The Influence of Organizational Ecology Factors on the Non-Survival of Organizations in the Paper and Pulp Industry

Thesis Master - Strategic Management

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1. Introduction

In June 2023, it was announced that paper factory De Hoop located in Eerbeek is closing its business after existing for over 350 years. Just before that, in Januari 2023 the paper factory was sold to a Finish company (NOS, 2023). This is not the first factory that got sold to a foreign company or exited the market. In 2015, InnovioPapers was declared bankrupt (Omroep Gelderland, 2015) and in 2017 Coldenhove Fabriek was sold to an American company, Neenah Paper (LokaalGelderland, 2017). When looking back centuries ago, the Netherlands was one of the most important suppliers of paper and board in Europe (Bouwens, 2012). By 2000, only 30 organizations were still operating in this industry in the Netherlands, of which 60% of the companies were already owned by a foreign company. The pride that the Dutch once had in this industry has slowly vanished over the years (Bouwens, 2012).

At the beginning of the eighteenth century, there was a production of 5,000 tons of paper annually by almost 200 wind and watermills in the Netherlands. The two centers of this industry in the Netherlands were the Zaanstreek and the Veluwe. They together contained over 155 organizations operating in the paper and pulp industry (Bouwens, 2012). The most important industrial installations of mills however were located in the Zaanstreek. During the eighteenth century, the Netherlands lost its dominant market position as papermaker, but was still able to maintain a prominent position. Shortly before the Second World War in 1945, only 50 organizations were still operating. In the 1970's the industry had to conquer a severe crisis. This has resulted in losses for most companies and limitations in their growth strategies (Bouwens, 2012).

As can be read in the paragraph above, a lot of organizations in the paper and pulp industry in the Netherlands did not survive over the past decades. Within different industries, for example the retailing industry (Michael & Kim, 2005), labor unions (Hannan &n Freeman, 1989), semiconductor manufacturers (Hannan & Freeman, 1989), research has been conducted into the non-survival of organizations, while taking the organizational ecology into account. Many factors have an influence on the organizational ecology of an industry. Age, leading to a liability of newness, and size, leading to a liability of smallness, are important population characteristics to take into account (Aldrich & Auster, 1986). Additionally, the density dependence model is closely linked to organizational ecology, looking at the growth rate of a population (van Wissen, 2004). Lastly, resource partitioning reasoning is occasionally included, looking at the competition between the generalists, being the large and established organizations, and specialists, being the small producer organizations (Carol, Dobrev & Swaminathan, 2002).

As already mentioned, some research has already been done about these above-mentioned organizational ecology factors impacting the non-survival of organizations in other industries. However not much research has been conducted in the paper and pulp industry. One example of a study that has already been conducted in this industry is the one from Delacroix and Carroll (1983), that focuses on the population growth rate and the influence of external factors (economical and political). Until today no study has integrated all the factors that were mentioned in the previous paragraph into one study within the paper and pulp industry.

This paper aims to make a first attempt to fill in this information gap and investigate the influence of these organizational ecology factors, being density dependence, liability of smallness, liability of newness and resource partitioning, on the non-survival of organizations in the paper and pulp industry in the Netherlands, taking the organizational ecology of this industry into account. This study will be conducted, stating simultaneously the unit of analysis of this study, over the organizations that were/are operating in the Zaanstreek from the year 1605 until the present, as this was the most important region for industrial installations in the Netherlands (Bouwens, 2012).

Specifically, this study, and thus attempt to fill the current existing information gap, is done via a quantitative study in the paper and pulp industry in the Zaanstreek to try and answer the following question:

H*ow do the organizational ecology factors influence the non-survival of* organizations *in the paper and pulp industry in the Zaanstreek from the year 1605 - 2024?*

The scientific relevance of this study can be found in the lack of knowledge with regards to the impact of these organizational ecology factors on the non-survival of organizations within the paper and pulp industry in the Netherlands. This paper makes a first attempt to capture what is missing in this information gap and add to the literature in two ways. Firstly, it adds to the organizational ecology literature, as little to no information is known about this theory and its impact yet on the paper and pulp industry in the Netherlands. Secondly, this study also adds to the literature of the paper and pulp industry in the Netherlands, as it conducts complementary research with regards to its life cycle and mortality. After this study has been conducted, the results of this industry can be compared to the results of other industries to check for possible similarities or differences. This could complement and strengthen the current literature or highlight possible voids that require further research.

The societal relevance of this study lies in the use of this knowledge for current existing organizations in the paper and pulp industry in the Netherlands, as well as provides information to the possible new starting owners. Currently there are 5 organizations active in the Zaanstreek, in the Netherlands, in the paper and pulp industry (*Stichting Zaanse Papiergeschiedenis - Actief*, n.d.). The knowledge obtained through this study can help those organizations to understand why their predecessors/competitors did not survive and what possible organizational ecology factors are linked to that. By obtaining this knowledge, the organizations can single out the factors that possibly make them vulnerable and that led to the non-survival of other organizations, to try to stay alive in the current industry. Additionally, this information provides new starting owners with the information on how viable their organizations would be in the current industry and whether some characteristics of their organization could be an advantage or disadvantage for them. This could influence the decision whether or not they want to take the leap into starting an organization in this industry and also prepare them better if they do decide to continue.

The research question is answered after conducting a quantitative study with data obtained from the website zaansepapiergeschiedenis.nl, complemented by the book 'De Papiermolens in de provincie Noord Holland' by Voorn (1960). The information provided by both data sources is inverted into a database, which enables the realization of this study. For the analysis, the Cox Proportional Hazard Model and the Log Rank test as used by the Kaplan-Meier Analysis are used.

This paper starts off by drawing up a theoretical framework in which all included factors will be explained and the hypotheses will be drawn up. Then the methodology of this study is explained, providing an explanation how the study will be performed, a thorough clarification of the models and how all variables will be measured. Next, the analysis is made and the results are presented. After the results, the discussion and conclusion provide an answer to the research question. Then, the theoretical contributions are explained, the limitations of the study are highlighted, as well as future research possibilities. The theoretical and practical implications are mentioned, as well as some recommendations that can be made towards (future) owners of organizations in the paper and pulp industry in the Netherlands. Lastly, an overall reflection of the process and personal process is given.

2. Theoretical framework

The second chapter of this study consists of the theoretical framework on which this study is built. It starts off with an explanation of the organizational ecology itself. Next the organizational ecology factors; density dependence, liability of smallness, liability of newness and resource partitioning reasoning; are explained followed by hypotheses for all factors.

Organizational ecology

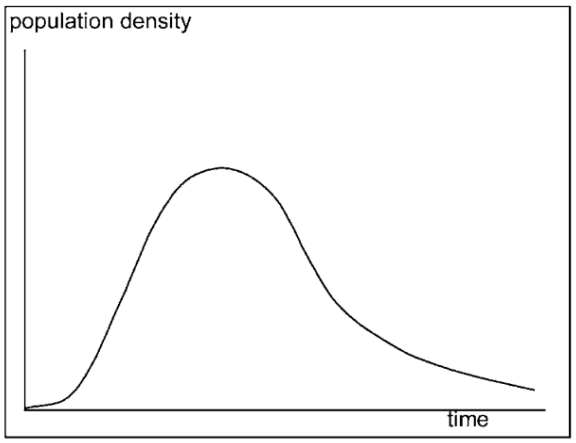
The theoretical framework used for this study is the organizational ecology framework to explain organizational survival and mortality. Organizational ecology is a framework that models the relationship between an industry and its organizations (Michael & Kim, 2005). Another explanation of organizational ecology is that it looks at the impact of social conditions on the rates that new organizations are formed, impact of social conditions on the rates at which organizations don't manage to survive and impact of social conditions on the rates at which organizational forms change, while also taking the dynamics of what happens within an organization into account (Hannan & Freeman, 1989; Singh & Lumsden, 1990). Singh and Lumsden (1990) add to this, stating that organizational ecology lies an emphasis on the founding process of organizations, changes and mortality. When looking at the mortality side of organizational ecology, there are multiple factors to take into account. To name some of these factors; density dependence, liability of smallness, liability of newness and resource partitioning (Michael & Kim, 2005; Singh & Lumsden, 1990). A short explanation of these factors will be provided below:

Density dependence

Within an industry, the organizations can be bounded into populations (Michael & Kim, 2005). These boundaries can depend on the structures, strategies and goals of individual organizations or on the social processes that create social boundaries (Freeman & Hannan, 1989). The density entails the number of organizations that are in existence in a specified population (Hannan & Carroll, 1992; Singh & Lumsden, 1990), also called population size (van Wissen, 2004). With regards to the density of an industry, the density dependence model can be used. This model states that the rates of births and deaths of organizations is dependent upon the organizational density (van Wissen, 2004). Freeman and Hannan (1989) state that the effect of population density on the births and mortality rates is not linear, as the Lotka-Volterra model of population growth states. It can be seen that low levels of population size have an increasing effect on the number of births and a decreasing effect at high levels of size. When looking at the mortality rates, this goes the other way around. At low levels of population size, the mortality rate is low, whereas with high levels of population size the mortality rate is high. The combined effect of births and mortality of organizations is the population growth rate. This growth pattern can differ considerably over different populations, but in the figure below a basic pattern of growth is shown (Figure 1).

Figure 1.

Basic growth pattern according to density dependence model.



Note. From "A spatial interpretation of the density dependence model in industrial demography", by L. van Wissen, 2004, *Small Business Economics, 22,* p. 255.

It can be seen in Figure 1. that at the start, the initial growth rates are small. As the density increases, the birth rates increase and mortality rates are low. The overall growth rate thus increases. This period can also be called the growth period of the industry. This study will refer to this period as 'phase 1' of the life cycle of the industry. When birth rates stabilize and start declining, the mortality rates increase, leading to a decline in growth rate (Carroll & Hannan, 2000). This period can be referred to as the declining period of the industry, which will be referred to as 'phase 2'.

The population density also integrates elements regarding the legitimacy and competition as included in the fitness set theory. This theory entails that organizations survive if the organization 'fits' the environment/niche it operates in (Michael & Kim, 2005; Sing & Lumsden, 1990). This 'fit' is dependent on two things, the organization's legitimacy and its competition (Sing & Lumsden, 1990). Organizations need to confirm to a set of positions and roles in the organizational network to be accepted in the environment they operate in. Additionally, organizations need to establish their own networks. When having this, organizations can become legitimate in the industry (van Wissen, 2004) Legitimation is also explained as the 'taken-for-grantedness' of the company by the society (Carroll & Hannan, 1989). Next to that they also face competition, which they have to conquer/take into account if they want to survive (Michael & Kim, 2005; Sing & Lumsden, 1990). This competition is divided into structured competition and diffuse competition (van Wissen, 2004). Structured competition entails the direct rivals the organizations have to deal with. Diffuse competition are the competitors that compete for the same resources (van Wissen, 2004).

Those two together, the legitimation and the competitive forces, shape the development of the population size as used in the density dependence model (van Wissen, 2004). It can be stated, that if the density increases, the legitimation effects will be overwhelmed and the mortality rates will increase (Sing & Lumsden, 1990). Also if the density increases, the competition becomes more intense, increasing the mortality rate (Abbott, Green & Keohane, 2013).

A study conducted among organizations in the automobile industry investigated the effect of density dependence on the mortality rate (Hannan, Carroll, Dobrev & Han, 1889a). They state that the effect of density at the birth rate is positive, meaning higher survival rates, up until a certain point is reached. After this point is reached, a growth in density will lead to higher mortality rates and lower birth rates, decreasing the growth rate and the density (Hannan, et al., 1889a). Additionally, the study in the automobile industry has found no evidence of density-dependent legitimation, but has found strong levels of density-dependent competition in the mature phase of this industry (Hannan, Carroll, Dobrev & Han, 1889b). Delacroix, Swaminathan and Solt (1989) also confirm the impact of population density on the growth rate, creating a curve where at first there is a higher birth rate leading eventually to an increase in mortality rate, similar to the results from Minkoff (1994). Similar to the study of Van Kranenburg, Palm and Pfann (1998), two separate hypotheses will be drawn up to test the density dependence over both the growth period and the declining period of the industry.

This knowledge will be applied and investigated in this study through the following two hypothesis:

H1: During phase 1 of the life cycle of the paper and pulp industry, a higher density is positively related with the survival rates of organizations.

H2: During phase 2 of the life cycle of the paper and pulp industry, a lower density is negatively related with the mortality rates of organizations.

Liability of smallness

The size of an organization also has an impact on its survival. Larger scaled organizations have an advantage due to for example economies of experience, economies of scale and market power (Hannan et al., 1998; Pfeffer & Salancik, 1978; Woo & Cooper, 1991). Additionally, small organizations are less able to weather transitions (Mata & Portugal, 1994) and have more difficulty to access capital (Aldrich & Auster, 1986). Small organizations often also have difficulty in understanding the costs they have. Larger organizations often have more insights into their costs, leading to a better pricing and better interpretation of uncertainty in the environment (Michael & Kim, 2005). Overall, it can be stated that larger organizations have an advantage in their mortality rates compared to the smaller organizations (Micheal & Kim, 2005; Sing & Lumsden, 1990).
Dobrev and Carroll (2003) also did a study in the automobile industry, investigating the impact of liability of smallness on the mortality rates. They state that as organizations grow larger, they experience less mortality, making a side note that this only holds if the company's growth rate is not outpaced by its competitors. Guercini and Milanesi (2016), Ulvenblad and Barth (2021) and lastly Hannan, Carroll, Dobrev and Han (1889a; 1889b) also confirm this, with the latter stating that the liability of smallness is not proportional to the mortality rates.

The liability of smallness will be tested through three hypotheses. Hypothesis three and four will test the effect of the liability of smallness over the two phases that the paper and pulp industry has gone through. The next hypothesis, number five, will test the effect of the liability of smallness over the whole life cycle that the industry has gone through.

H3: During phase 1, larger organizations experience more positive survival rates than smaller organizations do.

H4: During phase 2, smaller organizations experience more negative mortality rates than larger organizations do.

H5: The size of organizations is positively related with the mortality rates over the whole life cycle of the paper and pulp industry.

Liability of newness

Young or new organizations have higher failure rates than older organizations (Hannan et al., 1998; Michael & Kim, 2005; Stinchcombe, 1965). This has multiple reasons. To start off, young organizations still need to learn things about their new roles inside the organization. Apart from that, they also need to develop new relationships with other organizations in their environment and outsiders (Aldrich & Auster, 1986; Aldrich & Fiol, 1994). These new, young and still learning organizations have to compete with existing organizations with well-established client bases. (Singh & Lumsden, 1990). Additionally, modern societies favor organizational forms with high accountability and reliability. For an organizational form to have this accountability and reliability, the organizational structures have to be highly reproducible. Based on processes internally, as well as socialization and coordination, the reproducibility of the organizational structures increases with age. Another reason is that new organizations, as they don't have solid relationships developed yet, don't have legitimacy with customers and others in their environment (Stinchcombe, 1965). A lack of legitimacy leads to difficulty in the acquisition process for resources, which could result in a dissolution of the organization (Aldrich & Auster, 1986). As this process unfolds, organizational mortality decreases with age, highlighting the liability of newness (Michael & Kim, 2005; Singh & Lumsden, 1990).

The above mentioned study of Hannan, Carroll, Dobrev and Han (1889a; 1889b) within the automobile industry also investigates the effect of the liability of newness. They confirm that this effect is present, but is not proportional to the mortality rates in that industry. The liability of newness is also confirmed by Haveman (1992) and Delacroix, Swaminathan and Solt (1989).
Lastly, Carroll and Delacroix (1982) conducted a study in the newspaper industries in Ireland and Argentina about organizational mortality. Among other things, they took the liability of newness into account. They investigated the mortality rates over the different population ages within the newspaper industry in both Ireland and Argentina. They state that in the early years of operation, the mortality rates are very high. Having passed these early years, the mortality rate slowly decreases. Between both countries, the threshold where the mortality rates started to decrease after the early years of operation differed (Ireland; 5 years, Argentina; 2 years), but it can be stated that the connection between the liability of newness and mortality rates is similar and present in both countries (Carroll & Delacroix (1982).

The liability of newness will be tested through the next hypothesis:

H6: The age of an organization is positively related with the mortality rates.

Resource partitioning reasoning

Lastly, each organization aims to obtain the center of its industry, pushing other organizations out of the center (Sing & Lumsden, 1990). Resource partitioning looks at the generalists and specialists. Generalists are the large established organizations in an industry. Specialists are the small producer organizations (Carol, Dobrev & Swaminathan, 2002). Resource partitioning states that if there is a high concentration of generalists in the core of the market, the mortality rate of generalists increases and that of specialists decreases. The reason is that specialists thrive on the periphery and will outcompete the generalists if there are only a few dominant generalists in the core, decreasing the mortality rates for the specialists (Carol, Dobrev & Swaminathan, 2002). Additionally, the specialists have an advantage through exploitation of small market segments that are too small for the generalists (Hannan, Carroll, Dobrev & Han, 1998). If there are an increasing number of generalists, some generalists will be pushed to the periphery. They eventually will outcompete the specialists because of their large size, increasing the mortality rates for the specialists and decreasing them for the generalists (Carol, Dobrev & Swaminathan, 2002; Sing & Lumsden, 1990).

The study of Dobrev and Carroll (2003) in the automobile industry as mentioned before, also investigated the impact of the size of the organizations with regards to the resource partitioning. They state that the smaller specialist organizations can exploit their technology and production process less efficiently than the large firms, turning the specialists into 'laggards'. This confirms with resource partitioning, as the presence of many generalists, as is the case in the automobile industry, outperform the few specialists (Dobrev & Carroll, 2003). Carroll and Swaminathan (2000) and Freeman and Lomi (1994) also confirm the impact of the resource partitioning reasoning on the specialists/generalists.

This leads to the final hypothesis for this study:

H7: The specialists will have a higher mortality rate compared to the generalists.

3. Methodology

In this section, the methodology of this study is elaborated. It starts off with an explanation why a quantitative approach is applicable to this study. Next, the unit of analysis and data collection are elaborated. The utilized model is explained, followed by the operationalization of the variables that are used in this study. Lastly, the research ethics are discussed.

Quantitative Approach

This study will be a quantitative study. Quantitative research entails methods that are concerned with systematic investigation, using numerical or statistical data, of social phenomena (Watson, 2015). This method thus involves measurement and assumes that the phenomena utilized in the study can be measured. Quantitative studies use this data to analyze trends and relationships. The unique characteristic of quantitative research is that it can test formulated hypotheses and apply statistical analysis (Watson, 2015) Quantitative research also provides the opportunity to generalize the collected knowledge, because a larger group is studied (Holton, 2005).

Qualitative research on the other hand generates knowledge based upon collected materials that capture rich insights and opinions (Tenny, Brennan, Brennan & Sharts-Hopko, 2017). It creates empirical data collected through direct observation (Bleijenbergh, Van Engen & Lansu, 2022). Qualitative data focuses on collecting a deep and detailed understanding about a limited group or sample (Holton, 2005).

As this study wants to research the influence of multiple organizational ecology factors, being density dependence, liability of smallness, liability of newness and resource partitioning, on the mortality rate of organizations in the paper and pulp industry through testing multiple hypotheses, numerical data is necessary. This eliminates the option of utilizing a qualitative method and supports the use of a quantitative method. This study wants to understand the influence of the above mentioned factors on the mortality rate over a whole population within an industry and thus needs a large sample, which also makes quantitative research suitable. This leads to the ability of generalizing the generated knowledge.

Quantitative research also has multiple weaknesses. First of all, in qualitative research there is no ability to ask follow-up questions (Gaille, 2019). Additionally, the researcher doesn't gain access to specific details. The reason for both these weaknesses is that the methods that are used to gather data in this type of research don't allow this (Gaille, 2019). As this study is based solely on numerical data and no forms of opinions wherever, this weakness will be avoided.

Unit of analysis and data collection

The unit of analysis and thus the population that will be used are the organizations that were/are active in the Zaanstreek from the year 1605 until 2024 in the paper and pulp industry. These organizations are all measured individually to create a complete overall image of the paper and pulp industry that is located in the Zaanstreek in this time period. This study also counts paper mills as separate companies. A few mills were integrated into other companies for a certain number of years. This study views these integrations only as a collaboration between two (or more) companies, not as an exit of a mill/company. The reason for this is that most of the mills that are covered in the database for this study started off individually and exited the market individually, not while they were in a collaboration with another company. From now on, mills and companies will both be addressed under the term 'company'.

To conduct this study, data regarding the organizations active in the Zaanstreek is analyzed. This data is mainly collected from the website zaansepapiergeschiedenis.nl (*Welkom Bij De Zaanse Papiergeschiedenis*, n.d.). This website contains data from the year 1605 until the present. It provides 9 timeframes, each containing 50 years of history. In each of these timeframes, the active organizations are shown and provided with characteristics of that organization and possibly some additional information, for example the starting date, specific location, year it exited the market and other information (*Historie - Zaanse Papiergeschiedenis*, n.d.). The timeframe that will be investigated in this study will be similar to the timeframe that is present on the website, from the year 1605 until 2024. The reason is that by including all available information, the image about the paper and pulp population over time will become as clear as possible. This will enable for example the research into the density dependence, where providing more information about the history of a population will provide a clearer image about the growth rate of the population.

Additionally, this data is complemented with information from the book 'De Papiermolens in de provincie Noord Holland' by Voorn (1960). This book has served as a back-up to add information where the website lacked to provide it, as well as a doublecheck the information that the website has provided.

The data of the timeframes that are mentioned above is collected and transformed into a database. This database contains all the organizations in the paper and pulp industry from the Zaanstreek from the year 1605 until 2024, providing an overview of characteristics needed for the study. These characteristics are discussed in a moment. This database is used for the analysis, indicating whether or not the drawed up hypotheses in the theoretical framework can be confirmed or rejected.

Models

Two different models are used to analyze the data and review the hypothesis. The proportional hazard model from Cox is used to check hypothesis one through six. Hypothesis seven is checked by performing a Log Rank Test from the Kaplan-Meier Analysis.

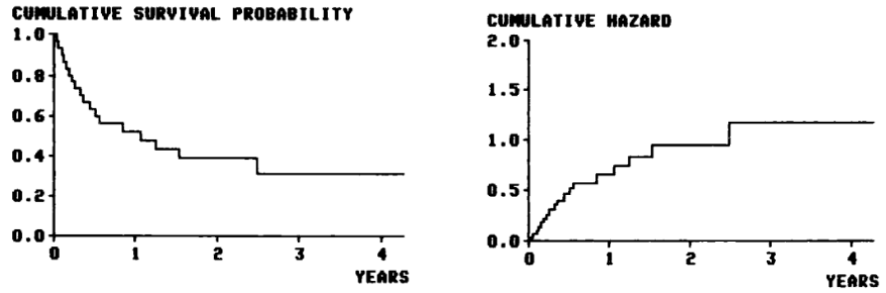
Proportional Hazard Model

This study will make use of the Proportional Hazard Model as explained by Cox (1975), also called the Cox model. It is one of the most important statistical models (Bender, Augustin & Blettner, 2005). This model analyzes the predator variable with its pattern of survival to identify variables (or a combination of them) which predict its survival the best (Christensen, 1987). As the research question poses, this study focuses on the non-survival of the organizations. This non-survival will be measured through the mortality rate of organizations. To come up with the mortality rate in the Proportional Hazards Model mortality rate, the survival probability will be transformed into a measurement called the hazard rate. This rate indicates in how much danger of dying an organization is. This force can be illustrated by the slope of the survival probability (Christensen, 1987). As the hazard rate and the survival probability have a negative relationship, it can be easily transformed by taking the negative natural logarithm of the belonging survival probability (Christensen, 1987).

Figure 2. provides an illustration of this transformation. The left graph shows an example of the slope of the survival probability, which is transformed into the hazard rate as shown in the graph on the right side, utilizing the above explained method.

Figure 2.

Estimates cumulative survival probability and cumulative hazard.



Note. From "Multivariate survival analysis using Cox's regression model", by E. Christensen, 1987, *Hepatology*, *7*(6), p. 1347.

The results of this model are presented in the form of a 'pocket chart', which clearly indicates the survival rates and hazard rates of a subject (Christensen, 1987), being the organizations in this study. The graphs in Figure 2. are examples of pocket charts.

Similar to Hannan and Freeman (1987) the duration between events is used to measure the effect of covariates on the hazard rate. An upside of this model is that it can simultaneously assess effects of multiple predictor variables (also called covariates) on the hazard rate (Su, Lin, Hung & Lee, 2022) The class of models that will be used has the below stated general form (Hannan et al., 1889a):

$$\ln\mu_i(u,t) = m_p + \gamma_p \ln s_{iu} + \theta_p \ln r_{iu} + \zeta_p v_{iu} + \lambda_p e_{iu} + \mathbf{x}'_{it}\pi,$$
$$u \geqslant 0, u \in I_p.$$

Here, (u) shows the exit rate in the industry, (t) shows the industry/population age, (s) entails the absolute size and (r) the relative size. A dummy is included for very small sizes (v), (e) stands for prior existing organizations and (Xt) entails other measured covariates (Hannan et al., 1889a).

To be able to perform this analysis, the proportional hazards assumption needs to be checked. The Cox model assumes that the values of the predictors have proportional hazards regardless of how the hazard changes over time (George, Seals & Aban, 2014). In other words, the hazard itself may change over time, but the hazard ratio needs to stay consistent (Koletsi & Pandis, 2017). If this assumption is validated, the Cox Survival Analysis can be performed. If this assumption is invalid, the Cox Analysis with Time-Dependent Variable needs to be performed (George, Seals & Aban, 2014).

To analyze the Cox Survival Analysis, a confidence interval of 95% is utilized. If the p-value given in the analysis exceeds this 95% interval, the correlation between variables is not significant. If the p-value respects this interval the effect can be said to be significant and the correlation is present.

Log Rank Test

The other model that is used to analyze the data is the Log Rank test. This test is a part of the Kaplan-Meier Analysis. This test can be utilized to compare the survival of two groups (or more) (Bland & Altman, 2004). After the analysis is finished, it can detect if differences between groups are significant. This test cannot provide an estimate of the exact size of the difference (Bland & Altman, 2004). As this test is only utilized to test hypothesis seven, regarding whether the mortality rate differs between the generalists and the specialists, this test suffices for this study.

The Log Rank test also has multiple assumptions that need to be validated to perform the analysis (*Kaplan-Meier Method in SPSS Statistics | Laerd Statistics*, 2018). First of all the data should consist of variables with mutually exclusive states and additionally be collectively exhaustive. This means that an event has happened, or it hasn't. It can not be both or neither.

Next, the survival time has to be precisely measured and clearly defined (*Kaplan-Meier Method in SPSS Statistics | Laerd Statistics*, 2018). Third, left-censoring should be avoided. Left-censoring means that the starting point of the measurement is unclear. This leads to the data not being able to reflect the observed survival time. Lastly, the data should be measured independently of other events, meaning that the occurrence of an event should not be caused by something unrelated (*Kaplan-Meier Method in SPSS Statistics | Laerd Statistics*, 2018). For this test, similar to the Proportional Hazards Model, a 95% confidence interval is used, leading to a p-value that has to be measured below .05 for a correlation to be present.

Operationalization of the variables

As mentioned, this study researches the influence of the density dependence, liability of smallness, liability of newness and resource partitioning on the non-survival of organizations in the paper and pulp industry in the Zaanstreek. To be able to research these influences, these constructs need to be defined into measurable constructs. Below, the operationalization of these variables will be elaborated.

Dependent variable

As the influence of multiple organizational ecology factors on the non-survival of organizations will be researched, the dependent variable is the non-survival of organizations. As this concept itself is not measurable, it needs to be transformed into another variable that is measurable. This new variable, as mentioned before, is the mortality rate of organizations which is measured through the hazard rate. This rate will capture the number of organizations that are declared bankrupt or have exited the market, indicating the non-survival of those organizations.

Independent variables

The factors possibly influencing the dependent variable are the independent variables. As the density dependence, liability of smallness, liability of newness and resource partitioning all possibly influence the non-survival of organizations, these are the independent variables.

The density dependence combines the number of births and mortality into a growth rate. To get an insight into the number of births as well as the mortality in the population, this variable will be measured through the number of active organizations in a certain time frame. This number will show whether or not the population has increased or decreased showing the growth rate. This growth rate eventually shows a growth curve. This curve is created out of a combination of the pocket charts of the survival probability and the hazard rate of the years. To be able to measure this accurately, the years are transformed into centered years. This means that the year 1605 has become year 0, the year 1606 has become 1 and so forth. After the analysis has been made with the centered years, they are

transformed back into the real years to build up a growth curve representing the population between the years 1605 and 2024.

The liability of smallness shows the impact of the size of organizations on the mortality rate. The variable size is not easily measurable, as it does not integrate a concrete meaning of what size entails. This study measures the size of organizations through the number of locations an organization has in its possession.

Liability of newness shows the impact of the age of organizations on the mortality rate. Thus, this variable is measured through the age of the organizations, being the years it is active.

The resource partitioning reasoning shows the interplay between the generalists and the specialists. As this is not concrete enough to measure, it is measured through the mortality of organizations divided between the large organizations and the small organizations. If the mortality for the large organizations lies higher, the specialists are in advantage and vice versa. As the dataset only provides a limited number of companies with more than one location in its possession, this study will view the companies with only one location as small companies, the specialists and the companies with more than 1 location in its possession as large companies, the generalists. The survival of both these groups will then be compared to each other to examine whether or not there is a difference in their mortality rate.

Moderating variable

To test hypotheses three and four, the size of organizations has to be implemented as a moderating variable, for hypothesis three between the density and the survival rates, and for hypothesis four between the density and hazard rates. This variable is the same variable as is used to test for the resource partitioning. Here also the division between the small companies, with one location in its possession, and the large companies, with more than one location in its possession, is present.

In the database these measurements are transformed into the following variables:

1. Centered Starting Year: The year that the company initially appeared with the year 1605 transformed into the year 0.
2. Centered Ending Year: The year that the company disappeared from the market, added up from the year 0 (1605 in reality).
3. Number of Locations: The number of locations that a company has in its possession.
4. StartingYear: The Initial year of appearance of the company.
5. EndingYeart: The year of disappearance of the company from the market.
6. Age: The number of years that the company existed/exists.
7. Survival: Whether or not the company is still in existence today, measured through 0 stating the company has ended and 1 stating that the company is still in existence.
8. Small/Large Companies: Indicating the difference between small and large companies, translating a company with one location into a small company and companies with two or more locations into large companies.
9. Dens1: Represents the density in the growth period of the industry from the year 1605 until 1725.
10. Dens2: Represents the density in the decline period of the industry from the year 1725 until 2024.
11. Sur_1: Measures the survival function.
12. Haz_1: Measures the hazard function.

Research ethics

All research has to be conducted ethically. The five recommendations from APA's Science Directorate were used as a guide for this study to comply with the ethical principles (Smith, 2003). First of all, if any errors come up, which will lead to a change in the interpretation of the findings, the study will be corrected or retracted. Additionally, all data used to conduct this study will be stored. By doing this the authenticity of this study can be confirmed. The dataset as generated will be placed in RIS for students, a database, where it will be available for other students, who then have the possibility of replicating the results. Next, only one role will be taken on during this study. I solely act as a researcher. I have no other relationships with the companies that are included in the database. My view is kept as impartial as possible because of this. Third, all organizations that are included in the dataset are included in an online website, zaansepapiergeschiedenis.nl, which highlights all the companies that were active between 1605 and 2024. It forms an openly available dataset of sorts which, for this study, is transformed into another format. Additionally, which comes up to the fourth principle, no organization is singled out or highlighted individually. All organizations are treated similarly and no unnecessary or sensitive information of any organization is published during this study. Lastly, I have reminded myself of these ethics during the study to stay aware of my behavior and responsibilities during the process.

4. Results

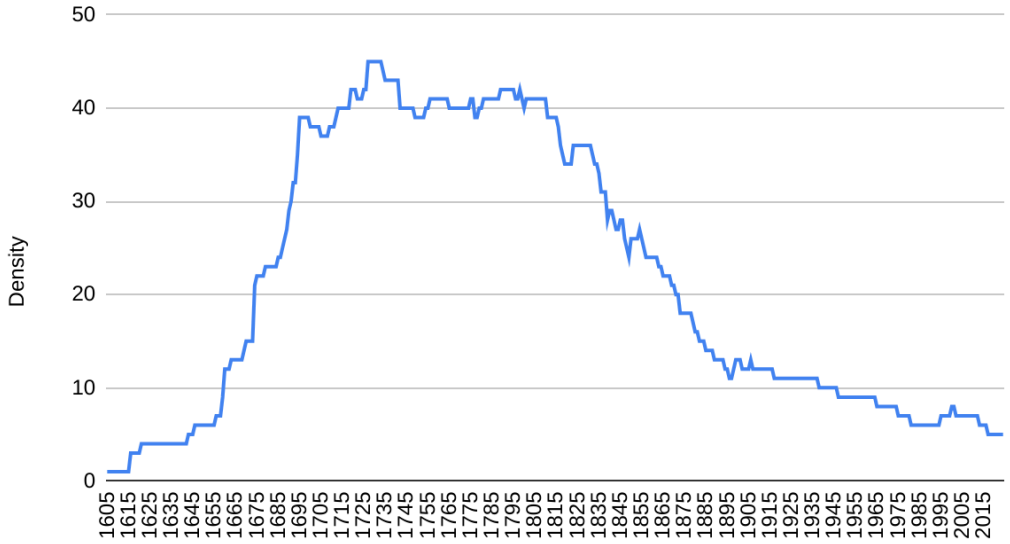
The dataset ended up containing 81 companies that had been active between the year 1605 and 2024. For three companies, some data was not present regarding the year in which the company started or in which the company exited the market. This had led to the presence of missing data. Missing data can be ignored when it is measured below 10% of its overall data set (Hair & Black, 2018). The percentage of missing data in this data set is measured at 3,7%. This means that these companies are left in the dataset and the analysis continues with inclusion of all companies.

As to the assumptions which are elaborated in the 'Methodology' section, the proportional hazard assumption is valid. This means that the Cox Proportional Hazard Model can be used to conduct the analysis. Additionally, the data is mutually exclusive. The dataset clearly defines whether a company is still active or has exited the market in the present times. The data set also provides a clear starting time for almost all companies (excluding the companies with missing values). Left-censored data is thus avoided. Additionally, the survival times of almost all companies is clearly measurable and defined in the number of years it has existed. Lastly, independence of events is also confirmed. This leads to all assumptions being validated. The Log Rank test can also be performed.

In Figure 3. the growth pattern of the dataset of the paper and pulp industry that is used for this study is shown. From the model, it becomes clear that in the early years of the paper and pulp industry the number of companies that existed kept on rising. After a period of growth, the growth started to stabilize and turned into a period of stabilization. In this new period, the number of companies in existence kept fluctuating around more or less the same level. This period of stabilization is then followed by a period of decline. During this period, it can be seen that the number of companies in existence slowly decreases. Nowadays only five companies are still in existence. Due to the transition across these periods of growth, stabilization and eventually decline, a growth curve is created resembling a U-shape, similar to the example shown in Figure 1. To test hypotheses one, two, three and four, this growth curve has to be divided into two phases, phase 1 indicating the growth period of the industry and phase 2 indicating the declining period of the industry. The turnover point between these two phases in this dataset, is the year 1725. The years before 1725 will be referred to as 'phase 1' and the years thereafter as 'phase 2'.

Figure 3.

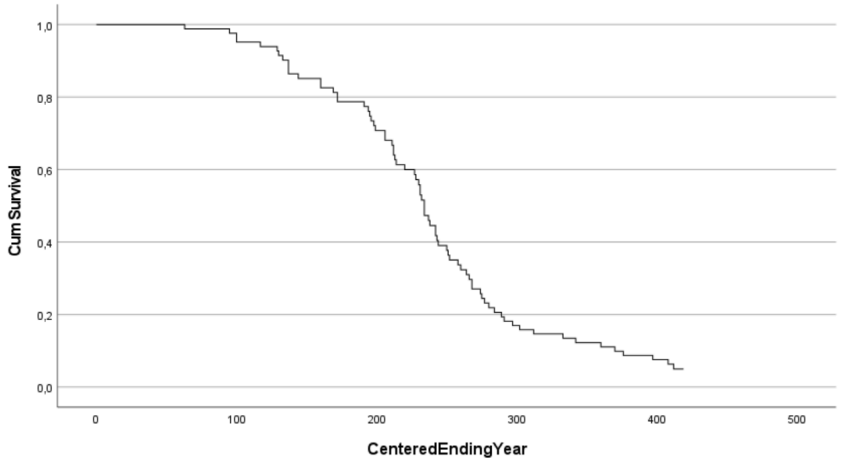
Growth pattern according to the Density Dependence Model.



After conducting the Cox Survival Analysis, two pockets charts are provided showing the survival probability and the hazard rate. As to the survival probability of the dataset, as seen in Figure 4., in phase 1 of the population, the survival probability is high. It is showing a survival rate of 1, being 100%. As time passes on and phase 2 is reached, the survival probability starts to decrease heavily, until after almost 400 years of existence of the population, the survival probability shows a measure of 0.05. This shows only a 5% probability of survival for companies active in the current times in the paper and pulp industry.

Figure 4.

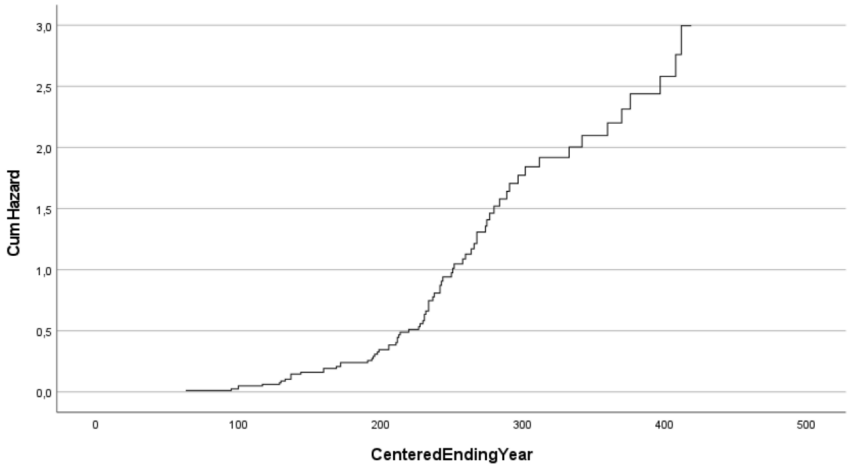
Pocket Chart Survival Probability.



Below, in Figure 5. the cumulative hazard pocket chart is shown, indicating the hazard rate. Here it can be seen that in phase 1 of the population the cumulative hazard is close to 0. This means that almost no organizations during that time exited the industry. As time passes and phase 2 is reached, the cumulative hazard increases and keeps on increasing. After 400 years, the figure shows a cumulative hazard of 3, which is the maximum hazard that can be achieved for this dataset. This means that the currently existing organizations experience a hazard rate of almost 100%.

Figure 5.

Pocket Chart Hazard Function.



When the survival probability and hazard rate are combined, the growth pattern of a population, in this study of the paper and pulp industry, will become visible as it is created according to the density dependence model. This growth model of the paper and pulp industry resembles the model as illustrated in Figure 3.

To test for the first two hypotheses the survival rate has to be analyzed during the growth period, phase 1, and the hazard rate during the declining period, phase 2. To start off with hypothesis one: '*During phase 1 of the life cycle of the paper and pulp industry, a higher density is positively related with the survival rates of organizations.'*, Table 1 shows the outcomes of this analysis.

It can be seen that the belonging p-value is 0,842. This exceeds the 95% confidence interval and is measured to be not significant. Thus hypothesis one is rejected and a higher density is not necessarily positively related to higher survival rates of organizations in the paper and pulp industry according to this dataset.

Table 1.

Survival Rate - Phase 1

	B	***SE***	***P-Value***	***Exp(B)***	***-2 Log Likelihood***
Survival Function	0,071	0,356	0,842	1,074	623,453

Next, in Table 2. the hazard rate during phase 2 is analyzed against the density to test hypothesis two: *'During phase 2 of the life cycle of the paper and pulp industry, a lower density is negatively related with the mortality rates of organizations.'.* The provided p-value is 0,055. This also slightly exceeds the confidence interval of 95%. This means that this effect is also not significant enough to conclude that a lower density is negatively related with mortality rates of organizations. Hypothesis two is thus also rejected.

Table 2.

Hazard Rate - Phase 2

	B	***SE***	***P-Value***	***Exp(B)***	***-2 Log Likelihood***
Hazard Function	-0,319	0,166	0,055	0,727	634,322

It can be concluded that the modelfit, as seen in the Log Likelihood Ratio, in Table 2 for hypothesis two is slightly higher, 634,322, then for hypothesis one in Table 1., 623,453. This means that the modelfit of the hazard rate during phase 2 is better than the modelfit of the survival rate during phase one, but both are not significant enough to confirm the correlation.

Due to a lack of additional information about the organizations, the influence of the competition and/or legitimation of the organizations on the density dependence model cannot be determined.

As mentioned before, the liability of smallness is tested through three hypotheses. To start off with hypothesis three and four:

H3: During phase 1, larger organizations experience more positive survival rates than smaller organizations do.

H4: During phase 2, smaller organizations experience more negative mortality rates than larger organizations do.

To analyze hypothesis three and four, the size of organizations needs to be implemented as a moderating variable into the analysis of the survival function in phase one and hazard function in phase two. Table 3. shows the outcome of the analysis. As can be seen, the p-values that are given from both phases exceed the 95% confidence intervals. For phase 1, a p-value of 0,377 is given and for phase 2, a p-value of 0,968 is given. This means that there is no significant relationship measured between the large or small companies and the survival rates in phase one or hazard rates in phase two. Hypotheses three and four are thus also rejected.

Table 3.

Moderating variable: size.

	B	***SE***	***P-Value***	***Exp(B)***
Small_LargeCompanies (Phase1)	0,365	0,413	0,377	1,441
Small_LargeCompanies (Phase2)	-0,014	0,356	0,968	0,986

Hypothesis five '*The size of organizations is positively related with the mortality rates over the whole life cycle of the paper and pulp industry.'* and six '*The age of organization is positively related with the mortality rates.'* are analyzed simultaneously. The analysis is performed with the variables 'age' and 'number of locations'. Their impact on the hazard rate of the organizations is analyzed to come up with an answer. To continue the analysis, the overall model fit of these variables on the hazard rate has to be significant. If it is not significant, there are no relationships found between the variables. If it is measured as significant, at least one of the variables has a relation with another variable. The overall model fit of the Cox Survival Analysis is significant with a p-value of 0,002. This means that at least one of the relations between the variables is significant and the analysis can continue. The next step is to take a look at the individual relations between 'number of locations' and the hazard rate and 'age' and the hazard rate.

The influence of the number of locations organizations have in its possession on the hazard rate that organizations have, provides a p-value of 0,720, as visible in Table 4. This value does not respect the 95% confidence interval, making it not significant. It can thus be said that within this dataset no connection is found between the number of locations organizations have in their possession and the mortality rate that organizations experience, leading to a rejection of hypothesis five. As all three hypotheses regarding the liability of smallness are thus rejected, it can be stated that within this dataset of the paper and pulp industry, the liability of smallness is absent.

Table 4. also shows the p-value of the influence of the variable ‘age’ on the hazard rate, being <0,001. This means its relation is measured to be significant, as the 95% interval is respected. The coefficient belonging to this relation is -.006. This means that with every additional unit, in this situation with every additional year of existence, the mortality rate of the organizations decreases by 0,6%. This indicates that as organizations get older, the mortality rate they experience decreases and that younger organizations have higher mortality rates than older organizations have. Hypothesis six and with that the liability of newness can thus be confirmed.

Table 4

Omnibus Test of Model Significance

Overall (score)	**Change from previous step**	**Change from previous block**
Sig.	***P-Value***	***Sig.***
0,002	0,001	0,001
	P-Value	***B***
Age	<0,001	-0,006
Number of Locations	0,720	-0,054

Lastly hypothesis seven is tested: ‘*The specialists have a higher mortality rate compared to the generalists.’* As mentioned before, the Log Rank test is used to perform this analysis. The group of specialists is compared to the group of generalists. The group of the specialists contains 69 numbers of organizations in this dataset compared to 9 organizations that are viewed as a part of the generalists group. The comparison of the survival times of both groups provides a p-value of 0,877. Based on the 95% confidence interval, in combination with the given p-value, it can be stated that there is no significantly different relationship measured between the generalists and specialists and their mortality rates. This dataset thus shows similar relationships between all companies, regardless of the number of locations it has, and their mortality rates. Based on this, hypothesis seven also has to be rejected and resource partitioning is not present in this dataset.

Table 5.

Log Rank test.

	Chi-Square	***P-Value***
Log rank (Mantel-Cox)	0,024	0,877

5. Discussion & Conclusion

The central research question that this study wants to find an answer to, is the following:

H*ow do the organizational ecology factors influence the non-survival of* organizations *in the paper and pulp industry in the Zaanstreek from the year 1605 - 2024?*

To do this, this study has tested seven different hypotheses regarding the organizations in the paper and pulp industry between the year 1605 and 2024. To test these hypotheses a quantitative study was created with a dataset of 81 companies that were/are active in the Zaanstreek in the Netherlands. This data was analyzed using two different models. The first model is the Cox Proportional Hazard Model, which is used to analyze hypotheses one through six. This model is used to analyze the pattern of survival to point out the variables that predict the survival of organizations (Christensen, 1987). As the hypotheses focus on the mortality rate of organizations, the Cox Proportional Hazard model in this study is used to analyze hazard rates to point out variables that predict the mortality. The second model is the Log Rank test, which is used to analyze hypothesis seven. This test compares the non-survival of two or more groups (Bland & Altman, 2004).

The Cox Proportional Hazard Model provided a growth pattern according to the density dependence model as well as two pocket charts showing the survival probability and hazard rate of the paper and pulp industry between the year 1605 and 2024. It is shown that in the early years of the population, the survival probability is close to 100% and the hazard rate close to 0%. As time passes by, the survival probability decreases heavily to a 5% probability of survival in the present. The hazard rate increases to 3, which states that the hazard rate lies close to 100%. Overall, the growth curve increases, stabilizes and then decreases to show a sort of U-shape.

Similar to the research of Van Kranenburg, Palm and Pfann (1998) two different hypotheses are drawn up to test the density dependence in the growth period and declining period of the industry life cycle. Both hypotheses were rejected, meaning that no significant effect is measured between the growth period of the industry and the survival rates, hypothesis one, and the declining period of the industry and the mortality rates, hypothesis two. This is contradicting the expectations based upon the utilized literature in this study. Hannan, Carroll, Dobrev and Han (1889a) confirmed the relationship between the growth period and higher survival rates as well as the relationship between the declining period and higher mortality rates. Delacroix, Swaminathan and Solt (1989) also confirmed this.

To test for the liability of smallness, three hypotheses were drawn up, one for the growth period of the industry, one for the declining period of the industry and one for the overall life cycle of the industry. To start off, the liability of smallness does not have a significant relationship with either the growth period of the industry or the declining period of the industry, as is analyzed by implementing the size of organizations as a moderating variable into the Cox Survival Analysis.

Additionally, the influence of the number of locations organizations possess on their hazard rate in the overall life cycle of the industry is measured to not be significant. There is thus no measured difference in the mortality rate of organizations in this dataset between organizations that possess one or more then one location.

So, hypothesis three to five are rejected and the liability of smallness is not present in the growth period, declining period and the life cycle as a whole in this dataset of the paper and pulp industry. Compared to the literature, some sort of relationship would be expected. As mentioned before, small organizations should have more difficulty in surviving compared to large organizations (Hannan et al., 1998; Pfeffer & Salancik, 1978; Micheal & Kim, 2005; Sing & Lumsden, 1990). However, the results of this study do not confirm this as no difference between small and large organizations is seen to be present.

Lastly, the Cox Proportional Hazard Model is used to analyze the influence of the age of the organizations on their mortality rate. With regards to the age of organizations, a significant negative link is found between it and the hazard rate organizations experience. It can be stated that per extra year that organizations get older their mortality rate decreases by 0.6%. New organizations thus have a higher mortality rate than older organizations have. Hypothesis six is thus accepted. This outcome is as expected. New organizations have less accountability and reliability as older organizations. They lack yet to form legitimacy with customers (Stinchcombe, 1965). Organizational mortality should decrease with age (Michael & Kim, 2005; Singh & Lumsden, 1990), as is confirmed during this study.

Lastly, the Log Rank test is performed to measure differences in mortality rate between specialists and generalists. This relation is also measured to be non-significant. The dataset thus shows no differences in mortality rate between specialists and generalists, leading to a rejection of hypothesis seven. The generalists thus don’t outperform the specialists or the other way around. This also clashes with the expectations, as some sort of outperformance from one of the two should have been present according to the literature (Dobrev & Carroll, 2003; Carrol & Swaminathan, 2002; Freeman & Lomi (1994).

In conclusion, the growth rate of the paper and pulp industry in the Zaanstreek between the year 1605 and 2024 shows a U-shaped curve with an increase in the number of organizations initially, eventually leading to a decrease in the number of organizations. The density of the industry does not have an impact in the growth period on the survival rates as well as in the declining period on the hazard rates. The liability of smallness is not found in this industry in the Zaanstreek, as the possession of one or multiple locations does not make a difference in the mortality rate for organizations. This absence is present for the growth period, the declining period and the overall life cycle of the paper and pulp industry. The older organizations do have a lower mortality rate then younger organizations, leading to the presence of liability of newness. Lastly, there is also no different mortality rate between the small specialist and the large generalists, indicating that resource partitioning is not applicable in this industry in the Zaanstreek.

Theoretical Contributions and Implications

Within the paper and pulp industry in the Netherlands no research has been conducted regarding the non-survival of organizations. This study contributes thus both to research in the paper and pulp industry in the Netherlands, as well as to the organizational ecology literature in general. This paper has made a first attempt to capture the impact of the density within this industry, as well as the impact of the number of locations the organizations possess, being the liability of smallness, and the age of the organizations, being the liability of newness, on their mortality rate. It has shown that the impact of the density is not significantly related to the survival rates in the growth period or the hazard rates in the declining period. This contradicts the current theory, as the literature states that in the growth period the density should be positively related to the survival rates and in the declining period negatively related to the mortality rates (Hannan, et al., 1889a; Delacroix, Swaminathan & Solt ,1989; Minkoff, 1994). The liability of smallness is not confirmed during this study in the overall life cycle of the industry, as well as in the growth or declining period. Possibly, this could show the existence of a void in the theory, which is not yet covered. Most literature indicates the presence of it, due to larger organizations being stronger compared to smaller organizations (Hannan et al., 1998; Pfeffer & Salancik, 1978; Woo & Cooper, 1991). There could be another mediating or moderating variable counteracting this relationship or other reasons why it is not present in this industry. The liability of newness is confirmed by this study, similar to literature generated in other industries (Hannan et al., 1998; Michael & Kim, 2005; Stinchcombe, 1965). This strengthens the theoretical foundation of this liability, as it is confirmed to be present in a not yet much studied industry for this topic. Lastly, the resource partitioning is also not shown to be present in this study. Similar to the liability of smallness, this could indicate that the theory is not completely solid and could show a void in the theory as it is presented today by for example Carol, Dobrev and Swaminathan (2002) or Sing and Lumsden (1990).

Limitations

It is important to acknowledge that this study also has multiple limitations. First of all, the sample size in the dataset that is used provides a limitation for this study. The number of cases that are integrated is 81. Of these 81 cases, 3 cases have missing data. This is a very small number of cases on which conclusions are drawn. As this study only covers the Zaanstreek and the used sources only provided 81 companies that have existed in the studied time period, this number of cases suffices for this study, but it does make the conclusions that are drawn debatable (Andrade, 2020). Due to the smallness of the sample size, the conclusions are not directly indicated to be representative to the population, being the paper and pulp industry. The accuracy of the results is also smaller, as there is less confirmation in smaller sample sizes than with large sample sizes (Andrade, 2020). Additionally, a small sample size could lead to possible false conclusions through a false negative or a false positive (Andrade, 2020; Faber & Fonseca, 2014).

The second limitation is the unequal sample size that is used in the Log Rank test. The group specialists include 69 cases compared to the group generalists, which only includes 9 cases. As the difference in the number of cases is very large between both groups, the statistical power belonging to the drawn conclusion is smaller (Grace-Martin, 2023). This does not invalidate the results drawn in this study, but it does lead to a more cautious approach when interpreting the results (Grace-Martin, 2023).

The third limitation is that this study is performed in a small region of the Netherlands. This does not indicate that the results in other regions of the Netherlands, the whole country or industry would be similar to the results of this study. It might be that insights that came up during this study will not be present in other studies or outcomes might differ. The generalizability of this study could be reduced because of this. This could be something to also take into account for future research.

Lastly, there is also a possibility that there are confounding variables present during this study. Confounding variables are variables that are not measured or taken into account during the study, but might have an influence on the outcome and thus conclusions of it (Hassan, 2023). Some examples of confounding variables are environmental factors or socioeconomic status of company owners. The possible presence of these variables might harm the reliability and generalizability of the study as well as insert possible biases making it harder to indicate whether a relation between variables is accurately measured or based upon the confounding variables (Hassan, 2023).

Future Research

First of all, this study could be replicated including a larger sample size. By increasing the sample size compared to this study, the generalizability and representativeness of the population would increase. This larger sample size could include other regions in the Netherlands, the whole country (or another country), a continent or the whole paper and pulp industry. With regards to the latter, the feasibility is debatable, but this would strengthen the results and conclusions tremendously.

In addition to this suggestion, a replication of the Log Rank test with more equal groups would be advisable. This replication could also strengthen the outcome of the test in this study, leading to it having more statistical power and becoming more representative to the population.

The non-significant results for the density dependence model, liability of smallness as well as the resource partitioning also show possibilities to conduct new research. As mentioned in the theoretical contributions and implications, the lack of the presence of a relation between the variables could indicate a void in the current theories. Possible variables could interfere with these relations. New studies could take a look at these possible voids to indicate whether the relation is simply not present during this study or that a new angle needs to be studied to complement these voids.

Lastly, as this study only covers a small part of the organizational ecology theory, the dataset that is created for this study, could also be used to conduct additional research surrounding other topics covered by this theory. An example could be to study the influence of other organizational characteristics on the mortality rate. This additional research could lead to a more complete image of the organizational ecology in the paper and pulp industry in the Zaanstreek between the year 1605 and the present. This could add to the organizational ecology theory by complementing the current theory or by being able to falsify aspects which could then again lead to follow up research, both of which strengthen the organizational ecology theory.

6. Practical Implications, Recommendations & Reflection

Practical Implications & Recommendations

As this study mostly focuses on testing hypotheses linked to the organizational ecology theory, the practical implications that this study offers are modest. The foremost practical implication of this study is intended for the owners of organizations in the paper and pulp industry. This study is the first to investigate the influence of the organizational ecology factors as mentioned before on the mortality rate of organizations in the paper and pulp industry in the Netherlands. Due to this, the growth curve created by the dataset, as well as the liability of newness is in accordance with the organizational ecology theory and the density dependence, liability of smallness, as well as the resource partitioning reasoning are lacking in this industry according to this study. The owners of the organizations that currently still exist in the Netherlands can take this into account while making plans for their future to keep on existing. The liability of newness theory provides them with the information that the longer their companies already exist, the lower their mortality rate should become. On the other hand, the growth curve of the industry provides them with the knowledge that the industry is thinning out with only five companies in existence in the Zaanstreek currently. The absence of the resource partitioning reasoning and the liability of smallness shows the owners that organizations with one location in its possession provides them with as much hazard as organizations with more than one location in its possession. This information could form a foundation for these owners on what to do with their organization; continue with how it is going at that moment, possibly expand or maybe give in to the existing risks and exit the market.

Additionally, this study proves itself to also be relevant for possible new starting owners of organizations in the paper and pulp industry. By knowing the information this study provides before investing into a new organization, these people know the current state of the growth curve of the paper and pulp industry in the Zaanstreek, indicating that many organizations do not exist anymore. The absence of a negative impact of a lower density on the hazard rate on the other hand provides the owners with the information that they do not necessarily have a disadvantage due to the current state of the industry life cycle compared to early starters.

Next to this, they also have a disadvantage as newcomers into this industry, as this study indicates that new organizations have a solid disadvantage in their mortality rate compared to older established organizations. As the liability of smallness and resource partitioning showed that the number of locations does not have an impact on the mortality rate of organizations, possible new owners don’t have to take this into account as there is no disadvantage due to this compared to already established organizations. Overall, the information that this study provides, gives the possible new owners of organizations in the paper and pulp industry more insights into the mortality rates they will have to conquer to keep on existing and to base a decision upon whether or not it is worth the risk.

Reflection

Overall Reflection

Overall, I am very satisfied with the process of producing this master thesis. The planning as I had worked out, suited this study perfectly. This had led to the thesis being finished in time and leaving some spare time to refine it as much as possible.

The dataset that was used provided enough information to analyze 81 companies in the paper and pulp industry between the years 1605 and 2024. I had hoped that the dataset would contain more companies to strengthen the analysis and thus the results that this study provides, as already explained in the limitation section. Unfortunately, this was not the case and the analysis had to continue with the number of cases that were available.

The analysis as conducted, using two different models, went well. As I did not have very elaborated knowledge of the data analysis program, SPSS, it took me some time to figure out whether or not the dataset confirmed the assumptions and how both models could be run. Additionally, the interpretation of the results once the analysis had been conducted took some time to figure out. Once that had succeeded, the remaining part of this thesis could be written.

In hindsight, a point of improvement with regards to the used models would be to use the Kaplan-Meier Analysis for the whole analysis instead of partly using the Cox Proportional Hazard Model and partly the Log Rank test from the Kaplan-Meier Analysis. The way the analysis is conducted in this study suffices, but it has led to the use of two separate models. The Kaplan-Meier Analysis also analyzes the (non-)survival of variables, similar to the Cox Proportional Hazard Model. It would have been easier to only use the Kaplan-Meier Analysis, as only one model would have to be used and could have been studied more thoroughly before the analysis was conducted instead of getting into two separate models.

The limitations as explained above, are mostly due to the modest size of the dataset used in this study. This has an impact on the generalizability, representativeness of this study as well as reliability. These limitations have led to many possibilities for further future research, to elaborate or complement on the results which this study has found. As for now, the impact of the density dependence model, liability of smallness, liability of newness and resource partitioning on the mortality rates in the paper and pulp industry between the year 1605 and 2024 are known and provide a basis for additional research to complement the organizational ecology theory in the Netherlands.

Personal Reflection

My personal strength is that I can work very productively and do not hover around the little things initially, so I can go on with the development of the total process. This has helped me a lot in developing this master thesis. After the broad outlines have been worked out, I have focussed on improving the details. By using this work order, it is clear to me what is and should still be stated to make it as clear and consistent as possible. Also, if I am interested in a certain topic, I want to gain more knowledge about it. This has also proved itself to be an advantage to me during this process.

My personal weakness is that I can sometimes postpone certain things if I feel unsure how to handle it or do not know what to expect. During the development of this thesis, I have managed to keep this to a minimum, apart from the week before the start of the data analysis. As I have mentioned above, the use of SPSS is not my strong suit, which made me doubt if I could complete a correct analysis. After collecting the courage needed to dive into the Cox Proportional Hazard Model and the Log Rank test, with the use of the necessary Youtube videos explaining what to do every step and what each number means, I think I handled the analysis, as well as the overall process of the development of the thesis quite well. I can in the end say I am satisfied with the outcome of it.

To finish off this thesis I want to thank my supervisor, Prof. dr. H.L van Kranenburg. He helped me in finding the right track of what to research as well as provided a lot of literature during the whole process of the thesis. He gave me a lot of space to choose my own path, but always provided the necessary support if requested.

7. Literature

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