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Systematic Literature Review on Annuity Modeling of Plantation Replanting Cost Reserves Based on The Cobb-Douglas Model

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ABSTRACT

The annuity concept in preparing reserves for plantation replanting costs plays an important role but is rarely studied in depth, especially regarding the use of the Cobb-Douglas model. This article aims to fill this knowledge gap by discussing several key topics. First, is the object of research related to the Cobb-Douglas or annuity model in the context of plantation replanting. Second, the method used in solving problems related to annuities in plantation replanting. Third, the application of the method used in solving the problem. The method applied in this study is the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA), which allows systematic analysis through structured steps: Identification, Screening, Eligibility, and Inclusion-exclusion. A careful review of the literature was conducted using various databases such as Scopus, Science Direct, Dimensions, and SAGE, with data analysis using "bibliometrix" software in RStudio, the results of which can be accessed through the "biblioshiny()" command. The results show that there is no research that specifically addresses annuity modeling for replanting cost reserves using the Cobb-Douglas model. This finding encourages further exploration of the potential use of the Cobb-Douglas model in annuity modeling for plantation replanting cost reserves.

Keywords: Annuity; Cobb-Douglas; PRISMA; Cost Reserves; Plantations

INTRODUCTION

Mathematical modeling serves as a tool to represent real-world phenomena in a mathematical framework [1]. In the realm of financial markets, mathematical models, such as annuities, play a crucial role in determining periodic payments like dues or installments [2]. Banks and financial institutions leverage annuities to structure regular payments for their clients, enhancing the efficiency of setting dues and installments.

An annuity is defined as a sequence of payments made at regular intervals. Initially, the term "annuity" referred only to yearly payments, but its scope has now broadened to include payments at other regular intervals, such as semesters or monthly payments [2]. Generally, annuities can be categorized into four types:

1. Annuity-Immediate

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According to [2], an immediate annuity involves a series of payments made at the end of each period over n periods. The present value $a_{\bar{n}|}$ must be equal to the sum of the present value for each payment, expressed as:

$$a_{\bar{n}|} = A\frac{1-(1+i)^{-n}}{i} \tag{1}$$

The total accumulated value $s_{\bar{n}|}$ should align with the total accumulated value for each payment, given by:

$$s_{\bar{n}|} = A\frac{(1+i)^{n}-1}{i} \tag{2}$$

2. Annuity-Due

As per [2], an annuity-due involves a series of payments initiated at the beginning of each period for n periods. The present value $\ddot{a}_{\bar{n}|}$ must be equal to the sum of the present value for each payment, expressed as:

$$\ddot{a}_{\bar{n}|} = A\left(\frac{1-(1+i)^{-n}}{\frac{i}{1+i}}\right) \tag{3}$$

The total accumulated value $\ddot{s}_{\bar{n}|}$ must match the total accumulated value for each payment, given by:

$$\ddot{s}_{\bar{n}|} = A\frac{(1+i)^{n}-1}{\frac{i}{i+1}} \tag{4}$$

3. Deferred annuity

[3] defines a deferred annuity as an annuity in which the initial payment begins at some point in the future. Consider an annuity consisting of n units of payment with the first payment scheduled for time $m+1$. The present value $m|a_{\overline{n|}}$, specifically:

$$m|a_{\overline{n|}} = A\left(\frac{(1+i)^{-m}-(1+i)^{-(m+n)}}{i}\right) \tag{5}$$

The total accumulated value $m|s_{\overline{n|}i}$, specifically:

$$m|s_{\overline{n|}} = A\left(\frac{(1+i)^{n+m}}{i}-\frac{(1+i)^{m}}{i}\right). \tag{6}$$

4. Increasing annuity-immediate

[3] discusses a direct annuity in which payments follow an arithmetic progression. Consider a direct annuity with an initial payment of P, where subsequent payments are structured as $P+D, P+2D$, and so forth until the jth payment becomes $P+(j-1)D$. The present value $(Ia)_{\bar{n}|}$, specifically:

$$(Ia)_{\bar{n}|} = A\left[\frac{\left(1-\left(\frac{1+p}{1+i}\right)^{n}\right)}{i-p}\right] \tag{7}$$

The total accumulated value $(Is)_{\bar{n}|}$, specifically:

$$(Is)_{\bar{n}|} = A\left[\frac{((1+i)^{n}-(1+p)^{n})}{i-p}\right]. \tag{8}$$

A production function is a mathematical equation that delineates the correlation between inputs and outputs, essentially capturing the factors employed in creating a particular product. The Cobb-Douglas production function stands out as a standardized equation specifically employed to elucidate the utilization of two or more inputs in the production process.

Ever since its introduction in the article titled "A Theory of Production" by Paul Cobb and Charles Douglas in 1928, the Cobb-Douglas production function has been widely referenced in research on production [4]. This exponential production function establishes a relationship between a dependent variable and two or more independent variables [4]. In mathematical terms, the function can be expressed as follows:

$$Q = \beta X_1^{\alpha_1} X_2^{\alpha_2} \mathrm{e}^{u}, \quad (9)$$

with:

Q : Total production
X_1 : Capital
X_2 : Labor
u : random error
e^u : Exponent of random error

A research study conducted by [5] delved into annuities, specifically exploring the comparison between the present value and accumulated value of annuities with varying interest rates. The study's findings indicate that the total present value and accumulated value of annuity-present with a specific interest rate surpass the sum of the present values of annuity-present with different interest rates. This trend is also observed in maturing annuities. Additionally, the functions representing the present value and accumulated value of such annuities exhibit convex-Schur properties within a certain range of interest rates. This characteristic enables the comparison of annuities with different interest rates and facilitates the identification of the optimal interest rate. These results contribute to a deeper understanding of the relationship between interest rates and the value of annuities, offering valuable insights for decision-making in financial and actuarial contexts.

Prior research on annuities has primarily concentrated on their application within the banking sector and financial institutions. However, in everyday scenarios, annuities possess broader potential applications across various sectors that adhere to the principle of periodic payments or installments within specific time intervals. An illustrative instance of annuity application can be observed in the plantation sector. In this context, certain plants have defined productive periods, requiring a replanting process when they enter an unproductive phase. Replanting involves replacing old or unproductive plants with superior varieties capable of yielding better results [6]. In plantation replanting planning, mathematical models prove valuable for estimating and determining the associated costs [7].

In a study by [8], the annuity principle was employed to calculate contributions and allocate costs in the context of replanting, assuming a static scenario where farmers' income and palm oil prices remain unchanged. The study's outcomes encompass the estimation of contributions and cost allocation through various annuity models, such as immediate annuities, advance annuities, delayed immediate annuities, and increasing or decreasing annuities. Each annuity model corresponds to a distinct case study, yielding unique findings. The study's conclusions suggest that the immediate annuity model is more effective in computing replanting fees, while the declining annuity model is better suited for cost allocation. While earlier studies have utilized annuity models to estimate dues and allocate costs in the context of oil palm replanting, they have predominantly employed existing models and compared their respective outcomes.

Literature review by [9] discusses the paradox in the demand for long-term care insurance (LTCI) and life annuities. In this study, researchers used a systematic literature review to analyze the factors that limit the demand for this insurance. The analysis is separated for LTCI and annuities, identifying factors such as substitution by social

security, adverse selection, non-standard preferences, as well as limited financial literacy and risk ignorance, which systematically inhibit ownership of these two insurance products. By conducting a systematic search through various databases, 3,945 unique results were obtained, and findings from 187 studies were integrated in the analysis. The results of this study highlight that insurance ownership tends to be concentrated among wealthier and subjectively healthier individuals.

While the literature review by [10] discusses the impact of pension fund management on economic growth. This research identifies that pension funds allow individuals to save during their working lives to finance consumption needs in retirement, either through lump sum payments or annuity provision, while also supplying funds to end users such as firms, other households (through collateralized loans), or governments for investment or consumption. The research method used was a desktop literature review, where relevant references and journal articles were identified using Google Scholar with inclusion criteria covering papers that were no more than ten years old. The results of this study show that contributory pensions have the potential to increase GDP with competent risk and portfolio management by pension fund administrators and custodians.

Previous research becomes the state of the art in literature review related to annuity or Cobb-Douglas model. The main focus of previous research and literature review is on the application of annuities in financial institutions and financial instruments. However, there is an important gap in the literature, which is the absence of adequate exploration of the application of annuities in sectors other than finance. This is the main differentiator of this research. This research will explore and conduct a literature review on the use of annuities or Cobb-Douglas models in the context of the plantation sector. By filling this knowledge gap, it is expected that this research will provide valuable new insights in the management of annuities in the plantation sector, as well as address the barriers associated with the existing knowledge gap.

In this paper, several key topics will be discussed. Firstly, it examines the research objects concerning Cobb-Douglas or annuity models within the realm of plantation replanting, aiming to elucidate their effective application in managing replanting cost reserves. Secondly, it delves into the methodologies utilized to address annuity-related challenges in plantation replanting, enhancing the understanding of the modeling process and cost estimation. Thirdly, it scrutinizes the practical application of these methodologies in plantation management, offering insights into their implementation for efficient replanting cost reserve management. Through a comprehensive exploration of these topics, this article aims to furnish accurate insights into the existing literature on the utilization of the Cobb-Douglas model in annuity reserves' context, providing a thorough understanding of research conducted in this domain and facilitating further advancements in plantation replanting practices.

This article examines a Systematic Literature Review (SLR) that employs the Cobb-Douglas model to depict annuities as reserves for the costs associated with replanting in plantations. The Cobb-Douglas model is utilized to gauge the income generated by the plantation, serving as the basis for calculating the corresponding annuity. The primary objective of this SLR is to offer a comprehensive overview and critical analysis of prior studies pertaining to this specific research topic.

The deficiencies observed in existing research on the application of the Cobb-Douglas model, particularly in the realm of annuity modeling for plantation replanting cost reserves, serve as the primary motivations for conducting this SLR. This article employs the SLR methodology by adhering to the Preferred Reporting Items for

Systematic Review and Meta-Analysis (PRISMA) guidelines. The PRISMA approach provides algorithms and steps for article selection, bibliometric analysis to showcase article interconnectedness, the identification of research themes, and the identification of research gaps along with recommendations for future research.

In this paper, we primarily draw upon source [11] to inform our use of the PRISMA method. This approach provides a standardized and precise protocol for delineating criteria related to article selection, search strategies, data extraction, and procedures for data analysis [12]. Within the scope of this article, we employ the PRISMA method in conducting a bibliometric map analysis using RStudio software. This analysis is facilitated through the "R-bibliometrix" command, and its details will be further expounded upon later in this document. The article is organized into distinct sections: Section 2 presents a concise overview of the materials and steps involved in the PRISMA method. Section 3 delves into the research findings and discussion, encompassing bibliometric maps, relational visualization via RStudio software, evolution analysis, and the outcomes of the SLR. Finally, Section 4 provides a succinct conclusion summarizing the key points discussed in the preceding sections.

METHODS

Preferred Reporting Items for Systematic review and Meta Analyzes (PRISMA)

The investigation employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method for the literature search. Before discussing the intricacies of the PRISMA method, the initial phase involved identifying crucial materials necessary to support the Systematic Literature Review (SLR) presented in this article [9]. The general algorithm and steps for conducting SLR with PRISMA, following inclusion and exclusion principles, are outlined as follows: (1) Identification involves searching for articles through research databases like Scopus and Science Direct, followed by paper identification through the Mendeley application; (2) Screening includes duplicate checks, as well as title and abstract screening; (3) Eligibility; and (4) Inclusion comprises full-text screening.

The first step in the PRISMA process is Identification, which involves two key activities. Firstly, it entails gathering all the relevant database records based on specified keywords from a particular source. Secondly, it involves supplementing these records with any additional articles from other sources that may not have been initially included. This initial stage results in identifying a certain number of articles. Moving on to the second phase, known as Screening, the focus is on eliminating duplicate articles from the pool identified in the first stage. This is achieved through checks to ensure that each article is unique, particularly by comparing article titles. Consequently, after this duplication screening process, the number of articles is typically reduced. The third stage, Eligibility, involves a more in-depth assessment of each article against predetermined criteria, which will be elaborated upon later. This thorough examination helps to further narrow down the selection, retaining only those articles that are closely aligned with the research objectives. Additionally, qualitative synthesis is performed during this stage. The fourth stage, Inclusion, involves quantitative synthesis, often in the form of meta-analysis. This phase focuses on the selected articles and involves synthesizing their data to draw meaningful conclusions. The chosen final articles serve as the basis for establishing the current state-of-the-art and identifying research gaps, often facilitated by generating bibliometric maps using R Software.

This preliminary step included the selection of relevant keywords related to the

article's research topic, specifically the annuity modeling of replanting cost reserves using the Cobb-Douglas model. These keywords were subsequently grouped into seven categories, as delineated in Table 1. General terms like Annuity, Cobb-Douglas Model, Plantation, and Agriculture were allocated to Keyword Groups A, B, and C, respectively. Furthermore, keywords D, E, F, and G represented specialized combinations of keywords A, B, and C.

Table 1. Keyword Classification

Code	Keywords
A	"Annuities" OR "Annuity" OR "Present Value" OR "Future Value" OR "Annuity Modeling" OR "Financial forecasting"
B	"Cobb-Douglas"
C	("Plantation" OR "Agriculture" OR "Agricultural" OR "replanting") AND ("cost" OR "cost reserve")
D	A AND B ("Annuities" OR "Annuity" OR "Present Value" OR "Future Value" OR "Annuity Modeling" OR "Financial forecasting") AND ("Cobb-Douglas")
E	A AND C ("Annuities" OR "Annuity" OR "Present Value" OR "Future Value" OR "Annuity Modeling" OR "Financial forecasting") AND ("Plantation" OR "Agriculture" OR "Agricultural" OR "replanting") AND ("cost" OR "cost reserve")
F	B AND C ("Cobb-Douglas") AND ("Plantation" OR "Agriculture" OR "Agricultural" OR "replanting") AND ("cost" OR "cost reserve")
G	A AND B AND C ("Annuities" OR "Annuity" OR "Present Value" OR "Future Value" OR "Annuity Modeling" OR "Financial forecasting") AND ("Cobb-Douglas") ("Plantation" OR "Agriculture" OR "Agricultural" OR "replanting") AND ("cost" OR "cost reserve")

Upon finalizing the selection of keywords, the subsequent step involves determining the source of the article database. The seven identified keywords from Table 1 will be input into the database, utilizing four distinct sources in this study: Scopus, Science Direct, Dimensions, and SAGE. This database serves as the foundational material for implementing the PRISMA method, wherein data is extracted from these four sources based on several specified conditions. These conditions include ensuring that the database exclusively consists of research article publications, is an open-source database with unrestricted internet access, and covers the article title, abstract, and keywords in the search. Furthermore, the database should encompass publications from the last 15 years, spanning from 2009 to 2023. It should also cover various aspects such as article publication types, journal names, assistance, funding, and country/region, while being in the English language. Subsequently, the results will be presented in Table 2, indicating the total number of databases filtered based on these specified conditions.

Table 2. Results obtained from mining databases across four sources.

Code	Scopus	Science Direct	Dimensions	SAGE	Total
A	5753	912	9596	21	16282
B	782	80	1991	8	2861
C	17910	1481	28983	33	48407
D	4	1	7	0	12
E	290	-*	322	1	613
F	33	4	63	0	100
G	0	-*	0	0	0
Total	24773	2478	40963	63	68277

Note: *Database mining is restricted due to the limitation of using a maximum of eight Boolean connectors per field.

Table 2 illustrates a noticeable association between the increasing specificity of

inputted keywords and a subsequent reduction in the volume of the retrieved database; this trend persists even for keyword G, which yielded no identified articles. After obtaining supporting materials for the Systematic Literature Review (SLR) process outlined in this article, literature searches can be conducted directly by following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). As highlighted in the study undertaken by [13], PRISMA offers explicit and well-defined instructions for conducting systematic literature reviews. Additionally, the research conducted by [14] has demonstrated that PRISMA contributes to enhancing the quality of literature reviews, leading to improvements in both methodology and outcomes. PRISMA is structured into four distinct stages: identification, screening, eligibility, and inclusion. Throughout these stages, various criteria can be applied, including preferred publication type (research article, review article, book, etc.), publication year, language, topic of discussion, and numerous other criteria [15] [16].

RESULTS AND DISCUSSION

Mining Data using PRISMA Method

After extracting information from the article repository and acquiring keywords designated from A to G, as outlined in Table 2, the data is stored in the ".bib" file format. Subsequently, the PRISMA Method algorithm is implemented. In the initial phase, Mendeley software is utilized to identify articles in the database, excluding those with the ".bib" extension that cannot be identified. The second phase of the PRISMA method involves a filtration process, where the identification of duplicates is conducted with the aid of Mendeley software, resulting in adjustments to the total article count. Furthermore, an evaluation based on title and abstract is carried out through diverse title checks. Initially, the articles are scrutinized for a broad discussion on annuities, particularly focusing on issues related to plantations. Subsequently, emphasis is placed on articles utilizing the Cobb-Douglas model to address the identified issues. Following the duplication process for keywords A to C, an analysis is performed to examine the interrelation between these keywords, assessing their potential for further research—a topic that will be explored subsequently.

Table 3. The outcomes of the chosen articles employing the PRISMA methodology.

Identification (1)			Screening (2)		Eligibility (3)		Included (4)
Code	**Total**	**Recognized by Mendeley**	**Verification of duplications**	**Title and Abstract Screening**	**Step 1***	**Step 2****	**Full Text Screening*****
D	12	12	8	7	5	4	2
E	613	594	405	22	14	10	7
F	100	99	72	43	33	10	3
TOTAL			485	72	52	24	12

Note: *not as pertinent/less relevant, **Dataset 1 for bibliometric mapping, ***Dataset 2 for literature review

In the third phase of the PRISMA method, known as Eligibility, studies undergo categorization based on their relevance levels, categorized into two steps: Step 1 and Step 2. Step 1 research encompasses articles subject to additional scrutiny, involving discussions related to Cobb-Douglas or annuity issues. In contrast, Step 2 research includes articles specifically focusing on annuity or Cobb-Douglas problems as applied to plantations. A total of 52 articles were identified in Step 1, while 24 articles were more specific to Step 2. This subset of 24 articles, referred to as Dataset 1, was utilized for bibliometric analysis using RStudio software.

The fourth and final stage of the PRISMA method is the Inclusion stage. The chosen articles, denoted as Dataset 2 (Full Text Screening), will be employed for conducting the Systematic Literature Review (SLR) analysis in the form of a result table. Following additional screening, a total of 12 definitive articles were selected. These articles encompass discussions on annuities by applying the Cobb-Douglas model to various problems.

Mining Data using RStudio Method

The twenty-four articles encompassed in Dataset 1 during the feasibility stage were published between 2009 and 2023, spanning a 15-year publication period. With an average of 7.04 citations per document, each article featured an extensive reference base of 175 sources. The pertinent information derived from this dataset was acquired through the utilization of RStudio software, which facilitated the generation of bibliometric mappings revealing the interconnections among author keywords, illustrated in Figure 1.

During the RStudio process, the 'biblioshiny()' command was utilized to establish a connection to the "shiny web interface." The application of the Louvain Cluster algorithm involved setting a minimum of 50 nodes and a minimum number of edges at 2. This ensured that the generated bibliometric map had at least one connection between each pair of nodes.

Figure 1 depicts the bibliometric map of the title column, featuring 19 keywords, with clusters differentiated by color. These clusters offer insights into the grouping of keywords based on the twenty-four research topics found in Dataset 1. Notably, the eight red clusters hold significant relevance as they form clusters around the keywords "Economic" and "analysis," which are the most pertinent terms in the ten keywords from the titles. Additionally, the seven blue clusters represent the second most relevant keyword, "Production." Lastly, the four yellow clusters represent the group of keywords that appear most frequently. This implies that the larger the size of the word or phrase, the more frequently the keyword is utilized in the research.

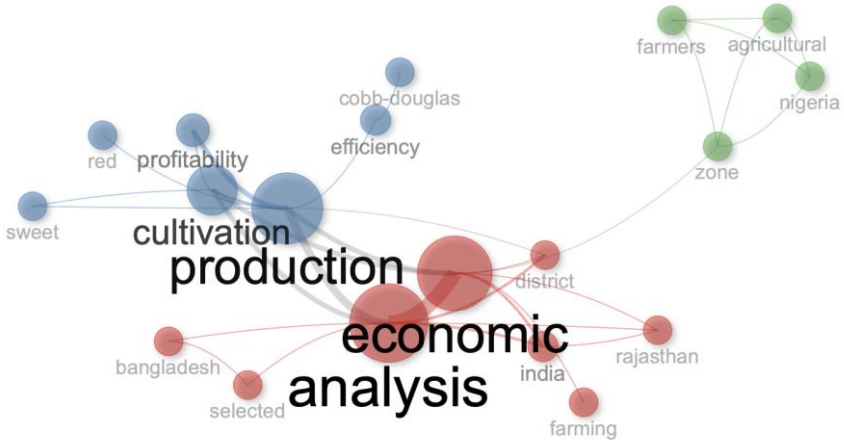


Figure 1. Bibliometrix Maps of Title

Figure 2 depicts the word cloud of author's keywords, encompassing 50 words, with "profitability" emerging as the most frequently appearing keyword. Following closely are "resource use efficiency" and "Cobb-Douglas production function" as the second most prominent words in the author's keywords. Notably, other pivotal words discussed in this study, namely "annuity" and "agriculture," do not feature as prominently in the author's keywords.

Figure 2. Wordcloud of Author's keywords

Figure 3 illustrates the bibliometric map of the abstracts, employing the Louvain Cluster algorithm with a minimum of 50 nodes and a set minimum of 3 edges. A total of 43 abstract keywords are categorized into three groups, each identified by distinct colors. The 12 abstract keywords in green pertain to the methodology employed in addressing the research problem, specifically the Cobb-Douglas production function. Meanwhile, the 15 abstract keywords in blue revolve around data, function, and farmers. The final 16 abstract keywords in red are associated with discussions on results, cost, study, and production. Notably, within the green abstract keyword group, certain keywords like "agricultural" and "Cobb-Douglas" exhibit larger circles, indicating a substantial volume of research related to the agricultural context and the application of the Cobb-Douglas model.

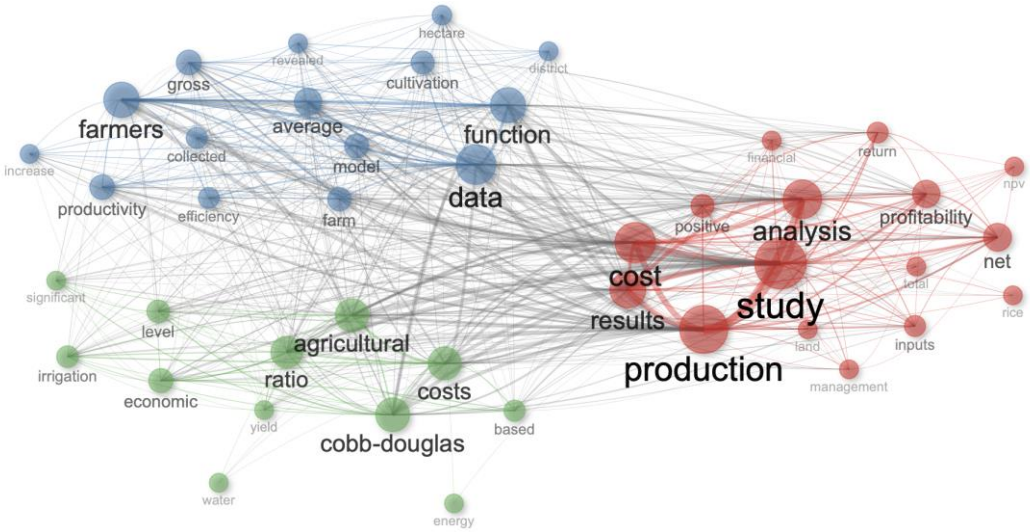


Figure 3. Bibliometrix Maps of Abstract

Evolution Analysis

The analysis of topic evolution plays a pivotal role in providing essential insights into the diverse subtopics addressed by article authors, as indicated by the clusters generated spanning the period from 2009 to 2023. In this context, Dataset 2, comprising 12 articles, undergoes a comprehensive evolution analysis.

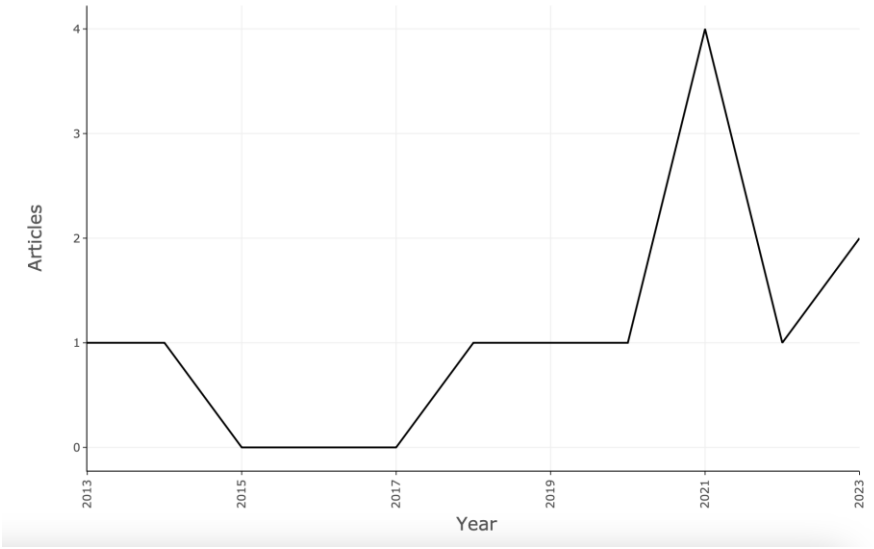


Figure 4. Annual Scientific Production

Figure 4 illustrates the annual scientific production for Dataset 2, revealing patterns over the specified timeframe. Upon examining the outcomes of annual scientific production obtained through RStudio software, it is observed that the highest article production occurred in 2021, with four articles published. Subsequently, in 2023, two articles were published. Additionally, in the years 2013, 2014, 2018, 2019, 2020, and 2022, each saw the publication of one article. Conversely, no articles were published in the years 2009, 2010, 2011, 2012, 2015, 2016, and 2017. This trend indicates that research related to the subject of this article experiences fluctuations or variations in the level of publication activities from year to year.

The choice of the abstract field is based on its precision in accurately representing keywords. Thematic evolution maps use the X-axis to represent the extent of relevance (centrality) and the Y-axis to represent the degree of development (density), serving as indicators for identifying these subjects. This data is then utilized to explore the evolution of themes in four distinct quadrants. Centrality, which determines the level of interaction between clusters, is analyzed to assess how closely a topic is connected to other issues or the overall interaction level between clusters. On the other hand, density reflects the time period over which a topic has evolved between terms within a specific cluster.

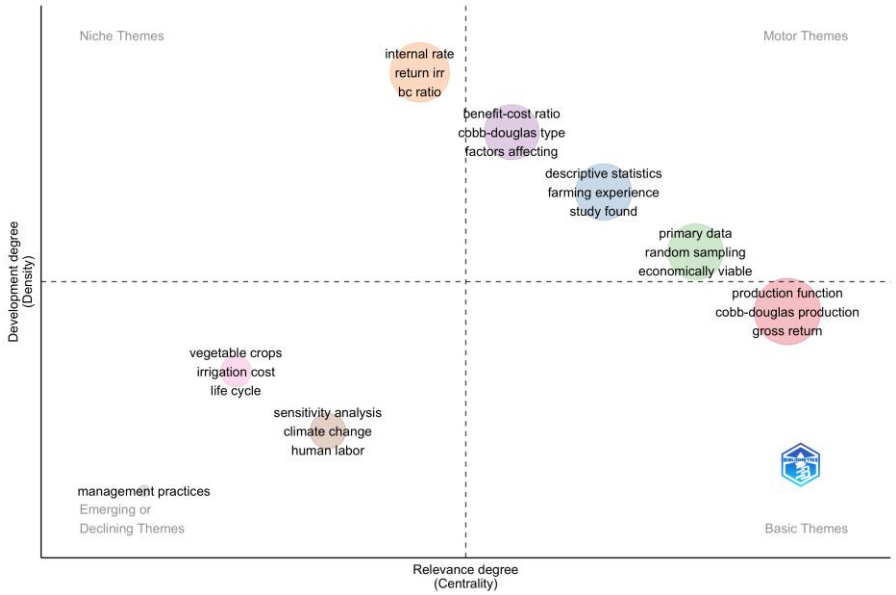


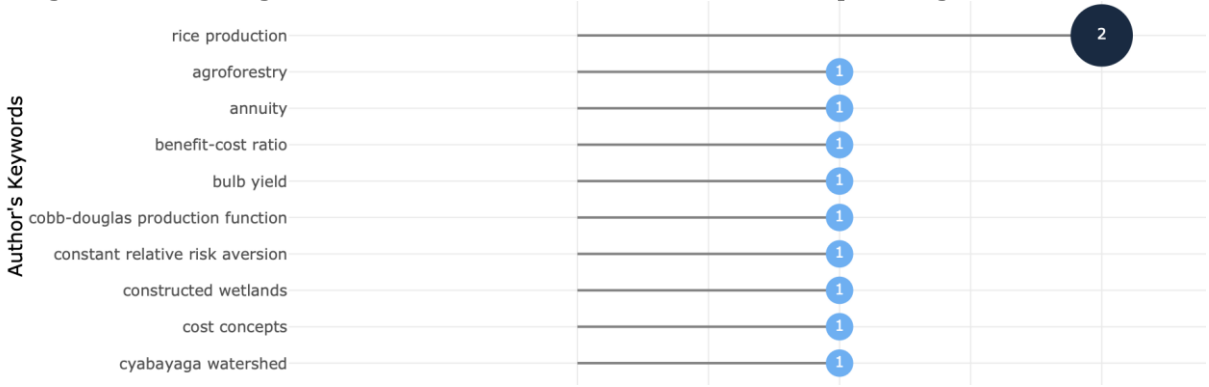
Figure 5. Thematic Map in Abstract Field

Based on the observations from Figure 5, it can be deduced that the upper right quadrant encompasses topics with both high centrality and density, signifying substantial and well-developed influence in the research. In contrast, the lower right quadrant comprises topics with strong centrality (capable of influencing other issues) but low density, indicating a less advanced state of development. The lower left quadrant includes topics with low centrality and low density, suggesting limited influence on the research and insufficient development. Lastly, the upper left quadrant comprises issues that are inversely positioned compared to the lower right quadrant.

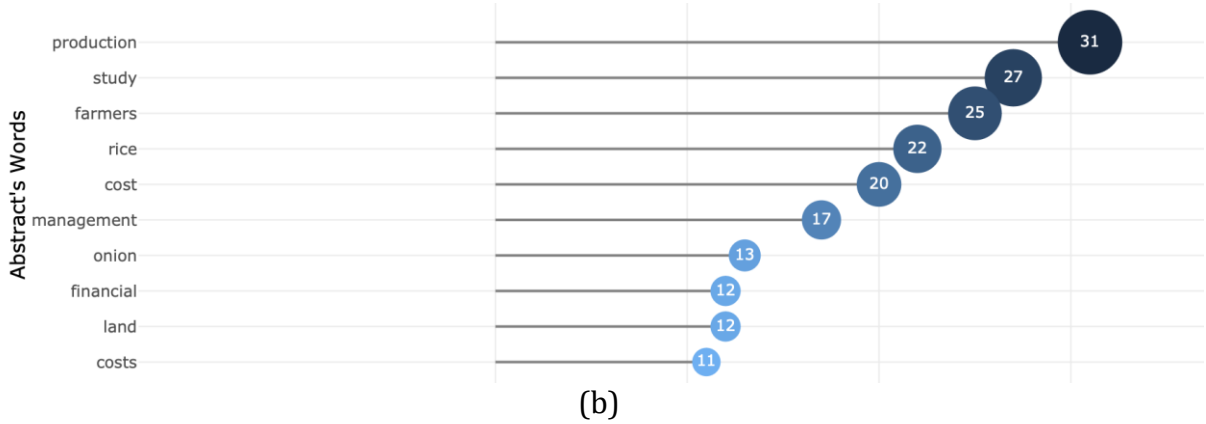
From the given explanation, it is evident that the topics "benefit-cost ratio, Cobb-Douglas type, factors affecting," "descriptive statistics, farming experience, study found," and "primary data, random sampling, economically viable" reside in the upper right quadrant, indicating their influence on research and well-developed nature. However, topics relevant to the discussion in this paper, specifically "Cobb-Douglas," "Agricultural," and "cost reserves," do not exhibit a significant impact on research. In summary, the investigation into the Cobb-Douglas topic concerning agricultural cost reserves, in particular, is relatively scarce or non-existent, presenting an opportunity for further exploration and contributions to future research.

A meticulous follow-up analysis pertains to the evolution of the most pertinent words. The results obtained from the RStudio software yield three categories of the most pertinent words: unigrams (single-word occurrences), bigrams (two-word occurrences at maximum), and trigrams (three-word occurrences at maximum). This research specifically concentrates on the most relevant words within the keywords and the most pertinent unigrams in the abstract. The objective of this analysis is to evaluate the frequency of keyword occurrences, pinpoint keywords that hold potential for further development in research, and identify those that have been extensively discussed in the existing literature.

In Figure 6a, the display highlights the top ten most pertinent words concerning various topics within the keyword domain. Notably, "rice production" takes precedence, holding the first position with two relevant words. Conversely, Figure 6b exhibits the ten most relevant words within the abstract domain, where "production" claims the top spot with thirty-one relevant words. Upon examining the information conveyed by Figures 6a and 6b, it can be inferred that the ten pertinent words identified do not collectively encapsulate the subject matter of this research, which revolves around the Annuity Model utilizing the Cobb-Douglas Production Function for Plantation Replanting Cost Reserve.



(a)



(b)

Figure 6. (a) most pertinent words in the keywords field and (b) most relevant words in the abstract field

Another crucial element in examining the development of article analysis is the word growth map, another output. The time span from 2009 to 2023 allows the visualization of the word growth map, as illustrated in Figure 7. In this representation, the Y-axis indicates the number of articles written, the X-axis denotes the year, and the word growth is portrayed through diverse color plots. Ten distinct color plots depict ten classifications of word growth topics.

For example, it can be noticed that in the time span from 2013 to 2023, the topic "production" saw an increase in word growth, and between 2019 to 2023, the growth was even more significant. On the other hand, it can also be seen that the topic "financial" has increased from 2018 to 2023. This indicates that research on both topics is growing. However, it should be noted that the topic "annuity" which falls under the financial domain and the topic "Cobb-Douglas production function" which falls under the production domain have not been heavily involved in research, suggesting further research opportunities on both topics.

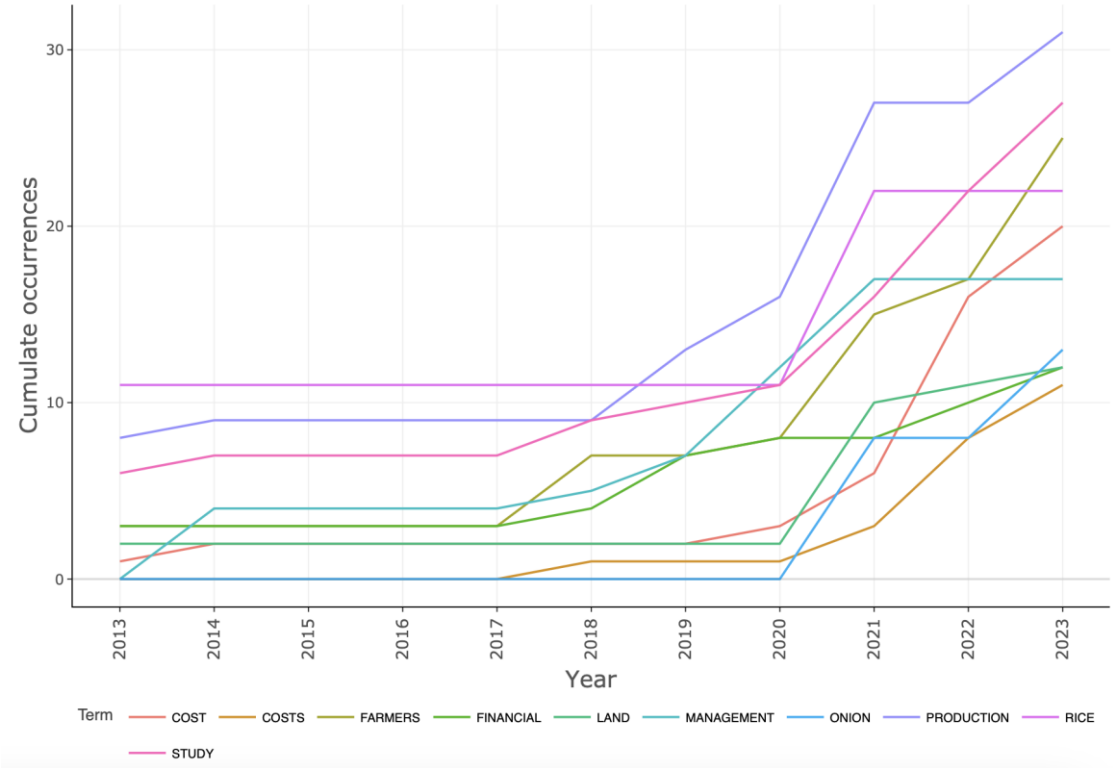


Figure 7. Word Growth Map of Abstract

The Results of the Systematic Literature Review

This section unveils the outcomes of the study derived from Dataset 2, a compilation of twelve articles that successfully progressed to the final stage, as illustrated in Table 4. The articles encompassed in Dataset 2 were published within the timeframe of 2009-2023.

According to the findings from Dataset 2, the twelve articles predominantly delve into the plantation topic, employing the Cobb-Douglas method and exploring its evolution. Additionally, these articles address various developments in economic and financial analyses, including discussions on the benefit-cost ratio, annuity, Equivalent Annual Annuity (EAA), Internal Rate of Return (IRR), and Average Production Cost (APC).

Table 4. State-of-the-art Dataset 2

No	Author	Method	Object	Application Method
1	[15]	Cobb-Douglas Production Function	Rice farmers Insurance	The utilization of the Cobb-Douglas function is employed to ascertain the optimal insurance payout and premium acquired.
2	[16]	Statistics that describe data, the profit margin, and a probabilistic profit frontier function model based on the Cobb-Douglas type.	Red Onion production	Investigated the efficiency in profitability among small-scale farmers engaged in the cultivation of red onions within the Sironko district located in eastern Uganda.
3	[17]	Monte Carlo method, Equivalent Annual Annuity (EAA), Internal Rate of Return (IRR) and Average Production Cost (APC)	Small forest Farmer's plantation	To incorporate uncertainties into the standard approach, the Monte Carlo method is utilized to choose the most effective management strategy for plantations owned by small-scale forest farmers.
4	[18]	Cobb-Douglas Production Function	Pearl Millet	Cobb-Douglas functions are employed for the examination of compound growth rates, costs and benefits, resource use efficiency, and agricultural income inequality.
5	[19]	Cobb-Douglas production function	Rice Cultivation	Perform an examination of the economic aspects of production and the factors influencing the overall revenue generated from rice cultivation in the Gorkha district of Nepal during the year 2020.
6	[20]	Cobb-Douglas production function	Vegetables cultivation	To ascertain the costs, returns, and resource use efficiency in the cultivation of potatoes and tomatoes.
7	[6]	Annuity	Smallholder Oil Palm Plantations	The application of annuities is employed to compute contributions and distribute the costs associated with replanting oil palm plantations.
8	[21]	Annuity, NPV, benefit-cost ratio	Onion planting	Assess the potential of shallot varieties under an agroforestry system based on Populus deltoides Bartr. ex Marsh.
9	[22]	Cobb-Douglas Production Function	Bajra	Estimate the factors influencing the yield of Bajra production using the

				Cobb-Douglas type production function.
10	[23]	Cobb-Douglas stochastic frontier cost function	Small Scale Soyabean farmers	Assess the degree of economic efficiency and the factors influencing it in the small-scale cultivation of soybeans.
11	[24]	Cobb-Douglas Production Function	French Guiana shrimp fishery	Utilize the Cobb-Douglas function to describe the natural growth and harvest of prawns.
12	[25]	The multiple Cobb-Douglas production function, Projects evaluation method	Red sweet pepper	Assess the profitability of cultivating red sweet peppers (Capsicum annuum L.) with regard to the labor and capital investments involved in chosen horticultural farms.

Drawing from the discussion on the acquisition of Datasets 1 and 2 through the PRISMA Method and subsequent evolutionary analysis, it becomes evident that the research topics covered in the discussed articles reveal certain gaps in the existing literature. Firstly, the bibliometric analysis presented in Figure 1, Figure 2, and Figure 3 (representing articles in dataset one) and Table 4 (representing articles in dataset 2) indicates a lack of research specifically addressing annuity models for plantation replanting cost reserves using the Cobb-Douglas Production Function. This gap in prior research presents an opportunity for novel exploration and development in future studies. Secondly, there is an absence of research specifically focusing on the annuity model of replanting cost reserves utilizing the Cobb-Douglas Production Function. As observed in Table 4, while seven articles use the Cobb-Douglas model to address production issues in the plantation sector, none specifically target plantation replanting cost reserves. Additionally, five other articles employ annuities to tackle plantation problems, yet none specifically discuss plantation replanting cost reserves.

CONCLUSIONS

In this comprehensive analysis, we present a systematic literature review (SLR) that focuses on applying the Cobb-Douglas model to describe annuities as costs reserved for the replanting of agricultural areas. This review strictly adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol, ensuring a standardized approach to clarify criteria for article selection, search strategies, and procedures for data extraction and analysis. Adherence to PRISMA is recognized for enhancing the overall quality of literature reviews. Our search encompassed six different combinations of keywords, resulting in a total of 72 articles retrieved from esteemed digital libraries such as Scopus, Science Direct, Dimensions, and SAGE.

After meticulously following PRISMA guidelines, we identified twenty-four articles constituting dataset 1, which we employed for bibliometric mapping and phylogenetic analysis. Upon scrutinizing dataset 1, it became apparent that the articles span the period from 2009 to 2023, with an average publication year of 5 years, an average of 7.04 citations per document, and a cumulative total of 175 references. However, it is crucial to highlight that the pertinent terms generated in the bibliometric outcomes, extracted from keywords, titles, and abstracts, do not precisely capture the essence of our research focus—specifically, a model for annual renewal costs using the Cobb-Douglas production function. This indicates an underexplored area, presents an avenue for further research, and contributes to the discourse on potential future investigations.

Moreover, we conducted a manual selection of full texts and obtained 12 articles (Dataset 2). We answered our research questions posed in the Introduction. In summary, we found that some publications on the object of research in the field of plantation have used annuity or Cobb-Douglas models. In addition, there are other methods used in solving plantation problems. Furthermore, these methods are applied to solve the plantation problem.

Upon reviewing Dataset 2, we uncovered a significant deficiency in the current body of research. There were no studies found regarding the application of the annuity model to replanting cost reserves in plantations utilizing the Cobb-Douglas methodology. While previous literature has explored the use of the Cobb-Douglas model in seven articles focusing on various productivity aspects in plantations, and an additional five articles have applied financial analysis to address diverse challenges in plantation management, none of these studies specifically addressed the issue of resolving replanting cost reserves. This notable research gap serves as a substantial basis for future inquiries within this field.

The systematic literature review conducted in our study is subject to certain limitations. Initially, we employed four databases, namely Scopus, Science Direct, Dimensions, and SAGE, for data extraction. While we aimed to capture a comprehensive range of articles, there remains a possibility that some relevant studies from other databases were not included in our analysis. Additionally, our choice of keywords was tailored to our specific research topic, potentially overlooking articles that may have used different terminology to address similar concepts. Furthermore, in an effort to mitigate subjectivity in article selection, we adhered to a standardized procedure when evaluating titles and abstracts. Despite these efforts, there may still be inherent biases in the selection process that could influence the inclusivity of our review.

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