine, through provision or wearing of respirator with filter during mining or excavation and transportation of ore. Living quarters must be a distance way from the mining area. There must be minimum denudation of vegetation around the site. Chest X- rays of all employees once/yearly in order to detect any incipient pulmonary disease such as persistent coughing and/or shortness of breath. Such measures will reduce the risk of lung-impregnated diseases to people working within the area (Occupational Health Act, 1976). Construction of installing boreholes and blair toilets at panning sites.

Conclusion

The study set established the major negative impacts and damages caused by illegal gold panning activities caused Gwanda district. It provided baseline information for the effective management of the environmental and disaster strategies in the region. The study also provided mitigatory strategies in order to curtail the impacts of gold panning and the associated disasters. Environmental damages resulting from gold panning, like siltation of rivers, deforestation, soil erosion, land degradation, water aquatic based food chains destruction, water pollution and environmental damages and costs are outlined in the discussions. Issues related to social effects of gold panning were also presented. Poor sanitation facilities in the panning sites and the general spread of HIV/AIDS, as a result of people overcrowding in the panning sites were highlighted.

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