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FIRM SURVIVAL IN AGRICULTURE: A SYSTEMATIC REVIEW OF ANALYTICAL APPROACHES

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ABSTRACT

The long-term viability of agricultural enterprises remains a key policy and research issue, particularly in sectors exposed to market and environmental uncertainties. This systematic literature review examines the application of survival analysis in studying the persistence and exit of agricultural firms. The review encompasses peer-reviewed studies published between 2014 and 2024, identified through structured searches in the Web of Science and ScienceDirect databases. Studies were included if they applied survival analysis or related quantitative methods and were published in journals ranked at least in the Q3 category according to SCImago. Thirteen publications met the inclusion criteria. Most studies employed Cox proportional hazards models or Kaplan–Meier estimators and analyzed a range of explanatory variables, including demographic, financial, organizational, and institutional factors. While the majority focused on general farm-level dynamics, only two addressed wine-producing enterprises. These highlighted the importance of cooperative membership, institutional networks, and prior performance in determining survival outcomes. The review identifies a clear gap in the literature on the survival of wine sector firms, particularly in Central and Eastern Europe. The findings support the relevance of survival analysis in agricultural economics and provide a conceptual basis for future empirical studies on Hungarian grape and wine enterprises. The findings also provide methodological guidance for future empirical research and may support policy discussions related to the resilience of wine-producing enterprises.
Keywords: survival analysis; agricultural enterprises; firm exit; wine sector; systematic literature review

INTRODUCTION

Agricultural enterprises play a crucial role in sustaining rural economies, ensuring national food security, and maintaining socio-economic stability in many regions (*Nugroho & Lakner*, 2022; *Fresco et al.*, 2021; *Pawlak & Kołodziejczak*, 2020). In Hungary, the agricultural sector has undergone profound structural changes over the past seven decades, shaped by land reforms, socialist collectivization, and the post-socialist transition to a market economy (*Swain & Hamza,* 2023*; Lennert & Farkas,* 2020). Despite these transformations, the long-term viability of agricultural businesses remains a critical policy and research concern, particularly in sectors such as viticulture, which are exposed to market fluctuations, environmental uncertainties, and evolving institutional frameworks (*Gomes et al.,* 2021*; Russo et al.,* 2021).

Understanding why some agricultural enterprises survive while others exit the market is increasingly important for decision-makers, researchers, and farm operators. Survival analysis has emerged as a valuable statistical tool in economics for examining firm longevity, exit probability, and resilience in the face of various external and internal shocks (*Afin et al.,* 2025*;* *Ronen,* 2024). While widely used in medical research and human sciences (*Beis et al.,* 2024*; Allison,* 2014), its application in agricultural economics, especially at the enterprise level, remains limited and fragmented (*Morán Santamaría et al.,* 2024*; Kramer et al.,* 2019). This gap is particularly acute in the context of wine-producing enterprises, where long production cycles, branding strategies, and international competition create unique survival challenges.

In agricultural settings, survival analysis enables a time-dependent, event-based examination of farm dynamics. Unlike cross-sectional studies, it captures both the duration and the risk of exit, while accounting for censored observations – i.e., farms that remain active at the end of the observation period. This methodological strength is particularly relevant in agriculture, where data incompleteness (*Onofri et al.,* 2018), ownership changes, and sectoral volatility (*Hansson & Nilsson,* 2021*; Corsi et al.,* 2021) are frequent. Moreover, survival models can incorporate a wide range of covariates, including demographic attributes (e.g., age, education), financial indicators (e.g., return on assets, debt ratios), organizational features (e.g., cooperative membership), and broader institutional or market variables (*Xu & Mai, 2024; Grashuis,* 2019).

The ability to quantify these factors and estimate their impact on the probability of firm exit provides a powerful foundation for both theoretical development and evidence-based policy. Popular models such as the Cox proportional hazards model and the Kaplan–Meier estimator enable researchers to assess the relative influence of explanatory variables, compare survival curves across groups, and identify critical thresholds or vulnerabilities. In doing so, survival analysis contributes to a deeper understanding of enterprise-level resilience and offers insights into how policy interventions, market structures, or strategic decisions affect long-term viability.

To address the current research gap, this study presents a systematic literature review of scholarly publications that apply survival analysis in the context of agriculture. Particular emphasis is placed on studies exploring the exit and survival of agricultural enterprises. The review aims to synthesize methodological approaches, summarize key empirical findings, and highlight underexplored areas. This work also serves as a conceptual and methodological foundation for future empirical analysis of Hungarian grape and wine-producing enterprises – an economically and culturally significant but under-researched segment of the agricultural sector.

THEORETICAL FOUNDATIONS OF SURVIVAL ANALYSIS

Survival analysis is a statistical approach used to examine the time until a specific event occurs, such as firm exit or bankruptcy (*Johansson et al.,* 2024). It is closely related to duration analysis and has been widely applied in disciplines such as medicine, engineering, and the social sciences (*Defrancesco et al., 2018; Vance & Geoghegan,* 2002). In economics, survival analysis was first introduced by *Lancaster* (1979) to investigate the duration of unemployment (*Defrancesco et al.,* 2018). Duration analysis is particularly useful in economic research because it allows researchers to examine how long an entity remains in a given state before an event occurs. Since then, its application has expanded significantly, including studies on firm survival in competitive markets (*Rousselière*, 2019; *Valette et al.,* 2018).

Survival models estimate the hazard rate, which represents the conditional probability that an event will occur within a given time interval. In economic contexts, these models help identify the likelihood and determinants of firm persistence or exit relative to competitors (*Johansson et al.,* 2024). The literature distinguishes between continuous-time parametric models (e.g., exponential, Weibull), semi-parametric models (e.g., Cox regression), and discrete-time hazard models (*Singer & Willett,* 2003*; Defrancesco et al.,* 2018). The choice between continuous and discrete-time frameworks typically depends on the nature of the survival time being analyzed *(Demaris, 2004).*

METHODOLOGY

A systematic literature review is a method used to identify, evaluate, and analyze published research on a specific topic. It involves a thorough search for relevant studies (*Kataike & Gellynck*, 2018). Both *Kataike and Gellynck* (2018) and *Kahn et al.* (2003) outlined five steps to carry out this process.

1. Planning - Formulate framework questions for the research
2. Searching - Search for relevant studies
3. Screening - Determine inclusion criteria
4. Extraction and synthesis - Summarize the results
5. Report - Interpret the results.

These steps were methodically followed in this study to ensure rigor, transparency, and consistency in the literature review process.

Planning

This review aims to synthesize insights from existing empirical research using survival analysis to understand the factors that influence market survival and exit, initially focusing on grape and wine-producing enterprises. However, a systematic search revealed a nearly complete absence of such studies specific to the viticulture and winemaking sector. As a result, the scope of the review was expanded to include agricultural enterprises more broadly. Survival analysis studies in this wider domain were examined to identify transferable findings and methodological patterns relevant to the original research goal.

Searching

A key goal of a systematic literature review is to gather and evaluate as many relevant sources as possible to ensure comprehensiveness and reduce selection bias (*Khan et al.,* 2003). Searching across multiple scientific databases enhances the breadth of coverage and increases the likelihood of identifying pertinent studies. However, this approach may also lead to duplication of records, which requires careful management.

In this review, two major academic databases were used: Web of Science and ScienceDirect. To construct precise and effective search queries, Boolean operators were applied to define logical relationships between search terms:

AND = exact matching of terms
OR = choice between synonym groups
„" = search for a specific term
* = replace any number of characters
() = create a search order (*Gelencsér et al.,* 2022)

Following multiple refinements of keywords and Boolean logic, the final search expression was constructed as:

(„Survival analysis" OR „Survival method" OR „Overlapping generations model" OR „Competing risks model") AND („Wine* OR „Vine*" OR „Agribusiness" OR „Agricultur*" OR „Farm*").

Since survival analysis is not the only method applied in economic studies to investigate market entry and retention, the search strategy was expanded to include related models, such as the Overlapping Generations Model (OGM) and the competing risks model. Although the Overlapping Generations Model is not a survival analysis method in a strict statistical sense, it was included during the exploratory search phase to ensure that studies addressing long-term structural persistence of agricultural enterprises were not overlooked. However, none of the final studies included in the review applied this model as the primary analytical framework for firm survival. The OGM, originally developed by Paul Samuelson, captures intergenerational economic dynamics and long-term structural effects (*Weil*, 2008). The competing risks model represents a specific form of survival analysis that accounts for the possibility of multiple, mutually exclusive events influencing the timing of an outcome (*Wolbers et al.,* 2014).

Furthermore, due to the lack of sufficient results related specifically to grape and wine-producing farms, the scope of the search was broadened to encompass studies focusing on other segments of the agricultural sector.

Screening

The search was conducted in two major academic databases, Web of Science and ScienceDirect, using the search string defined above in both platforms.

ScienceDirect

The initial search in the ScienceDirect database yielded a total of 6,116 results. To narrow down the scope and improve relevance, the following filters were applied using the platform's built-in filtering tools:

Year: 2014-2024 (3564)
Article type:
Review articles
Research articles (3137)

Subject area:
Agricultural and Biological Science
Environmental Science
Economics, Econometrics and Finance
Social Science (2095)

Following the application of these filters, the titles of the resulting publications were screened for relevance, and 67 studies were selected for further review and download.

Web of Science

The Web of Science database yielded fewer results, with a total of 462 articles matching the predefined search terms. To refine the results and enhance relevance, the following filters were subsequently applied:

Year: 2024-2014 (297)
Document type:
Article
Review Article (293)
Web of Science Categories:
Ecology
Environmental Studies
Economics
Multidisciplinary Science
Agricultural Economics Policy
Agriculture Multidisciplinary
Statistics Probability
Regional Urban Planning
Business
Management Science
Other areas

After applying the filters, the titles of the resulting publications were screened for relevance, and the abstracts of 40 selected studies were subsequently downloaded for further evaluation.

Rayyan.ai

The selected publications were uploaded to the Rayyan.ai platform to support a transparent and structured review process. Rayyan is designed explicitly for systematic literature reviews and meta-analyses, offering functionalities that facilitate screening and organization.

Duplicate records were automatically identified by the platform, resulting in the removal of four duplicates. The remaining 137 abstracts were then screened and categorized into three groups: include, maybe, and exclude. Most of the excluded records were unrelated to economics or agriculture. Following this screening process, a total of 20 publications were retained for inclusion based on the predefined eligibility criteria (*Table 1*).

Table 1: Defining criteria

Quality criteria	Reason for inclusion/exclusion
Eligibility criteria	
Year of publication	Publications were published between 2014-2024
Language of publication	Most scientific journals are published in English.
Topic	Focus on the factors influencing the survival and market entry and exit of economic actors in the field of agriculture to narrow the research question and synthesize relevant results.
Scientifically published articles	Provide more rigorous knowledge in the field of agricultural enterprises and the factors influencing their market survival, market entry and exit
Exclusion criteria	
Publications in other disciplines	The use of the survival method is popular, even more so, in other disciplines, such as medicine, veterinary medicine, herbal medicine, agriculture, etc.
Publications in other sectors	In the field of economics, survival analysis is popular in research on finance and society.
Conference proceedings, books, theses, reports	To ensure quality and consistency, all articles are peer-reviewed.

Extraction and synthesis

Various approaches exist for synthesizing results in systematic literature reviews (*Kataike & Gellynck,* 2018). The present review focused on identifying studies that applied survival analysis – or other relevant quantitative methods – to agricultural enterprises, with the aim of uncovering factors influencing their market survival or exit.

Of the 20 studies retained after abstract screening, 13 publications met all predefined eligibility criteria and were included in the final synthesis. Although the initial number of potentially relevant studies was substantial, the strict application of inclusion and exclusion criteria significantly narrowed the sample. This outcome highlights the limited availability of international research specifically addressing the survival dynamics of agricultural enterprises – particularly within the wine sector.

Nonetheless, such narrowing is not uncommon in high-quality systematic literature reviews in agricultural economics. For instance, *Abdul-Majid et al.* (2024) retained 30 publications from an initial 388 results in their review on the effects of technological innovation on farmers' well-being. Similarly, *Miranda et al.* (2023) included 36 out of 285 articles in their analysis of agri-food business models, while *Borda et al.* (2023) selected 55 studies from an initial 90 in their investigation of generational change in agriculture.

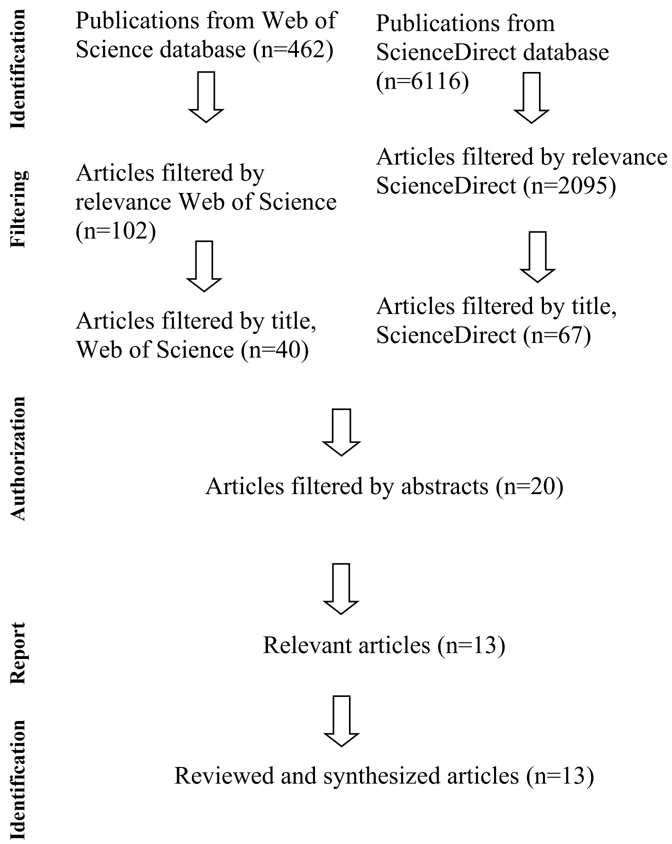
It is also worth noting the widely cited review by *Stewart et al.* (2015), which – despite being published outside of a top-tier journal – remains influential. Their study synthesized 19 relevant publications on the role of training, innovation, and technology in improving the well-being and food security of African smallholder farmers.

These examples demonstrate that the scientific merit of a systematic review lies not in the number of studies included, but in the methodological rigor and clarity with which the literature is evaluated.

Report

Based on the predefined research question, as well as the keywords and search terms applied, all publications unrelated to the study scope were excluded. The most relevant scientific articles were identified through a structured filtering process. The steps of the review protocol and the corresponding numerical results are summarized in *Figure 1*.

Figure 1: Searching-Rating Taxonomy Diagram



RESULTS

The final set of 13 publications included in the review was evaluated based on journal quality and disciplinary relevance, as summarized in *Table 2*. Eight articles (62%) were published in Q1-ranked journals, four (31%) in Q2, and only one (7%) appeared in a Q3 outlet, indicating that the majority of the selected studies originate from high-impact publication venues.

Table 2: Classification of publications

Author	Year	Journal	Field	Classi-fication
Liu et al.	2014	Technological Forecasting and Social Change	Management of Technology and Innovation	Q1
Eskander & Barbier	2017	Ecological Economics	Economics and Econometrics	Q1
Defrancesco et al.	2018	Land Use Policy	Agricultural and Biological Sciences	Q1
Kim et al.	2018	European Review of Agricultural Economics	Economics and Econometrics	Q1
Valette et al.	2018	Journal of Wine Economics	Business, Management and Accounting (miscellaneous)	Q2
Khataza et al.	2018	Technological Forecasting and Social Change	Management of Technology and Innovation	Q1
Wencong & Kwasi	2019	Land Use Policy	Agricultural and Biological Sciences	Q1
Grashuis	2019	Agribusiness	Economics and Econometrics	Q2
Rousselière	2019	Journal of Quantitative Economics		Q3
Nolte	2020	Applied Geography	Geography, Planning and Development	Q1
Olmos et al.	2021	British Food Journal	Business, Management and Accounting (miscellaneous)	Q2
Lou et al.	2023	Journal of Agricultural and Resource Economics	Economics and Econometrics	Q2
Fertő et al.	2024	Agricultural System	Agronomy and Crop Science	Q1

In terms of disciplinary classification, the journals predominantly belonged to the fields of economics and econometrics, as well as agricultural and biological sciences, and business and management, reflecting the interdisciplinary nature of survival analysis in agricultural enterprise research.

As part of the synthesis, the selected studies were examined with respect to their geographical focus, temporal scope, sample size, and data sources. These characteristics provide insight into the contextual diversity and empirical depth of the reviewed literature. An overview of these attributes is presented in *Table 3*.

Table 3: Geographic Scope, Time Period, Sample Size, and Data Sources of the Reviewed Studies

Reference	Location	Time period	Sample	Source
Liu et al. (2014)	China	1985-2005	9928 patents	China State Intellectual Property Office (SIPO)
Eskander & Barbier (2017)	Bangladesh	2000, 2005, 2010	7440, 10080, 10200 farms	Household Income and Expenditure Survey, questionnaire
Defrancesco et al. (2018)	Italy, Veneto	2000-2015	2922 farms	Official regional registers
Kim et al. (2018)	Kansas	1993-2015	41340 farming	Kansas Farm Management Association (KFMA)
Valette et al. (2018)	France	2009-2014	365 cooperatives, 586 companies	CCVF, AGEVE, French Ministry of Agriculture
Khataza et al. (2018)	Kasungu and Mzimba districts in Malawi	2013/14 growing season	340 farms	Questionnaire; Administrative Delimitation of the Ministry of Agriculture
Wencong & Kwasi (2019)	Ghana	2013-2014	1727 farmers	Survey of Large and Medium Farmers and Agricultural Mechanization, questionnaire
Grashuis (2019)	USA	2005-2018	950 companies	USDA, Rural Development Cooperation Programs (USA) and Annual Publication
Rousselière (2019)	France	1984-2006	1631 cooperatives, 7644 non-cooperative enterprises	French Ministry of Agriculture, Annual Business Survey

Reference	**Location**		**Sample**	**Source**
Nolte (2020)	International (Africa)		1915 projects	Land Matrix Initiative (LMI)
Olmos et al. (2021)	Spain, Rioja	From the initiation of the enterprise's winemaking activity until its exit from the market (complete observations), or until the end of the study period, 31 May 2020.	123 wineries	Rioja Designation of Origin Regulatory Council (580 wineries), structured questionnaire
Lou et al. (2023)	New Zealand	1989-2019	558 connections	United Nations Merchandise Trade Statistics Database, WDI, CEPII, FAO, WHO, New Zealand Ministry, Primary Industries Website, ILO, World Bank.
Fertő et al. (2024)	17 post-communist Central and Eastern European countries	2007-2019	16990 companies	van Dijk ORBIS Office Database

The descriptive characteristics of the reviewed studies are presented in Table 3, including their geographic scope, study period, sample size, and data sources. A total of five studies were conducted in Europe, among which two focused specifically on the wine sector.

Valette et al. (2018) investigated the survival rates of French wine cooperatives compared to individual enterprises between 2009 and 2014, drawing data from the Confederation of French Wine Cooperatives (CCVD), the General Association of French Wines (AGEVE), and the French Ministry of Agriculture.

Olmos et al. (2021*)* analyzed the survival of 123 wineries in Spain's Rioja region, from their establishment to market exit or up to May 31, 2020. The study used data collected via structured questionnaires, sourced with the support of the Rioja Designation of Origin Regulatory Council.

In terms of temporal coverage, most studies applied a single continuous observation window. The longest study periods were observed in *Kim et al.* (2018) and *Rousselière* (2019), both spanning 22 years. *Olmos et al.* (2021) applied firm-specific start dates, likely reaching back to pre-1998 in some cases. Sample sizes ranged from 123 (*Olmos et al.,* 2021) to 41,340 observations (*Kim et al.,* 2018).

While the majority of studies focused on farm- or firm-level survival in agriculture, two exceptions were identified: *Liu et al.* (2014) examined the evolution of agricultural patent value in China, and *Nolte* (2020) investigated the failure dynamics of land-based investment projects, focusing on project-level rather than enterprise-level outcomes.

Appendix 1 displays the analytical methods and explanatory variables used in the reviewed publications. The studies employed various survival analysis techniques – including parametric, semi-parametric, and discrete-time models – based on data structure and research goals. A wide range of covariates was also identified, such as demographic characteristics (e.g., age, education), financial indicators (e.g., return on assets, debt ratios), organizational features (e.g., cooperative membership), and contextual or institutional variables.

As shown in Appendix 1, the reviewed studies applied a range of survival analysis techniques adapted to the structure of their respective datasets. The sample size, time span, and the number and type of explanatory variables primarily influenced the selection of analytical models.

The Cox proportional hazards model emerged as the most frequently used method, appearing in multiple studies (e.g., *Liu et al.,* 2014*; Kim et al.,* 2018*; Valette et al.,* 2018*; Khataza et al.,* 2018*; Grashuis,* 2019*; Olmos et al.,* 2021). This semi-parametric model is widely applied in both medical and economic research, enabling the simultaneous assessment of multiple covariates – both continuous and categorical – on the hazard function (*Cox,* 1972).

Several studies also applied the Kaplan–Meier estimator, particularly in cases involving censored data (*Defrancesco et al.,* 2018*; Valette et al.,* 2018*; Olmos et al.,* 2021*; Fertő et al.,* 2024). This non-parametric method allows the estimation of survival probabilities over time and is typically visualized through step functions. In addition, topic-specific models – such as discrete-time hazard models or Bayesian approaches – were employed in a few cases to reflect the data structure or the complexity of the research questions.

The explanatory variables used across the studies were aligned with the research objectives and available datasets. These included:

- Demographic factors (e.g., age, gender, education),
- Financial indicators (e.g., return on assets, solvency ratio, debt ratio),
- Organizational and structural variables (e.g., firm size, cooperative membership, export orientation),
- Institutional and regional characteristics.

Data sources varied: most studies relied on official secondary datasets (e.g., *Liu et al.*, 2014; *Kim et al.*, 2018; *Grashuis*, 2019; *Rousselière*, 2019; *Fertő et al.*, 2024), while others used primary survey data (e.g., *Eskander & Barbier*, 2017; *Khataza et al.*, 2018; *Wencong & Kwasi,* 2019). This methodological diversity reflects the broad applicability of survival analysis in agricultural economics. Across the studies, dummy variables were commonly employed to encode categorical predictors, allowing for binary representation in regression models.

Among the reviewed publications, the studies by *Valette et al.* (2018) and *Olmos et al.* (2021) were particularly relevant to the present research focus. *Valette et al.* (2018) demonstrated that French wine cooperatives exhibited longer survival times than individual enterprises, a finding attributed to more effective environmental adaptation and internal knowledge transfer. *Olmos et al.* (2021) examining wineries in Spain's Rioja region, found that institutional embeddedness and prior financial performance were positively associated with the likelihood of survival. Interestingly, variables such as R&D expenditure and export activity did not significantly influence survival outcomes in that context.

In summary, the methodological approaches and empirical findings presented in the 13 reviewed studies confirm the relevance and versatility of survival analysis for investigating firm dynamics in the agricultural sector. These results support the application of survival models in future research on Hungarian grape and wine enterprises. Taken together, the reviewed studies reveal several recurring patterns, including the dominant use of Cox proportional hazards models and the frequent role of financial performance, firm size, and institutional relationships as determinants of enterprise survival.

DISCUSSION

The findings of this systematic review identify several recurring patterns across the reviewed studies, in terms of both methodological choices and empirical results. These patterns not only reflect the current state of survival analysis in agricultural economics but also emphasise areas where further research is warranted.

Methodological convergence. The reviewed literature demonstrates a clear methodological consensus around semi-parametric approaches, especially the Cox proportional hazards model, which was utilised in most studies (e.g., *Liu et al.*, 2014; *Kim et al.*, 2018; *Valette et al.*, 2018; *Grashuis*, 2019; *Olmos et al.*, 2021). This prevalence aligns with broader trends in applied econometrics, where the Cox model is preferred for its flexibility and minimal distributional assumptions. The Kaplan–Meier estimator is often presented alongside it as a descriptive complement, allowing visual comparison of survival curves across groups. Parametric and Bayesian approaches, although less frequently used, were adopted when theoretical assumptions about the hazard function could be justified or when data complexity necessitated greater modelling flexibility (*Rousselière,* 2019). This methodological agreement indicates that survival analysis in agricultural economics has achieved a certain level of maturity, though it also highlights a relative underexploration of more recent extensions, such as time-varying covariate models or competing risks frameworks.

Empirical patterns and contextual heterogeneity. Across the reviewed studies, a consistent set of firm-level determinants emerged as significant predictors of survival:

financial performance indicators (e.g., return on assets, solvency ratios), firm size, age at entry, and organizational form, particularly cooperative membership. These findings align with traditional industrial organisation theory, where resource availability and institutional embeddedness are seen as key buffers against exit risk. At the same time, the evidence is not consistent. Notably, *Olmos et al.* (2021) found that R&D expenditure and export activity did not significantly influence survival among Spanish wineries, a result probably explained by the specific institutional context of the Rioja designation of origin system, where regulatory protection and collective reputation may lessen the marginal survival benefit of individual innovation efforts. This contextual sensitivity emphasises the importance of interpreting survival analysis findings within their specific sectoral and institutional frameworks, rather than applying them broadly across agricultural settings.

Geographical and sectoral gaps. Despite the extensive review of the literature, a clear geographical imbalance remains. Most studies were carried out in North America, East Asia, and Western Europe, leaving Central and Eastern Europe underrepresented, even though the region has firm-level administrative datasets and experiences significant volatility in the agricultural sector following the post-socialist transition. Specifically, in the wine industry, only two of the thirteen reviewed studies focused on wine-producing companies, both from Western Europe (France and Spain). This gap is especially important given the specific features of Hungary's grape and wine sector, where small and medium-sized enterprises face market uncertainty, subsidy reliance, and changing regulations. This review highlights a valuable research opportunity: using established survival analysis techniques (like the Cox proportional hazards model or accelerated failure time models) on Hungarian wine enterprise data could produce both academically innovative and policy-important insights.

CONCLUSION

This systematic review examined how survival analysis has been applied in agricultural economics to study firm longevity and market exit. Thirteen peer-reviewed studies published between 2014 and 2024 were identified and synthesised, revealing a coherent body of literature with clear methodological preferences and recurring empirical findings.

The review confirms that survival analysis offers a robust and versatile framework for understanding enterprise dynamics in agriculture. The identified patterns – methodological convergence around Cox-type models, the consistent relevance of financial and organisational factors, and the context-dependence of innovation-related variables – provide a solid conceptual foundation for future empirical work.

This review enriches the existing literature by consolidating methodological practices and empirical insights, and by explicitly identifying the underexplored intersection of survival analysis, the wine sector, and Central and Eastern Europe. It provides a conceptual and methodological basis for upcoming empirical studies on Hungarian grape and wine enterprises – research that could yield valuable insights for policymakers and practitioners seeking to enhance sectoral resilience amid market and environmental uncertainties.

Limitations and Future Research

This review has several limitations that should be acknowledged. First, the literature search relied on two major academic databases, Web of Science and ScienceDirect, which may not include all relevant publications available in other databases. Second, the strict inclusion criteria – such as focusing only on peer-reviewed journal articles ranked at least Q3 – reduced the number of eligible studies.

Future research could expand the scope of database searches and further explore the application of survival analysis in specific agricultural subsectors. In particular, empirical studies examining the survival dynamics of wine-producing enterprises in Central and Eastern Europe remain very limited. Applying survival models such as the Cox proportional hazards model or accelerated failure time models could provide valuable insights into the factors influencing the long-term viability of these enterprises.

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APPENDIX

Appendix 1: Analytical Methods and Explanatory Variables Used in the Reviewed Studies

Reference	Factor	Method
Liu et al. (2014)	Patent scope; patent renewal; foreign (dummy); company/firm (dummy); individual (dummy); year dummies; area dummies; breadth; number of inventors; highly important	Weibull and Cox proportional hazards models
Eskander & Barbier (2017)	Conservation investment Human capital investment Land ownership; Leased land; Tenure security; Gender Dummy; Age; Household size; Search members; Students; Years of schooling; agricultural machinery ownership; Agricultural household; Women's scholarship	overlapping generations model
Defrancesco et al. (2018)	2 dummy covariates: signing of the first contract, dichotomous variable: (dummy) 1=farmer is in the target areas when signing the contract; background factors: farm size; whether he increased the area during the contract period (dummy), planting/maintaining shrubs (dummy)(positive environmental attitude), farmer age class, change of owner/occupier (dummy), proxy for neighborhood effect, decision to stay at times.	discrete-time model, Kaplan-Meier estimated survival function
Kim et al. (2018)	Total crop hectares, Operator age, years in operation, (labor input, crop)/(labor input, livestock), non-farm income, debt/asset ratio, land owned/total land, fixed asset decline, last year insured, number of years insured in the last 3 years, in the last 5 years	dynamic panel model, Cox proportional hazards model; duration model, nonparametric model, Kaplan-Meier survival curve, semi-parametric model
Valette et al. (2018)	Sales, number of employees, total assets, net income/sales, return on assets, return on equity, financial leverage, export intensity; Cox model: Cooperatives, size, export, profitability, financial leverage, ROA, ROE, Alsace, Bordeaux, Bourgogne, Loire, South (dummy)	Cox model, Kaplan-Meier estimation
Khataza et al. (2018)	Adoption time, own ruminants, age, gender, education, dependency ratio, farm size, social network member, peer learning, advisor learning, radio communication, livestock index, soil fertility, distance from farm, district, year 2000 dummy, year 2012 dummy	Discrete duration model, Cox model

Reference	Factor	Method
Wencong & Kwasi (2019)	Asset value; Years of education, time to event/staying at risk; Dummy: government support; no government support; worked before becoming a farmer; used to work alongside farming, but no longer; currently works alongside farming; gender of farmer; inheritance related to farming; possible change in land use; member of farming organization/cooperative; Motivation for farming: occurrence of medium and large farms: parents were farmers, inherited the farm, farming to feed the family, farming as a business, earning extra money, supporting a large family	Markov regime switching model, survival analysis terminology
Grashuis (2019)	Demographic characteristics: age, number of members; Financial characteristics: asset turnover ratio, debt ratio, current ratio; Strategic characteristics: trademark owner, service mark owner	Cox model
Rousselière (2019)	Age, 1984-1991 period, 1992-1995 period, 1996-2002 period, 2003-2006 period, previous legal status, number of employees, turnover, tangible investments, intangible investments, uniformity (sectoral diversity), exports, other legal status, limited liability companies and joint stock companies.	Bayesian generalized discrete-time semiparametric hazard model
Nolte (2020)	Investment-specific factors: Size of investment, Type of investment, Ownership structure, Financial endowment, Investor capabilities; Micro-investment context: Social context (poverty, inequality, social conflicts), Institutional context (access to natural resources, political stability, corporate organizational routine, investment environment), Accessibility, Stability, Technological affinity; Macro-investment context: Macroeconomic trends and shocks	Survival analysis
Olmos et al. (2021)	Composition of the senior management team, winery size, R&D intensity, international experience, past performance, relationships with institutions	non-parametric (Kaplan–Meier plot) and semi-parametric survival models (Cox proportional hazards model)
Lou et al. (2023)	multiple, origin, destination, GDP; distance, language, colonial production, credit food security long-distance market	Discrete-time hazard model

Reference	Factor	Method
Fertő et al. (2024)	Joint-stock company < Limited liability company/cooperative; large shareholder ownership; foreign ownership; central state ownership; Return on assets (ROA); Profit margin; Labor productivity; Solvency ratio; Total number of employees; Years of operation; Agricultural area; Employment in agriculture; Agricultural value added; Labor productivity in agriculture; Agricultural trade openness	accelerated failure time model, Nelson-Aalen estimate (cumulative hazard function), Kaplan-Meier survival function, two-level mixed-effects Weibull accelerated failure time model