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IDENTIFICATION OF ASYMMETRIC INFORMATION IN AGRICULTURE SUPPLIER-BUYER RELATIONSHIPS

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The purpose of this paper is to develop an influence-effect model as a construct for determining information asymmetry influencing factors between suppliers and customers. In order to understand the cause-effect principle of the influencing factors, the principal-agent theory is used to characterize the supplier purchaser relationship. The analysis of supplier evaluations enables the indirect derivation of information asymmetry influencing variables. Social, legal, or the internal influencing issues of companies (e.g., integrated management systems, cooperating systems, etc.) are determined as information asymmetry influencing factors. An explanatory model is designed to determine the information asymmetry influencing variables. The paper provides a structured overview of the main information asymmetry variables that can be assigned in general, but in particular to food supply chains.

Keywords: Asymmetric information; information asymmetry influencing variables; principal-agent theory

JEL Classifications: M10

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1. Introduction

With the advent of global trade and the accompanying increase in associated actors (Aničić & Nestorović, 2020; Pilinkienė, 2016), countless interconnections of supply chains and associated supplier-buyer relationships have emerged over time (Zinn & Goldsby, 2020; Wincewicz-Bosy & Nowak, 2018;). This can be explained by the bundling of technical expertise in order to impose this on the markets through improved efficiency and effectiveness as well as corporate interests (Fossas-Olalla et al., 2010). Due to the ever-increasing networking of supplier partners and the subsequent increased complexity of supply chains, the information advantages of one supplier partner and the information deficit of the associated supplier partner cause so-called information asymmetries (Martin &

Johnson, 2010; Lotfi et al., 2013). Possible motives, conflicts of interest, or self-interest of the respective supplier pair favor the emergence of information asymmetries (Steinle et al., 2014), which does not enable perfect action (Tong & Crosno, 2016; Dawson et al., 2011), but rather represents a welfare loss and ultimately leads to market failure (Dari-Mattiacci et al., 2021). The analysis of information asymmetries, especially information asymmetry in supply chains, has posed an enormous challenge to scholars for over two decades, and this challenge continues to this day (Sceral et al. 2018). Akerlof pioneered the understanding of information asymmetries (Akerlof, 1970) by laying the theoretical foundation and presenting numerous approaches to solving each type of information asymmetry. Regardless of the type of industry in which the sup-

ply chain is located, information asymmetry can be assumed to be profound, as each pair of actors (suppliers and buyer) withholds information from the respective counterpart to maximize their own defined economic objectives (Minarelli et al., 2016). Food supply chains are chosen as a reference example for this paper, on the one hand because information asymmetry can be a critical problem concerning information on food safety and quality, and on the other hand the simple and linear design of food supply chains and processes allows a clear definition of different principal and agent couples along the chain, thus making the analysis and discussion of their relationships or influencing factors easier.

The complexity of the food supply chain can be explained as follows:

The food industry has a prevalent disparity of numerous actors who differ based on size, scope of supply, sales strength, deployment, as well as adherence to existing standards, starting from small farmers to large food industry corporations (Loughrey & Donnellan, 2016; Berk, 2013).

The complexity of the food value chain also stems from continuously changing, increasing, and diverse actors attempting to assert their own interests in the market (Sinkovics et al., 2018).

Food value chains are added to the more complex value chains not least by unpredictable circumstances such as weather conditions, trust scandals etc. (Chhogyel et al., 2010).

Principal-agent theory enables the definition of properties of individual pairs of actors, (Bernhold & Wiesweg, 2021). Furthermore, principal-agent theory enables the representation of relationships of individual pairs of actors and the possible occurrence of information asymmetries (Popovic et al., 2012). However, principal-agent theory neglects the representation of factors influencing the individual actor and thus the determination of which missing information leads to which manifestation of information asymmetry. It is not possible to draw conclusions about the level and extent of the information asymmetries of the respective pairs of actors due to the lack of consideration of the influencing variables.

2. Methodology of Review

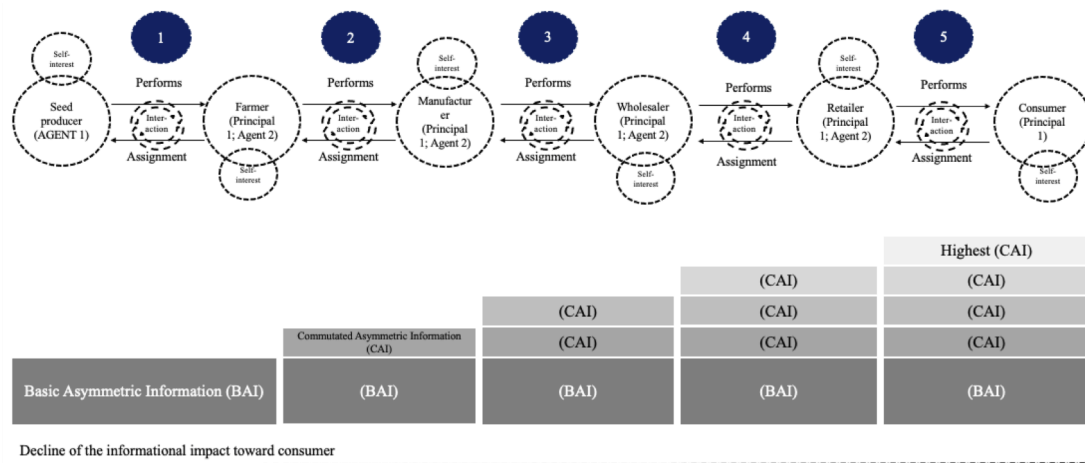
A structured literature review is attempted, as shown in figure 2.

Step 1. Conception and theoretical consideration:

The focus is on the supplier-purchaser relationship in food industry. This allows the concrete identification of potential information asymmetry influencing variables of pairs of actors.

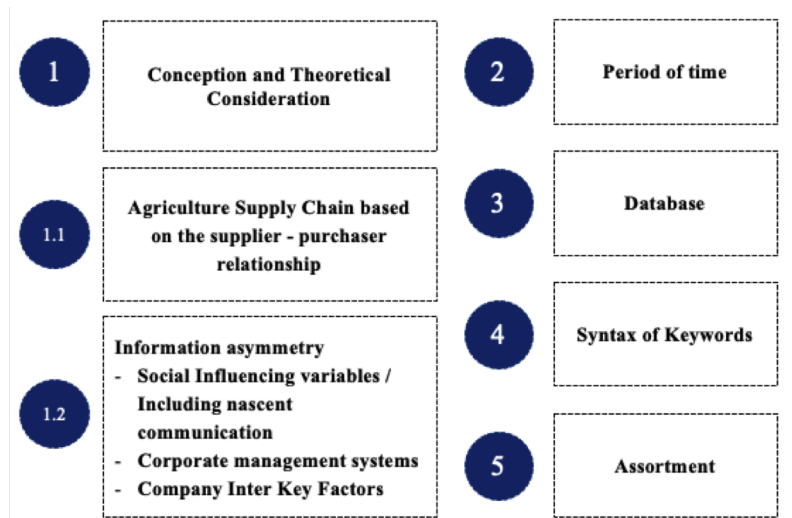
Step 2. Period of time:

Information asymmetries occur in different areas of business and industry, regardless of size or other characteristics. The aim of the literature review is to take up findings in the research area of information asymmetry and to use these to provide further information for the present paper. In this regard, the peri-



Source: own representation

Figure 1: Principal-Agent interactions using the example of the food supply chain



Source: Own representation

Figure 2: Steps for the selection of target literature

od from the 2000's onwards was considered for the literature search.

Step 3. Database:

In particular, databases such as Scopus, Taylor & Francis, SpringerLink, JSTOR and Emerald Insight databases proved to be very useful due to the high hit rates for the topic under investigation.

Step 4. Syntax of Keywords:

To achieve a high hit rate of essential literature which could provide useful results for the analysis, a syntax of essential keywords was created.

Step 5. Assortment:

The papers that were selected were once again purged by separate exclusion criteria which contribute to answering the research question and thus to identifying the information asymmetry influencing variables.

Finally, 110 papers are identified as useful for essential analysis of the theoretical treatment of the information asymmetry influencing variables.

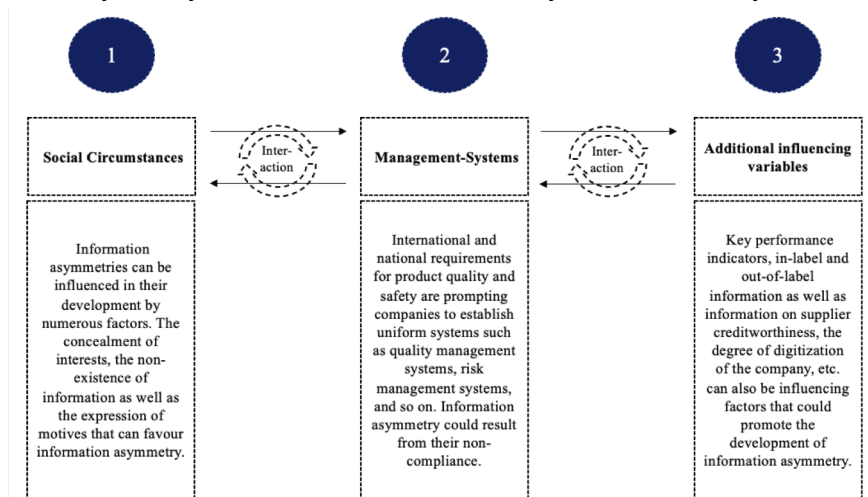
3. Methodological Approach and Results

Supplier assessment is an essential reference point that is used to identify information asymmetry influencing variables. Characteristics which presented on the part of the purchaser to the supplier and those on the part of the supplier are retained, and these can represent possible information asymmetry influencing variables. The focus here is on the

existing cooperative processes that could potentially influence the information asymmetry for both the supplier and the customer, but above all for the customer (principal). Regardless of the size of the company, companies endeavor to obtain information about the market as well as about suppliers through numerous risk analyses, supply chain management processes, evaluation of other processes and by conducting benchmarking (Khan & Rahman, 2014; Bager & Lambin, 2022). In an era of globalization and increasingly complex supply chains (Yang et al., 2021; Reich et al., 2021), the practical implementation of supplier analysis, which has an immense impact on the success of a company, has become increasingly difficult (Creazza et al., 2011; Sydow & Frenkel, 2013). Through the use of comprehensive strategies and methods of analysis, companies nevertheless attempt to gain an all-encompassing overview of the supplier-customer relationship and, if necessary, locate information deficits (Martin & Johnson, 2010; Suryawanshi & Dutta, 2022). Information deficits of the purchaser vis-à-vis the market and essentially vis-à-vis the suppliers favor the emergence of information asymmetries, which then have an influence on the supplier-customer relationship and ultimately also affect the company's own entrepreneurial actions (Vanpoucke et al., 2021; Gur et al., 2021). Thus, it is necessary to iden-

tify the variables of influence on the purchaser that could favor the expression of information asymmetry. The examination of information asymmetry influencing variables is based on three fundamental points, namely the social circumstances, the analysis of management systems, and the identification of further information asymmetry influence variables.

information asymmetry influencing variables such as supplier creditworthiness (Moretto et al., 2019), the status of digitalization (Stoldt et al., 2018), and the integration of sustainable processes in the company (Hermundsdottir & Aspelund, 2021) can provide comprehensive insight into the supplier's profitability and sustainability etc. This in turn serves as



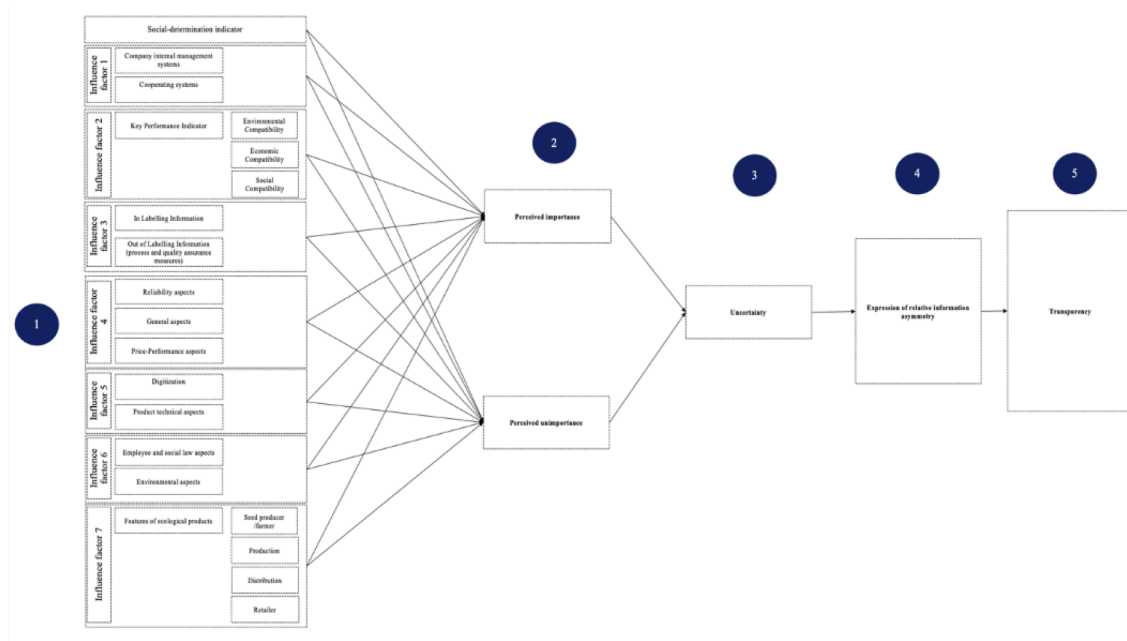
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Figure 3: Model for determining information asymmetry influencing variables

The reason for using these three points is that although companies carry out numerous analyses to reduce possible information asymmetries, their motives, conflicts of interest (social determinants) etc. may remain unknown to the opposite side (Azoulay et al., 2004; Hartmann & Moeller, 2014;). Here, an indirect elicitation method (questioning) could help to uncover unknown motives and perceptions of interests of the supplier by circumventing and obfuscating the actual question, which in turn can inform the purchaser about the actual interests of the supplier (Kilian & Mann, 2021; Nikoofal & Gümüş, 2020). Furthermore, the analysis of management systems, especially cooperative and integrated management systems, can provide insight into the inner workings of the company (supplier) (Wei et al., 2021) and its interconnectedness with the purchaser and can unearth possible influencing variables, which may possibly provide conclusions about any prevailing information asymmetry (Kirst & Hofmann, 2007). Ultimately, the analysis of other

an essential database that can make it possible to draw conclusions with regard to information asymmetry (Bhatti et al., 2014). In order to identify necessary influencing factors and thus to be able to draw conclusions about the information asymmetry, it is important to identify numerous processes within the company that could possibly have an impact on the customer and the customer's actions (points 4 and 5 represent extensive features of possible information asymmetry influencing variables). In Figure 4, a proposed conceptual model of influence variable analysis is presented; this has been developed based on the literature. In particular, the identification of the information asymmetry influencing variables is in the foreground in this context.

8 groups of information asymmetric influence factors could be recorded. Social influences, such as motivation, representation of interests as well as the non-existence of information, can lead between pairs of actors to the expression of information uncertainty. Other influencing factors such as (IF1)



Source: own representation

Figure 4: Model for determining the information asymmetry influencing variables

Company internal management systems, Cooperation systems, (IF2) Key Performance Indicators, (IF3) In-label and out-of-label information, (IF4) Reliability-, General-, and Price-Performance aspects, (IF5) Digitization, Product technical aspects, (IF6) Employee and social law aspects, Environmental aspects, (IF7) Features of ecological products, can lead to the development of information asymmetry. Finally, the hypothetical assumption of transparency Step 5 of the basic model can be interpreted as follows: Through an extensive (Step 1) literature search and finding the (Influence factor 0-7), actor pairs can select the perceived (Step 2) importance/unimportance of the (IF 0-7), (Step 3) depending on the expression of uncertainty and the (Step 4) information asymmetry. (Step 5) Last but not least, this course could represent the transparency between the pairs of actors.

4. Information Asymmetry Influencing Factors

4.1. General aspects as information asymmetry influencing variables

Independently of the information asymmetry influencing factors described above, there are

numerous other factors that could influence the information asymmetry of the purchasing company. Factors such as a positive supplier credit rating, positive customer ratings as well as proper supplier documentation are important for purchasing companies (Roy & Ganguly, 2021). Supplier creditworthiness ratings tell companies whether the supplier will meet its payment obligations to credit institutions or other companies within a specified period (Nicholas et al., 2010; Chang et al., 2015). A supplier default could have serious consequences for a company, and could ultimately lead to far-reaching existential problems. Proper documentation from the supplier provides the purchasing company with information about the supplier's creditworthiness. Likewise, the factor of the reference evaluations of the supplier is relevant for the accepting company, since positive reference evaluations allow conclusions to be drawn about the performance of the product as well as product quality and product safety (Chen et al., 2004). All of the above factors are important for the accepting company; non-compliance leads to uncertainty and the strengthening of information asymmetry on the part of the purchaser.

4.2. Reliability aspects as information asymmetry influencing factors

Due to the changing demands of consumers and the strongly increasing desire for sustainably produced products, companies are under enormous pressure to meet these requirements, which are used by the company as a guide to formulate requirements for the company's suppliers (Lestari et al., 2021; Beske et al., 2014). Factors such as adherence to delivery dates (timely provision of products), ad hoc implementation of agreements, continuous availability, responsiveness to the company's internal needs and the existence of a sense of cooperation on the part of the supplier vis-à-vis the buying companies represent important influencing variables that the purchaser demands from its suppliers so that the needs of the subsequent pairs of actors and ultimately the customers are satisfied (Zou et al., 2019; Handfield & Bechtel, 2002). Therefore, these factors can be defined as information asymmetry influencing variables, and compliance with these leads to a reduced expression of uncertainty towards the suppliers and ultimately keeps the information asymmetry at a low level.

4.3. Price-performance aspects as information asymmetry influencing variables

Sustainable products require extensive due diligence and compliance with standards and regulations required by legislators and some wholesalers and retailers. However, as a result, product prices are correspondingly more expensive than conventional products (Ekins & Zenghelis, 2021; Wognum et al., 2011). Even though customers are increasingly willing to pay a higher price for sustainable products, price fluctuations can inhibit customers and their willingness to buy. Thus, companies require their supplier to provide continuous and reasonable price stability, and stable price-performance ratios (Lai et al., 2005; Susila et al., 2020). Arbitrary price increases on the supplier's side could make the downstream production steps in the purchasing company more expensive, which affects the pricing of the product for the consumer (Sibdari & Pyke,

2014; McLaughlin, 2004). In this respect, price-performance factors are classified as information asymmetry variables, and non-compliance with these leads to uncertainties for the purchasing company and ultimately to the development of information asymmetry.

4.4. Digitization aspects as information asymmetry influencing variables

The use of digital infrastructures in a future- and revenue-oriented company is of utmost interest (Sagayarajan & George, 2019). The automation of processes brings a variety of benefits to the company, for example reduced labor costs, reduced misprediction, increase of production output, etc. (Bataev & Davydov, 2020; Salvador & Forza, 2002). To continuously maintain the company's automated processes, purchasing companies formulate supplier requirements such as the presence of automated ordering capabilities (Wang et al., 2012), process automation that is already in place, the possibility of source-to-pay processes, and the possibility of automated release of products (Hallikas et al., 2019). It is also relevant for purchasers that suppliers protect the company's own technical expertise from cyber-attacks (Ghadge et al., 2019; Polatidis et al., 2018). This is because companies of all types are increasingly suffering massive data losses due to security breaches in their systems, with serious consequences for the company (Urciuoli et al., 2013). Thus, purchasing companies require suppliers to have cyber security measures in place (Jean et al., 2014). Accordingly, the factors mentioned above in section 4.4 can be determined as information asymmetry influencing factors. Uncertainties as well as the resulting information asymmetry for the accepting company can arise in the event of non-compliance with these factors.

4.5. Product technical aspects as information asymmetry influencing factors

A further aspect of digitalization is the factor of product technology. In order to optimally adapt the internal company process to the needs of the supplier, increasing numbers of companies are relying on

real-time data streams of the product (Lechler et al., 2019; Van den Berg et al., 2013), so that the automated processes of the buying companies can be maintained. Not only is this an advantage for real-time data streams, but also for the resulting process and product safety, as well as the continuous information monitoring of products and processes (Indralingam et al., 2020; Rahman et al., 2017;). Consequently, increasing numbers of companies are requiring that their suppliers provide technical tools to enable factors such as product tracking and tracing systems (Shamsuzzoha & Helo, 2011), product temperature monitoring (Ting et al., 2014), ad hoc product transport duration determination, product-appropriate hygiene measures and efficient transport management systems (Koster et al., 2017). Here, too, in the event of non-compliance with the requirements on the part of the supplier, uncertainty and information asymmetry apply on the part of the purchasing company.

4.6. Employment law and social aspects as information asymmetry influencing factors

For some time now, companies have been under enormous pressure to look after the interests of their employees (Makushina, 2020; Lee et al., 2013). Younger customers in particular demand that companies respect their employees interests, if not improve them far beyond the legal requirements (Chatzopoulou, 2020). Companies that fail to comply with labor legislation and social expectations increasingly suffer reputational damage (Davies & Olmedo-Cifuentes, 2016; Carberry et al., 2018). Purchasing companies implement a variety of labor law protections to safeguard the interests of employees, and also require this from their suppliers (Abbott & Bhutta, 2020; Wright & Kaine, 2015). Factors adequate social protection standards, the prohibition of child labor (Haq et al., 2020), hygiene standards, transparent and fair remuneration of workers (Duan et al., 2020), the possibility of establishing works councils, commitment to employees and society, and the existence of SA 8000 - Social Accountability International (SAI) (Rohitratana,

2002; Llach et al., 2015) represent the basic set of values of the purchasing company, compliance with which is required from the supplier. Non-compliance in turn leads to uncertainties and the reinforcement of information asymmetries.

4.7. Environmental aspects as information asymmetry influencing factors

Climate protection measures are one of the most important pillars of a company today (Okereke & Küng, 2013). Both legislators and customers increasingly require companies to integrate climate protection measures into their business processes (Sullivan & Gouldson, 2016; Tan & Hong Yao, 2011). As a result, increasing numbers of companies are focusing on regional awareness (short-supply chain and miles principle), the use of sustainable energy resources, recyclability, sustainability campaigns (green image), and environmentally friendly production processes, etc. (Kaartemo & Gonzalez-Perez, 2020; Konrád et al., 2019). In order to guarantee the comprehensive climate protection aspects vis-à-vis the legislator as well as the customers, the aforementioned factors are not only implemented within the company but are also required by the supplier (Giménez & Tachizawa, 2012). If the supplier complies with the essential factors, it can be assumed that there is less uncertainty and less information asymmetry.

5. Specific Information Asymmetry Influencing Variables in the Food Supply Chain

In order to guarantee the sustainability of crops and the further utilization of products, farmers rely on high-quality and sustainable seed production (Tonapi et al., 2020; Kansime et al., 2021). Even the origin of the seed allows numerous conclusions to be drawn about the characteristics of organic seed production (Bishaw et al., 2007; Cavatassi et al., 2012). Consequently, increasing numbers of farmers are demanding that seed producers comply with international standards such as ISO:22000 (Food Safety Management Systems) (Escanciano & Santos-Vijande, 2013; Silva et al., 2016). Guidelines to refrain from using genetically modified seeds are

of relevance to farmers who specialize in sustainable agriculture (Xu et al., 2016; Wickson et al., 2016; Verhoog, 2007). In addition, farmers require that seed producers refrain from using synthetic pesticides and instead use biologically degradable pesticides (Orsini et al., 2020; Chable et al., 2014; Brühl et al., 2021). In order to ensure the sustainability of their products, farmers also require seed producers to produce the seeds naturally, without any addition of synthetic hormones (Orsini et al., 2020; Solfanelli et al., 2022). An organic certification label is also required to guarantee compliance with the requirements and the sustainable quality of the product (Van der Burg et al., 2003; Giovannucci & Ponte, 2005). All of the factors described above can be defined as information asymmetry influencing variables. Compliance with these factors on the part of the seed producer leads to a reduced level of uncertainty and information asymmetry on the part of the farmer.

Just as farmers have demands of seed producers, producers also have demands of farmers (Schin et al., 2017). In order to guarantee the sustainability of products in the supply chain, producers require farmers to refrain from using synthetic additives and/or treatments (Benbrook et al., 2021; Padel et al., 2009; Hu et al., 2017). Furthermore, reduced waste generation on the part of farmers is important to producers, as this indicates optimally adapted resource efficiency (Bajzelj et al., 2020; Jagtap et al., 2021; Sanyé-Mengual et al., 2017). Alongside the use of renewable energy and technologies on the farm and in the overall management of food products, reduced energy and water consumption are also important factors for producers in terms of sustainability (Sulewski et al., 2017; Martinho, 2018; Selfa et al., 2008; Azadi et al., 2011). The certification of products offered by farmers is also an important factor for producers (Brau & Bulte, 2021; Velčovská, 2016; Kilian et al., 2006). All of the abovementioned factors can be determined as information asymmetry influencing variables. Here, too, non-compliance leads to uncertainty and

the emergence of information asymmetries on the producer's side.

Distributors can be seen as essential actors in a supply chain; without them the transport of goods from A to B would not be possible or may be associated with high costs. (Stošić-Mihajlović, & Trajković, 2020). There are also factors on the part of the distributor which must be observed in order to meet the specified requirements of their client (supplier). The following factors apply not only to producers, but also to all those who wish to transfer goods through a distributor. The following factors are particularly relevant for distributors: Electrification of the production process; recycling of packaging (Mahmoudi & Parvizioman, 2020; Meherishi et al., 2019); the existence of re-distribution facilities (Hertel et al., 1970); automated distribution procedures (Huhns & Stephens, 2001; Xu et al., 2021); and modern warehousing (Omotilewa et al., 2018). Overall, these factors can be seen as information asymmetry influencing variables on the distributor's side. The manifestation of uncertainty as well as the associated information asymmetry can result from the supplier's non-compliance with the distributors. This also applies to all of the described information asymmetry influencing variables which are important for the distributor in the relationship between the retailer as purchaser and the distributor as supplier.

Consumers are the last link in an economic chain, and they too have various demands regarding the retailer or a particular product. In addition to the in-label information (Perumal et al., 2022; Karstens & Belz, 2006), increasing numbers of consumers are demanding from the retailer a commitment to sustainable image building (Tascioglu et al., 2019) as well as a balanced organic product range (Wang & Tsai, 2014; Hwang & Chung, 2019). Furthermore, consumers are also demanding the use of recyclable packaging increasing numbers of retailers are meeting this demand and implementing it within their means. It must be reported that increasing numbers of consumers have lost the actual overview of the

necessary product information with regard to correct labeling. All of this leads to misunderstandings and ultimately to inhibition of product purchase (Fitzgerald et al., 2019), and all of these factors can be recorded as information asymmetry influencing variables. Here, too, it is assumed that non-compliance leads to an increased level of uncertainty as well as a strengthening of information asymmetry.

6. Discussion and Conclusion

Relationships between suppliers and purchasers have been under enormous challenge and tension for quite some time. This can be explained by the increasingly necessary agreements, legislation, regulations, and specific requirements that must be met in the context of the activity. Last but certainly by no means least, the advent of globalization and the accompanying increase in internationally active players has contributed to the tensions between suppliers and customers. Certainly, internationally operating actors represent a potential to form strategic partnerships, but each actor is subject to the principle of economic efficiency and thus also the enforcement of the entrepreneurial interest. Consequently, information asymmetries represent one of the most important factors which exist between suppliers and purchasers. The principal-agent theory is an essential tool that makes it possible to classify and define the characteristics of the supplier and the purchaser as well as the respective pairs of actors. Thus, it can be stated that the agent has a distinct information advantage over the principal, while the latter has an information deficit, which corresponds to the basic understanding of the emergence of information asymmetry. Above all, the buyer is at a disadvantage in the supplier-buyer relationship, which leads to the fact that due to the information asymmetry and the possible uncertainty regarding the supplier, supplier evaluations are carried out by the buyer in order to minimize the risk of cost increases, profit minimization and supplier failure. The primary goal of this paper was to identify influencing factors of information asymmetry for the buyer. Influencing factors, which are important

for buyers and are not fulfilled by the supplier, have an impact on product safety and product quality and thus on the uncertainty of the buyer and ultimately on the expression of the information asymmetry of the company. Using the explanatory model described above, it was possible to identify 8 groups of influencing factors that are expected by the buyer vis-à-vis the suppliers. The following factors can be identified as information asymmetric influencing factors, based on the literature: social influencing factors; integrated management systems; cooperating systems; key performance indicators; in-label and out-of-label information; reliability aspects; price-performance aspects; general aspects; digitalization aspects; product technology aspects; labor and social law aspects; and environmental aspects etc. All of the abovementioned factors have been identified in the literature as information asymmetry influencing factors through the use of the indirect approach. However, in order to be able to substantiate the accuracy and completeness of the explanatory model and the information asymmetry influencing factors contained therein, future research should follow the following action points: (1) reviewing the operationalization structure, (2) conducting a representative content review through expert interviews that falsifies the influencing factor model and the influencing factors contained therein or, if necessary, expands them to include additional factors. ♦

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Summary

Mục đích của bài viết này là phát triển một mô hình ảnh hưởng - hiệu ứng như một cấu trúc để xác định các yếu tố ảnh hưởng đến sự bất đối xứng thông tin giữa nhà cung cấp và khách hàng. Để hiểu nguyên lý nhân - quả của các yếu tố ảnh hưởng, lý thuyết người ủy thác - người đại diện được sử dụng để mô tả mối quan hệ người mua nhà cung cấp. Việc phân tích các đánh giá của nhà cung cấp cho phép tạo ra nguồn gốc gián tiếp của thông tin bất đối xứng ảnh hưởng đến các biến số. Các vấn đề xã hội, pháp lý hoặc ảnh hưởng nội bộ của công ty (ví dụ: hệ thống quản lý tích hợp, hệ thống hợp tác...) được xác định là yếu tố ảnh hưởng đến sự bất đối xứng thông tin. Một mô hình giải thích được thiết kế để xác định sự bất đối xứng thông tin ảnh hưởng đến các biến. Bài viết cung cấp một cái nhìn tổng quan có cấu trúc về các biến thông tin bất đối xứng chính có thể được chỉ định nói chung, đặc biệt là đối với chuỗi cung ứng thực phẩm.