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PREFACE

Management is an art of getting things done through and with the people in formally organized groups. It is an art of creating an environment in which people can perform and individuals and can co-operate towards attainment of group goals. Management Study HQ describes Management as a set of principles relating to the functions of planning, directing and controlling, and the application of these principles in harnessing physical, financial, human and informational resources efficiently and effectively to achieve organizational goals. A good management is the backbone of all successful organizations. And to assist business and non-business organizations in their quest for excellence, growth and contribution to the economy and society, Management Book Series covers research knowledge that exists in the world in various management sectors of business through peer review chapters. This book series helps company leaders and key decision-makers to have a clear, impartial, and data-driven perspective of how factors will impact the economy moving forward and to know what they should be doing in response. It also focuses on a range of issues but not limited to General Management

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CONTENTS

A STUDY ON DETERMINANTS OF STUDENT LOYALTY IN HIGHER EDUCATION

Abstract

Students are the primary stakeholders in higher education institutions (HEIs), and ensuring the quality of education and meeting their requirements and expectations is crucial for HEIs to remain competitive in the education market. This study aimed to identify the determinants of student loyalty in higher education. A descriptive and analytical study was conducted, randomly selecting 250 undergraduate students from Kannur University in Kerala. Statistical tools such as one-sample t-test and multiple regression were employed to analyze the data. The study results revealed that HEIs in Kerala place significant importance on various aspects of the academic program, including the quality of teaching, experience and qualifications of faculties, innovative teaching methods, curriculum relevance, and quality of academic facilities. Additionally, HEIs in Kerala have a positive reputation in the educational market, and students expressed satisfaction with higher education in the region. Students also exhibited a sense of belongingness and trust towards higher education institutions. The study also found that student satisfaction, institutional reputation, trust, and perceived quality significantly influenced students' loyalty towards higher education institutions. However, the sense of belongingness did not demonstrate a significant impact on student loyalty. The study highlights the importance of addressing student requirements and expectations, as well as ensuring the quality of education in HEIs.

Keywords: Loyalty, Satisfaction, Perceived Quality, Trust.

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I. INTRODUCTION

The higher education sector is experiencing a growing demand for quality education, driven by competition among institutions, the advancement of quality standards, and the increasing expectations of students. Factors such as globalization and digitalization have further intensified the need for high-quality education. In this highly competitive environment, every institution strives to foster student loyalty by offering excellent campus facilities, a wide range of student support services, and by employing qualified and experienced faculty members. Recognizing the significance of quality in higher education, the government has introduced various measures to ensure its maintenance. The University Grants Commission (UGC) in India, for instance, considers student satisfaction surveys as a key factor in assessing the quality initiatives undertaken by higher education institutions across the country. Consequently, modern-day HEIs place a strong emphasis on cultivating student loyalty through the fulfilment of student needs and expectations.

II. LITERATURE REVIEW

Various studies have been performed to determine the student's loyalty and satisfaction.(Babar & Rehman, 2010) concentrated on several factors including the courses offered, teachers' expertise, classroom facilities, and learning environment to understand. Among these factors, the study found that teachers' expertise had the most significant influence on student satisfaction. Student loyalty has a positive influence on student satisfaction, while student satisfaction also shows a positive influence on loyalty. Additionally, factors such as image, services, and perceived values have only an indirect effect on student loyalty (Kumudini, 2019)has been observed that the financial support and services provided by the university have a positive and direct impact on satisfaction. Loyalty also positively influences student satisfaction, and conversely, satisfaction has a positive effect on loyalty. These observations are based on the constructs of services, image, financial support, and perceived values. (Helena & Raposo, 2006) mentioned that Student satisfaction in higher education is primarily influenced by the institution's image, followed by its value, and then the perceived quality. Student loyalty is mainly built through word-of-mouth recommendations from student to student (Māris & Zaksa, 2012) pointed out that constructs such as study content, academic staff, readiness for the labour market, and acquired skills were correlated with students' perceived quality. These constructs have also been found to influence student loyalty.(Sepideh, Minavand, & Afshardost, 2013) observed that university facilities, advisory services, curriculum, tuition costs, and financial assistance positively influence the level of student satisfaction.(Jacqueline, McClelland, & Davies, 2008) mentioned that education managers should focus on important areas such as responsiveness, communication, and access.(Steluta Todea, Adriana AnaMaria Davidescu , Nicolae Al. Pop , & Tanase Stamule, 2022)Identified commitment was the crucial factor that directly affected student loyalty. (Wan & Chapman, 2023) focused on student satisfaction through different types of interactions among students. These interactions include formal student-student interactions, informal student-student interactions, and student-instructor interactions. The study examined several variables, including satisfaction with the program, teaching quality of lecturers, institution reputation, campus facilities, student support services, personal learning experiences, overall university experience, and the overall student life within the university. The aforementioned studies highlight the factors in higher education that have an influence on subsequent loyalty to the institution. Hence, the aim of this research is to investigate

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student loyalty in higher education within the specific context of Kerala, which is recognised as the most literate state in India.

III. OBJECTIVES OF STUDY

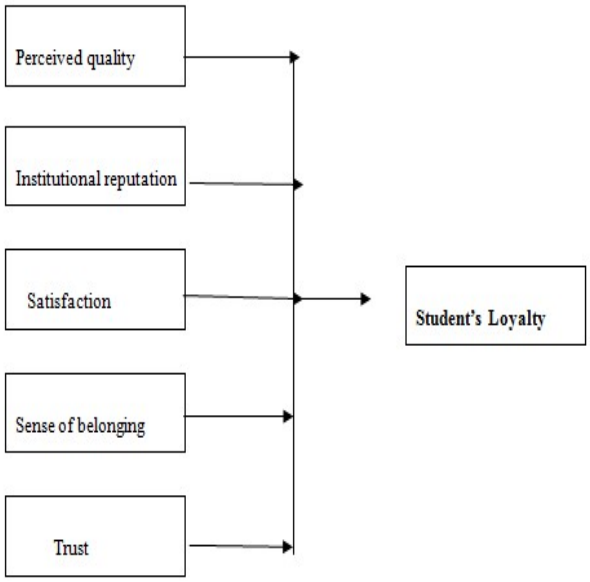
1. To determine the level of student loyalty towards higher education institution.
2. To identify the factors influencing student loyalty, including satisfaction, institutional reputation, trust, perceived quality, and self-belongingness, towards higher education institution.
3. To analyze the impact of satisfaction, institutional reputation, trust, perceived quality, and self-belongingness on students' loyalty towards higher education institution.

IV. RESEARCH METHODOLOGY

The study utilizes a descriptive and analytical research design to examine the determinants of student loyalty towards HEIs. A sample size of 250 undergraduate students from various colleges under Kannur University in Kerala is selected using a simple random sampling method. The primary data is collected through a structured questionnaire. The reliability of the scaled questions is assessed using Cronbach's alpha, and all the scaled questions exhibit acceptable reliability with Cronbach's alpha values above 0.7. Multiple regression analysis is employed to analyze the impact of satisfaction, institutional reputation, trust, perceived quality, and self-belongingness on students' loyalty towards higher education institutions.

V. THEORETICAL FRAMEWORK

The study has observed several important variables such as the perceived quality of the academic program, student satisfaction, institutional reputation, self-belonging, and trust. These variables are identified through a literature review as factors that can influence student loyalty. The conceptual framework of student loyalty is presented here.



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VI. ANALYSIS AND DISCUSSION

Table 1: Profile of the Data

		Frequency	Percentages
Name of Discipline	Arts	72	29
	Commerce	79	32
	Management	48	19
	Science	51	20
Gender	Male	80	32
	Female	170	78

Source: Primary data

Table 1 reveals that there were 80(32%) male and 170(78%) female students, with 72(29%) from arts, 79(32%) from commerce discipline,48(19%) from management and 51(20%) from science discipline.

Table 2: Student's Loyalty towards Higher Education Institution (HEI)

Variables		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean	S.D	t	Sig.
I have an intention to continue studying at the institution	N	20	16	84	86	44	3.47	1.10	6.77	0.000
	%	8.0	6.4	33.6	34.4	17.6				
I am willing to recommend the institution to others	N	20	20	73	104	33	3.44	1.07	6.47	0.000
	%	8.0	8.0	29.2	41.6	13.2				
I am ready to participate in the activities that promote the institution.	N	20	14	73	94	49	3.55	1.11	7.85	0.000
	%	8.0	5.6	29.2	37.6	19.6				

Source: Primary data

The results of the one-sample t-test indicate that the mean value of student loyalty, specifically regarding the statement "I am ready to participate in the activities that promote the institution," was significantly higher than the mean of the response scale three. The mean score for this loyalty variable was(M=3.55, S.D=1.11) and t value was (t (249) = 7.85, p=0.000). This indicates a strong willingness among students to actively engage in activities that contribute to the development of the institution. Furthermore, additional loyalty variables such as the intention to continue studying at the institution (M = 3.47) and willingness to recommend the institution to others (M = 3.44) also exhibited significantly higher scores compared to the mean of the response scale three. These findings indicate the students' loyalty and positive attitudes towards the institution.

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Table 3: Perceived Quality of the Academic Program

Variables		Very poor	Poor	Average	Good	Excellent	Mean	S.D	t	Sig.
Relevance of the curriculum	N	10	16	72	126	26	3.57	0.908	9.89	0.000
	%	4.0	6.4	28.8	50.4	10.4				
Quality of teaching	N	2	10	44	110	84	4.06	0.862	19.4	0.000
	%	.8	4.0	17.6	44.0	33.6				
Quality of academic facilities	N	14	14	81	111	30	3.52	0.97	8.41	0.000
	%	5.6	5.6	32.4	44.4	12.0				
Innovative teaching methods	N	8	14	76	129	23	3.58	0.857	10.7	0.000
	%	3.2	5.6	30.4	51.6	9.2				
Experience and qualification of the faculties	N	8	8	52	115	67	3.9	0.941	15.1	0.000
	%	3.2	3.2	20.8	46.0	26.8				

Source: Primary data

The analysis of the table revealed that the statement "Quality of teaching" had the highest mean for the perceived quality of the academic program, with a significantly higher mean than the response scale mean of three (M = 4.06, S.D = 0.862), (t (249) = 19.4, p = 0.000) indicates that the higher education institution (HEI) effectively ensured the quality of teaching.

The results indicate that the institution has successfully prioritized and maintained high standards in teaching, which may contribute to students' satisfaction and ultimately their loyalty to the institution. The analysis further revealed that the statement "Experience and qualification of the faculties" obtained the second highest mean score for perceived quality of the academic program, with a mean of 3.9 (S.D = 0.941). The t-value of (t(249) = 15.1, p = 0.000) indicated that this difference was statistically significant. Other statements such as ‘Innovative teaching methods’(M=3.58), ‘Relevance of the curriculum’ (M=3.57) and ‘Quality of academic facilities’ (M=3.52)were also significantly higher than mean score of three.

The findings indicate that the higher education institution has successfully prioritized various aspects of the academic program, such as quality of teaching, experience and qualification of faculties, innovative teaching methods, curriculum relevance, and quality of academic facilities. These factors play a crucial role in shaping students' perceptions of the institution's quality, enhancing their satisfaction, and potentially fostering loyalty towards the HEI.

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Table 4: Student's Opinion towards Institutional Reputation

Variables		Very poor	Poor	Average	Good	Excellent	Mean	S.D	t	Sig.
Academic excellence	N	4	10	88	124	24	3.62	0.78	12.50	0.000
	%	1.6	4.0	35.2	49.6	9.6				
Status of HEI in the education market	N	4	26	68	117	35	3.61	0.91	10.66	0.000
	%	1.6	10.4	27.2	46.8	14.0				
Student support services provided by HEI	N	8	14	76	113	39	3.64	0.92	11.05	0.000
	%	3.2	5.6	30.4	45.2	15.6				
Participation of HEI in co-curricular activities	N	10	26	78	107	29	3.48	0.97	7.79	0.000
	%	4.0	10.4	31.2	42.8	11.6				

Source: Primary data

The analysis revealed that the mean of the institutional reputation statement "Student support services provided by HEI" (M=3.64, SD=0.92) was significantly higher than the mean of three. The t-value was (t(249)=11.05, p=0.000), indicating a significant difference. This suggests that the student support services provided by the higher education institution (HEI) were significantly good.

Additionally, other variables related to institutional reputation, such as Academic excellence (M=3.62), Status of HEI in the education market (M=3.61), and Participation of HEI in co-curricular activities (M=3.48), also exhibited significantly higher scores compared to the mean of three.

Table 5: Student's Satisfaction towards Higher Education

Variables		Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied	Mean	S.D	t	Sig.
Teaching and learning	N	12	8	56	112	62	3.82	1.00	12.89	0.000
	%	4.8	3.2	22.4	44.8	24.8				
Campus facilities	N	16	26	83	103	22	3.36	1.00	5.63	0.000
	%	6.4	10.4	33.2	41.2	8.8				
Student support activities	N	12	28	69	109	32	3.48	1.01	7.57	0.000
	%	4.8	11.2	27.6	43.6	12.8				
Career guidance and placement	N	14	10	88	102	36	3.54	0.98	8.80	0.000
	%	5.6	4.0	35.2	40.8	14.4				
Affordability of education	N	8	12	56	125	49	3.78	0.92	13.34	0.000
	%	3.2	4.8	22.4	50.0	19.6				

Source: Primary data

From Table 5, the results indicate that students' satisfaction with the teaching-learning process had the highest mean (M=3.82, SD=1.00) (t=12.89, p=0.000). Additionally, their satisfaction with the affordability of education had the second-highest mean (M=3.78, SD=0.92) (t=13.34, p=0.000). Both results are statistically significant. These findings indicate that students expressed higher levels of satisfaction with the teaching-learning process and the affordability of education.

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Moreover, the responses regarding satisfaction with career guidance and placement had a mean of (M=3.54), satisfaction with student support activities had a mean of (M=3.48), and satisfaction with campus facilities had a mean of (M=3.36), all of which were significantly higher than the population mean .These results illustrate that the students were satisfied with the opportunities for guidance and placement, student support activities, and infrastructure facilities provided by their HEIs.

Table 6: Student's Self-Belonging Towards Higher Education

Variables		Very poor	Poor	Average	Good	Excellent	Mean	S.D	T	Sig.
Relationship with the institution	N	16	16	76	109	33	3.51	1.01	7.91	0.000
	%	6.4	6.4	30.4	43.6	13.2				
Relationship with peers	N	6	6	52	114	72	3.96	0.90	16.87	0.000
	%	2.4	2.4	20.8	45.6	28.8				
Relationship with Faculties	N	12	12	60	119	47	3.71	0.99	11.36	0.000
	%	4.8	4.8	24.0	47.6	18.8				
Relationship with administrative staff	N	8	14	85	111	32	3.58	0.90	10.21	0.000
	%	3.2	5.6	34.0	44.4	12.8				

Source: Primary data

From the table above, it is depicted that the relationship with peers has the highest mean (M=3.96, S.D=0.90) (t=16.87, p=0.000), which is statistically significant. Additionally, the responses regarding the relationship with faculties had a mean of (M=3.71), the relationship with administrative staff had a mean value of (M=3.58), and the relationship with the institution had a mean of (M=3.51), all of which were significantly higher than the mean value of three. These results highlight the fact that the students felt a strong sense of belonging towards higher education based on their relationships with peers, faculties, administrative staff, and the institution.

Table 7: Student's Trust towards Higher Education

Variables		Very poor	Poor	Average	Good	Excellent	Mean	S.D	t	Sig.
My institution is a reliable institution	N	4	10	64	133	39	3.77	0.82	14.95	0.000
	%	1.6	4.0	25.6	53.2	15.6				
My institution always keeps its promise	N	6	18	80	118	28	3.58	0.87	10.45	0.000
	%	2.4	7.2	32.0	47.2	11.2				
My institution always does the right things	N	6	12	68	125	39	3.72	0.87	13.00	0.000
	%	2.4	4.8	27.2	50.0	15.6				

Source: Primary data

The results indicated that the students had a good level of trust towards higher education. The results showed that the reliability of the institution had the highest mean (M=3.77, S.D=0.82) (t=14.95, p=0.000), which was significantly higher than the mean of three. Their responses to the statement 'My institution always does the right things' had a

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mean value of (M=3.72, S.D=0.87) (t=13, p=0.000), and their responses to the statement 'my institution always keeps its promise' had a mean value of (M=3.58, S.D=0.87) (t=10.45, p=0.000), both of which were also significantly higher than the population mean. In conclusion, the results indicated that the students had a good level of trust towards their institution in terms of reliability, doing the right things, and keeping promises.

Table 8: Impact of Satisfaction, Institutional Reputation, Trust, Perceived Quality, and Self-Belongingness on Students' Loyalty towards Higher Education Institution.

Hypotheses	Regression weights	B	t	P value	Results	VIF
H1	PQ ⟶ LY	0.306	4.696	0.000	Supported	3.974
H2	IR ⟶ LY	0.337	5.672	0.000	Supported	3.137
H3	SF ⟶ LY	0.118	3.378	0.001	Supported	1.626
H4	SB ⟶ LY	0.049	0.889	0.375	Not supported	2.778
H5	TS ⟶ LY	0.246	5.181	0.000	Supported	2.170
R	0 .768					
F (5,244)	161.399, P = 0.000					

Note: P<0.05, LY-Loyalty, PQ-Perceived Quality, IR-Institution Reputation, SF-Satisfaction, SB-Sense of Belonging, TS-Trust

The study aimed to examine the impact of satisfaction, institutional reputation, trust, perceived quality, and self-belongingness on students' loyalty towards higher education institution. The following hypotheses were tested-

H1: Perceived quality of the academic programme is positively related to students' loyalty
H2: Institutional reputation is positively related to students' loyalty
H3: Students satisfaction is positively related to students' loyalty
H4: Sense of belonging towards the HEI is positively related to students' loyalty
H5: Trust towards the HEI is positively related to students' loyalty

To test these hypotheses, the dependent variable, student loyalty, was regressed on the independent variables of satisfaction, institutional reputation, trust, perceived quality, and self-belongingness. The results indicated that the regression model satisfied the assumptions of normality of residuals, homoscedasticity, and the absence of serial correlation, as demonstrated by a Durbin-Watson value of 1.91, which is approximately equal to the threshold value of 2, suggesting the absence of significant serial correlation. Additionally, the VIF values were less than 10, indicating the absence of multicollinearity.

The study found that the variables such as student satisfaction, institutional reputation, trust, perceived quality, and self belongingness significantly predict student loyalty, with F(5,244)=161.399 and P=0.000. Moreover, the R^2=0.768 indicates that the model explains 76.8 percent of the variance in loyalty.

The coefficients for each independent variable were examined to determine their influence on students' loyalty. The results confirmed that the perceived quality of the academic programme (H1) has a significant positive impact on student loyalty (B = 0.306, t =

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4.696, p = 0.000). Similarly, institutional reputation (H2) was found to have a significant positive influence on student loyalty (B = .337, t = 5.672, p = 0.000).

Furthermore, student satisfaction (H3) was found to significantly and positively influence student loyalty (B = 0.118, t = 3.378, p =0.001). However, the hypothesis regarding the impact of sense of belonging (H4) on student loyalty was not supported by the results, suggesting that it does not have a significant effect (B = 0.049, t = 0.889, p =0.375).Finally, the analysis supported the hypothesis (H5) that trust towards the HEI has a significant positive influence on student loyalty (B = 0.246, t = 5.181, p = 0.000).

In short, the study demonstrates that satisfaction, institutional reputation, trust, and perceived quality significantly influence students' loyalty towards a higher education institution. However, the sense of belongingness did not show a significant effect on student loyalty in this particular analysis. These findings emphasize the importance of these factors in fostering loyalty among students in the context of higher education.

VII. FINDINGS AND CONCLUSION

HEIs in Kerala have a responsibility to provide quality services that cater to the needs and expectations of students, ensuring the overall quality of higher education. According to the regulations of the University Grants Commission, student satisfaction is a main factor in measuring the enhancement of quality in higher education institutions (HEIs). In this context, HEIs in Kerala are highly focused on creating satisfied and loyal students.

This study aimed to identify the determinants of student loyalty to HEIs. The findings revealed that HEIs in Kerala place significant importance on various aspects of the academic program, including the quality of teaching, experience and qualifications of faculties, innovative teaching methods, curriculum relevance, and quality of academic facilities. Furthermore, HEIs in Kerala have a good reputation in the educational market, and the study found that students expressed satisfaction with higher education in Kerala. Students also possess a sense of belongingness and trust towards higher education institutions in the region. Additionally, the study observed that satisfaction, institutional reputation, trust, and perceived quality significantly influence students' loyalty towards HEIs. However, the sense of belongingness did not show a significant impact on student loyalty.

In conclusion, it is essential for HEIs in Kerala to prioritize the quality of teaching, faculty qualifications, innovative teaching methods, curriculum relevance, and academic facilities to enhance student satisfaction and foster loyalty. Maintaining a good reputation in the educational market and nurturing a sense of belongingness and trust among students are also crucial. HEIs should continuously strive to meet students' needs and expectations, as student satisfaction plays a key role in assessing the quality enhancement of HEIs.

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ASSESSING THE KNOWLEDGE, AWARENESS, PERCEPTION AND PRACTICE OF HOME LOAN CUSTOMERS REGARDING HOME LOAN INTEREST RATE

Abstract

Customers' knowledge and awareness of home loan interest rates can lead to better financial decisions, which can have positive implications for their financial well-being and the their overall stability. This study aims to investigate the knowledge, awareness, perception, and practice of home loan customers regarding home loan interest rates. The study will explore the factors that influence the customers' knowledge and awareness of interest rates and how it affects their perception and practice when choosing home loan options. The data will be collected through a survey questionnaire from a sample of home loan customers. Using one-sample t-tests, the study evaluated the significance of respondents' scores in comparison to a predefined mean. The results indicated that certain aspects, such as fixed and variable interest rates, received significantly higher scores, suggesting a strong awareness and positive perception among borrowers. Conversely, aspects like the merits and demerits of specific interest rate options showed relatively lower scores, indicating room for improvement in knowledge and perception. Furthermore, a regression analysis was conducted to examine the influence of knowledge, awareness, and perception on borrowers' practices. The regression model demonstrated a satisfactory fit, meeting the assumptions of normality, homoscedasticity, and absence of serial correlation. The results revealed that these factors significantly impacted borrowers' practices related to home loan interest rates. The findings of this study will contribute to

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the existing literature on the factors affecting home loan customers' decision-making process regarding interest rates, and provide insights for financial institutions to develop effective marketing strategies to enhance customers' knowledge and awareness of home loan interest rates

Keywords: Fixed rate, floating or variable rate, MCLR, EBLR, RLLR, CIBIL score

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I. INTRODUCTION

The home loan is a crucial financial decision that individuals make in their lifetime, and the interest rate is a significant component of it. The knowledge, awareness, perception, and practice of home loan customers regarding the interest rate can influence their decision-making and financial well-being. Therefore, it is essential to understand the level of knowledge, awareness, perception, and practice of home loan customers regarding the home loan interest rate. The study underscored the importance of knowledge, awareness, perception, and practice in the decision-making process of home loan customers. It highlighted the need for borrowers to enhance their understanding of interest rates, improve awareness of various options, develop positive perceptions towards helpful features and implement effective practices. By doing so, borrowers can maximize the benefits of their home loan and make informed choices.

II. LITERATURE REVIEW

(Santhoshkumar, 2020) the study about the levels of awareness, perception, and satisfaction among home loan customers were measured, focusing on various aspects of their home loans. The researcher observed that these customers often faced disadvantages due to a lack of understanding regarding the procedures and conditions associated with floating and fixed interest rates, EMIs, property valuation, and the terms and conditions of obtaining a home loan. It was suggested that borrowers expected a higher level of transparency in housing finance transactions as an essential requirement for a well-functioning housing finance market. By employing Structural Equation Modelling, the study revealed that amenities and responsiveness provided by nationalized banks positively influenced the customers' satisfaction level. Conversely, the lack of effective communication, stringent procedures for collecting EMIs, high interest rates, and processing fees had a negative impact on the satisfaction level of home loan customers.

(Durai V, 2018) conducted a study on the factors that lead to satisfaction and dissatisfaction among customers regarding home loans offered by LIC Housing Finance Limited in Trichy Corporation. The researcher emphasized the importance of improving the transparency and simplicity of the interest calculation methodology. Currently, interest rates are calculated based on annual, quarterly, or daily diminishing balances, resulting in a notable difference between the quoted interest rate and the actual effective rate. This discrepancy can cause confusion among borrowers, and measures should be taken to prevent such confusion. The researcher also recommended that the bank make efforts to inform borrowers about frequent fluctuations in interest rates and any changes to the equated monthly instalment (EMI). Additionally, it was suggested that borrowers should be given the option to switch institutions without facing significant costs or delays if they desire to do so

(Sajeesh, 2019) conducted a study utilizing the Structural Equation Method to examine the relationship between awareness, perception, and satisfaction. The study revealed a significant association between awareness and the preference for home loans. However, no such significant relationship was found between perception and satisfaction regarding home loans. The preference of home loan consumers was notably influenced by an increased awareness of the procedures involved in obtaining a home loan, eligibility criteria, interest rates for different consumers, interest rates offered by housing finance institutions (HFIs),

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equated monthly installments (EMIs), bank charges, home loan protection schemes, as well as government housing schemes. However, consumer satisfaction was not affected by preferences related to accessibility, repayment options, special attractions, bank locations, loan processing, and consumer care.

(Nazrine, 2017) examined the awareness and satisfaction levels of borrowers in Tiruchirappalli district regarding housing finance. The findings indicated that borrowers with a moderate level of awareness generally exhibited a high satisfaction index, whereas those with a low level of awareness tended to have a lower satisfaction index. The average satisfaction index did not significantly vary among borrowers based on their awareness level. Furthermore, the study revealed no evident correlation between awareness and satisfaction.

(Gopinath, 2016) conducted a study on the relationship between awareness and perception among home loan customers in Chennai city. The study revealed that internal sources, such as purchasing options and add-on facilities, and social sources, including additional options, EMI payments, loan intention, and social intention, along with external sources affecting loan processing and hassle-free loans, have a positive impact on preferences for housing loans. On the other hand, social sources' influence on purchasing options, loan processing, and hassle-free loans, as well as external sources' impact on additional options and income, and government sources' effect on add-on facilities, negatively influences preferences for housing loans.

(Rashmi Chaudhary & Yasmin Janjhua, 2011)studied the perceptions and satisfaction of customers of Baghat Urban Co-operative Bank Limited (BUCB). The study observed that the bank's lower interest rates and easily repayable instalments have played a major role in creating trust and satisfaction among customers.
(Devlin J F, 2002)Observed customers have selected home loan institutions based on professional advice and interest rates. Demographic variables have also influenced the selection of home loans.

III. OBJECTIVES OF THE STUDY

1 To assess the level of knowledge and awareness among home loan customers about home loan interest rates.
2 To explore the perceptions of home loan customers towards home loan interest rates and their impact on loan-related decisions.
3 To investigate the impact of home loan interest rate on home loan customer practices, such as loan repayment and loan switching.
4 To investigate the influence of knowledge, awareness, and perception on the practices of home loan customers regarding home loan interest rates.

IV. HYPOTHESIS

1 H1: Knowledge about interest rates is positively related to the practices of home loan customers.
2 H2: Awareness about interest rates is positively related to the practices of home loan customers.

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3 H3: Perception about interest rates is positively related to the practices of home loan customers

V. RESEARCH METHODOLOGY

This study utilized a quantitative research design to investigate the knowledge, awareness, perception, and practice of home loan customers concerning interest rates. Data was collected through structured questionnaires administered to randomly selected sample of 212 participants. The collected data underwent analysis using various descriptive and inferential statistical techniques, including frequency and percentage, mean and standard deviation, one-sample t-test, and multiple regression analysis. These analytical methods were employed to examine the relationships and impacts of knowledge, awareness, and perception on participants' practices while controlling for other relevant factors

The study examined several variables, including:

1. **Knowledge:** Participants' understanding of various aspects of home loan interest rates.
2. **Awareness:** Participants' familiarity with different interest rate options, terms, and conditions.
3. **Perception:** Participants' subjective evaluation and opinions regarding the benefits and drawbacks of specific interest rate options.
4. **Practice:** Participants' actual behaviours and decision-making regarding home loan interest rates

VI. ANALYSIS AND INTERPRETATION

1. Demographic Variables

Table 1: Demographic variable of respondents

		Frequency	Percentage
Gender	Male	123	58.01
	Female	89	41.98
Age	Below 40	92	43.4
	40-50	97	45.8
	Above 50	23	10.8
Occupation	Public & Govt. aided	128	60.38
	Private	56	26.42
	Others	28	13.21
	Total	212	100

Source: Primary Data

Table 1 illustrates that out of the 212 respondents, 123 (58.01%) were male, and 89 (41.98%) were female. Among them, 97 (45.8%) fell into the 40-50 age group, 92 (43.4%) were below 40, and 23 (10.8%) were above 50. In terms of occupation, 128

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(60.38%) worked in the Government and Government-aided sector, 56 (13.215%) were employed in the private sector, and 28 (13.21%) had other occupations.

2. **Interest Rate of Home Loan:** In the realm of home loans, borrowers have various interest rate options. Fixed rates provide stability and predictability by maintaining a constant rate over a specified period. MCLR is a benchmark rate based on banks' cost of funds, allowing borrowers to benefit from changes in funding costs. RLLR is directly tied to the repo rate set by the central bank, ensuring immediate transmission of policy rate changes. EBLR is linked to external benchmarks like Treasury bill rates, offering transparency and responsiveness to market conditions. These frameworks empower borrowers with knowledge and flexibility when choosing an interest rate structure for their home loans

Table 2: Interest Rate of Home Loan

		Frequency	Percentage
Interest rate option for a home loan	Fixed interest rate	98	46.2
	MCLR	98	46.2
	RLLR	16	7.5
	EBLR	0	0

Source: Primary Data

The table above reveals that out of 212 respondents, 98 (46.2%) opted for a fixed interest rate, while another 98 (46.2%) chose the MCLR interest rate. Only 16 (7.5%) of the respondents selected the RLLR interest rate option for their home loan.

3. **Knowledge about Home Loan Interest Rates:** Knowledge about home loan interest rates is crucial for borrowers seeking financial stability and optimal loan terms. It equips individuals and families with the necessary information to compare loan options, assess the impact of interest rates on repayments, and evaluate the overall cost of borrowing

Table 3: Level of Knowledge of the Respondents

Variables		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	S.D	t	Sig.
I know there are fixed and variable interest rate options available for home loans	N	34	8	42	79	49	3.48	1.33	5.23	0.000
	%	16	3.8	19.8	37.3	23.1				
I know in a floating rate, MCLR, RLLR, EBLR interest rate options are there	N	28	39	72	40	33	3.05	1.24	0.61	0.542
	%	13.2	18.4	34	18.9	15.6				
I know the benefit of the MCLR, RLLR and EBLR interest rates	N	68	31	64	32	17	2.52	1.30	-5.34	0.000
	%	32.1	14.6	30.2	15.1	8				
I know the demerits of MCLR, RLLR and EBLR interest rates	N	58	49	48	32	25	2.61	1.34	-4.25	0.000
	%	27.4	23.1	22.6	15.1	11.8				
I know the interest rate calculation should be more transparent, flexible stable, and predictable	N	26	47	98	32	9	2.77	0.99	-3.39	0.001
	%	12.3	22.2	46.2	15.1	4.2				

Source: Primary Data

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Based on the table above, it is evident that respondents possessed a moderate level of knowledge regarding various aspects of home loan interest rates. The results of a one-sample t-test indicate that the mean value of knowledge about fixed and variable interest rate options (M=3.48, S.D=1.33) was significantly higher than the response scale mean of three, with a t-value of 5.23 and p-value of 0.000. This indicates that home loan customers have a very good understanding of fixed and variable interest rate options.

Furthermore, the awareness about floating interest rate options (M=3.05, S.D=1.24) was found to be significantly equal to the mean value of the response scale, with a t-value of 0.61 and p-value of 0.542. However, respondents displayed limited knowledge regarding the merits (M=2.52) and demerits (M=2.61) of MCLR, RLLR, and EBLR interest rate options. Their knowledge regarding the comparison of interest rates based on transparency, stability, and predictability of MCLR, RLLR, and EBLR options (M=2.77) was also relatively lower, significantly lower than the response scale mean of three.

These findings indicate that home loan customers have good knowledge about fixed and floating interest rates. However, they are least aware of the merits and demerits of various floating interest rate options in terms of flexibility, stability, transparency, and predictability of interest rates for home loans.

4. **Awareness about Home Loan Interest Rates:** Awareness about home loan interest rates goes beyond having basic knowledge. It involves being cognizant of the various factors that influence interest rates.

Table 4: Level of Awareness of Respondents

Variables		Not at all aware	Slightly Aware	Somewhat aware	Moderately Aware	Extremely Aware	Mean	S.D	t	Sig.
I am aware of considering the merits and demerits of fixed and floating interest rate of home	N	39	42	40	50	41	3.06	1.40	0.59	0.556
	%	18.4	19.8	18.9	23.6	19.3				
I am aware of comparing the MCLR, RLLR, EBLR interest rates on the basis of stability, transparency, flexibility and predictability	N	39	50	58	40	25	2.82	1.27	-2.06	0.041
	%	18.4	23.6	27.4	18.9	11.8				
I am aware that banks provide a switching-over facility for changing the home loan interest	N	47	52	24	80	9	2.77	1.28	-2.58	0.011
	%	22.2	24.5	11.3	37.7	4.2				
I am aware that banks require some charges for changing the interest rate	N	39	44	56	56	17	2.85	1.23	-1.79	0.075
	%	18.4	20.8	26.4	26.4	8				
I am aware that the CIBIL score influences the calculation of the interest rate.	N	31	52	32	56	41	3.11	1.37	1.21	0.229
	%	14.6	24.5	15.1	26.4	19.3				

Source: Primary Data

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The results of a one-sample t-test indicate that the level of awareness among home loan customers regarding the influence of CIBIL score on interest rate calculations and the merits and demerits of fixed and floating rates shows a moderate level of awareness. The awareness about the influence of CIBIL score on interest rates had the highest mean value of (M=3.11, S.D=1.37) (t=1.21, p=0.229), which was found to be significantly equal to the response scale mean of three. Similarly, the mean value of awareness about the merits and demerits of home loans was (M=3.06, S.D=1.40) (t=0.59, p=0.556), also significantly equal to the response scale mean.

However, the mean value of awareness about the charges of changing interest rates (M=2.85, S.D=1.23) was found to be significantly equal to the response scale mean of three with a t-value of -1.79 and p-value of 0.075. On the other hand, the awareness about the switching over facility of changing interest rates (M=2.82) and the comparison of benefits and drawbacks of various interest rates (M=2.82) were significantly lower than the response scale mean. These results indicate that switching over facility of changing interest rates and the charges associated with changing interest rates to maximize benefits based on the flexibility, transparency, predictability, and stability of home loan interest rates is at lower level.

5. **Perception of Home Loan Customers:** Perception, on the other hand, reflects borrowers' subjective understanding and interpretation of home loan interest rates. It encompasses their beliefs, attitudes, and preferences towards different interest rate options and loan structures.

Table 5: Level of Perception of Respondents

Variables		Definitely not	Probably not	Probably	Very probably	Definitely	Mean	S.D	t	Sig.
I perceive that the interest rate I have chosen is the best type for a home loan	N	16	26	89	48	33	3.26	1.10	3.50	0.001
	%	7.5	12.3	42	22.6	15.6				
I believe that RLLR and EBLR were introduced to address the issues of lack of transparency, subjectivity, and the reset of the amount in MCLR.	N	40	33	56	66	17	2.94	1.24	-0.71	0.474
	%	18.9	15.6	26.4	31.1	8				
I believe that the RLLR rate is immediately adjustable to a customer's account whenever the REPO rate changes.	N	48	33	64	42	25	2.83	1.31	-1.94	0.053
	%	22.6	15.6	30.2	19.8	11.8				
I believe it is beneficial to consider the lowest interest rate when taking out a home loan	N	16	34	31	82	49	3.54	1.22	6.41	0.000
	%	7.5	16	14.6	38.7	23.1				
I believe that affordable Equated Monthly Instalments (EMI) and tenure play an important role when considering a home loan	N	24	42	31	58	57	3.38	1.36	4.13	0.000
	%	11.3	19.8	14.6	27.4	26.9				

Source: Primary Data

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From the table above, it is evident that the perception of home loan customers varies across different aspects. The highest mean value of the response was related to the perception of the benefit of choosing the lowest interest rate, with a mean value of (M=3.54, S.D=1.22) (t=6.41, p=0.000), significantly higher than the population mean. Furthermore, perceptions about affordable EMI and tenure (M=3.38) and the best type of interest rate chosen (M=3.26) also exhibited significantly higher scores compared to the mean of the response scale three.

On the other hand, the mean value of perception regarding the implementation of RLLR and EBLR to address issues of lack of transparency, subjectivity, and the reset of the amount in MCLR (M=2.94), and the immediate adjustability of RLLR rates to a customer's account whenever the REPO rate changes (M=2.83), were found to be significantly equal to the mean value of the response scale, indicating a neutral perception.

The results indicate that respondents very likely believe that, before taking a home loan, the consideration of the lowest interest rate is crucial, and they perceive the interest rate they have chosen as the best type for a home loan. Additionally, they believe that RLLR and EBLR may or may not have certain advantages compared to MCLR.

6. **Practice of Home Loan Customers:** However, knowledge, awareness, and perception alone are not sufficient without translating them into practice. Practice refers to the actions and decisions borrowers take based on their understanding and perception of home loan interest rates. It encompasses practices such as comparing interest rates and fees from different lenders, considering the impact of prepayment penalties and other charges, and evaluating the cost-benefit of changing interest rates.

Table 6: Practices of Home Loan Customers

Variables		Never	Rarely	Occasionally	Frequently	Always	Mean	S.D	t	Sig.
I will consider the cost-benefit of reducing the total interest and total repayment amount when changing my existing interest rate category to another	N	40	18	50	56	48	3.26	1.40	2.65	0.009
	%	18.9	8.5	23.6	26.4	22.6				
I will consider the procedure and additional charges involved when changing your existing interest rate type	N	16	50	57	33	56	3.30	1.29	3.35	0.001
	%	7.5	23.6	26.9	15.6	26.4				
I refinance my home loan to change the interest rate type or to take advantage of lower interest rates	N	42	32	57	55	26	2.96	1.30	-0.47	0.636
	%	19.8	15.1	26.9	25.9	12.3				
I will compare interest rates and fees from different lenders when shopping for a home loan or refinancing my existing home loan.	N	42	8	56	39	67	3.38	1.46	3.80	0.000
	%	19.8	3.8	26.4	18.4	31.6				
I will consider the impact of prepayment penalties, foreclosure charges, or other fees on the total cost of my home loan	N	42	24	24	56	66	3.38	1.51	3.64	0.000
	%	19.8	11.3	11.3	26.4	31.1				

Source: Primary Data

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The results of the one-sample t-test indicate that the practices of home loan customers, specifically regarding the statements "I will compare interest rates and fees from different lenders when shopping for a home loan or refinancing my existing home loan" and "I will consider the impact of prepayment penalties, foreclosure charges, or other fees on the total cost of my home loan," were significantly higher than the mean score of the response scale three.

The mean score for the practice of comparing interest rates was (M=3.38, S.D=1.46) (t=3.80, p=.000), and the mean score for considering the procedure of changing interest rates was (M=3.38, S.D=1.51) (t=3.64, p=.000). Additionally, the mean score for the practice of considering the procedure and charges of changing interest rates was (M=3.30, S.D=1.29) (t=3.35, p=.001), and the mean score for considering the cost benefit of changing interest rates was (M=3.26, S.D=1.40) (t=2.65, p=.009). All these scores were significantly higher than the mean of the response scale three.

These results indicate that respondents frequently consider the cost benefit, procedure, and charges associated with various home loan interest rates offered by different housing finance institutions, as well as the different interest rate options provided by the same housing finance institutions.

However, the mean value of the response regarding the practice of willingness to change the interest rate was (M=2.96, S.D=1.30) (t=-47, p=.636), which was found to be significantly equal to the response scale mean three. This indicates that respondents only occasionally think about changing the interest rates of their home loans to take advantage of the lowest interest rates available

7. **Influence of Knowledge, Awareness and Perception Towards the Practice of Home Loan Customers:** Understanding the interplay between knowledge, awareness, perception, and practice is essential for borrowers seeking the best possible home loan outcomes. When borrowers have good knowledge and awareness of market trends and lending policies, have a positive perception towards certain interest rate options, and implement sound practices in their decision-making, they can enhance their financial position and achieve their homeownership goals more effectively.

Table 7: Influence of Knowledge, Awareness and Perception Towards the Practice of Home Loan Customers

Hypothesis	Regression Weights	B	T	p-value	Results	VIF
H1	Kn ⟶ Pr	-0.226	-3.467	0.001	Supported	2.382
H2	Aw ⟶ Pr	0.259	4.169	0.000	Supported	2.467
H3	Pe ⟶ Pr	0.963	12.534	0.000	Supported	3.025
R	0.722					
F(3,208)	180.465, P=.000					
Note.*p<0.05, Kn: Knowledge, Aw: Awareness, Pe: Perception, Pr : Practice)						

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The study aimed to examine the influence of knowledge, awareness, and perception of home loan customers on their practices. The following hypotheses were formulated:

H1: Knowledge about interest rates is positively related to the practices of home loan customers. H2: Awareness about interest rates is positively related to the practices of home loan customers. H3: Perception about interest rates is positively related to the practices of home loan customers.

To test these hypotheses, the dependent variable, the practices of home loan customers, was regressed on the independent variables of knowledge, awareness, and perception. The results of the analysis indicated that the regression model satisfied the assumptions of normality of residuals, homoscedasticity, and the absence of serial correlation. The Durbin-Watson value of 1.998, which is approximately equal to the threshold value of 2, suggests the absence of significant serial correlation. Additionally, the VIF values were less than 10, indicating the absence of multicollinearity.

The study found that variables such as knowledge, awareness, and perception of home loan customers significantly affect their practices, with F(3, 208) = 180.465 and P =0 .000. Moreover, the R^2 =0 .722 indicates that the model explains 72.2 present of the variance in practice of home loan customers.

The coefficients for each independent variable were examined to determine their influence on the practices of home loan customers. The results confirmed that knowledge of various aspects of interest rates of home loans (H1) has a significant positive impact on the practices of home loan customers (B = -0.226, t = 4.696, p =0.001). Similarly, awareness about various aspects of interest rates (H2) (B = 0.259, t = 4.169, p =0.000), and perception of home loan customers (H3) (B = 0.963, t = 12.534, p =0.000) were found to have a significant positive effect on the practices of home loan customers.

In summary, the study demonstrates that knowledge, awareness, and perception about interest rates of home loans significantly influence the practices of home loan customers. These findings emphasize the importance of these factors in maximizing the benefits from home loans by understanding the merits and demerits of various types of interest rates and considering switching to the most cost-effective interest rates offered by housing finance institutions.

VII. FINDINGS AND CONCLUSION

The study assessed the knowledge level of home loan customers regarding interest rates. The findings indicated that a significant proportion of participants had a good understanding of various interest rate frameworks, such as fixed rates and floating interest rates. However, they had limited awareness of the pros and cons of different floating interest rate options in terms of flexibility, stability, transparency, and predictability for home loans. The home loan customers possessed a moderate level of awareness regarding the impact of CIBIL score on interest rates and the advantages and disadvantages of fixed and floating interest rates. But, their awareness of various floating rates, switching facilities, and

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associated charges for maximizing benefits based on interest rate flexibility and stability was at a lower level. The study also revealed that when taking a home loan, respondents considered the lowest interest rate as crucial, and they perceived the interest rate they chose as the best option. Additionally, they held mixed beliefs about the advantages of RLLR and EBLR compared to MCLR. Then customers actively compared interest rates and fees from different lenders and took into account the cost implications of prepayment penalties and other charges. However, their willingness to change interest rates was relatively low, indicating a preference for stability. This study highlights the significant impact of knowledge, awareness, and perception of interest rates on the practices of home loan customers. These findings underscore the importance of these factors in optimizing the benefits of home loans, enabling borrowers to understand the advantages and disadvantages of different interest rate options and make informed decisions about switching to more cost-effective rates offered by housing finance institutions .It is recommended to enhance awareness among home loan customers about the advantages and disadvantages of various floating rate options, as well as educate them on the flexibility, stability, transparency, and predictability of interest rates. Increasing knowledge about floating rates, switching facilities, and associated charges can help borrowers maximize the benefits of their loans. Additionally, promoting understanding of the impact of CIBIL scores on interest rates can empower borrowers to improve their creditworthiness and secure more favourable loan terms. Encouraging borrowers to actively compare interest rates and fees, considering the cost implications of penalties and charges, and providing incentives for rate changes can further support informed decision-making and help borrowers optimize the affordability of their home loans. The study emphasizes the importance of knowledge, awareness, and perception of interest rates in enabling home loan customers to make informed decisions, switch to more cost-effective rates, and optimize the benefits of their loans.

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'*Vinchi Pattukal'* A Diverse Cultural Representation of The Mappila *Khalasis* in Kerala

Nasreena P.K

The Khalsis played a significant role in the maritime history of Malabar, boasting a distinct identity for their unparalleled technical expertise in handling heavy goods. The origin of Khalasi is seen as a fusion of Arab and local indigenous groups, with the term Khalasi being derived from the Arabic word Khalasi which means black and white together. Khalasis remained relevant and adapted to the changing times by embracing modern technology and integrating it into their work. Despite the shift in job roles, their expertise in handling equipment and their skills were still highly valued. From the initial period, Khalasis played a vital role in the coastal areas of Beypore and gradually extended their settlements to other coastal areas like Chaliyam, Karuvanthuruthy, and Feroke, depending on the possibilities of their work. Their expertise in using these tools made their work much simpler and more efficient. Several traditional songs and chants associated with their heavy work are known as "Vinchipattukal" "Ambapattukal" and "Elayya pattukal," which signify their historical connection with their profession. The Panipattu or Vinchi pattukal were not limited to just artistic expressions; they served a greater purpose in creating a sense of unity and strength among the laborers. The chief purpose of the Khalasis using work songs is to gain energy and motivation for

their work. These songs provide a source of strength for the workers. These work songs, such as Amba pattukal, play a vital role in the Khalasi community, representing their culture, customs, and collective spirit. The songs serve as a reminder of their shared heritage and inspire unity among Khalasis making them an essential element of their cultural identity.

Key Words: Khalasis, Muppan, Vinchipattukal, Daver, Kappi, Ambapattukal, Elayyapattukal, Panipattu.

The *Khalasis*, played a significant role in the maritime history of Malabar. They had a distinct identity for their technical expertise in handling heavy goods. However, with changing times and the transformation of coastal areas, the significance of *Khalasi* community gradually faded from the mainstream maritime history of Malabar. Despite being a major social group in the Malabar coastal region, their role in Kerala's maritime history remained largely unexplored. This article tries to shed light on the significance of the social history of Malabar. The present study attempts to explore the uniqueness of *Khalasis* traditional work song, known as *vinchi pattukal*. When we look into the different aspects of *khalasi* work culture, definitely have to focus on their settlements. This article tries to analyse the historical significance of their coastal settlements. The primary objective of this paper is to preserve their legacy, highlighting their contributions to Kerala's cultural heritage, which has remained unnoticed.

Tracing the Roots: Historical Exploration of the Khalasi Community

The Arabs were the most significant contributors to the coastal trade and the cultural history of Kerala. Even before the rise of Islamic expansion, Arabs played a crucial role in commercial ties with Kerala. Both Kerala and Arabs share the centuries-old heritage of trade and cultural exchange. The great commercial relations between Kerala and the Arab world were one of the main reasons for the establishment of Arab settlements on the seashore of Kerala. The dynamic trading culture influenced the Malabar Coast to open up a new space for diverse religions. During the early period of Islamic emergence in Kerala, the construction of Muslim mosques showed architectural

similarities with Hindu temples, representing a level of assimilation of Hindu- Muslim community.

Arab traders came to Kerala's seashores to trade and cater to the needs of the large wooden boats. They were settled in various coastal regions of Malabar. During that time, they married local women, and this led to the formation of a new marriage tradition in Kerala. The marriage was known as *Mutha* marriage This custom of marriage was well-known in the region of Malabar. The *mutha* marriage was a conventional practice that was not comparable to any other custom prevalent at that time in Malabar. *Mutha* marriage was not considered regular marriages and did not involve customary rituals. Arab traders, who temporarily settled in the coastal regions with the intention of living there for a certain period to carry out their trade and fulfill their needs. So, the Arab traders engaged in *mutha* marriages. This kind of marriage had several distinctive features. As a result, a new generation was born with a mixed heritage of both Arab and local communities. The offspring born through this relationship are considered to have a mixed heritage, with both Arab and indigenous backgrounds. They are seen as a fusion of Arab and local groups known as *Khalasi*. The term *Khalasi* is derived from the Arabic word *Khilasiyy* which means black and white together. The word is reflecting the acknowledgment of the mixed heritage of the children born from these marriages (personal interview, Haasan Koya, 26th January, 2023).

Beypore was one of the most significant ports town in ancient Kerala. From the early period, *Khalasis* played a vital role in the coastal areas of Beypore. Gradually they extended their settlements to other coastal areas like Chaliyam, Karuvanthuruthy, and Ferok, depending on the possibilities of their work. Their technical skills, physical strength, and expertise in performing heavy physical tasks on both land and sea made them a vital part of different labor-intensive projects (C.P. Musthafa, 2019, 337). The technical skills possessed by *Khalasis* allowed them to tackle challenging tasks on both sea and land, along with their counterparts in other labor fields. They held a significant position in the labor sector during that period. However, as technology advanced, their exclusive importance gradually diminished, and scope of their work underwent changes accordingly. Still, they

remained relevant in certain specific workspaces that required their expertise.

Khalasis were used traditional methods and equipment such as wooden beams, coir ropes, chain blocks and *kappi* to lift and move heavy loads. Their specialized knowledge and skill in handling such equipment allowed them to control and manage extensive weights effectively. All works was led by their *Muppan (*Head of particular *Khalasi* group) and they performed challenging tasks with the utmost dedication. Their settlements were mainly concentrated in the coastal areas, from the southern regions of Malabar to the northern parts. They strategically chose locations that offered significant work opportunities. *Khalasis'* local knowledge and expertise in dealing with various issues helped them efficiently execute their work tasks, which varied depending on regional requirements. They adapted their work based on the specific challenges and opportunities present in each region.

The nature of jobs is that *Khalasis* used to handle heavy mechanics. They were skilled laborers using various tools and equipment to lift heavy objects and transport them from one place to another. With the help of simple tools and their experience, they were capable of carrying out demanding tasks efficiently. They were highly esteemed in their profession (Muhammad Sadham Chaliyam, 2013, 120). During the modern period, traditional occupations transformed and modern machinery took over many tasks in different industries. However, *Khalasis* remained relevant and adapted to the changing times by embracing modern technology and integrating it into their work. Despite the shift in job roles, their expertise in handling equipment and their skills were still highly valued. Over the years, *Khalasis* have established their flexibility by effectively incorporating modern machinery into their work without losing their traditional importance. They continue to be an integral part of society, living with great significance and contributing to various industries without losing their essential skills.

From the early days, Beypore served as the primary center for shipbuilding in India, and this is why the *Khalasi* community became

more centralized in this region. Their skills were essential for both ship construction and later launching the ships into the sea. They possessed the expertise to handle heavy loads on both land and water. *Khalasis* were adept at performing challenging tasks in the sea and on the coast with equal competence. There are two divisions within the *Khalasi* community. One division is involved in land-based works, including railway work, construction, huge flat air condition work, factory machine erection work, and rescue operations at sites where accidents involving vehicles occur. Their knowledge and competence in managing complicated tasks that were beyond the capabilities of machines were recognized throughout different parts of Kerala. In regions such as Chaliyam, Karuvanthiruthy, Feroke, Thazhekkad, Pakkumkara, Muzhuppilangad, Valapattanam and Kannur. *Khalasis* were involved in various works related to shipbuilding and harbors.

From Tradition to Present: How the Khalasis are Staying Relevant

Khalasis, who had been involved in the construction of ships in Beypore, has a rich history and a deep-rooted connection with the traditional knowledge and skills passed down through generations (personal Interview, Ummer Muppan, 12th December, 2022). Their traditional technical skill and dedication have earned them immense respect and admiration, not only in the local community but also globally. Their contribution is being recognized even beyond the boundaries of Malabar. However, as industrialization and European influence brought changes to Kerala's socio-economic scenario, they adapted to the evolving times. With the advent of modern machinery and the impact of colonialism, they expanded their expertise to embrace new professions and industries. During the colonial period *Khalasis* played a significant role in shaping the traditional craftsmanship of Kerala and creating new opportunities to excel in diverse fields ((Muhammad Sadham Chaliyam, 2013, 121). *Khalasis*, with their diverse skills and adaptability, have managed to maintain their relevance and significance in various industries. Both within and beyond their traditional domains, making them a respected and valued community in Kerala's social fabric.

During the time of British rule in India, *Khalasis* played a significant role in various railway construction activities. They were involved in heavy work such as building rail tracks, bridges, and large factories where heavy machinery was installed. Their expertise was beneficial for many government projects in Kerala. The British government relied on *Khalasi* services not only in Kerala but also in other regions. Gradually *Khalasis* gained recognition and were known for their exceptional skills, both within and outside Kerala. They were sought after by organizations beyond colonial India for their technical expertise in handling large-scale projects. In the colonial period, when India witnessed several major construction projects, *Khalasis* technical skills were highly valued. Their ability was manifest in the construction of massive railway bridges and huge dams, showcasing their engineering capabilities. *Khalasis* played a vital role in the infrastructure development of India during the British colonial period, with their technical skills being highly appreciated and recognized in various significant projects.

During the time of the First World War, there are references in some British records suggesting that *Khalasis* were employed for heavy work in railway construction outside India. It was mentioned in discussions related to the construction of the Bara-Basra Mesopotamia railway line that Chaliyam *Khalasis* were used for this purpose (personal interview, Hassan Koya, 26th January 2023). The British records mention that the *Khalasis*, who cooperated very effectively in the construction of the railway, were given leased land in the coastal region of Malabar as a token of appreciation. Projects like the Kadalundi Bridge and Mettur Dam are some examples of the early works undertaken by *Khalasis* during the colonial era. The construction of the clock tower in Mecca (The Clock Tower in Mecca is a prominent land mark and a symbol of the city's identity. It is officially known as 'Abraj Al Bait Clock Tower. It is visible from various parts of the city and serves as a reference point for millions of pilgrims who visit Mecca during Hajj and Umrah) is another example of the work undertaken by *Khalasis* .(personal interview, Muhammed Koya, 23rd April, 2022)

In the activities related to the sea, another essential division of the *Khalasis* was their involvement in the construction and

maintenance of wooden boats in the region of Malabar. In the early days, certain circumstances large ships were unable to navigate directly to their destination. It was during such situations that the *Khalasis* played a crucial role in navigating and steering the boats. In the early days large wooden boats were used for transporting goods, especially spices, sandalwood and other precious products. Due to their size and design, they were unable to reach the harbors directly. In such cases, the *Khalasis* were responsible for guiding the boats and maneuvering them to reach the nearest harbor. These skilled individuals had an exceptional understanding of the sea and the local waterways, allowing them to safely navigate the boats. Their expertise was also valuable when loading and unloading cargo. They ensured that heavy goods and materials were handled efficiently and securely during the process. Additionally, their proficiency in handling heavy objects was a significant asset when lifting and elevating items on both land and sea. The major areas where we can find *Khalasis* involved in such activities related to the sea are Chaliyam, Beypore, Kallayi, Ponnani, and Tirur. They possess specific regional expertise and utilize technological skills that we can observe in each of these regions (personal interview A Najeeb 30th November 2022).

The *Khalasi* of Beypore gained worldwide recognition, and one of the most significant events in their history was the Peruman train accident in 1988. Mappila *Khalasi* from Beypore, Chaliyam and Karuvatthuruthi regions had actively taken part in the Peruman rescue mission (Personal interview, Ummar Muppan 2nd November, 2022). The technology of the traditional *khalasis* was not yet well known to the general public. They showed the world in the face of disaster how heavy things could be lifted using their traditional weapons. The *Khalasis* took up the task when all the rescue operations launched with the help of heavy machinery could not be successful. The *Khalasi* of Beypore and Chaliyam were able to lift the bogies with relative ease when several modern engineering techniques failed to retrieve railway bogies from the depths of the lake (Alex George, May 6, 1989, *Economic and Political Weekly,* p.965)

From the beginning the Indian Army's Armed Recovery Vehicle took over the rescue mission. So, the *khalasis* were not directly

involved in the rescue mission. However, even then, they played a crucial role in helping the army climb up by fixing iron ropes on the bogies sunk several feet below the water surface. But the attempts to lift the train using crane failed. The mission failed when the iron rope tied to the bogie to lift it broke. Rail coaches were gone under the water again. The *Khalasis* then took over the responsibility of lifting the bogies. In this critical situation, the Mappila *Khalasi* used their traditional tools such as *kappi* and rope, for this rescue operation (Personal interview, Ummar Muppan 2nd November, 2022). However, initially, the railway engineers did not have much faith in the skills of the *khalasis*. The Khalasis, with their strenuous efforts, pulled out the railway bogies one by one from the water. The people present watched the work of the *khalasis* with great wonder.

Unique Cultural expression's

In Beypore, *Khalasis* have an exceptional role in the construction of traditional wooden boats known as *Uru*. Due to the long history of *Uru* construction, they have a rich heritage and experience in this field. They have been involved in building *Uru.* Their expertise is especially significant in the construction of traditional wooden boats, which is a unique aspect of their craft. The *Khalasis* of Beypore play a crucial role in launching the newly constructed *Uru* into the water. This task requires a specific set of skills that are mastered by the *Khalasis* through their long-standing involvement in the *Uru* making process. In addition to their involvement in sea-related activities, *Khalasis* were skilled in handling large boats that entered the harbors. When such boats got stuck in the area of little water, the *Khalasis* themselves were capable of maneuvering and freeing the vessels. To accomplish such tasks competently, *Khalasis* relied on their special tool called "*Dhawar*" commonly known as a wooden *vinch*. Along with *Dhawar*, *Khalasis* used additional tools such as "*kappi*" and "coir" to aid in their effort (C.P Musthafa, 2019 p.338). Their expertise in using these tools made their work much simpler and more efficient. Several traditional songs and chants associated with their heavy work are known as "*Vinchi pattukal*" "*Amba pattukal*" and "*Elayya pattukal*," which signify their historical

connection with their profession (personal interview with Muhammed Koya, 23rd April, 2021)

Due to the serious nature of their work, a sense of solidarity among the laborers becomes crucial. Providing inspiration and enthusiasm to the workers is the purpose of such songs. Often, these songs aim to simplify challenging tasks and elevate the mood of the workers. The rhythm and melody of these songs were designed to invigorate the laborers, encouraging them to work with more energy and dedication. (B. Muhammed Ahammed, 2006, 52). These songs create a sense of unity and shared experience among all the workers, making them feel more connected and driven to achieve their common goal. When we study the history of work songs, we can indeed observe a uniform nature. All types of songs used in workplaces aim to reduce the burden of labor and foster amity among the workers. The use of work songs created a sense of collaboration and cooperation among the workers, leading to a collective effort in achieve their goals. The lyrics of these songs were not purely for artistic purposes; rather, their significance lay in motivating the workers and creating a sense of solidarity within the workforce. So, the lines of these work songs did not follow the conventions of refined music; instead, they prioritized the essential message of unity and encouragement. Workplaces are filled with various emotions, joys, sorrows, and challenges. All of these characteristics are reflected in the work songs, making them an integral part of the work environment.

The work songs sung by the *Khalasis*, who were involved in the construction of Beypore *Uru* are known as "*Panipattu*" or "*Kappal* p*attu*." These songs hold significant impact of the *Khalasi* Muslim community, which was engaged in the different stages of *Uru* building activities (personal Interview, Ummer Muppan, 12th December, 2022). The style of singing and the vocal techniques used in these songs were influence by *Mappila pattu*. The lyrics song contains references to *Allah*, the divine power, reflecting the deep faith and spirituality of the workers. The *Panipattu* or *Kappal pattu* was not limited to just artistic expressions. They served a greater purpose in creating a sense of unity and strength among the laborers. These songs incorporated the legends of Prophet Muhammad,

*Karamat (*Arabic term commonly used in Islamic religious context to refer the miracles or extraordinary acts performed by saints or holy person. These miracles are believed to be manifestations of divine power and are often considered as signs of the person's spiritual and connection with God) of Sheikh or *Auliyas*. *Panipattu* or *Kappal pattu* played a significant role in the work environment. It bringing together the workers and motivating them to carry out their tasks with determination and unity.

The chief purpose of the *Khalasis* using work songs is to gain energy and motivation for their work. These songs provide a source of strength for the workers. The term commonly used to refer to those who sing work songs is known as "*Ambakkaran*". The leader of the group is called "*Khalasi Moopan* who acts as *Ambakkaran*". '*Jawabmar'* as the term used to refer to those who respond to the song or repeat it is sung by *Ambakaran*. Their usage of specific words and context depends on the situation and the demands of the work environment (personal interview with Mammu,15th December, 2022). Some of the work songs may contain short poetic verses, and they are used accordingly based on the rhythm or tempo of the work. Various workers may sing the same song, but the lyrics may be adapted to fit the context of the different work sites.

This paper mainly focuses on the distinct style of *Amba* songs. When analyzing the lyrics of these work songs and examining the techniques used, it becomes possible to gain a clear understanding of the different work environments. *Mappila Khalasi Katha parayunnu* the malayalam work written by C.M Mustafa Haji Chelembra discusses the detailed references to the unforgettable experiences of the *Khalasis.* In this work, Chelembra narrates the details of the strenuous work that *Khalasis* undertook using traditional equipment called *Vinchi* to lift weights at the construction sites in Malabar (C.M Musthafa Haji Chelembra, 2011, pp.37-40) Before attempting to lift a heavy object, the experienced *Khalasi* in the group would call out "*Pidikkalle*" (going to lift) to which others would respond. Then the lifting process started and everyone joined together (C.M Musthafa Haji Chelembra, 2011, pp.37-40). After that throughout the work, they would continue singing the *Amba Pattukal.* Everyone, hold it and lift

it together. The *Khalasis* would engage in the laborious task while singing *Amba Pattukal*, making their work more manageable and inspiring each other with a sense of unity. Some lines from the *Amba paattukal* that the *Khalasis* used to commonly use in their workplaces are mentioned in this context.

Ailasa… ailasa….

Oblamali ailsa…

Thalla pokkaru ailasa…

Ailasa… ailasa… (personal interview, Abubaker , 18th December, 2022)

It is impossible to find the exact literary meaning of lines mentioned above. The workers sing these lines together, called "*ailasa*," to make the task of lifting heavy objects more strenuous. It is more likely that the term "*thalla pokkar*" refers to an imaginary leader. Such *amba* songs were used during times of heavy lifting and also during times of pulling or pushing heavy loads.

We can see different kinds of amba *pattukal* that the *Khalasis* used to sing, depending on the nature of the work. The nature of the song totally different when they sang it during rescue operations at accident sites. Here is the translation of the famous lines from the *amba pattukal* sung by Khalasis during vehicle accidents and rescue operations:

Vandi marinje …ailasa..

Undikkettu ailasa…

Ailasa…ailasa

Oblamali ailasa.. (personal interview, A Najeeb, 30th November, 2022)

The words "*vand*i *marinje*" and "*unthikettu*" are in the traditional common usages."*vandi marinje*" means that the vehicle has overturned. "*unthikettu*" refers to the collective effort of lifting a fallen vehicle using everyone's strength. Khalasis commonly use *ailasa* calls in all kinds of heavy lifting tasks to reduce the workload.

Kallayi River (Kallayi puzha is merge with the Arabian Sea in Kozhikode. The river is significant for its historical and cultural importance) which was strongly connected with the lives of *Khalasis*

in Malabar. In the trade history of Malabar Kallayi River was considered the main center of the ancient timber trade. The main theme of the *amba pattukal* revolves around the Kallayi river, as it had a profound impact on the professional and social lives of the Khalasis. From the song of a*mba Pattu*, we can assume how much influence and impact the Kallayi River had on the lives of *Khalasis*.

Allante kamalu rahmathu
Thannalu rabee barakkathu
Allante kamalu rahmathu
Thannalu rabee barakkathu
Kallayippuzhayude rahmathu
Thannalu rabee barakkath (*personal* interview, Hussain P , 26th January, 2023)

The Kallayi River was an integral part of the lives of *Khalasis* in Malabar, and it played a significant role in shaping their livelihoods. It served as a major center for their activities, and they depended closely on the river for various stages of their lives. The main thing that is being indicated in these lines is that the biggest blessing that God has given to the *Khalasis* is the Kallayi River. This song "*amba pattukal*" reflects the association between *Khalaasis* and the Kallayi River, symbolizing the wealth and prosperity bestowed upon them by God.

Another important place where the Khalasis sang amba pattukal was in connection with the different stages of uru making. Khalasis used to be involved in all the stages of Uru making. The Khalasis themselves used to do all the different heavy-duty tasks related to Uru construction. In all these stages, the *Khalasis* used to sing *vinchi* songs to lighten their workload. During the time of *Uru* launching in to the sea, the *Khalasis* sang a song to ease their fatigue from laborious work (personal interview, Ummer Muppan, 12th December, 2022). During this period, they sang song known as *vinchi pattu*. In these vinch songs, everything that brings enjoyment and comfort to the mind will find its place in the lyrics. They used *vinchi pattu* song inspired by Muhiyudheen Sheik's extraordinary skill. They believe that Muhiyudheen Sheik's exceptional abilities would bring about more

significant accomplishments in this meticulous endeavor (personal interview, Ummer Muppan, 12th December, 2022).

Alla alla ya salama
Porishayerum nurudheen sheik
Ya auliya
Alla allay a salama (personal interview, Mammu, 15th December, 2022).

It is possible to witness profound songs in the *vinchi* tradition, expressing deep religious sentiments in the cultural history of Malabar. *Auliyakkal* played a significant role in shaping the strong beliefs and cultural values in Malabar. Hence, we can indeed have an enormous collection of poignant *vinchi* songs.

Shahid abubakkar samadani oliyulla
Allahi alla salamu
Shahid abubakkar samadani oliyulla
Allante alla kaval
Shahid abubakkar samadani oliyulla (personal interview, Hussain P ,26th January, 2023).

We can see many *vinchi* songs that mention the miracles of the *Auliyas*. In such songs, we can see the *Auliyas* being praised in an immense way. The *Khalasis* believed that when doing heavy work, the *Auliyas* would be with them and help them lift the weight invisibly. This belief gave them the confidence to lift even the heaviest objects.

The existence of such *Amba paattukal*, which praised *Allah* (God) and the *Auliyas*, was another important proof of the strong faith that the Mappilas possessed.

Alla alla…yallaa…
Keripokatte ya allaa
Alla allay a alla…

The song *Ellayya pattukal* was commonly used by *Khalasis* to lift heavier loads during manual labour. In some places, these types of work songs were also known as *amba pattukal* or a*layya pattukal*. These songs provide rhythm and motivation for the workers, making

it easier for them to coordinate their efforts and lift heavy weights together.

Othupidichal malayum porum elayya
Kakkane njangale ellayya
Pavangalan elayya
Mureed auliya ealayya
Alla alla elayya
Kakkane alla elayya
Muthu nabiye elayya

Each *Elayapatt* or *Ambapatt* song provides valuable information about the lives of Khalasis. By analyzing the *Elayapatt* songs mentioned above, we can find facts that support these observations. *Othupidichal Malayum Porum:* The phrase "*Othupidichal malayum porum"* means that if we stand together, even an impossible task like breaking a mountain becomes easy. This reminds us of the importance of unity and cooperation among the Khalasis. They were a community that worked hard together and helped each other.

"*Kakkane njangale ellayya- Pavangalan elayya -Mureed auliya elayya*" we see the poor *Khalasis* praying to the saints (*auliya*) for their protection. *Khalasis* himself says that they were very poor and they faced many hardships. Therefore, they believe that the help of God and the saints is essential for them. It is clear that, through such *amba pattukal*, they greatly desire the mercy and compassion of God. Songs like ambapatt and elayapatt reveal important details about the social, cultural, and economic standing of *Khalasis*. These songs give us a clear picture of their unity, cooperation, faith in God, poverty and hardships. They serve as an important source for understanding *Khalasi* culture.

Allase ele mali
Allase ele chumbra
Allase ya maoulani
Allase musakka
Allase beeran ponni
Allase maveli nattil

Allase vilayatt undedo (personal interview, Ubaith , 15th December, 2022)

The *Khalasis* used to sing a large number of work songs that were widely common at the work sites. These *amba pattukal* (work songs) played a vital role in the lives of *Khalasis*, providing them with much-needed relief during their laborious tasks. With the help of these songs, they could synchronize their efforts while lifting heavy weights and the rhythm of the songs made their work more manageable and inspiring. The songs were used in conjunction with their work routines. The *Khalasis* adjusted the lyrics of the songs based on the nature of their work and the difficulty of the task. Depending on the specific work, they used different verses and adjusted the tune accordingly. For example, they sang *Bhakti Pattukal* (devotional songs), *Hasya Pattukal* (comical songs), and *Theri Pattukal* as per the context of their work (personal interview, Ubaith , 15th December, 2022). Many types of songs were frequently sung in accompaniment to *Amba paattukal*. The enchanted verses of these songs embodied humor, faith, and life itself. *Khalasis* unity is the most significant component of their work. When a *Khalasi* in a group is not giving his work his full attention, the other members of the group tease him and sing about it. Such lines were quickly making their way into their songs. In the same way, occasionally they would pair these songs with swearing songs. Such swearing songs were regarded by them as a type of workplace humor. All those involved in the *Khalasi* profession were part of these songs. The truth is that these songs, whether they were swearing songs or mocking songs, never had an adverse impact on the *Khalasis* sense of unity.

Conclusion

The unique and outstanding feature of *Khalasi* culture is the representation of their work songs, known as "*amba pattukal*." These songs have a deep-rooted connection with the cultural life of the *Khalasi* community in Kerala. Regardless of the nature of the work, the *Khalasis* used these songs to efficiently coordinate and manage their labor-intensive activities. These songs were a perfect example of how work and cultural practices could intertwine harmoniously.

Even the *Vinchi Pattukal* served as a cultural representation of traditional community practices. The *Khalasis'* social group in Malabar exhibits a strong cultural unity, heavily influenced by their beliefs, customs, and rituals, which are reflected in their lives. These songs also brought out their talents and showcased their traditions through competitive representation. Irrespective of regional differences and variations in work types, the *Khalasis* demonstrated unity by coming together to sing and perform during laborious tasks, making these work songs a significant aspect of their cultural heritage. Throughout different regions and diverse work assignments, the *Khalasis* maintained their unique cultural identity by integrating these labor songs into their work routines. This tradition of using work songs has been passed down through generations, allowing them to preserve their customs and beliefs. The notable ability of the *Khalasis* to adapt their work songs to different contexts and work environments highlights their creativity and resilience. Whether it was a representation of *vanchi pattukal* or *Amba pattukal* to demonstrate their cultural heritage and bring together diverse beliefs and practices. These work songs, such as *Amba pattukal*, play a vital role in the *Khalasi* community, representing their culture, customs, and collective spirit. The songs serve as a reminder of their shared heritage and inspire unity among *Khalasis* making them an essential element of their cultural identity.

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CHAPTER

Framework for implementing circular economy in agriculture

2

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2.1 Introduction

Imagine a world devoid of waste; a place where resources are harnessed efficiently and perpetually reintegrated into the system. This is the essence of a circular economy, a progressive economic framework that seeks to reduce waste, optimize resource use, and foster sustainable development (Benyus, 1997).

In recent years, there has been growing recognition of the limitations of our current linear economic model—one that follows a "take-make-dispose" pattern. It is clear that this approach is not sustainable in the long run as it depletes natural resources and contributes to the environmental degradation. In an epoch defined by ceaseless consumption and the inexorable exploitation of nature, the call for a paradigm shift in our systems of production and consumption has never been more profound.

As we stand on the precipice of ecological calamity, the dawn of a new era beckons us—the era of the circular economy. Particularly in the realm of agriculture, an industry notorious for its environmental impacts, this shift holds the potential for a salubrious revolution. Agriculture, as it stands today, operates predominantly on a linear model, a "take-make-waste" approach that has led to significant environmental challenges. As Ellen MacArthur, a leading advocate for the circular economy, has noted, "A circular economy is one that is restorative and regenerative by design" (MacArthur, 2013).

The circular economy offers an alternative solution by rethinking our entire approach to production, consumption, and waste management. It promotes strategies such as recycling, reuse, repair, remanufacturing, and sharing economies—all aimed at keeping products and materials within the cycle for as long as possible.

In the words of the renowned environmental scientist, Jane Goodall, "You cannot get through a single day without having an impact on the world around you. What you do makes a difference, and you have to decide what kind of difference you want to make" (Goodall, 2013). This chapter is an exploration of the

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difference we can make by embracing a circular economy within the agricultural sector, a domain that has a profound impact on our world.

2.2 What is a circular economy?

Circular economy is a concept that has been gaining momentum in recent years as we strive to find sustainable solutions for our planet. In simple terms, a circular economy is an economic system that aims to eliminate waste and keep resources in use for as long as possible.

In a circular economy, products are designed with durability in mind. They are meant to be repaired or upgraded rather than discarded after use. This shift toward a more cyclical system has numerous benefits for both the environment and the economy. In this type of economy, products are designed with the intention of being repaired, reused, or recycled at the end of their life cycle. This means moving away from the traditional linear model of "take-make-dispose" and instead adopting a closed-loop approach.

The principles of a circular economy include reducing waste and pollution, keeping products and materials in use for longer periods through reuse or recycling, regenerating natural systems, and fostering innovation. By implementing these principles on a large scale, we can create a more sustainable future.

Transitioning to a circular economy requires collaboration between businesses, governments, consumers, and other stakeholders. It involves rethinking how products are designed and manufactured to ensure that they can be easily repaired or disassembled into recyclable components. It also requires investing in infrastructure for recycling and creating markets for recycled materials. The goal of a circular economy is to minimize resource extraction while maximizing value creation. By embracing this approach, we can reduce environmental impacts while also stimulating economic growth and job creation. The transition won't happen overnight but taking steps toward building a circular economy now will have long-lasting benefits for both our planet and future generations.

2.3 Differences between a linear economy and a circular economy

Economics, as a discipline, is as much an examination of choices as it is about systems and structures. At its heart lies the question of how we manage our resources. Two prevailing economic paradigms currently vie for prominence in this discussion: the traditional linear model and the innovative circular model. These are not mere theoretical constructs, but the blueprints that shape our reality, our interaction with the natural world, and our prospects for sustainable development.

The concepts of linear and circular economies represent two fundamentally different approaches to the use of resources. These models impact every sector of

the economy, from agriculture to manufacturing, and their implications stretch from environmental sustainability to economic resilience.

2.3.1 Linear economy

The linear economy is reminiscent of a relentless march, a one-way journey from cradle to grave (Fig. 2.1). It is underpinned by a straightforward, albeit fundamentally flawed, logic: extract resources, manufacture products, consume them, and finally dispose of them as waste. A linear economy is an economic model that is based on a "take-make-dispose" approach to the use of resources. This traditional model is called "linear" because it follows a straight line: raw materials are extracted, processed into products, used, and then discarded as waste. This approach assumes that resources are abundant, available, and cheap enough to be disposed of without significant economic loss.

2.3.1.1 Resource extraction (take)

The first step in a linear economy involves the extraction of natural resources, such as minerals, fossil fuels, or timber, from the environment. These resources serve as the raw materials needed for production.

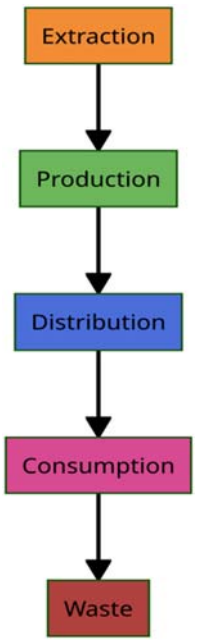

FIGURE 2.1

Linear model of economy.

2.3.1.2 Manufacturing (make)

The extracted resources are then used to manufacture goods. This step can involve various processes, including refining, assembly, and packaging.

2.3.1.3 Consumption (use)

Once produced, goods are sold to consumers, who use them to fulfill various needs and wants. Once these goods are no longer useful or desirable to the consumer, they reach the end of their life cycle.

2.3.1.4 Disposal (dispose)

The final stage in a linear economy is waste disposal. This often means products are sent to landfills, incinerated, or left in the environment, contributing to pollution.

2.4 Challenges of the linear economy

The linear economy, characterized by a take-make-dispose approach, faces numerous challenges in today's world. One of the biggest challenges is resource depletion. As resources are extracted and used without consideration for their limited availability, we are rapidly depleting our natural reserves.

Another major challenge is waste generation. In a linear economy, products are designed to have a short life span and end up as waste once they serve their purpose. This leads to massive amounts of waste being produced, which not only burdens our environment but also poses health risks.

Furthermore, the linear economy contributes significantly to pollution levels. From the extraction of raw materials to manufacturing processes and disposal of products, each step releases harmful substances into the environment. This pollution affects ecosystems and human health alike.

In addition, the linear economy relies heavily on fossil fuels for transportation and energy needs. The burning of these fuels releases greenhouse gases that contribute to climate change and global warming.

Moreover, the linear economy fails to consider social equity issues. It often results in unequal distribution of wealth and resources among different communities, leading to social tensions and disparities.

The linear model lacks resilience due to its dependence on finite resources and unsustainable practices. As these resources become scarce or too expensive to access, it becomes increasingly difficult for businesses and industries operating within this framework to sustain themselves economically.

These challenges highlight the urgent need for transitioning toward a circular economy in agriculture—one that aims at reducing resource consumption while maximizing value creation through sustainable practices such as recycling materials, minimizing waste generation, promoting renewable energy sources, and fostering equitable distribution of wealth.

2.4.1 Circular economy

As we chart the turbulent waters of the linear economy, a beacon of sustainable economic design emerges on the horizon—the circular economy (Fig. 2.2). A stark contrast to its linear predecessor, the circular economy is a system that seeks harmony with nature, a harmony deeply embedded in the rhythm of regeneration and restoration.

The circular economy, contrary to the "take-make-dispose" approach, follows a revitalizing cycle of "make-use-return." This model seeks not just to reduce waste but to redefine the concept of waste altogether. Under this system, waste is not an inevitable by-product but a resource out of place. Every output is configured to serve as an input for another process, emulating the cyclical processes of nature where nothing is wasted. A circular economy (often referred to simply as "circularity") is an economic system aimed at eliminating waste and the continual use of resources (Geissdoerfer, Savaget, Bocken, & Hultink, 2017).

2.4.1.1 Reduce-reuse-recycle model

The circular economy follows a "reduce-reuse-recycle" model. It aims to minimize waste and to make most of the resources by creating closed-loop systems where waste is repurposed or cycled back into the production process.

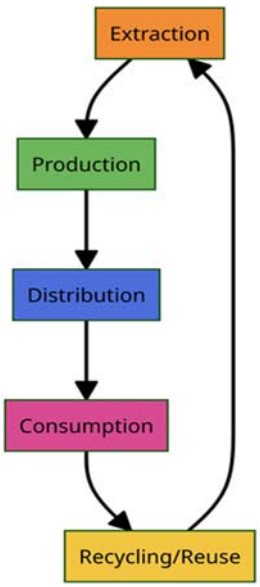

FIGURE 2.2

Circular model of economy.

2.4.1.2 Resource efficiency

Circular economies focus on maximizing the life cycle of resources. This can involve designing products for durability, reuse, and recycling, thereby reducing the demand for resource extraction.

2.4.1.3 Sustainability and resilience

The circular economy places a strong emphasis on environmental sustainability and resilience. It seeks to minimize environmental impact, reduce greenhouse gas emissions, and build economic resilience by decoupling economic activity from the consumption of finite resources.

2.4.1.4 Long-term focus

The circular economy takes a long-term perspective, considering the impact of today's decisions on future generations. It places a value on preserving natural capital and maintaining the health of ecosystems.

2.4.1.5 Waste as a resource

In a circular economy, waste is viewed not as a problem but as a resource. Waste from one process can be used as an input in another process, reducing the overall amount of waste produced and the need for new raw materials.

In conclusion, while the linear economy is characterized by the extraction, use, and disposal of resources, the circular economy aims for sustainability through the efficient use of resources, waste minimization, and the creation of closed-loop systems. The shift from a linear to a circular economy is seen as crucial for achieving sustainable development in the face of environmental and resource challenges.

2.5 Why do we need a circular economy?

The path to a sustainable future is intricately woven into the fabric of the circular economy, a truth more pertinent within the agricultural sector than perhaps any other. Yet, one may ask: Why do we need a circular economy? To answer this, we must first gaze upon the distressing canvas of our present realities.

Our world is locked in the vice of the linear economy, an economic model fixated on growth and consumption, ignorant of the finiteness of our resources, and blind to the repercussions of our actions. It's an economic modus operandi that has driven unprecedented progress, yet also delivered us to the doorstep of environmental calamity.

This linear path, particularly within agriculture, is characterized by rampant resource extraction, environmental degradation, and a waste narrative that is increasingly untenable. It is an agricultural sector in which soil fertility declines year by year, biodiversity is eroding, and water scarcity is becoming a defining

challenge of our times. It is in this context that the need for a circular economy becomes not only desirable but also indispensable.

The circular economy offers a beacon of hope amid these growing challenges. By decoupling economic activity from resource consumption and environmental degradation, the circular economy offers an alternative pathway that is restorative and regenerative by design. It presents a model where waste is eradicated, resources are continually reused, and the natural environment is restored and enhanced (Ghisellini, Cialani, & Ulgiati, 2016).

A circular economy offers an alternative solution by aiming to keep materials and products in use for as long as possible through recycling, reusing, and remanufacturing. By closing the loop on resource consumption and waste generation, we can reduce carbon emissions, conserve natural resources, and minimize pollution. This not only benefits the environment but also creates economic opportunities.

Here are the main reasons why we need transition toward a circular economy:

1. **Resource Scarcity and Efficiency**: The linear model of consumption assumes an endless supply of resources, which is not sustainable. A circular economy promotes efficient use of resources, minimizes waste, and strives to keep materials in use as long as possible, contributing to the conservation of these finite resources.
2. **Environmental Protection**: Traditional linear economies often result in significant environmental degradation, including pollution, climate change, and loss of biodiversity. By designing out waste and minimizing negative impacts, a circular economy can significantly reduce harm to the environment.
3. **Economic Resilience**: The linear economy's reliance on finite resources creates economic risks, including price volatility and supply chain disruptions. By reducing dependency on scarce resources and creating new opportunities for innovation, the circular economy can contribute to more resilient economies.
4. **Climate Change Mitigation**: The circular economy can play a significant role in combating climate change. By promoting renewable energy, minimizing waste, and encouraging the efficient use of resources, it can significantly reduce greenhouse gas emissions.
5. **Innovation and Job Creation**: The transition to a circular economy can drive innovation, leading to the development of new technologies, products, and services. It can also stimulate economic growth and job creation in new and emerging industries.
6. **Societal Well-being**: A circular economy can improve societal well-being by reducing pollution and waste, which in turn can have significant health benefits. It also encourages sustainable practices that can lead to cleaner environments and improved quality of life.

In summary, the circular economy offers a viable and sustainable alternative to the traditional linear economy. By promoting efficiency, sustainability, and resilience, it can help to address key environmental, economic, and social challenges facing the world today.

2.6 The circular economy: a vital response to the global waste challenge

The modern world, with its rapid urbanization, economic development, and burgeoning population, stands at a crossroads. On one hand, these developments signify progress, offering more products, services, and opportunities to citizens. On the other hand, they bring forth an alarming consequence: escalating waste generation. As we navigate this dichotomy, the importance of transitioning to a circular economy becomes increasingly evident (Stahel, 2019).

Waste generation is an inevitable by-product of our contemporary lifestyle. As cities swell and nations prosper, the volume of waste they produce grows proportionally. Initial estimates had pegged global waste production at 1.3 billion tonnes per year (Silpa, Yao, Bhada-Tata, & Van Woerden, 2018). However, by 2016, this had surged to an astounding 2.01 billion tonnes (Table 2.1). The distribution of this waste is not even. Regions such as East Asia and Pacific, along with Europe and Central Asia, contribute a staggering 43% of the world's total waste. Such disparities not only highlight the varied challenges different regions face but also underscore the universal and pressing need for sustainable waste management solutions.

The data on waste generation serves as a clarion call. As regions grapple with the multifaceted challenges of waste management, the circular economy emerges as an indispensable strategy. It offers a blueprint for a sustainable future, where resources are used judiciously, waste is minimized, and the environment is revered. Embracing the circular economy is not just a choice, it's an imperative for a world seeking harmony between development and sustainability.

Table 2.1 Waste generation by region.

Sl. No.	Region	Amount of waste generated (millions of tonnes per year)	Percentage
1.	Middle East and North Africa	129	6
2.	Sub-Saharan Africa	174	9
3.	Latin America and the Caribbean	231	11
4.	North America	289	14
5.	South Asia	334	17
6.	Europe and Central Asia	392	20
7.	East Asia and Pacific	468	23

Note: *Data adjusted to 2016.*
From Silpa, K., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a Waste 2.0, A global snapshot of solid waste management to 2050, International Bank for Reconstruction and Development/The World Bank 1818 H Street NW, Washington, DC 20433.

2.7 Importance of circular economy in agriculture

The traditional agricultural model, dominated by intensive farming and monocropping practices, has led to numerous environmental challenges. Soil degradation, water pollution, and biodiversity loss are among the significant issues we face today. Enter the circular economy—a transformative approach that can help agriculture to becomes more sustainable and resilient.

In the agricultural sphere, the circular economy takes on an even more profound significance. This is an industry whose roots delve deep into the soil of our natural environment, an industry that is both affects and affected by ecological cycles. From crop production to livestock rearing, from food processing to waste management (Murray, Skene, & Haynes, 2017), the opportunities to implement circular principles are abundant.

The paramount importance of the circular economy in agriculture can be explicated in threefold: environmental restoration, resource optimization, and sustainable development.

2.7.1 Environmental restoration

Traditional farming practices have inflicted scars on our environment, such as soil degradation, water pollution, and loss of biodiversity. The circular economy, with its emphasis on regenerative practices, could heal these wounds. Through strategies like agroforestry, permaculture, and organic farming, we can restore soil health, conserve water, and promote biodiversity.

2.7.2 Resource optimization

Agriculture is a resource-intensive industry. The linear model's profligacy stands at odds with our planet's finite resources. A circular approach to agriculture could rectify this imbalance. By maximizing the value of agricultural by-products, optimizing the use of water and energy, and promoting the reuse and recycling of materials, we can significantly reduce resource consumption.

2.7.3 Sustainable development

With the global population predicted to reach 9.7 billion by 2050, the challenge of feeding the world sustainably has never been greater. Here, the circular economy presents an elegant solution. By decoupling agricultural growth from resource consumption and environmental impact, it provides a path to sustainable development. A circular agriculture system could deliver food security, livelihood opportunities, and economic prosperity, without sacrificing our environment.

In essence, the circular economy in agriculture is not a mere economic model; it is a transformation in our relationship with our planet, a shift from exploitation to harmonization. By embracing its principles, we can craft a future where agriculture no longer depletes our environment but nourishes it, a future where the act of feeding humanity reaffirms our kinship with nature.

2.8 Definition and principle of circular agriculture

Circular agriculture, at its core, is the application of the circular economy's principles in the field of agriculture. It's an approach to farming that aims to make the most efficient use of resources and minimize waste through a closed-loop system. "Circular agriculture is the farming practice designed to minimize waste and recycle as much as possible. It involves using waste from one product as a resource for another, thereby creating a closed-loop system" (*Adapted from "Closing the Loop - An EU action plan for the Circular Economy,"* European Commission, 2015).

Circular agriculture strives to create an agricultural system that:

1. Reduces its reliance on finite natural resources,
2. Minimizes environmental harm, and
3. Contributes positively to the economy and society.

Circular agriculture is a concept that aims to revolutionize the way we approach farming and food production. It involves designing agricultural systems that minimize waste, promote resource efficiency, and prioritize sustainability. At its core, circular agriculture follows the principles of a circular economy by closing the loop on resources and eliminating linear processes.

The central tenet of circular agriculture is the elimination of waste. In this enlightened paradigm, what we have traditionally deemed as "waste" is recast as a resource. Crop residues, livestock manure, and food waste are no longer viewed as problems to be discarded, but as valuable inputs for other processes. Through composting, anaerobic digestion, and bioenergy generation, these so-called wastes are transformed into organic fertilizers, renewable energy, and nutrient-rich feeds, creating a cycle of resource regeneration.

The principle of circular agriculture lies in its commitment to creating a regenerative system where nothing goes to waste. Instead of viewing waste as a problem, it sees it as an opportunity for value creation. This means finding innovative ways to reuse, recycle, or repurpose agricultural by-products and residues.

One key aspect of circular agriculture is nutrient cycling. Rather than relying heavily on synthetic fertilizers, this approach emphasizes the use of organic matter such as compost and manure to replenish soil nutrients. By returning organic

materials back into the system instead of discarding them or letting them become pollutants, circular agriculture ensures sustainable soil health.

Another principle central to circular agriculture is diversification. Traditional monoculture practices often deplete soil quality over time due to their heavy reliance on chemical inputs and lack of biodiversity. Circular agriculture promotes crop rotation, intercropping, and agroforestry practices, which enhance natural pest control mechanisms and improve overall ecosystem resilience.

In addition, water management plays an essential role in circular agriculture principles. Efficient irrigation techniques like drip irrigation or precision farming can reduce water consumption while optimizing plant growth outcomes.

By embracing these principles—minimizing waste generation through recycling or reusing agricultural products, promoting nutrient cycling through organic matter utilization, encouraging diversification through crop rotation methods, and implementing efficient water management strategies—farmers can plan for transition towards more sustainable practices aligned with the concepts of a circular economy.

2.9 Benefits of circular agriculture

Environmentally, circular agriculture offers a panacea for the ills inflicted by conventional farming practices. It mitigates the impacts of soil degradation, water pollution, and biodiversity loss, which are predominant in traditional agricultural models. By adopting practices such as crop rotation, cover cropping, and composting, circular agriculture not only reduces agricultural waste but also enhances soil health, optimizes water use, and promotes biodiversity (Wezel et al., 2009).

Economically, circular agriculture presents a transformative model that maximizes resource efficiency and generates new value streams. By reimagining agricultural by-products as resources rather than waste, farmers can develop additional revenue sources. For instance, crop residues can be turned into biofuels, livestock manure into organic fertilizers, and food waste into compost, generating economic benefits while contributing to a closed-loop system (Ellen MacArthur Foundation, 2013).

Socially, circular agriculture strengthens food security and promotes rural development. By enhancing the productivity and resilience of agricultural systems, it helps to secure the supply of nutritious food for growing populations. Moreover, it fosters rural development by creating new jobs and opportunities in green and blue economies, particularly in sectors such as organic waste management and sustainable bioenergy.

From a broader perspective, circular agriculture aligns agriculture with the goal of sustainable development. It helps to address critical global challenges such as climate change, resource scarcity, and biodiversity loss. By reducing greenhouse gas emissions, minimizing resource extraction, and fostering ecological resilience, circular agriculture plays a critical role in driving a sustainable and resilient future.

2.10 Framework for implementing circular economy in agriculture

The implementation of a circular economy in agriculture is crucial for sustainable and efficient agricultural practices. A framework serves as a guide to ensure the successful integration of circular principles into the agricultural sector.

The transition toward circular agriculture requires a holistic, systemic shift. It necessitates the transformation of current agricultural practices, policy frameworks, market mechanisms, and societal norms. While this may appear daunting, breaking down this complex process into manageable steps can illuminate the path forward.

2.11 Step 1: understand and assess

The journey begins by understanding the concept of the circular economy and assessing its relevance and potential in the agricultural context. This involves studying successful case studies, identifying potential applications, and gauging the current level of circularity in existing agricultural practices.

In this initial phase, we embark on a quest for comprehension, delving into the theoretical and practical intricacies of the circular economy. Subsequently, we shift our gaze inward, conducting a comprehensive assessment of the current agricultural landscape and our place within it (Ellen MacArthur Foundation, 2013).

Understanding the circular economy requires us to reorient our traditional perspectives on economic activity. We need to immerse ourselves in the philosophy of a system that shuns the linear "take-make-dispose" model and embraces a holistic, regenerative loop of "reuse-recycle-recover." It is a model where waste is not a terminal point but a springboard for new cycles of production and consumption. This understanding necessitates a comprehensive study of literature, case studies, and successful implementations of the circular economy across various industries.

In parallel, it's crucial to comprehend how the principles of the circular economy can illuminate the agricultural domain. We need to elucidate the concept of circular agriculture, a system where agricultural waste is not discarded but transformed into valuable resources, where nutrients flow is in a cyclical pattern, enhancing soil fertility, and where ecosystems are not compromised but bolstered. This understanding is vital to conceptualize how such a system could operate and interact with the socioeconomic and environmental facets of our world.

Upon acquiring a robust understanding, transition into the assessment phase could be done. This involves a meticulous examination of the current agricultural practices and their level of alignment with the circular principles. This introspective phase involves asking challenging questions: How much agricultural waste do we generate and how it is managed? How are nutrients used and reused within

our agricultural systems? What are the impacts of our farming practices on ecosystems and biodiversity?

Through this assessment, we construct a clear picture of our starting point in this transformative journey. It provides us with a baseline from which we can measure future progress, identify existing gaps and opportunities for circularity, and define our specific objectives.

The "Understand and Assess" phase is not merely a point of departure; it is the bedrock upon which our entire transition toward circular agriculture is built. By nurturing a profound understanding of the circular economy and conducting an exhaustive assessment of our agricultural systems, we lay the groundwork for the subsequent steps of our journey toward a more sustainable, resilient, and circular agriculture.

2.12 Step 2: identify opportunities and challenges

Once an understanding is established, the next step involves identifying opportunities for circular practices and potential challenges. This could involve recognizing the potential of agricultural waste as a resource, the opportunities for improving nutrient cycles, and the challenges that may impede the transition. This phase is akin to standing on the precipice of innovation, scanning the horizon for potential paths to circularity, while being cognizant of the hurdles that may impede our progress (Kirchherr, Reike, & Hekkert, 2017).

The first half of this step is to uncover the latent opportunities for circular practices within the agricultural sector. This requires us to think innovatively and identify how resources, once viewed as waste, can be transformed into valuable assets. It may involve recognizing the potential of crop residues as biofuels, understanding how livestock manure can become organic fertilizers, or perceiving how wastewater could be reused for irrigation. It also includes identifying ways to optimize nutrient cycles, such as composting, cover cropping, and crop rotation, which contribute to soil health and reduce the need for synthetic fertilizers.

Alongside these opportunities, we must also explore the potential socioeconomic benefits of circular agriculture. These might include new job creation in sectors such as organic waste management and sustainable bioenergy, rural development through the enhancement of local economies, and improved food security through more resilient farming practices.

However, our journey isn't merely about basking in the glow of these opportunities. We must also acknowledge the shadows cast by the challenges that lie ahead. These challenges might range from technical issues, such as the need for new farming equipment or technologies, to economic concerns, such as initial investment costs or changes in market dynamics. They could include regulatory hurdles, like outdated policies that don't support circular practices, or societal barriers, like resistance to change or lack of awareness about the benefits of circular agriculture.

Identifying these challenges is not meant to dissuade us but rather to equip us with a realistic understanding of the landscape we needed to navigate. It allows us to plan ahead, develop strategies to overcome these obstacles, and anticipate the support we might need to facilitate this transition.

In essence, Step 2 of our journey is about illuminating the path toward circular agriculture. It is about appreciating the promise of what lies ahead, understanding the terrain we must traverse, and preparing ourselves for the expedition. By identifying both the opportunities and challenges, we equip ourselves with a comprehensive understanding that will guide us in developing and implementing effective strategies for circular agriculture.

2.13 Step 3: stakeholder engagement and collaboration

Implementing circular agriculture necessitates the engagement of a broad array of stakeholders, including farmers, consumers, policymakers, and researchers. Collaboration across these stakeholders is vital for developing shared visions, aligning interests, and fostering innovation.

This phase recognizes that the transformation of our agricultural paradigm is not an endeavor to be undertaken in isolation but a collective journey that requires the engagement, commitment, and cooperation of all parties involved (Stahel, 2016).

Stakeholder engagement is not merely about informing various actors about our transition to circular agriculture. Rather, it is about fostering meaningful relationships based on dialog, mutual understanding, and shared objectives. It is about creating a platform where farmers, consumers, policymakers, scientists, and businesses can voice their perspectives, articulate their concerns, and contribute their ideas. This multifaceted engagement helps to ensure that the shift toward circular agriculture is not only environmentally sound but also socially equitable and economically viable.

Beyond individual engagement, we must also facilitate collaborative dynamics among these stakeholders. The complex challenges associated with the circular economy necessitate innovative solutions that can only emerge from interdisciplinary and intersectoral collaboration. For example, scientists might need to work closely with farmers to develop efficient methods for waste-to-resource conversion, or policymakers might need to collaborate with businesses to design incentives for circular practices. Such collaborations can harness the unique capabilities and knowledge of different stakeholders, thereby fostering innovation and enabling holistic solutions.

This step also emphasizes the role of education and capacity building. By nurturing an understanding of the circular economy among stakeholders, we can foster an appreciation for circular practices, facilitate the adoption of new technologies, and cultivate a culture of sustainability. Furthermore, by equipping stakeholders

with the necessary skills and knowledge, we can empower them to actively contribute to the circular transition.

In essence, stakeholder engagement and collaboration is about weaving a rich tapestry of shared visions, collective action, and mutual learning. It is about recognizing that the path to circular agriculture is not to be walked alone but to be journeyed together. By fostering active engagement and collaboration among all stakeholders, we can ensure that our transition toward a circular economy in agriculture is not just a change in practices, but a transformative process that brings about social, economic, and environmental prosperity.

2.14 Step 4: develop and implement circular strategies

After identifying opportunities and fostering collaboration, the next step involves developing and implementing strategies that foster circularity. These may include changes in farming practices, such as composting and cover cropping; development of circular business models, such as bioenergy production from waste; and the implementation of policy measures that encourage circularity.

This phase is about harnessing our understanding, our identification of opportunities and challenges, and our stakeholder engagements into tangible, effective strategies that catalyze the transition toward circular agriculture.

The development of circular strategies requires creative thinking, informed decision-making, and meticulous planning. It involves designing methods to transform agricultural waste into valuable resources, conceptualizing practices to optimize nutrient cycles, and identifying technologies that can facilitate these processes. It requires a delicate balance between leveraging cutting-edge technology and maintaining respect for the natural limits of our ecosystems.

At the heart of these strategies, we must ensure that the pillars of sustainability—environmental preservation, social equity, and economic viability—are firmly embedded. Our strategies should not only aim to reduce waste or improve resource efficiency but also strive to enhance the livelihoods of farmers, improve the resilience of rural communities, and stimulate green economic growth.

Once these strategies have been developed, the next challenge is their implementation. This step may involve a multitude of actions, including the adaptation of farming practices, investment in new technologies, or training of farmers. Implementing these strategies may also require modifications in market mechanisms, such as the development of new business models that monetize waste or the creation of market incentives for circular products.

Moreover, the implementation of circular strategies is not a one-size-fits-all approach. It must be tailored to the specificities of different agricultural systems, local environmental conditions, and socioeconomic contexts. This demands flexibility, adaptability, and a keen understanding of the local context.

In essence, this step is about transforming our vision of circular agriculture into reality. It is about turning the gears of change, setting in motion a transformative process that gradually aligns our agricultural systems with the principles of the circular economy. By developing and implementing effective circular strategies, we embark on the path toward a more sustainable, resilient, and prosperous agricultural sector.

2.15 Step 5: monitor, evaluate, and adapt

Finally, it's crucial to monitor and evaluate the outcomes of the implemented strategies. This not only involves tracking the impacts on waste reduction, resource efficiency, and ecosystem health but also assessing the social and economic impacts. Based on this evaluation, strategies may need to be adapted to optimize outcomes.

This concluding phase does not signify the end, but rather, it marks the beginning of an ongoing, iterative process of learning and evolution that is intrinsic to the ethos of the circular economy.

Monitoring involves the systematic tracking of our actions and their outcomes. It demands the collection and analysis of data related to the implementation of our circular strategies, such as the amount of waste transformed into resources, the reduction in resource usage, or the socioeconomic impacts of our actions. This data not only provides us with insights about the progress of our transition toward circular agriculture but also serves as an important tool for accountability and transparency.

Evaluation, on the other hand, is the process of assessing the effectiveness and impact of our strategies. Are our circular practices leading to a significant reduction in waste? Are they contributing to the resilience of our farming systems and local economies? Are they enhancing the livelihoods of farmers and rural communities? By answering these and other critical questions, evaluation helps us to measure our success, identify areas of improvement, and validate the relevance and effectiveness of our strategies.

While monitoring and evaluation provide us with valuable insights, the crux of this phase is our ability to adapt. The journey toward circular agriculture is an uncharted territory, filled with complexities and uncertainties. Hence, it is imperative that we remain flexible, responsive, and open to change. If our strategies are not yielding the desired outcomes, we need to have the courage to reevaluate our approach, learn from our experiences, and adapt our strategies accordingly.

In essence, this step is about embracing the spirit of continual learning and improvement. It is about understanding that the journey toward a circular economy in agriculture is not a straight line but a spiral, where each cycle brings us closer to our goal. By diligently monitoring our actions, evaluating their impacts, and adapting our strategies based on these insights, we ensure that our transition

toward circular agriculture is not only effective but also dynamic, resilient, and responsive to the changing landscapes of our world.

2.16 Econometric model of the implementation of circular economy in agriculture

When specifying an econometric model for the implementation of the circular economy in agriculture, we'll consider the factors influencing the circularity of the agricultural sector, such as resource utilization, waste management, and the yield and economic output from agricultural activities. Given that the model's purpose is to measure the impact of circular practices on these aspects, a simplified model could be specified as follows:

1. Model Specification

Let's consider a multiple regression model where the dependent variable (Y) is the level of circularity in a farm, factory, or agricultural area, measured through a circularity index or score (which can be developed considering factors such as the level of waste recycling, resource efficiency, and sustainable practices). The independent variables might include:

$X1$: Amount of resources used (e.g., water, energy, and fertilizers)
$X2$: Amount of waste generated (e.g., agricultural by-products and postharvest waste)
$X3$: Level of recycling and waste management practices
$X4$: Crop yield
$X5$: Economic returns from the agricultural activity

The model can then be specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

where,

Y represents the circularity index.
β_0 is the intercept of the model (i.e., the circularity index when all independent variables are zero).
β_1 to $\beta 5$ are the coefficients of the respective variables, indicating the change in circularity index for a unit change in the corresponding variable, ceteris paribus (all else being equal).
ε is the error term, accounting for other unmeasured factors affecting the circularity index.

2. Estimation, Testing, and Validation

Once the model is specified, the next step is to estimate the model using regression analysis, based on the collected data. After estimating the model,

testing and validation should be conducted to ensure the model's reliability and accuracy.

This model is a simplification and should be modified according to the specific context and availability of data. Real-world scenarios might require more complex models, including additional variables, considering nonlinear relationships, or employing different estimation techniques. For instance, the model might need to account for time lags between implementing circular practices and observing changes in yield or economic returns.

In conclusion, an econometric model offers a powerful tool for quantifying and understanding the impacts of transitioning toward a circular economy in agriculture, informing decision-making and policy formulation.

2.17 Technologies supporting circular agriculture

The implementation of circular agriculture is strongly supported by technological advancements. These technologies are playing a crucial role in maximizing resource efficiency, reducing waste, and enhancing productivity. Here are some of the key technologies that are supporting the transition to circular agriculture:

1. **Precision Agriculture Technologies**: Precision agriculture or "smart farming" harnesses technologies such as Global Positioning System (GPS), satellite imaging, remote sensing, and Internet of Things (IoT) devices to manage and control farm operations. It allows farmers to apply water, fertilizers, and pesticides in the right amount and at the right place and time, thereby reducing resource wastage and environmental pollution.
2. **Sensors and IoT**: The use of sensor technologies and the IoT in agriculture helps to optimize resource use, reduce waste, and increase productivity. These technologies collect data on various parameters such as soil moisture, nutrient levels, weather conditions, and crop health, allowing farmers to make informed decisions and intervene only when necessary.
3. **Biotechnology**: Biotechnology can enhance circularity in agriculture through the development of genetically modified crops that are resistant to pests and diseases, reducing the need for chemical inputs. In addition, biotechnology can also be used to convert agricultural waste into valuable products such as biofuels and biofertilizers.
4. **Blockchain Technology**: Blockchain can support traceability and transparency in the agricultural supply chain, helping to reduce food waste and ensure fair transactions. By providing a reliable record of each product's journey from farm to consumer, blockchain technology can reduce inefficiencies, promote responsible consumption, and enhance the overall sustainability of the food system.
5. **Artificial Intelligence (AI) and Machine Learning (ML)**: AI and ML can optimize farm management, predict crop yields, and identify diseases or pest infestations. Such predictive analytics can save resources, improve efficiency,

and avoid crop losses, contributing significantly to the principles of a circular economy.

6. **Aquaponics and Hydroponics**: These are innovative farming systems that epitomize the principles of a circular economy. In aquaponics, the waste from fish tanks is used as a nutrient source for plants, which in turn purify the water for the fish, creating a closed-loop system. Hydroponics, on the other hand, allows for soil-less cultivation of plants, saving water, and preventing soil degradation.
7. **Renewable Energy Technologies**: Incorporation of renewable energy sources like solar and wind power in farm operations can reduce dependency on fossil fuels, cut greenhouse gas emissions, and contribute to circularity. Bioenergy generated from farm waste is another notable example of renewable energy in a circular agricultural context.
8. **Robotics and Automation**: Agricultural robots can conduct tasks such as planting, harvesting, and weeding more accurately and efficiently than human labor. Automation helps to optimize resource use, reduce waste, and improve productivity, making it a key component of circular agriculture.

Adopting these technologies can substantially contribute to the transition toward circular agriculture. However, it's vital to note that technology adoption must be balanced with socioeconomic considerations, such as farmers' technical skills and economic capacity, to ensure the shift toward circularity is inclusive and sustainable.

2.18 Role of technology

Technology stands as the backbone of the transition toward a circular economy in agriculture, serving as the linchpin in transforming traditional linear agricultural systems. It plays a crucial role in multiple facets, including resource efficiency, waste management, transparency, and productivity. Let's delve into the profound influences of technology in implementing a circular economy in agriculture:

Optimizing Resource Use: With the advent of precision farming technologies, including IoT sensors, GPS, and drones, agricultural processes can be optimized to reduce waste and ensure the most efficient use of resources. From soil moisture sensors informing irrigation needs to GPS-guided machinery enabling precise application of fertilizers and pesticides, technology aids in reducing wastage and overuse, thereby aligning with the principles of a circular economy.

Waste Management and Upcycling: Modern technologies provide innovative solutions for managing and repurposing agricultural waste. For instance, biodigesters can convert organic waste into biogas for energy and biofertilizer for soil enrichment. Similarly, composting technologies can turn crop residues and livestock waste into nutrient-rich compost, helping to close the nutrient loop in agriculture.

Increasing Transparency and Traceability: Blockchain and other digital technologies can foster transparency and traceability in the agricultural supply

chain. This can reduce food wastage by streamlining logistics, ensure fair transactions, and enable consumers to make informed decisions about the products they purchase, promoting sustainable consumption.

Enhancing Productivity and Resilience: The application of AI and ML in agriculture helps to predict crop yields, optimize farm management, and identify potential threats such as disease or pest infestations. These technologies can improve agricultural productivity and resilience, critical elements in maintaining a sustainable circular system.

Facilitating Information Sharing and Learning: Digital platforms can facilitate the sharing of knowledge and best practices among farmers and other stakeholders, aiding the transition to circular agriculture. This includes information on sustainable farming techniques, waste management practices, market trends, and more.

Enabling Monitoring and Evaluation: Remote sensing technologies, data analytics, and other digital tools can aid in the monitoring and evaluation of circular practices. These technologies can track key performance indicators and assess the environmental, social, and economic impacts of circular interventions, supporting continuous learning and improvement.

Supporting Policymaking and Governance: Digital data can inform policymaking, helping to design targeted interventions and regulations to support the transition to a circular economy. For instance, accurate data on resource use, waste generation, and environmental impact can aid policymakers in implementing effective policies, subsidies, or incentives.

While technology provides an arsenal of tools to support the transition to a circular economy in agriculture, it is important to note that the adoption of these technologies should be mindful of local contexts, economic capacities, and social implications to ensure that the transition is inclusive, fair, and sustainable.

Innovations Facilitating Circular Agriculture: The field of circular agriculture is marked by a plethora of groundbreaking innovations designed to foster sustainability, mitigate resource depletion, and reduce environmental harm. Here are some notable developments facilitating the transition toward a more circular agricultural paradigm:

1. **Regenerative Agriculture**: This is a holistic land management practice that leverages the power of photosynthesis in plants to close the carbon cycle, and build soil health, crop resilience, and nutrient density. Regenerative agriculture embodies the principles of circularity by improving the resources it uses, rather than depleting or harming them.
2. **Food Waste Valorization**: Innovations in this realm seek to convert food waste into useful materials, thereby adhering to the principle of waste as a resource. Examples include the production of biofuel from used cooking oil, compost from vegetable scraps, and bioplastics from food waste.
3. **Aquaponics and Hydroponics**: Aquaponics combines conventional aquaculture with hydroponics in a symbiotic environment. It minimizes waste

by using the effluent-rich water from aquaculture to fertilize plants in a hydroponic system. The water is then recirculated back to the aquaculture system, creating a circular loop. Hydroponics, on the other hand, is a method of growing plants without soil, thereby saving water and preventing soil degradation.

4. **Insect Farming**: Farming insects for animal feed is a rapidly growing field. Insects, such as black soldier flies, can convert organic waste into high-protein animal feed, effectively closing the loop in agricultural and food waste.
5. **Vertical Farming**: This is the practice of producing food in vertically stacked layers, often in controlled environments. Vertical farming uses sophisticated technology to control factors such as light, temperature, and nutrients, optimizing growth conditions and thereby significantly reducing resource use. Moreover, by situating production closer to consumers, it can minimize transportation and associated emissions.
6. **Biobased Fertilizers and Pesticides**: The production of fertilizers and pesticides from biological waste sources is an essential aspect of circular agriculture. Biobased products not only close the loop on waste but also reduce dependency on synthetic, often harmful, agrochemicals.
7. **Digital Platforms**: These platforms facilitate knowledge exchange and collaboration among farmers, researchers, policymakers, and other stakeholders in the agricultural sector. They can accelerate the adoption of circular practices by providing information on best practices, market trends, regulations, and more.
8. **Bioplastics**: Production of biodegradable plastics from agricultural waste like corn stalks and wheat straw can contribute to circularity by reducing pollution and dependence on fossil fuels.

These innovative practices in circular agriculture, when implemented effectively, can lead to a more sustainable and resilient food system. As such, it is important that these innovations are supported by suitable policies, research, and investments to reach their full potential.

2.19 Examples of circular economy in agriculture: case studies from around the globe

The principles of a circular economy have been progressively permeating the agricultural sector, yielding compelling case studies that reveal the multifaceted potential of this paradigm. As these initiatives intertwine with the field of bioscience, they deliver more sustainable and resilient systems of food production. Let's take a closer look at a few case studies from around the globe:

1. **Japan—Circular Rice Farming**: A fascinating model of circular agriculture can be found in Japan's paddy fields. Researchers and farmers have developed

a system where ducks, fish, and rice coexist in a symbiotic relationship. The ducks eat insects and weeds, naturally reducing the need for pesticides and herbicides, while their droppings provide organic fertilizer for the rice plants. At the same time, fish feed on the pests in the paddy fields, and their waste adds additional nutrients for the rice plants. This method, called aigamo farming, illustrates an effective strategy of creating a circular system in agriculture using biological methods.

2. **Denmark—Biogas Plants:** In Denmark, an innovative approach to managing pig manure has turned a waste management issue into a clean energy solution. Manure is collected from pig farms and transported to local biogas plants where it is digested anaerobically to produce biogas, a renewable source of energy. The remaining digestate is then used as a nutrient-rich, biobased fertilizer that is returned to the farmlands, effectively closing the loop.
3. **Netherlands—Insect Farming:** The Netherlands is home to Protix, a company that farms insects on a commercial scale. Protix rears black soldier fly larvae on organic waste such as vegetable scraps, producing a high-protein animal feed that can replace traditional, environmentally taxing protein sources like soy and fishmeal. This not only repurposes waste but also contributes to more sustainable livestock farming.
4. **Australia—Circular Aquaponics:** In Australia, several aquaponics initiatives have been gaining traction. One example is Green Sky Growers, an urban farm that combines aquaculture and hydroponics in a closed-loop system. The nutrient-rich water from fish tanks is used to fertilize vegetables grown hydroponically. The plants, in turn, purify the water, which is then recirculated back to the fish tanks.
5. **United States—Turning Food Waste into Biofuel:** In the United States, a company named Vanguard Renewables employs anaerobic digestion technology to turn organic waste from food and farms into renewable energy. This not only diverts waste from landfills but also provides a sustainable source of energy, turning waste into a resource in a circular manner.
6. **Brazil—Using Insect Farming to Manage Waste:** In Brazil, a bioscience start-up called Fazenda Futuro is using insects to manage organic waste and produce protein for animal feed. The company farms black soldier fly larvae, which consume organic waste and transform it into a rich source of protein. This innovative approach embodies the circular economy principle of closing loops and creating value from waste.
7. **India—Enhancing Soil Health with Biofertilizers:** In India, many farmers are turning to biofertilizers to enhance soil health and reduce the use of chemical fertilizers. Biofertilizers are made from living organisms that contribute to the nutrient requirements of plants. They not only improve soil fertility but also enhance crop yield and soil biodiversity, demonstrating a sustainable, circular approach to farming.

These case studies from around the world show us how bioscience is facilitating the implementation of a circular economy in agriculture. They offer inspiring examples of how we can redesign agricultural systems to be more sustainable, efficient, and regenerative.

2.20 Challenges in implementing circular agriculture

Implementing circular agriculture, despite its numerous benefits, is not devoid of challenges. Transitioning from the conventional linear model to a circular one is a complex process that entails significant systemic changes, requiring us to surmount a range of hurdles. Here, we delve into these challenges to shed light on the obstacles in the path of realizing a truly circular agricultural system.

2.20.1 Lack of awareness and understanding

Circular agriculture, while gaining traction, is still a relatively novel concept for many, particularly in regions where traditional agriculture is deeply entrenched. Many farmers, stakeholders, and policymakers are not fully aware of what circular agriculture entails and how it can benefit them and the environment. The lack of understanding can result in resistance to change, slowing down the adoption of circular practices.

2.20.2 Economic considerations

The transition to circular agriculture can entail significant upfront costs. Implementing sustainable farming practices, investing in new technologies, and rethinking waste management systems all require financial resources. Furthermore, the economic benefits of circular agriculture, while substantial, may not be immediate, which can deter farmers operating on thin margins.

2.20.3 Technological challenges

While technology plays a pivotal role in enabling circular agriculture, access to appropriate technology can be a challenge, particularly for small-scale farmers in developing countries. Moreover, the lack of technical skills and knowledge to use these technologies can further impede the transition.

2.20.4 Policy and regulatory hurdles

The existing policy and regulatory frameworks in many regions are often aligned with traditional, linear agricultural practices. These frameworks may not provide

the necessary incentives or support for the adoption of circular practices. In some cases, they may even present barriers.

2.20.5 Market dynamics

Market dynamics, such as consumer demand and supply chain requirements, can influence the adoption of circular practices. If consumers are not aware of or willing to pay for sustainably produced products, farmers may have less incentive to implement circular practices.

2.20.6 Infrastructure and logistics

In a circular agricultural system, waste from one process becomes a resource for another. This requires efficient logistics and infrastructure, which can be a significant challenge, particularly in rural or remote areas.

2.20.7 Sociocultural factors

Last but not least, sociocultural factors can pose challenges to implementing circular agriculture. Farming practices are often deeply rooted in local cultures and traditions. Changing these can be a complex and sensitive process, requiring careful handling and community engagement.

Overcoming these challenges requires concerted efforts from all stakeholders, including farmers, policymakers, businesses, research institutions, and civil society. It entails raising awareness, fostering innovation, implementing supportive policies, building capacity, and promoting collaboration. By addressing these challenges head-on, we can pave the way for a sustainable, resilient, and truly circular agricultural system.

2.21 The future of circular economy in agriculture

The future of the circular economy in agriculture is a promising vista, holding immense potential for reshaping the way we produce and consume food. As we continue to grapple with the existential threats of climate change, resource depletion, and biodiversity loss, the importance of transitioning to a more sustainable, circular agricultural system cannot be overstated (FAO, 2017; FAO, 2019). Let's contemplate this exciting future and explore the opportunities it presents.

2.21.1 Toward sustainable food systems

One of the key aspects of the future of circular agriculture is the transformation toward sustainable food systems. Circular agriculture seeks to close resource

loops, reduce waste, and enhance the efficient use of resources, which can significantly contribute to the sustainability of our food systems. This approach is becoming increasingly pertinent as we strive to feed a growing global population within the carrying capacity of our planet.

2.21.2 Innovation and technology

The future of circular agriculture is also characterized by remarkable innovation and technological advancements. From precision farming technologies that optimize resource use to biotechnology innovations that convert agricultural waste into valuable resources, technology is playing a crucial role in enabling circular practices. We can expect even more groundbreaking developments in the coming years, further propelling the transition toward circular agriculture.

2.21.3 Regenerative practices

Regenerative practices are likely to become more mainstream in the future of circular agriculture. These practices, which aim to enhance the health and resilience of ecosystems, are inherently circular as they strive to mimic nature's cycles. They include agroforestry, organic farming, permaculture, and others that not only sustain but also regenerate the environment.

2.21.4 Value for waste

In the future circular agricultural economy, waste will be viewed not as a problem but as a valuable resource. Innovative approaches to waste management will transform agricultural waste streams into a plethora of useful products, from biofuels and biofertilizers to building materials and textiles.

2.21.5 Collaboration and partnerships

The future of circular agriculture is one of increased collaboration and partnerships. Realizing a circular agricultural system is a shared responsibility, requiring concerted efforts from all stakeholders—farmers, businesses, policymakers, researchers, and consumers. We can expect to see more partnerships aimed at fostering circular practices and transforming our food systems.

2.21.6 Policy support

In the future, we can anticipate greater policy support for circular agriculture. Governments around the world are recognizing the importance of a circular economy for sustainable development. This is likely to translate into more policies and regulations that incentivize and facilitate circular practices in agriculture.

The future of the circular economy in agriculture is not only promising but also necessary. The challenges we face are immense but so are the opportunities. As we move forward, embracing a circular, regenerative approach in agriculture can lead us toward a more sustainable, resilient, and equitable future.

2.22 Predictions and opportunities

As we look ahead to the future of circular economy in agriculture, there are several predictions and opportunities that lie on the horizon. One key prediction is that the adoption of circular agricultural practices will continue to increase as more farmers recognize the benefits it offers. This shift toward a more sustainable and efficient way of farming presents numerous opportunities for growth and innovation within the industry.

One exciting opportunity is the development and implementation of new technologies specifically designed to support circular agriculture. These technologies can help to optimize resource use, enhance waste management processes, and improve overall efficiency in farms. From smart irrigation systems to precision farming techniques, technology has the potential to revolutionize how we approach agriculture in a circular manner.

Another promising opportunity lies in the realm of policymaking. As governments around the world become increasingly aware of environmental challenges, they are taking steps to promote sustainable agricultural practices through legislation and incentives. This opens up avenues for collaboration between policymakers, researchers, industry leaders, and farmers themselves to collectively work toward implementing circular economy principles in agriculture.

Moreover, there is an immense scope for research and development in this field. Scientists are continually exploring innovative solutions that can further enhance resource efficiency, reduce waste generation, and promote regenerative practices within agriculture. These advancements have far-reaching implications not only for food production but also for mitigating climate change impacts.

In addition to these predictions and opportunities at a global level, it is crucial to consider regional contexts as well. Different regions may face unique challenges when transitioning toward a circular economy in agriculture due to varying socioeconomic factors or ecological conditions. Therefore, careful consideration must be given while developing strategies tailored specifically for each region's needs.

As we navigate this transformative journey toward a truly sustainable agricultural system based on circular principles, it is important not only to focus on short-term gains but also anticipate long-term impacts. By seizing these predicted opportunities with proactive measures such as collaboration among stakeholders at all levels, from small-scale farmers to multinational corporations, we can pave the way for a more resilient and regenerative agriculture.

2.23 Conclusion

The transformation of agriculture toward a circular economy isn't just a trend—it's an essential shift that our planet urgently needs. Circular agriculture provides a framework that can address numerous global challenges, from climate change to resource scarcity, and from food insecurity to economic inequality. It not only offers a blueprint for a more sustainable and resilient agricultural system but also promises significant economic, social, and environmental benefits.

The transition won't be easy, and we will undoubtedly face numerous hurdles along the way. However, by embracing key elements such as efficient resource use, waste management, collaboration, and technology, we can navigate these challenges. In addition, the adoption of sustainable agricultural practices and a commitment to resource efficiency will be crucial in this journey.

This transition also brings with it a world of opportunities, from the emergence of new business models to job creation in the field of circular agriculture. As we look to the future, it's clear that the circular economy will play a pivotal role in the evolution of agriculture.

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