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From Waste to Wealth: Sustainable Business Innovations Driving Waste Management in Kerala

Arun M S [1]*

ABSTRACT

The rapid rise in population growth, urbanization and changes in consumers' consumption patterns has caused an increase in volume of waste produced. The increasing volume of waste creates a number of environmental and economic problems and requires that sustainable waste management practices are put into place. The current study, "From Waste to Wealth: Business Innovations in Sustainable Waste Management in Kerala", identifies how innovative business practices are transforming waste into a valuable resource leading to sustainable development. This study seeks to determine the level of public awareness and perception regarding the waste-to-wealth concept; to evaluate the current level of public participation in implementing sustainable waste management practices; to examine the use of sustainable business practices; to identify some of the barriers to implementing waste-to-wealth initiatives; and to analyse what role public perception, participation and growth of the waste-to-wealth business models. The research method used for this study included both descriptive and analytical research design, and involved the collection of primary data from 160 respondents through structured questionnaires as well as the collection of secondary data from books, journals, reports, and government publications. A variety of analysis including mean percentage analysis technique, ranked analysis technique, weighted average score analysis, and chi-square test were used to analyse the collected data. The outcome of the research revealed that the majority of respondents are aware of the waste-to-wealth initiatives and approved positively regarding their implementation with a high level of participation in activities such as waste segregation, recycling, composting, and reuse. The research has revealed that sustainable business innovation, such as plastic recycling companies, composting plants, biogas production facilities, and e-waste recycling centers, are a significant contributor to productive waste management and resource recovery. The most common impediments to the development of waste-to-wealth businesses were identified as financial limitations, low levels of public awareness, insufficient demand from the market for recycled products, limited government help, and limited access to technology. Furthermore, there is a significant correlation between how the public views and engages with sustainable waste management activities. The research finds that by enhancing financial assistance, creating greater awareness, providing more resources for technological improvement, adjusting policy initiatives to support ecological growth, and providing more opportunities in the marketplace for products made from

[1] Assistant Professor, P.G. Department of Commerce, Sree Vivekananda College, Kunnamkulam, Thrissur Dt, Affiliated to the University of Calicut, Kerala and Research Scholar, Research Department of Commerce, St Joseph's College (Autonomous), Irinjalakuda, Thrissur Dt, Kerala, Affiliated to the University of Calicut, Kerala
*Corresponding Author

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recyclable materials, waste-to-wealth innovative businesses will grow and create a lasting circular economy throughout Kerala and Thrissur District.

Keywords: *Waste-to-Wealth, Sustainable Business Innovations, Waste Management, Circular Economy, Recycling, Resource Recovery, Public Participation, and Kerala*

Rapid population growth, urbanization, industrialization, and shifts in consumption have drastically increased global waste. Traditional collection and disposal methods are becoming unsustainable because of their harmful effects on the environment, economy, and society. So, there's been a push towards "Waste to Wealth." Instead of seeing waste as a problem, this idea looks at it as something useful for creating jobs, economic benefits, and protecting the environment. It follows circular economy principles that stress recycling, reuse, and sustainable production.

Kerala's high literacy rate and solid local self-governance make it stand out. The state's moved forward with managing waste in eco-friendly ways. They've pushed this through initiatives like the Haritha Keralam Mission, Suchitwa Mission, Clean Kerala Company, and Haritha Karma Sena. Thanks to these programs, waste management now aids in creating jobs, supporting livelihoods, and keeping the environment green. Plus, Haritha Karma Sena helps communities by having women collect, separate, and recycle trash. This project rocks because it cleans up while empowering locals. In Kerala, turning waste into wealth is getting more attention. Local governments, private firms, startups, and communities are looking at new ways to use waste. They turn organic scraps into compost, bio-fertilizers, and biogas. Plastic, paper, glass, metal, and e-waste get collected and reused too. New projects focus on collecting e-waste, making fancy recycled items, and adopting a circular economy. This reduces damage to the environment and creates income streams.

Thrissur District, known as the cultural capital of Kerala, is a great place to look at sustainable business ideas in waste management. It's got cities, towns, commercial zones, and rural areas all mixed together, creating different kinds of trash. Because of projects focused on waste management, along with the work of local groups and government bodies, resource recovery and businesses centered around waste have really picked up. They've built material recovery facilities and recycling centers too. With its push towards being eco-friendly and supporting startups, Thrissur shows us how clever business plans can turn garbage into gold, economically speaking. The study titled "From Waste to Wealth: Sustainable Business Innovations Driving Waste Management in Kerala – with Special Reference to Thrissur District" looks at new business ideas, startup projects, and green practices that help manage waste better. It wants to see how turning waste into wealth creates jobs, boosts the economy, conserves the environment, and encourages sustainability. Plus, it plans to check out how government groups, local councils, private firms, and community teams work together to build a circular economy and improve trash management in Thrissur District.

STATEMENT OF THE PROBLEM

Kerala has made huge strides in waste management thanks to government programs and community efforts. But, rapid urbanization, a growing population, shifting lifestyles, and consumerism mean there's more complex waste than ever before. This creates real environmental and economic issues. Lots of waste isn't being used properly, which means wasted resources, more pollution, and higher management costs. While some areas turn waste into revenue through recycling and a circular economy, we don't fully know how successful,

scalable, or economically sound these endeavors are. Thrissur District produces all sorts of waste from homes, businesses, schools, and factories. There's major potential here to transform this into value through creative, sustainable business practices. Unfortunately, things like limited tech use, financial troubles, and uneven community involvement hold these efforts back. So, we should look at what drives waste management in Kerala, focusing on Thrissur. We want to figure out how these initiatives convert waste into profit, boost the environment, create jobs, and help develop a circular economy.

IMPORTANCE OF THE STUDY

The current study, "From Waste to Wealth: Sustainable Business Innovations Driving Waste Management in Kerala" really stands out because of growing environmental worries, more waste, and the big need for sustainable growth. Traditionally, we manage waste by collecting and dumping it. But the waste-to-wealth idea aims higher—it focuses on turning garbage into useful resources through a circular economy. This research is crucial since it explores how new biz models and entrepreneur efforts can create valuable goods and services from trash, all while tackling eco-issues.

Objectives of the study

1. To assess public awareness and perception of the waste-to-wealth concept in Kerala.
2. To evaluate the extent of public participation in sustainable waste management practices.
3. To examine the role of sustainable business innovations in promoting waste-to-wealth initiatives.
4. To identify the major barriers that hinder effective waste-to-wealth innovations in Kerala.
5. To analyse the relationship between public perception, participation, and the growth of waste-to-wealth business models.

Hypothesis of the study

H_0: There is no significant relationship between public perception towards waste-to-wealth initiatives and participation in sustainable waste management practices.

RESEARCH METHODOLOGY

1 Research Design

The study "From Waste to Wealth: Sustainable Business Innovations Driving Waste Management in Kerala – With Special Reference to Thrissur District" takes a descriptive and analytical approach. It looks at current waste management practices and initiatives that turn trash into treasure. The study not only describe what's going on but also analyze its economic, environmental, and social effects. It figures out what makes these efforts successful or unsuccessful too.

2 Population

The population consists of people who are residing in Thrissur District of Kerala State.

3 Sample size

The sample size includes 160 respondents who are residing in Thrissur District of Kerala State.

4 Sampling Technique

Purposive sampling method has been used for selecting samples from the population. Samples were selected purposively from the residents who are residing in Thrissur District of Kerela State.

5 Sources of Data

Primary Data

Primary data were collected through a self-administered questionnaire from the people who are residing in Thrissur District of Kerela State.

Secondary Data

Secondary data were collected from various journals, websites etc related to waste management.

6 Tool used for data Collection

Questionnaire is the tool used for collecting data from the respondents.

7 Tools used for Analysis

Both Mathematical and Statistical tools have been used in this study for analysing the data collected. Mathematical Tools like simple percentage analysis and Weighted Average Method has been used in this study. Statistical tool, Chi-square has also used for analysis purposes.

8 Tool used for presentation of data

Tables are used for presenting the data analysed.

ANALYSIS OF THE DATA

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	No. of Respondents	Percentage
Gender	Male	92	57.5
	Female	68	42.5
	Total	**160**	**100**
Age	Below 25 years	28	17.5
	25–35 years	52	32.5
	36–45 years	38	23.8
	46–55 years	26	16.2
	Above 55 years	16	10.0
	Total	**160**	**100**
Educational Qualification	SSLC	24	15.0
	Plus Two	36	22.5
	Undergraduate	58	36.3
	Postgraduate	34	21.2
	Others	8	5.0
	Total	**160**	**100**
Occupation	Government Employee	22	13.7
	Private Employee	48	30.0
	Business	35	21.9

Demographic Variable	Category	No. of Respondents	Percentage
	Student	28	17.5
	Others	27	16.9
	Total	**160**	**100**
Monthly Income	Below ₹25,000	32	20.0
	₹25,001–₹50,000	48	30.0
	₹50,001–₹75,000	38	23.8
	₹75,001–₹1,00,000	24	15.0
	Above ₹1,00,000	18	11.2
	Total	**160**	**100**
Area of Residence	Urban	94	58.8
	Rural	66	41.2
	Total	**160**	**100**

Source: Primary Data

The demographics show that most respondents are men (57.5%), aged 25-35 (32.5%). Many have an undergrad degree (36.3%), and lots work in the private sector (30.0%). When it comes to money, many earn between ₹25,001 and ₹50,000 monthly (30.0%), while others bring in ₹50,001–₹75,000 (23.8%). Most live in cities (58.8%), highlighting how important waste management and sustainable business ideas are becoming in Thrissur's urban areas.

Table 2: Awareness of the Waste-to-Wealth Concept among Respondents

Awareness Level	No. of Respondents	Percentage (%)
Highly Aware	42	26.3
Aware	58	36.2
Moderately Aware	35	21.9
Slightly Aware	18	11.2
Not Aware	7	4.4
Total	**160**	**100**

Source: Primary Data

The table shows that most people have heard of the waste-to-wealth idea. From the 160 people who were asked, 58 (36.2%) said they were aware of it, and 42 (26.3%) said they were highly aware. Combined, that's 62.5% of people who've at least heard of this, showing decent public awareness about such programs in Kerala. Another 35 folks, or 21.9%, had a moderate understanding, meaning they know something but aren't experts. Yet, 18 people (11.2%) were just slightly aware, and an even smaller group, 7 people (4.4%), hadn't heard of it at all. Overall, it looks like lots of folks know about turning trash into treasure, which could boost their involvement in recycling programs and help create new waste-related businesses in the Thrissur District.

Table 3: Public Perception towards Waste-to-Wealth Initiatives

Perception	No. of Respondents	Percentage
Strongly Positive	46	28.8
Positive	61	38.1
Neutral	28	17.5
Negative	17	10.6
Strongly Negative	8	5.0
Total	**160**	**100**

Source: Primary Data

The table shows that most people have a really good view of waste-to-wealth programs. Out of the 160 people who answered, 61 (or 38.1%) had a positive view, and 46 (which is 28.8%) felt very positive about it. Combined, that means 66.9% of the folks surveyed like these programs, pointing to strong public support in Kerala. Now, 28 respondents (that's 17.5%) didn't have a strong opinion either way. On the not-so-positive side, 17 folks (10.6%) thought negatively, and a smaller group of 8 people (5%) were strongly against it. These results show that many recognize the good these programs can do for the economy, environment, and society. Since there's such positive public opinion, it looks like things are set up well for growing sustainable businesses and expanding waste-to-wealth projects in Thrissur District and all throughout Kerala.

Table 4: Extent of Participation in Sustainable Waste Management Practices

Participation Level	No. of Respondents	Percentage
Very High	39	24.4
High	52	32.5
Moderate	36	22.5
Low	21	13.1
Very Low	12	7.5
Total	**160**	**100**

Source: Primary Data

The table indicates that a good number of people participate in sustainable waste management. With 160 total participants, 52 (32.5%) had a high level of involvement and 39 (24.4%) showed a very high level of involvement. This adds up to 56.9% of folks doing their part with activities like recycling, composting, and proper waste segregation. On top of that, 36 respondents (22.5%) were moderately involved, showing they're still helping out. However, some individuals weren't as engaged. A smaller group of 21 (13.1%) showed low participation, while another 12 respondents (7.5%) displayed a very low involvement in these eco-friendly practices. These numbers indicate that most folks are eco-minded and participating in ways that turn waste into something beneficial, which is happening more in Kerala these days. Yet, we still see room for improvement. There's clearly a need for more awareness programs and possibly incentives to get everyone onboard with making our waste management practices truly sustainable.

Table 5: Weighted Average Score Analysis of Sustainable Waste Management Practices

Waste Management Practice	Total Weighted Score	Weighted Average Score	Rank
Waste Segregation at Source	706	4.41	I
Recycling	664	4.15	II
Reuse of Materials (3R Practices)	628	3.93	III
Composting	591	3.69	IV
Participation in Haritha Karma Sena Programmes	564	3.53	V
Purchase of Recycled Products	511	3.19	VI

Source: Primary Data

The weighted average scores show that waste segregation at source is the most popular sustainable waste management practice, scoring 4.41. Recycling comes second at 4.15, and reusing materials follows with 3.93. Composting and joining Haritha Karma Sena activities are fourth and fifth. Buying recycled products gets the lowest score, 3.19, suggesting lower

consumer interest there. So, people are more into basics like segregation and recycling, but we need to boost awareness for market-related green actions.

Table 6: Role of Sustainable Business Innovations in Waste-to-Wealth Initiatives

Opinion	No. of Respondents	Percentage
Very Significant	51	31.9
Significant	59	36.9
Moderately Significant	28	17.5
Less Significant	15	9.4
Not Significant	7	4.3
Total	**160**	**100**

Source: Primary Data

The table shows that folks in Kerala think sustainable business innovations are really important for turning waste into wealth. From 160 people surveyed, 59 (36.9%) thought the role was significant, and 51 (31.9%) said it was very significant – totalling 68.8%. Clearly, most people believe that new business models can help with managing waste and recovering resources. Additionally, 28 folks (17.5%) found the role to be somewhat significant, showing an overall positive view. On the flip side, only 15 (9.4%) saw it as less important, and just 7 people (4.3%) believed it wasn't significant at all. These results tell us that there's a lot of faith in things like recycling, composting, biogas production, e-waste management, and upcycling. People get that these innovative business practices aren't just good for the environment but also for creating jobs and boosting the circular economy in Thrissur District and Kerala.

Table 7: Most Influential Business Innovations in Waste Management

Innovation	Respondents	Rank
Plastic Recycling Enterprises	132	I
Composting and Organic Fertilizer Units	125	II
Biogas Production Units	118	III
E-waste Collection and Recycling	112	IV
Upcycled Product Manufacturing	104	V

Source: Primary Data

The table ranks sustainable business innovations according to how influential people think they are for turning waste into wealth. Plastic Recycling Enterprises came out on top, favored by 132 respondents. This clearly shows it's seen as the biggest help in handling waste management and generating economic value from trash. Coming in at number two were Composting and Organic Fertilizer Units, chosen by 125 people. This spotlight growing interest in converting organic waste into helpful farm materials. Third place went to Biogas Production Units, picked by 118 respondents, showing how important it is to turn biodegradable garbage into green energy. Right after that, E-waste Collection and Recycling snagged fourth place with 112 backers, pointing to increased attention on managing e-waste. Rounding out the list, Upcycled Product Manufacturing was fifth with 104 supporters, highlighting its role in changing thrown-out stuff into goods that fetch a better price. From this, we learn that folks think recycling and resource-focused business ideas are driving forces behind turning waste into wealth in Kerala. Top marks for plastic recycling, making compost, and producing biogas show folks get how good these are for the planet and the economy. Not only do these projects lessen landfill use and environment but also create employment opportunities, promote entrepreneurship and contribute to the development of sustainable circular economy.

Table 8: Major Barriers to Waste-to-Wealth Innovations

Barriers	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Lack of Public Awareness	58	49	23	18	12	160
Inadequate Government Support	52	48	30	18	12	160
Financial Constraints	65	43	24	17	11	160
Limited Technological Access	47	51	29	21	12	160
Weak Market Demand for Recycled Products	54	46	27	20	13	160

Source: Primary Data

Based on respondent feedback, several barriers impede successful implementation and expansion of waste-to-wealth initiatives throughout Kerala. Most respondents either strongly agree or simply agree with one or more of the several items that were identified as significant barriers to the success of waste-to-wealth initiatives. One major barrier identified is financial constraints – there were 65 respondents who strongly agreed and 43 who agreed with the premise that a lack of funding and investment opportunities is a significant barrier to establishing and expanding waste-based businesses. A second barrier to success is the lack of public awareness; there were 58 respondents who strongly agreed and 49 who agreed that insufficient knowledge about waste-to-wealth practices impacts public participation and acceptance. Respondents also see weak market demand for recycled products as a significant barrier; most respondents agree that limited consumer preference for recycled products is a limitation on the growth of waste-based businesses. Another major barrier is limited government support; in addition, limited access to technology is also a barrier. Therefore, it is concluded that stronger policy interventions; financial incentives; infrastructure development; and technology assistance are required to facilitate long-term success of waste-to-wealth innovations in Kerala. Hence, while Kerala has a significant capacity to create sustainable waste-to-wealth innovations, the elimination of financial, technological, institutional, and awareness-related barriers is critical to ensuring their long-term sustainability and success.

Table 9: Ranking of Barriers to Waste-to-Wealth Innovations

Barrier	Mean Score	Rank
Financial Constraints	4.21	I
Lack of Public Awareness	4.08	II
Weak Market Demand	3.95	III
Inadequate Government Support	3.89	IV
Limited Technological Access	3.76	V

Source: Primary Data

The above table provides a ranking of the main obstacles to the successful venture of waste-to-wealth initiatives by their average (mean) scores. By far the greatest barriers as defined by the respondents were financial limitations. Financial limitations received the highest average score of 4.21 meaning that lack of financial resources, lack of access to financing, and lack of investment opportunities are viewed as the largest barriers to waste-to-wealth enterprise growth. The second largest barrier is lack of public awareness, with an average score of 4.08, meaning that the public is not adequately knowledgeable or understanding of waste-to-wealth concepts. As a result, they are not participating or supporting waste-to-wealth initiatives. The third largest barrier is weak

market demand for recycled goods with an average score of 3.95. Respondents are concerned about consumers accepting recycled goods and whether or not there is a viable commercial market for such products. The fourth largest barrier is lack of government assistance, with an average score of 3.89. Respondents view a strong policy framework, incentives, and institutional support as necessary in order to promote waste-based entrepreneurship. Finally, the fifth-largest barrier is limited access to technology with an average score of 3.76. Limited access to technology considered a barrier, is viewed as less significant than the financial and awareness barriers.

Table 10: Relationship between Public Perception and Participation

Public Perception	Low Participation	Moderate Participation	High Participation	Total
Negative	18	7	0	25
Neutral	8	15	5	28
Positive	7	34	66	107
Total	**33**	**56**	**71**	**160**

Source: Primary Data

H_0: There is no significant relationship between public perception towards waste-to-wealth initiatives and participation in sustainable waste management practices.

H_1: There is a significant relationship between public perception towards waste-to-wealth initiatives and participation in sustainable waste management practices.

Table 10.1 Observed Frequency

Public Perception	Low Participation	Moderate Participation	High Participation	Total
Negative	18	7	0	25
Neutral	8	15	5	28
Positive	7	34	66	107
Total	**33**	**56**	**71**	**160**

Source: Primary Data

Table 10.2 Expected Frequency

Public Perception	Low Participation	Moderate Participation	High Participation	Total
Negative	5.16	8.75	11.09	25
Neutral	5.78	9.80	12.43	28
Positive	22.06	37.45	47.49	107
Total	**33**	**56**	**71**	**160**

Source: Primary Data

Table 10.3 Chi-Square Calculation Table

Public Perception	O	E	$(O-E)^2/E$
Negative–Low	18	5.16	31.94
Negative–Moderate	7	8.75	0.35
Negative–High	0	11.09	11.09
Neutral–Low	8	5.78	0.85
Neutral–Moderate	15	9.80	2.76
Neutral–High	5	12.43	4.44

Public Perception	O	E	$(O-E)^2/E$
Positive–Low	7	22.06	10.28
Positive–Moderate	34	37.45	0.32
Positive–High	66	47.49	7.22
Total χ^2 Value			**69.25**

Source: Calculated from Primary Data

Calculation of Degrees of Freedom

df = (r-1) (c-1)

= (3-1) (3-1)

= 4

Table Value at 5% Level = 9.488

The calculated Chi-square value of 69.25 exceeds the critical value of 9.488 at the 5% level of significance for 4 degrees of freedom. So, we reject the null hypothesis and accept the alternative one instead. This shows that public perception about waste-to-wealth programs significantly influences participation in sustainable waste management. People with positive views are way more likely to segregate waste, recycle, and compost. Thus, boosting awareness and promoting positive attitudes could really amp up community involvement. This would help make sustainable waste management efforts much more successful in Thrissur District, Kerala.

FINDINGS OF THE STUDY

1. The findings of the study indicate that public awareness, positive perception, and active participation are essential elements that help to successfully implement waste to wealth initiatives.
2. Innovations in Sustainable Business, including plastic recycling, composting, and biogas production, can create economic value from waste products. However, financial constraints and lack of awareness about waste-to-wealth enterprises remain significant barriers to the growth of these enterprises.
3. By enhancing public awareness about the opportunities for waste-to-wealth enterprises, expanding market opportunities, offering financial assistance, and developing more effective technological support; they can greatly enhance their effectiveness.
4. There is a clear opportunity to promote a Circular Economy in Thrissur District through the introduction of innovative and sustainable waste management solutions.

CONCLUSION

The purpose of this report, "From Waste To Wealth - Sustainable Business Innovations Driving Waste Management" is that waste disposal is a potential avenue for creating sustainable development through turning wastes into valuable economic resources. The results show that the majority of the participants were aware of the waste-to-wealth initiative and viewed it positively; therefore, they participated in the sustainable development projects dealing with waste, such as waste segregation, recycling, composting, and re-use of waste materials. In addition to government support programs aimed at creating sustainable businesses through waste management, businesses that operate using sustainable business innovations, such as plastic recycling, composting facilities, biogas production, and e-waste recycling, are important

to the creation of wealth. Despite the potential for businesses based on waste management to create wealth and employment in Kerala, the expansion of businesses based on waste management and the effective recycling of waste are hampered by several challenges, including a lack of financing, insufficient public awareness about the benefits of recycling, a weak market for recycled products, insufficient governmental assistance for the establishment and operation of businesses based on waste management, and limited access to appropriate technologies.

SUGGESTIONS

1. Increasing awareness of the waste-to-wealth concept through public education initiatives, such as regular workshops, campaigns and training sessions to educate the public on the concept and benefits of waste-to-wealth.
2. Encouragement of entrepreneurship through financial and technical support to businesses involved in recycling, composting, biogas, electronic waste management and upcycling of waste materials into marketable products.
3. Providing access to finance for start ups and innovative green businesses through low interest loans, subsidies, grants and innovative funding programs.
4. Building the foundation for a market for eco friendly and recycled products through consumer confidence building programs, eco labels, and procurement policies.
5. Developing governmental support and policy frameworks through supportive policies, streamlined procedures, and incentive programs for businesses involved in eco-friendly recovery.
6. Encourage Technological Development: Waste management systems can achieve functional solvency by implementing advanced methods of collection, sorting, recycling, and closing the loop of options through the enhancement of potential users of these technologies (local entrepreneurs; Waste Management Agencies).
7. Encourage Composting and Biogas Projects: Emphasis should be placed on the organic component of waste through the use of mechanical and household composter and biogas projects as a means of reducing how much goes to landfill and enabling the production of renewable energy.
8. Encourage PPP Collaborations: Partnerships between local governments, private sector entities, NGOs, and community organizations would improve the delivery of infrastructure, investment, and innovative systems to improve systems for managing waste.
9. Enhance Haritha Karma Sena and Community Models: Community-based initiatives need to be improved by providing better wages/rates of pay, establishing better systems of training, providing appropriate equipment, and providing institutional support.
10. Educate on Waste Management: Education regarding environmental responsibility and the concept of waste to wealth should be included in educational curriculum at both the primary and secondary levels to develop habits of responsibility towards waste management for generations to come.
11. Promote Research and Development: Universities, research institutions, and members of the waste/recycling industry should conduct research to develop new technologies for utilizing waste; applying best practices within a circular economy; and developing viable business models to maximize the impact of the waste to wealth strategy.

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Conflict of Interest
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