

# ECOLOGY, ENVIRONMENT AND CONSERVATION

## VOL. 28 (3) : 2022

### CONTENTS

- 1–7 Comparison of Occlusal Molar Tooth Width of the Etawa Crossbreed Goat  
—*Soeharsono, Hana Elijani, Widjiati, Viski Fitri Hendrawan and Epy Muhammad Luqman*
- 8–11 A Survey on Fish Species at Tram Chim National Park, Vietnam  
—*D. H. Truong, T. M. Duong and V. L. Loi*
- 12–16 Effect of soursop leaf extract solution on the death of armyworm (*Spodoptera litura* F.) on mustard plants  
—*Akhmad Rizali, Noor Laili Aziza and Yusriadi Marsuni*
- 17–21 Teixobactin: A powerful antibiotic from natural resource  
—*Parichat Phumkhachorn and Pongsak Rattanachaikunsopon*
- 22–32 Impact of heavy metals and biochemical parameters on specific leaf area of roadside trees in Kathmandu, Nepal  
—*Jaya Prakash Hamal and Mukesh Kumar Chettri*
- 33–38 Survey on the Diversity of Species Composition of Phytoplankton at Bung Binh Thien  
—*D. H. Truong, T. M. Duong and V. L. Loi*
- 39–43 Effect of Dosage on Combination Ethylen Glycol and Dimethyl Sulfoxide as Cryoprotectant Using Vitrification on Viability of Mice (*Mus musculus*) Blastocyst Post Warming  
—*Zakiah Saumi, Viski Fitri Hendrawan, Widjiati and Epy Muhammad Luqman*
- 44–48 Domestic Waste Pollution of River Settlements, Banjarmasin City  
—*Sidharta Adyatma and Muhammad Muhaimin*
- 49–52 Different Concentration Organic Carbon Waste Cassava in Mixotrophic Cultivation on Protein and Beta Caroten Content of *Dunaliella* sp.  
—*Prive Widya Antika, Happy Nursyam and Arning Wilujeng Ekawati*
- 53–57 Aquatic Plants at Agricultural Station, Vietnam  
—*D. H. Truong, T. M. Duong and V. L. Loi*
- 58–66 The Effects of Formalin (Formyl Tetrahydrofolate) on CDK1 Protein on the Oocyte Maturation Process: Quantitative Structure Toxicity Relationships (QSAR) In Silico Analysis  
—*Lutvia Krismayanti, Widjiati, Bambang Purwanto and Dwi Krihariyani*
- 67–70 Freshwater Fish Survey by Land Use Type in Cantho City, Vietnam  
—*D. H. Truong, L. V. Ly, T. M Duong and H. T. Phung*
- 71–84 Structuring the *Bruguiera gymnorrhiza* Mangrove Area for Food Security in Paciran Village, Paciran District and Labuhan Village, Brondong District, Lamongan Regency, East Java  
—*Rudianto and Dwi Setijawati*
- 85–91 Effects of Temperature and Different Feed Uptake on Mercury (Hg) and Cadmium (Cd) Accumulation in Nile Tilapia  
—*Sunardi, Kabul Fadilah, Alfa Pratista Rakhmatul Fitri, Tiara Berliani and Keukeu Kaniawati Rosada*
- 92–95 Water Quality in Rice-shrimp Model  
—*Lien, B. T. B., Truyen, D. M., Dan, T. H., Loi, L. V. and Nga, L. K.*
- 96–110 African Elephant (*Loxodonta africana*) Impact on Selected Tree Species and Assessment of Piosphere Gradients in Venetia-limpopo Nature Reserve  
—*S.E. Nkosi, E. Adam, A.S. Barrett and L.R. Brown*
- 111–119 First record of heavy metal concentrations in the natural habitat of silkworms, Riau Province, Indonesia  
—*B. Budijono, Muhammad Hasbi and Yudho Harjoyudanto*

- 120–128 Evaluation soil changes under agricultural management and irrigation in an arid region: the case of Ghardaïa (Zelfana)  
—*Faredj Chikhi, Mohamed Benslama, Fouzi Benbrahim, Abderraouf Benslama, Sabrine Darem, Imane Hamel and Jose Navarro-Pedreño*
- 129–133 Assessment of Horse Shoes Lake (Oxbow) Conservation Assessment of Rantau New Village, Pelalawan Regency  
—*Rasoel Hamidy, Musrifin and Mulyadi*
- 134–139 Experimental evaluation of the stability of chitosan based biocomposites under various environmental conditions  
—*Wondalem Misganaw Golie and M.A. Azaz Ahmed*
- 140–153 A Modelling and Mitigation Strategy for the Impact of the Tsunami Disaster at Tamban Beach, Malang Regency, Using a Geographic Information System  
—*Rudianto, Maheno Sri Widodo, Guntur, Fahreza Okta Setyawan and Seftiawan Samsu Rijal*
- 154–159 Effect of Exposure to E-Cigarette Vapor and Cigarette Smoke on Seminiferous Tubules Diameter and Spermatozoa Quality of Mice (*Mus musculus*)  
—*Muhammad Alif Zulfikar, Eka Pramytha Hestianah, Herry Agoes Hermadi, Suzanita Utama, Tatik Hernawati, Suryo Kuncorojakti and Epy Muhammad Luqman*
- 160–169 Radial growth dynamics in Scots pine forests of the Yaloturovsky forest district of Tyumen region  
—*Epishkov A.A., Lipatkin V.A., Frolova V.A., Sidorenkov V. M., Stonozhenko L.V., Vorobyeva N.S. and Rumyantsev D.E.*
- 170–182 Rush fibers reinforced Adobe for green building  
—*Wassef Ounaies*
- 183–188 Habitat Characteristics and Abundance of Goonch (*Bagarius yarrelli*) in Perjaya Dam, Komering River, South Sumatra, Indonesia  
—*Sofian, Syaeful Anwar, Naim Pramono, Alfi Sahrin and Diah Ayu Satyari Utami*
- 189–195 A lizard diversity snapshot in the poorly studied Mila Region of north-eastern Algeria  
—*Madaci Brahim, Derradj Lotfi and Benmerzouk Bilel*
- 196–201 An Introduction of Autoinducer Biosensor for *Vibrio Parahemolyticus*, Pathogenic Bacteria in White Shrimp (*Litopenaeus vannamei*) Intensive Culture  
—*Mohamad Fadjjar, Sri Rahayu, Gumpita Windy Distiyanti and Jamilah Z. Janah*
- 202–209 The application of a Combination of Coconut Water and a Growth Regulator as (Effective Microorganisms) for Boosting Arabica Coffee Seedlings' Growth  
—*Evy Latifah and Hanik Anggraeni Dewi*
- 210–217 Effect of Biological Pollution on Human Health in North East Algeria "Case of Seraidi-Annaba Region"  
—*Imene Layachi and Mohamed Benslama*
- 218–225 The Effect of Temperature on *Goniastrea Aspera* Polyp Degradation and the Post-bleaching Resistance  
—*Pujiono Wahyu Purnomo, Max Rudolf Muskananfolo and Sigit Febrianto*
- 226–233 **The Waste Management Paradigm Shift from Linear Economy to Circular Economy in Campuses and Urban Communities**  
—*Z. Ariani, N. Septyanun, R. R. Harun, Syawaluddin, F. Khairunnisa, L. M. I. Hadini, D. Suryati*
- 234–241 Biochar from waste verbenas from a manure as an adsorbent to remove phenol from aqueous solution  
—*Houari Bella, Hayet Bendaikha and Yasmina Bendaikha*
- 242–246 Impacts of Fertilizer and Pesticide consumptions in Natural resources of India  
—*Avinash Sharma, Chowhani Manpoong, Hemant Sharma, Himanshu Pandey, Gaytri Soni, Supriya Sharma, Nirupa Kumari and Megha Raghavan*

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- 247–254 Effect of Air Velocity, Type and Size of Biomass on Performance of Downdraft Gasifier  
—*H. Manjunath, Vijayakumar Palled, M. Veerangouda, Devanand Maski and Ramachandra, C. T.*
- 255–266 Assessment of the effect of COVID-19 Lockdown on Water Quality of Baldi River Sahastradhara Sulphur Spring, Dehradun, Uttarakhand, India  
—*Shail Kulshrestha*
- 267–276 The Relationship between water quality and Macrophyte biomass of Kongba River, Manipur  
—*Beeteswari Khangembam and Asha Gupta*
- 277–285 Environmental Impact of Pesticide Usage in Cotton  
—*Almaszabeen Badekhan and K. Uma Devi*
- 286–288 Oxygen Generation by DBH Trees - A Study in Side RV College of Engineering (RVCE), Bengaluru, India  
—*Vinod A.R., Prasanth Acharya and Poornima*
- 289–293 Effect of bio-formulations on growth and yield of Pea (*Pisum sativum* L.)  
—*Michi Yarang, Chowhani Manpoong, Avinash Sharma, Megha Raghavan and V.S. Devadas*
- 294–299 Land Use and Land Cover Change Mapping: A Spatio Temporal and Correlational Analysis of Ramganjmandi Tehsil, Kota, Rajasthan  
—*Arushi Rana*
- 300–304 Effect of herbicides on weed infestation, productivity of groundnut and their residual effect on sunflower  
—*Shivanand N. Honnali and D.G. Sathihal*
- 305–313 A Study on Water Quality and Macrophyte Diversity in Three Wetlands of Sambalpur District, Odisha from Ecosystem Management Perspective  
—*Rajalaxmi Badra, Jijnasa Panda and Sunanda Sahoo*
- 314–320 Effect of Different Levels of Sulphur and Nitrogen on Growth Yield and Quality of Sesame (*Sesamum Indicum* L.) under Bael (*Aeglemarmelos* L.) based Agri-horti system  
—*Shailesh Kushawaha, Alok Kumar Singh, Abhinav Singh, Bipin Kumar Singh and Srishti Dipriya Minz*
- 321–329 The role of tillage practices, nitrogen management by inorganic and organic manure and fertilizers and foliar applied of zinc on wheat (*Triticum aestivum* L.) crop performance and physico-chemical properties of soil under rainfed conditions  
—*Manoj Kumar, Vikram Singh, Km. Nikam Kumari, Sagar Kumar, Thomas Abraham, Lipi Rina and J. J. Patel*
- 330–336 Study of Vitamin D<sub>2</sub> accumulation potential of two edible mushrooms from North-East India  
—*Marium Begum, Subhankar Ghosh and Siddhartha Proteem Saikia*
- 337–340 Studies on Phytoplankton diversity of Barehalla tank, Shivamogga, Karnataka, India  
—*H.A. Sayeswara and H.M. Ashashree*
- 341–355 A review on Immunostimulatory and antioxidant potential of herbs, *Curcuma longa* L., *Camellia sinensis* L. *Zingiber officinale* and *Allium sativum* Linn. in fish health: a sustainable approach for a healthy aquaculture  
—*Moirangthem Kameshwor Singh, Dhriti Borah, Manash Pratim Dutta, Simi Gogoi, Chandopal Saikia, Susmita Sonowal and Saimoun Ken Manhai*
- 356–361 Fixed Bed Modelling Column Adsorption Studies by Activated Carbon for Removal of Fluoride  
—*Keerthi B. Gurani and S.R. Mise*
- 362–366 Prediction of Smartphone Users in India Using Trend Analysis Looking for Better Planning of E-waste  
—*Shiv Kumar Singh Pundhir and Sandeep Kumar*

- 367–371 Influence of bio-fertilizers and growth regulators for enhancing yield and yield attributes of Indian mustard (*Brassica juncea* L.) grown under rainfed condition  
—Lipi Rina, Joy Dawson, Manoj Kumar, Gautam Ghosh, Liyir Rina and Bhura Singh
- 372–376 Biocompatible Herbal Polymeric Nano-formulation of [6]-gingerol: Development, Optimisation, and Characterization  
—Virendra Singh, Himanshu Pandey, Vatsala Misra and Devendra Singh
- 377–383 Development and Quality Assessment of Probiotic Ice-cream using Stevia as Sweetener  
—G. Nikhitha, P. Abhiram, Md. Haneef Azad and B. Amala
- 384–387 Some of the Immediate Damages and Preliminary Observations on the 22 June, 2020 Champhai Earthquake, India  
—Malsawmtluanga, P.C. Zoramthara, F. Zodinthara and J.L. Pachuau
- 388–392 Various Causes of Urban Heat Islands, Effects and their Mitigation Measures for Urban Ecology – A Review  
—Aneesa S. and Reshma J.K.
- 393–396 Stage Specific food consumption and utilization by the Mexican beetle, *Zygogramma bicolorata* Pallister (Coleoptera: Chysomelidae) on *Parthenium hysterophorus* Linnaeus  
—Amrit Mohapatra, Satya Narayan Satapathy, Dibyajyoti Swain, Soumya Sree Panda, Rupali Shrivastava, Priyanka Priyadarshini and Subhashree Subhasmita Paikaray
- 397–405 Efficacy appraisal of Cobalt oxide electrode module as a patron of sustainable energy harvesting super capacitor  
—Shubhangi Gavande, Shivani Gavande and B. R. Karche
- 406–414 Effect of potassium nitrate on germination physiology of magnesium nitrate primed and non-primed rice seeds var. Swarna  
—S. Mondal and B. Bose
- 415–425 Evaluation of Heavy Metals in Vegetables and Their Associated Health Risk Through the Consumption of Vegetables in the National Capital Region, India  
—Jyoti Rani, Tripti Agarwal and Sudesh Chaudhary
- 426–435 Tree Diversity and Timber Resources Richness of Reserve Forests under Pasighat Forest Division, Arunachal Pradesh  
—K. Ch. Momin, N. Lyngdoh, K. Upadhyaya and B. D. Mongjam
- 436–439 Comparative Study of DO, BOD and COD of Indrayani River Water, Pune (Maharashtra)  
—S.D. Jadhav and M.S. Jadhav
- 440–443 Key Information Sources and their Utility for Upliftment of Members of Tribal Farmer Producer Groups  
—Katiki Srikanth and M. Asokhan
- 444–460 Kinetic Indices of Enzyme Activity Used as Sensitive Biomarkers to Monitor Mine Spoil Genesis in Chronosequence Coal Mine Overburden Spoil  
—Payal Agrawal, Jitesh Kumar Maharana and Amiya Kumar Patel
- 461–465 Effect of Rice Establishment Methods and Nutrient Management Practices on Growth, Yield and Economics of Rice (*Oryza sativa* L.)  
—Jaya Bharti, Ashok Kumar Singh, C. S. Singh, Arvind Kumar Singh and Ranveer Kumar
- 466–470 Influence of renowned traditional liquid organic manure in conjunction with bacterial consortia on growth and yield of foxtail millet  
—Veerendra Manduri, Padmaja Bhimireddy, Malla Reddy Maduri and Triveni Sodimalla
- 471–475 Investigation on Mechanized Harvesting Requirements of Pokkali Paddy for Optimizing Harvester Design  
—Rathinavel S., Sindhu Bhaskar, Manoj Mathew and Jayan P.R.

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- 476–483      **Water Quality Assessment of River Kuwano, Basti (U.P.), using WQI and Pollution Indices**  
—*Gopal ji Kushwaha, Shivendra Mohan Pandey and Pradip Kumar*
- 484–494      **Eco-biological interaction of Polyphenols among *Acanthus ilicifolius*, detritus, and *Uca lactea annulipes* in estuarine-ecosystem**  
—*Munmun Ghosh, Santi M. Mandal and Susanta K. Chakraborty*
- 495–510      **Municipal Solid Waste Model Development through Binary Coding**  
—*Das Lalit, Das Adyasha and Mishra Sitikantha*
- 511–518      **Biobriquette: A Mixture of Palm Kernel Shell and Coconut Shell, An Indonesian Study Case**  
—*Efri Mardawati, Aldita Khoirul Ramadhan, Agus Kusnayat, Irfan Adriansyah and Hana Nur Fitriana*
- 519–523      **Impact of differential substitution of nutrients through organics on yield, nutrient uptake and economics of basmati rice in irrigated Shivalik foothills of J&K**  
—*Monika Banotra, B.C Sharma, Rakesh Kumar and Rohit Sharma*

# The Waste Management Paradigm Shift from Linear Economy to Circular Economy in Campuses and Urban Communities

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## ABSTRACT

The upstream to downstream problems of waste increase from year to year. The data shows that this is caused by the lack of community understanding of waste treatment and sorting. Research data on campus and municipal waste show that the most consumed types of food and beverages on campuses are packaged rice (65.8%) and drinks with plastic packaging (49.4%). Thus, there is great potential for the accumulation of inorganic waste generated from consumption activities on campus. This research focuses on the waste management paradigm shift in campuses and urban communities, from a linear economy to a circular economy. This research uses the socio-legal research method. It is hoped that this paradigm shift does not only strengthen and support the government's program, namely zero waste but also provide more economic benefits for the community, through circular economy-based waste management. In addition to a clean and healthy environment, the community can also use waste as a source of additional income.

**Keywords:** Waste management, Linear economy, Circular economy, Campus, Urban community.

## Introduction

In the last 150 years, the industrial economy has been dominated by linear (unidirectional) production and consumption. This linear concept is the process from the production, distribution, consumption, and disposal stages. This kind of business is not the right choice in the context of realizing sustainable earth. The rapid increase in the global population along with the increasing consumption of resources have negative impacts on the environment (Sundana, 2019).

A study in China showed that the circular economy offers an alternative development strategy to ease the tension between the desired national eco-

nomical development and environmental concerns. The circular economy is seen as a viable solution to China's resource scarcity and environmental problems (Heshmati, 2017). The circular economy concept has the potential to maximize the functioning of global ecosystems. Through this concept, everyone bears the responsibility to dispose of products at the end of their lives. In addition, each business sector is encouraged to measure its direct and indirect environmental impacts (Camilleri, 2018). In Indonesia, Danone-Aqua, the Coordinating Ministry for Maritime Affairs and Investment of Bali Provincial Government, and the Badung Regency government inaugurated the Integrated Waste Management Site My Waste My Responsibility (TPST Samtaku). One

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of these private companies fully initiated the TPST Samtaku, as a form of Corporate Social Responsibility (CSR) to the community. The waste management uses a circular economy model and zero waste to landfill, meaning that the waste collected at this facility will later be managed and can be fully reused so that nothing is wasted into the environment or ends up in the Final Processing Site (Rosadi, 2021).

In recent times, many economists, politicians, environmentalists, sociologists and philosophers search for new paradigms of development and viable growth within certain boundaries of planet earth. Sustainable development or carbon economy is a widely accepted concept, which seems right but is not enough. Such concepts address effects rather than causes. In this paper, the researchers analyze a broader approach, which places human activity into a long-term historical perspective, namely the circular economy (Bonciu, 2014). Geissdoerfer, *et al.* (2017) explained the definition of circular economy as follows: "...a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling." From the description above, in dealing with the waste problem, the importance of shifting the paradigm of the linear economy towards a circular economy cannot be ruled out anymore.

There are four forms of the economy as follows: **First**, Conventional Economics is degenerative or destructive with a mechanistic design, reductionist thinking, and dividing anything into small parts that seem to be unrelated. **Second**, Green Economy does less damage, though there is still damage. **The third** is a Sustainable Economy where there are no negative impacts at all. **Fourth**, a Restorative Economy that does not only stop all damage but begins to repair the damages created in the past (Parlan, 2021; Wartamu, 2021).

Then, the Ellen MacArthur Foundation formulates the principles of a Circular Economy. **First**, the design eliminates waste and pollution (no waste); **second**, it is certain that the products and materials can be used continuously (sustainable use); and **third**, the natural systems produced are regenerative (Parlan, 2021; Sundana, 2019).

Every country in the world has a waste problem. Every day, domestic and public domains create waste. Without special attention from relevant par-

ties, especially the government, this will become a serious problem. The biggest household waste is organic waste, such as food waste. Public places such as campuses, shopping centers, food corners, etc. also produce waste. The Republic of Indonesia's Minister of National Development Planning for the 2016-2019 period, Bambang Brodjonegoro, explained the serious threat related to food waste, where it can cause very serious Greenhouse Gas (GHG) emissions (LCDI Indonesia, 2021).

The zero-waste concept, which is a program from world organizations and the Indonesian government cannot run well, without the community's understanding that the waste problem is a shared problem and a shared responsibility of the community. People's mindset on "garbage" that is dirty, smelly, and is a source of disease, needs to be changed by instilling an understanding that garbage is a high economic commodity if it is used and managed properly. Zero waste principles, such as processing organic waste into compost, decomposer microorganisms, and recycling inorganic waste into vertical media may also bring income to the community (Fermin, *et al.*, 2020).

In West Nusa Tenggara (WNT) Province, Indonesia, the provincial government has made several efforts to realize the vision of "Realizing a Glorious WNT". One of its missions that correlates with this research is to realize a beautiful and sustainable WNT. In doing so, the provincial government has issued some regulations, including the Governor of West Nusa Tenggara Province Regulation Number 14 of 2020 concerning Regional Policies and Strategies in Waste Management and West Nusa Tenggara Provincial Regulation Number 5 of 2020 on Waste Management (Djalilah, 2021). In WNT's capital city, Mataram, the city government issued Regional Regulation Number 1 of 2019 concerning Waste Management. The Environmental Service of WNT in 2018 stated that the highest rate of waste is generated from households (62%), followed by traditional markets (13%), commercial centers (7%), and offices (5%), public areas (4%), and public facilities (3%). The rest (6%) is generated from other sources. If accumulated, the waste produced in WNT Province is 2,605 megagrams/day (Djalilah, 2021).

The regulations issued by the provincial government must certainly be accompanied by the awareness of communities. Implementation of regulations regarding waste through government pro-

grams, starting from the provincial to the village levels through the socialization of the circular economy paradigm, is the initial capital to realize the vision and mission of the WNT Provincial government, one of which is zero waste. The realization of waste reduction in WNTas of November 2020 was 7.03% or 183.27 megagrams of managed waste through waste banks, bio pore pits, bio pore wells, composters, Reuse-Reduce-Recycle Waste Management, Independent Black Soldier Fly, household waste management (Lantana Garden), National Adiwiyata School (Public Senior High School 1 Gerung), independent waste management, from a total of 2,605 megagrams of waste. In WNT Province, there are currently 466 waste banks spread across districts and cities (Djalilah, 2021).

Socialization of waste management to the community is no easy task. People's mindset and paradigm on "waste" which has no "value", must be supported by regular and sustainable socialization. There must be counseling and education services in schools, villages, and households as the largest producer of waste. The waste in landfills will keep on accumulating if the community's waste management has not shifted from the paradigm of linear to the circular economy.

The socialization of waste sorting must also be supported by the adequate availability of trash bins, the timeliness in picking up the garbage, and the application of the sorting rules from the starting point of picking up the garbage to the waste management site. In this case, the garbage transport officers must be given education, so that when picking up waste from a certain point, the organic and inorganic waste that is already sorted by the community will not be mixed again.

Waste separation can be the first step in utilizing existing waste and in shifting the waste management paradigm, from a linear economy to a circular economy. This research focuses on waste management within the campuses and urban areas. The campus environment is one of the places that produce waste, both organic and inorganic ones that can be economically used. The involvement of students in waste-sorting activities is an effort to instill awareness of the academic community, especially students, in managing the waste that is produced every day on campus. Raising awareness and inviting young people to be involved in waste management can start early as possible from elementary school students to university students (Kristianto,

2020a). The waste audit activity on campus, which has been carried out with the academic community at Universitas Muhammadiyah Mataram, WNT, Indonesia, can be the starting point for the birth of internal university regulations on proper waste management to create a healthy, clean, and beautiful campus environment. In addition, it is also to facilitate students to obtain the economic value of waste management, so that students have "garbage" savings that can be used to pay tuition fees, etc. Thus, this research studies the paradigm shift of waste management in campus and urban communities from a linear economy to a circular economy.

## Materials and Methods

This research uses the socio-legal research method. It is a combination of doctrinal and empirical legal research methods (social science methods). Thus, the researchers carry out the literature review and field studies (Irianto, 2009). The sociolegal approach provides understanding and context for the social and political configurations that affect the law and then its implementation. This method is required to answer the problems of social injustice. It also allows the testing of whether or not the law is working and the effectiveness and usefulness of the role, authority, and constructive efforts of legal reform. The socio-legal research method provides an effort to answer the gap between the ideal norms and social reality (Wiratraman, 2021). The qualitative method in this study describes the condition of the community in dealing with the daily problem of waste. The existing regulations need to be supported by a more comprehensive introduction to waste sorting, proper and correct waste management, and the shift from the linear economy to the circular economy paradigm. This is so that the people of Mataram City and the campus community feel the benefits and value from organic and inorganic waste.

## Results and Discussion

### Educational and Economical Values of Waste Sorting Activities

It is important to separate waste and introduce it to students as the younger generation. This is because, on campuses, which is a place to study, people seek knowledge, but sometimes they forget a very useful lesson for the future, namely keeping the campus





Fig. 1. Students sort out waste accompanied by lecturers

environment clean and healthy. The students and academia must understand the condition of waste in WNT province, to increase their awareness. The Environmental Service of WNT Province in 2020, states that out of 975848.34 megagrams of waste per day in the landfills, only 980.33 megagrams/day or around 37.63% can be handled.

The students were enthusiastic about sorting out waste though they are usually identical with a neat and clean appearance. The assistance provided by lecturers also went well. They sorted waste at several points that are used as samples.



Fig. 2. The waste is sorted out by students accompanied by lecturers

The waste audit at Universitas Muhammadiyah Mataram was carried out at three locations, namely, the Faculty of Islamic Religion, the Faculty of Law, and the Canteen for seven days. It resulted in 168,77 kg of waste with various types including recycled plastic waste, paper/cardboard, residuals, and organic garbage. The volume of organic waste was 71.19 kg (42%), the volume of plastic waste/packaging was 19.62 kg (12%), the volume of recycled plastic waste was 15.95 kg (9%), the volume of paper/

cardboard waste was 19.95 kg (12%), and lastly, the volume of residual waste was 42.05 kg (25%) (Astini, 2021). The volume of waste based on the location is: the volume of waste in the Faculty of Law was 92.24 kg (55%), the volume of waste in the Faculty of Islamic Religion was 48.09 kg (17%), and then, the volume of waste in the canteen was 28, 44 kg (17%) (Astini, 2021).

The waste sorting activity conducted at three sample locations at the Universitas Muhammadiyah Mataram which was conducted for 7 days, shows that organic waste has a fairly high volume with a percentage of 42%. If processed, organic waste can be transformed into useful products such as liquid fertilizer, animal food, etc. Recycled plastic waste can be turned into simple handicrafts, such as plant media, stationery holders, plastic plates, plastic sandals, and so on.



Fig. 3. Product waste innovation with economic value

The introduction and education of waste management and sorting activities in the context of a circular economy can be carried out as early as possible, starting from the level of playgroup, kindergarten, and elementary school. Children who are familiar with this activity can sort waste such as waste snacks, candy, ice cream, ready-to-drink milk, etc. properly. The principle of the circular economy needs to be introduced to schools to reduce the daily waste load and to create a healthier and cleaner school environment (Astini, 2021).



Fig. 4. Waste sorting activities involving elementary school students

Apart from that, what is no less important is the marketing of the produced recycled products. Quality skills in recycling waste are required to increase the product value so that it can be marketed. Therefore, training and coaching must be carried out continuously and sustainably. There must also be the strengthening of networks and partners in the marketing scope (Septyanun, 2021a).

### Shifting the Waste Management Paradigm from a Linear Economy to a Circular Economy

The concept of the linear economy only focuses on human activities without paying attention to the concept of environmental protection (Purwanti, 2021). One of the economic models offered is the circular model, where goods that have been consumed are reprocessed (Reduce, Reuse, Recycle, Replace, Repair). This circular economy concept is said to be the antithesis of a production economy that emphasizes linear calculations. So, there are elements that are depressed due to continuous production (Purwanti, 2021).

The results of the survey on waste management conducted to people of Mataram city and the Universitas Muhammadiyah Mataram academic com-

munity are shown in the following flow charts (Septyanun, 2021b).

Judging from the results of the survey above, the millennial generation students are expected to carry out sustainable approaches through the implementation of the Student Study Services program, such as by educating people on waste management and carrying out circular economy-based waste management.

Regarding the types of food and beverages that are most often consumed, in the campus environment, packaged rice dominates with a percentage of 65.8%, while drinks in plastic packaging are also

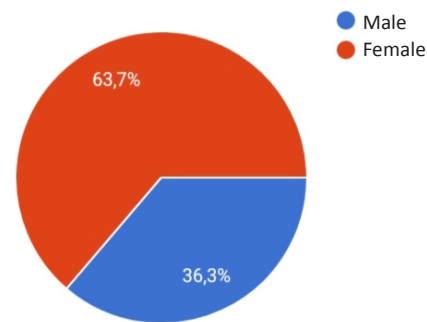


Fig. 5. The gender of survey respondents

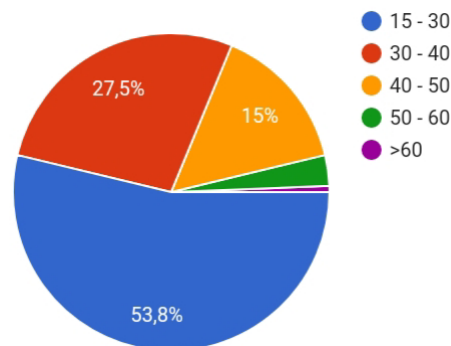


Fig. 6. Educational qualifications of the survey respondents

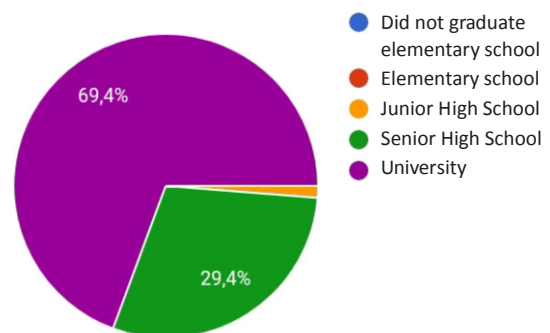


Fig. 7. The age range of the survey respondents

quite high, with a percentage of 49.4%. In the domestic environment, packaged rice also dominates with a percentage of 48.7% and followed by plastic packaged drinks (46.2%). From this data, rice waste and plastic bottle waste can both be utilized. Both organic and inorganic waste have economic potential (Septyanun, 2021b).

Today's society needs to be educated on how to treat waste properly, correctly, and regularly. There needs to be socialization from all related parties. There needs to be the cooperation of various parties, both government and private, both inter-sectoral or cross-sectoral, educational institutions in building public awareness and understanding, to take part in supporting government programs to create a clean, healthy, and beautiful environment.

As for the survey conducted to respondents regarding their understanding of waste sorting, 96.3% of respondents agree that waste sorting and management is necessary (Septyanun, 2021b). An understanding of the waste sorting process includes the understanding of the purpose of the sorting (Kristianto, 2020b). Individuals and groups in the community must understand the waste sorting process from the beginning to the end. The public must understand how the waste is sorted by type, where it will be taken, and to whom it will be handed over. If the people wish to recycle the waste themselves, they must also understand the process of producing the goods in question. So, there must be short-, medium-, and long-term socialization and education programs from related parties.

Socialization and education programs have the aim to reduce the volume of waste and to generate value from waste. The community must manage waste through waste banks that have a good banking management concept. People who save — referred to as bank customers — can have a savings book and borrow money (Ariani, 2021). Such a concept can improve the community's economy through waste management in the future. Garbage which was initially considered useless can provide financial income. The regulation of waste management activities is also very much needed to support activities and to improve the community's economy through waste management.

There is an urgent need for regulations regarding waste sorting and management from the smallest environment, such as in households and campuses. Sometimes, people need regulations to bring order to themselves, although there are also people who

depart from self-awareness and the self-will to be orderly (without having to be afraid of rules and sanctions). Regarding this regulation, through a survey that has been conducted on several respondents in campuses and the urban community in Mataram City, 72% of urban area respondents stated that there is a need for waste regulations in their environment and 72% of academia respondents stated that there is a need for waste regulations in the campus environment (Septyanun, 2021b).

The WNT provincial government has carried out maximum efforts in addressing and dealing with solid waste problems in its cities and regencies. It has provided funding, facilities, and infrastructure that support the government's zero waste program. It also provides trash cans, garbage transport cars, landfills, and other instruments to support sustainable environmental restorative activities.

Rosihan explained that the waste management budget for 2021 was Rp. 62,793,464,000. In its realization, the budget used was Rp. 45,263,112,057 with a percentage of 72.08% (Rosihan, 2021). Then, the 2022 budget plan for waste management, namely the environmental quality program is Rp. 175,165,635,000. In detail, the budget for waste management activities is Rp. 78,025,000,000, hazardous waste management is 9,685,000,000, waste management is Rp. 69,765.635,000, and the contamination recovery and hazardous waste emergency response is Rp. 17,690,000,000 (Rosihan, 2021). From the implemented budget and the budget plan, it can be seen that the government has great concern over the environment, especially waste management. The budget for the environment, regulations issued by the government, and public awareness to keep the environment clean, healthy, beautiful, and sustainable, must synergize properly. This is so that environmental and waste management activities bring good feedback and impacts to the present and future generations. Socialization and training for the community are still needed to change people's behavior in using their goods until they are decided to become waste. During the COVID-19 pandemic, domestic waste production has increased dramatically compared to the waste produced from offices, schools, or shopping centers. This condition shows that efforts must be made to change people's behavior that supports waste-free development everywhere (Handawati and Mataburu, 2020).

Waste sorting will certainly bring economic benefits to the community, as the sorted waste can be

reused, starting from depositing it into waste banks, to recycling it into financially valuable products. For example, in Bendungan Bogor Village, the eco-villages program has helped villagers gain economic benefits from wastecleaning up the environment (Wiradimadja *et al.*, 2018). The education on waste management and sorting, must not only be given to the community, from households, campuses, markets, and so on, but also to the garbage collectors. Garbage collectors must carry out their duties properly by maintaining the garbage that has been sorted by the residents and making sure that they safely reach the destination. Garbage collectors are not allowed to mix up the sorted waste again when putting it into the garbage truck, as residents have complained about such events. The residents feel that they are making a futile effort by sorting the waste according to its type because, during transportation, the waste is mixed again.

The circular economy provides innovative and revolutionary concepts that oppose traditional manufacturing and consumption processes. Goods are produced using recyclable materials, so that the waste may also generate income (Darmastuti *et al.*, 2021). Such a concept must continue to be developed. Good and productive waste management can be an oasis for the community amid the current COVID-19 pandemic. The utilization of waste with the concept of a circular economy will create a clean environment and generate income. Garbage, which is identical to something dirty, can be a source of livelihood for anyone in this country. After starting from the household level, we can invite the surrounding community to carry out waste management properly and correctly.

## Conclusion

Based on the results of the research, campus and urban communities already have concerns over waste management activities. However, there still needs to be comprehensive support from various parties, in providing waste management training and in introducing waste banks. Support for the government's zero waste program will shift in the paradigm of community waste management from a linear economy to a circular economy.

The governor's regulation and regional regulations concerning waste management must be followed up by public awareness. The inclusion of criminal sanctions in the form of reduced penalties

and fines in the regulation will not be effective if it is not supported by autonomous awareness from the community. Re-instilling a culture of cleanliness needs to start from the educational environment, as was done through this research. It is hoped that in the future, there will be a circular economy study center in Universitas Muhammadiyah Mataram. This study center can be a model for sharia-based waste management in WNT. In addition to the study center, the existence of a central Islamic waste bank/unit in Universitas Muhammadiyah Mataram is also needed. The organ will be focused on circular economic activities in managing the shares in the campus and the city.

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## Conflict of Interest

The authors declare that there is no conflict of interest in this research.

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