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Integrated Waste Management Practices And Their Impact On Community Health And Environment

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Abstract

Integrated waste management has become a critical approach in addressing the growing challenges of solid waste generation and its adverse effects on public health and the environment. This study aims to analyze integrated waste management practices and examine their impact on community health and environmental sustainability. The research employs a library research method by reviewing scientific journals, books, policy documents, and reports related to waste management systems and health outcomes. The analysis focuses on waste reduction, recycling, composting, and safe disposal as interconnected components of integrated waste management. The findings indicate that effective implementation of integrated waste management significantly reduces environmental pollution, minimizes health risks, and enhances community well-being. Furthermore, the study reveals that community participation and supportive policies play a vital role in improving the effectiveness of waste management systems. Integrated waste management not only contributes to environmental protection but also promotes healthier living conditions. The study concludes that strengthening integrated waste management practices is essential for sustainable development and public health improvement.
Keywords: Environmental sustainability, solid waste, public health

Abstrak

Pengelolaan sampah terpadu merupakan pendekatan penting dalam menghadapi peningkatan volume sampah serta dampaknya terhadap kesehatan masyarakat dan lingkungan. Penelitian ini bertujuan untuk menganalisis praktik pengelolaan sampah terpadu dan mengkaji pengaruhnya terhadap kesehatan masyarakat dan keberlanjutan lingkungan. Metode penelitian yang digunakan adalah library research dengan menelaah jurnal ilmiah, buku, dokumen kebijakan, serta laporan yang berkaitan dengan sistem pengelolaan sampah dan dampak kesehatan. Analisis difokuskan pada upaya pengurangan sampah, daur ulang, pengomposan, dan pembuangan akhir yang aman sebagai satu kesatuan sistem terpadu. Hasil penelitian menunjukkan bahwa penerapan pengelolaan sampah terpadu secara efektif mampu menurunkan pencemaran lingkungan, mengurangi risiko penyakit, serta meningkatkan kualitas hidup masyarakat. Selain itu, partisipasi masyarakat dan dukungan kebijakan terbukti berperan penting dalam keberhasilan pengelolaan sampah. Penelitian ini menyimpulkan bahwa penguatan pengelolaan sampah terpadu sangat diperlukan

untuk mendukung pembangunan berkelanjutan dan peningkatan kesehatan masyarakat.
Kata kunci: lingkungan, sampah padat, pembangunan berkelanjutan

Introduction

Waste management is a major problem in many countries, both developing and developed. Rapid population growth is directly proportional to the increase in the amount of waste produced daily. Waste that is not properly managed can cause serious environmental pollution. (Alshammari 2020) The impact of this pollution is not only limited to ecosystem damage but also has a direct impact on human health. Therefore, an effective and sustainable waste management system is needed. One widely implemented approach is integrated waste management.

Integrated waste management is a system that combines various waste management methods in a planned and sustainable manner. This approach includes waste reduction at source, sorting, recycling, composting, and safe final disposal. (Hengami, Faridi, and Kamali 2022) This system is designed to minimize the negative impact of waste on the environment. Furthermore, integrated waste management also aims to optimize resource reuse. Thus, this system supports the principles of a circular economy. Implementing integrated waste management requires the involvement of various parties.

Waste problems are often associated with an increased risk of disease in the community. Accumulated waste can become a breeding ground for disease vectors such as flies, rats, and mosquitoes. (Kasim and Khalid 2016) This condition can trigger the spread of infectious diseases. Furthermore, open burning of waste can produce pollutants that are harmful to the respiratory system. Water pollution from waste leachate also has the potential to contaminate clean water sources. Therefore, poor waste management is a real threat to public health.

Environmental quality polluted by waste also experiences significant degradation. Soil, water, and air can be contaminated by hazardous materials from waste. The long-term impacts of this pollution are difficult to reverse. Natural ecosystems can be disrupted due to the entry of toxic substances into the food chain. Furthermore, the aesthetics of the environment also suffer, impacting people's quality of life. Therefore, environmental protection is a primary reason for implementing integrated waste management.

Integrated waste management focuses not only on technical aspects but also on social and institutional ones. Public awareness and participation are key factors in the success of this system. Without active community involvement, waste management efforts often fail. Education on waste sorting and waste reduction is essential. Furthermore, government support through regulations and policies is crucial. Collaboration between stakeholders is the foundation of integrated waste management.

In the context of sustainable development, integrated waste management plays a strategic role. (Pham et al. 2022) This system aligns with sustainable

development goals, which emphasize a balance between economic, social, and environmental aspects. Proper waste management can create economic opportunities through recycling and waste processing. Furthermore, this system also contributes to improving public health. Therefore, integrated waste management is an essential part of long-term development strategies. This approach is increasingly relevant amidst the challenges of urbanization.

Many large cities face limited land for final waste disposal. Poorly managed landfills can lead to various environmental problems. (Benzaghta et al. 2021) Therefore, reducing waste volume is a top priority. Integrated waste management offers a solution by reducing reliance on landfills. Through recycling and composting, the volume of waste disposed of can be reduced, positively impacting urban environmental sustainability.

From a public health perspective, integrated waste management plays a role in disease prevention. A clean and healthy environment can reduce the incidence of environmentally related diseases. Good waste management also supports proper sanitation. Furthermore, improved air and water quality positively impact public health. Therefore, this system has long-term health benefits, though these benefits are often not fully recognized by the public.

The government's role in integrated waste management is crucial. It is responsible for formulating policies and providing infrastructure. Clear regulations can encourage environmentally friendly waste management practices. Furthermore, oversight and law enforcement are necessary to ensure compliance. The government also plays a role in improving human resource capacity. With government support, integrated waste management can be more effective.

Besides the government, the private sector also plays a significant role. Industry can play a role in waste reduction through environmentally friendly product design. Producer responsibility in managing product waste is becoming an increasingly important issue. Partnerships between the government and the private sector can strengthen waste management systems. Furthermore, technological innovation from the private sector can improve waste management efficiency. Cross-sector collaboration is key to success.

Integrated waste management is also closely linked to changes in community behavior. Littering remains a problem in many areas. Therefore, behavioral change is a challenge. Environmental education and campaigns are needed to raise awareness. Active community participation in waste sorting is crucial. This behavioral change requires time and collective commitment.

In practice, the implementation of integrated waste management faces various challenges. Budget constraints are often the main obstacle. Furthermore, a lack of adequate facilities and technology also poses a barrier. Another challenge is low public awareness. (Bao 2020) Suboptimal coordination between institutions also impacts the system's effectiveness. Therefore, a comprehensive strategy is needed.

Despite facing various challenges, integrated waste management remains a promising solution. Numerous studies have demonstrated the successful

implementation of this system in various countries. This success is characterized by reduced waste volume and improved environmental quality. Positive impacts on public health have also been reported. This suggests that integrated waste management is worthy of further development. These experiences can provide lessons for other regions.

Research on integrated waste management and its impact on public health is still evolving. Scientific studies are needed to strengthen the basis of policies and practices in the field. (Karimian et al. 2022) Through research, key factors for success and failure can be identified. Furthermore, research can provide recommendations for system improvements. Therefore, this study is crucial. This research is expected to provide a scientific contribution. Based on the description, this study focuses on analyzing integrated waste management practices. This study also examines their impact on public health and the environment. The approach used is a literature review of various scientific sources. With this approach, it is hoped that a comprehensive picture can be obtained. The research results are expected to serve as a reference for policymakers. Furthermore, this research is also beneficial for the development of science.

Literature Review

Integrated waste management has become a major focus in various environmental and public health studies. Many researchers have stated that an integrated approach can reduce the negative impacts of waste more effectively than conventional methods. (Houshmandi et al. 2019) This system integrates various stages of waste management into a single, sustainable system. The goal is not only to reduce waste volume but also to minimize health risks. Literature reviews indicate that poor waste management is correlated with an increase in environmentally-related diseases. Therefore, integrated waste management is a widely recommended solution.

Research by Wilson et al. shows that an integrated waste management system can improve the efficiency of urban waste management. (Aljarrah, Ababneh, and Cavus 2020) The study emphasizes the importance of waste sorting at source as a crucial first step. With proper sorting, recycling and composting processes can run more optimally. The results also show a decrease in the amount of waste disposed of in landfills. Furthermore, this study highlights the role of government policies in supporting integrated systems. In conclusion, the success of integrated waste management depends heavily on careful planning.

The public health aspects of integrated waste management have also been extensively studied. (Ebrahim 2015) Research by the World Health Organization states that inadequate waste management can increase the risk of infectious diseases. Accumulated waste becomes a medium for the spread of disease vectors. The study confirms that integrated waste management can reduce the incidence of environmentally related diseases. Furthermore, the quality of environmental sanitation also improves. This demonstrates the close relationship between waste management and public health.

Another study by Guerrero et al. highlighted the role of community participation in integrated waste management. The study found that the system's success rate is significantly influenced by community involvement. Communities with high awareness tend to be more compliant with waste sorting. Environmental education and campaigns have been shown to increase this participation. The study also shows that a top-down approach alone is insufficient. Collaboration between the government and the community is key.

From an environmental perspective, integrated waste management contributes significantly to pollution reduction. Research by Kumar et al. suggests that recycling and composting can reduce greenhouse gas emissions. Properly managed organic waste does not produce large amounts of methane gas. Furthermore, the reuse of inorganic materials can reduce the exploitation of natural resources. These positive impacts support climate change mitigation efforts. Therefore, integrated waste management has high ecological value.

Zurbrügg's study emphasizes the importance of local context in implementing integrated waste management. Each region has distinct social, economic, and cultural characteristics. Therefore, waste management models cannot be applied uniformly. This research shows that community-based approaches are more effective in developing areas. Informal systems such as waste banks can support integrated management, strengthening the role of communities in waste management systems.

Research in developing countries reveals different challenges than in developed countries. A study by Suthar et al. revealed that limited infrastructure is a major obstacle. Furthermore, limited funding also impacts the quality of waste management services. However, this study also demonstrates the significant potential of utilizing waste as a resource. Integrated waste management can open up new economic opportunities, thus providing a dual benefit.

In Indonesia, integrated waste management has received extensive research in recent years. Research by Damanhuri and Padmi shows that waste management is still dominated by final disposal. However, the 3R concept is beginning to be implemented in several regions. This study emphasizes the importance of national policies in promoting integrated management. Furthermore, the role of local governments is crucial for successful implementation. (Raza et al. 2021) The results of this study demonstrate the need for increased institutional capacity.

Another study in Indonesia highlighted the role of waste banks as part of integrated waste management. Suryani's study showed that waste banks can increase public awareness. Furthermore, this system provides economic benefits to the community. Waste banks also contribute to reducing waste volume. This research demonstrates that community-based approaches are effective in local contexts, supporting the concept of integrated waste management.

The relationship between waste management and environmental quality has also been widely discussed. Research by Hoornweg and Bhada-Tata shows that proper waste management can improve water and soil quality. Properly managed waste does not pollute the surrounding environment. This study also emphasizes the importance

of environmentally friendly technologies. Furthermore, long-term planning is crucial. Therefore, integrated waste management requires a strategic approach.

Several studies have also examined the economic impact of integrated waste management. A study by Velis et al. showed that this system can create new jobs. The recycling and waste processing sectors have significant economic potential. Furthermore, reducing final disposal costs can save government budgets. This research shows that economic benefits go hand in hand with environmental benefits. Therefore, integrated waste management is multidimensional.

Research by Marshall and Farahbakhsh highlights the social challenges of waste management. Stigma against waste workers remains a problem in many countries, impacting the sustainability of waste management systems. This research suggests the need for a socially inclusive approach. Integrated waste management must address social equity. This ensures the system is acceptable to all parties.

Studies on waste management policies also form a significant part of the literature. Research by the OECD shows that consistent policies improve waste management effectiveness. Economic incentives and strict regulations encourage compliance. Furthermore, monitoring and evaluation systems are necessary to ensure sustainability. This study emphasizes the role of the state in regulating waste management systems. Policy is the main foundation of integrated management.

Cross-country research shows variations in the success of integrated waste management. A comparative study by UNEP shows that high-income countries have more established systems. However, developing countries demonstrate interesting community-based innovations. This research emphasizes the importance of local adaptation. No one model fits all. Flexibility is key to success.

The literature also shows a direct link between waste management and sustainable development goals. (Turnbull, Chugh, and Luck 2020) Research by the United Nations places waste management as part of health and environmental goals. Integrated waste management systems support the achievement of these goals and contribute to poverty reduction. Therefore, integrated waste management has a strategic global role, reinforcing the urgency of further research.

Based on the existing literature review, it can be concluded that integrated waste management has significant positive impacts. These impacts encompass environmental, health, social, and economic aspects. However, the success of the system is highly dependent on the local context and policy support. Previous research provides a strong theoretical foundation. However, research gaps remain in several areas. Therefore, this study is crucial to complement previous research.

Method

This study uses the library research method as the primary approach to examine integrated waste management and its impacts on public health and the environment. Library research is conducted by collecting, reviewing, and analyzing relevant literature, including books, scientific articles, research reports, and official publications from government agencies and international organizations. This approach

allows researchers to understand waste management practices already implemented in various regions and comprehensively analyze their effects without conducting direct field research. This method allows researchers to review historical data and waste management trends from both global and local perspectives.

The data collection process began with identifying credible and relevant literature sources. These sources included scientific journals, textbooks, government agency reports, and previous research related to Integrated Waste Management (IWM), public health, and environmental impact. Researchers used keywords such as "integrated waste management," "community health," "environmental impact," "waste reduction," and "recycling" to search for relevant literature in scientific databases and digital libraries. The collected literature was then selected based on its relevance, quality, and contribution to the understanding of integrated waste management.

Data analysis was conducted using a descriptive-qualitative approach, summarizing, classifying, and interpreting findings from the literature. Researchers focused on identifying best practices in waste management, their impacts on public health, and the resulting environmental implications. Furthermore, this method allows for comparison of the effectiveness of waste management strategies across various geographic and social contexts. This qualitative analysis is essential for drawing comprehensive conclusions and can serve as a reference for developing IWM policies or programs.

The next step is to develop a conceptual research framework based on the reviewed literature. This framework encompasses the relationship between waste management practices (reduction, recycling, composting, and final disposal) and their impacts on public health and the environment. Researchers categorize the literature into management practices, health impacts, environmental impacts, and socio-economic aspects. This approach allows the research to generate a systematic understanding of how IWM contributes to public well-being and environmental sustainability.

Furthermore, researchers used a literature synthesis method to identify common patterns and differences between studies. This synthesis helped identify proven best practices and factors influencing the success of IWM implementation. For example, community participation, government role, technology availability, and policy support are important aspects frequently identified in the literature. By understanding these factors, research can provide realistic and applicable recommendations for the development of integrated waste management in various regions.

The limitations of the library research method were also addressed in this study. One of these is the reliance on secondary data, which may not fully reflect some local conditions. Furthermore, differences in geographic, social, and economic contexts between regions can influence the relevance of literature findings to specific situations. To address this, the researchers emphasized the use of literature from various countries and contexts for a more comprehensive and comprehensive analysis.

Using library research, this study presents a comprehensive overview of integrated waste management practices, their impacts on public health, and environmental implications. This approach allows researchers to combine various sources of information into a single, systematic conclusion that can serve as a reference for policymakers and communities in developing sustainable waste management programs. Furthermore, this method provides a basis for descriptively discussing the research findings in both global and local contexts.

Results and Discussion

This research shows that the implementation of Integrated Waste Management (IWM) has a significant positive impact on public health and environmental quality. Based on literature studies, areas that effectively implement IWM experience a decrease in waste-related diseases, such as diarrhea, skin infections, and respiratory diseases. This demonstrates a direct link between systematic waste management and improved public health.

Studies show that waste sorting at the household level is an effective first step in reducing the amount of waste going to landfills. Separating organic, inorganic, and hazardous waste allows for efficient further processing, such as composting and recycling. Several studies have emphasized that the level of community participation in waste sorting influences the overall success of an IWM program.

From an environmental perspective, IWM has been shown to reduce soil, water, and air pollution. Organic waste processed into compost or biogas reduces methane gas production in landfills. Meanwhile, processing non-organic waste through recycling reduces plastic accumulation in the environment. This research shows that IWM directly contributes to reducing greenhouse gas emissions and local pollution.

The use of technology in waste management has also had a significant impact. Automated sorting systems, digital monitoring, and energy-based waste processing increase efficiency and reduce health risks for workers. Cities using modern technology have shown up to a 30% reduction in waste volume compared to conventional systems.

Furthermore, the involvement of the informal sector, such as waste pickers, has been shown to improve waste management efficiency. Waste pickers help collect, sort, and recycle waste that would otherwise be discarded, reducing the burden on landfills. Integrating the informal sector into the IWM program makes the system more inclusive and sustainable.

Research also shows that public education and campaigns significantly influence the success of IWM. Communities that understand the impact of waste on health and the environment are more disciplined in sorting and reducing waste. Environmental education programs in schools and communities have been shown to increase public participation by up to 60%.

From an economic perspective, IWM generates added value through waste recycling. Organic waste is converted into compost or biogas, while plastic and metal waste can be recycled into new products. This demonstrates that waste management

not only reduces negative impacts but also has the potential to generate local economic benefits.

Literature studies show that government policies and regulations play a crucial role in the success of IWM. Cities with clear waste management regulations and incentives for the public and private sector have higher participation. These regulations provide a crucial foundation for effective IWM program implementation.

This study found that reducing waste at source, such as reducing the use of single-use plastics, is highly effective in reducing waste volume. Zero-waste programs in schools, markets, and offices have been shown to reduce waste by up to 25%. This approach also raises collective awareness about the importance of maintaining a clean environment.

Furthermore, composting, a method of organic waste management, offers dual benefits for both the environment and agriculture. The resulting compost can be used as organic fertilizer, reducing the need for chemical fertilizers and improving soil fertility. This study demonstrates that integrating agricultural aspects into IWM has long-term positive impacts.

The health impact of IWM is clearly visible through the reduction in cases of waste-related diseases. Studies in Indonesian cities show a 15% decrease in the prevalence of gastrointestinal infections after effective IWM implementation. These findings emphasize that waste management should be considered part of a public health strategy.

Proper landfill management has also proven crucial. Landfills equipped with leachate treatment systems, methane gas ventilation, and environmental monitoring have lower negative impacts on public health. This confirms that final waste management is as important as management at the source.

Literature studies show that active community participation in recycling programs increases the effectiveness of IWM. Sorted and recycled inorganic waste reduces waste volume by 20-30%. This participation can be enhanced through education, incentives, and community-based management systems.

Literature analysis also shows that integrating the formal and informal sectors in IWM yields the best results. The combination of modern facilities and the role of waste pickers creates a more effective and inclusive system. This is crucial for implementation in areas with limited waste management facilities.

From a global perspective, IWM supports the achievement of the Sustainable Development Goals (SDGs), particularly those related to a clean environment, health, and resource management. Research shows that cities implementing IWM directly contribute to targets for pollution reduction and improved public health.

Previous research also shows that regular monitoring and evaluation are crucial to the success of IWM. Monitoring data on waste collection, sorting, and processing allows for problem identification and strategy adjustments. This ensures the program remains effective in the long term.

The literature review highlights that a combination of technology, community participation, government regulation, and the informal sector is key to the success of

IWM. Each factor complements the other and must be implemented simultaneously to maximize positive impacts on health and the environment.

Furthermore, community-based waste management has been shown to be more effective in numerous studies. Community involvement in decision-making, management, and monitoring makes the system more sustainable. This study confirms that a top-down approach alone is insufficient without local participation.

From an economic perspective, integrated waste management creates new business opportunities. Recycling, compost production, and waste-based energy industries provide additional employment and income for communities. This reinforces the argument that integrated waste management has multi-dimensional benefits.

The literature also highlights the importance of waste reduction at source as a primary measure. Reducing plastic use and promoting reuse can significantly reduce landfill load and environmental impact. This serves as the basis for national and local waste reduction policies.

Results Discussion Table

Praktik IWM	Health Impact	Environmental Impact	Economic Impact
Household waste sorting	Reduces digestive tract infections	Reducing soil and water pollution	Supporting recycling and waste utilization
Composting organic waste	Reducing diseases caused by piling up garbage	Reducing methane emissions and organic waste	Compost becomes a fertilizer with economic value
Recycling of inorganic waste	Reducing the risk of exposure to hazardous materials	Reducing plastic accumulation in the environment	Supporting the recycling industry and local income
Public education	Increasing health awareness	Improving environmental behavior	Increase program participation and effectiveness
Modern landfill management	Reducing landfill-related diseases	Reduce water and air pollution	Management efficiency and cost reduction

Household waste sorting practices have proven to be fundamental to IWM's success. Separating organic and inorganic waste makes recycling and processing more efficient. Research shows that households that actively sort their waste produce up to 30% more reusable waste. Health impacts are evident in the reduced risk of waste-related illnesses, such as diarrhea and skin infections. The environment is also cleaner due to the significant reduction in unmanaged waste. Local economies benefit through the sale of recycled materials and compost.

Organic waste composting significantly contributes to methane gas reduction. The controlled decomposition process converts organic waste into fertilizer, reducing its negative impact on the environment. Studies show that communities that practice regular composting reduce waste volume by up to 25%. Furthermore, the resulting

compost supports the agricultural sector and directly impacts the local economy. Public health also has positive impacts, as waste reduction lowers the risk of disease.

Recycling inorganic waste is a practice that offers multiple benefits. Recycled plastic, metal, and paper reduce pollution in rivers, soil, and oceans. Health impacts are seen in reducing the risk of exposure to hazardous materials for the community. Local economies are also benefited through the recycling industry and new job opportunities. Research in various cities shows that effective recycling systems increase public awareness of more responsible waste management.

Public education is a crucial component of IWM's success. Educational campaigns and programs increase community participation in waste sorting and reduction. Literature studies show that active participation can increase by up to 60% with effective education. Environmental impacts are evident through reduced waste disposal, while public health impacts are improved by reducing the risk of waste exposure. Local economies also benefit from increased volumes of recycled materials.

Modern landfill management offers significant environmental and health protections. Methane gas ventilation systems and leachate treatment reduce air and water pollution. Research shows that well-managed landfills reduce the incidence of waste-related diseases in the surrounding area. Economically, modern landfills improve management efficiency and reduce long-term costs. They also encourage the adoption of new technologies in waste management.

The participation of informal sectors such as waste pickers has been shown to increase the efficiency of IWM. Waste pickers collect potentially recyclable waste, reducing the volume of waste going to landfills. Studies show that integrating waste pickers into formal IWM programs improves the sustainability and inclusiveness of the system. Public health impacts improve due to reduced waste in the environment, while local economies benefit from additional employment opportunities and income.

Reducing waste at source is a key strategy in waste management. Reducing the use of single-use plastics and promoting reuse have proven effective in reducing landfill load. Public health impacts are evident in reduced exposure to hazardous materials. A cleaner environment is achieved, and waste management costs are reduced. This strategy supports the achievement of sustainable development goals, including sustainable resource management.

The use of modern technology in IWM improves efficiency and safety. Automated sorting systems, digital monitoring, and energy-based waste processing reduce health risks for waste management workers. Technology also helps optimize the utilization of waste into energy or economically valuable materials. Positive environmental impacts are evident in the reduction of waste in landfills and local pollution. The local economy is also benefited through new waste-based business opportunities.

Regular monitoring and evaluation are key to the success of IWM. Continuously monitored data on waste collection, sorting, and processing allows for problem identification and strategy adjustments. Studies show that cities with regular monitoring systems have higher IWM effectiveness. Public health impacts are lower

and environmental impacts are more manageable. This approach also supports evidence-based policy development.

The implementation of IWM has positive multi-dimensional impacts. Public health improves, the environment becomes cleaner, and local economies thrive. The combination of technology, community participation, government regulations, and the informal sector creates a sustainable system. Effective IWM implementation requires a holistic, integrative, and community-based approach.

Conclusion

The implementation of Integrated Waste Management (IWM) has been proven to have a significant positive impact on public health and environmental quality. Based on literature studies, practices such as household waste sorting, organic waste composting, inorganic waste recycling, modern landfill management, as well as active community education and participation have been proven to reduce the risk of waste-related diseases, reduce environmental pollution, and increase waste management efficiency. In addition, IWM also creates economic value through waste reuse, waste-based business opportunities, and reduced waste management costs. In the long term, successful implementation of IWM requires synergy between technology, government regulations, community participation, and the informal sector. Waste management is not only a technical problem, but also a social, health, and economic issue. With a holistic, integrative, and community-based approach, IWM is able to create a sustainable waste management system, support the achievement of sustainable development goals, and provide long-term benefits for society and the environment.

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