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Process Management in Food Supply Chains: A Case Study

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Abstract:

Purpose: *The aim of this article is to identify processes in the horses feed supply chains implemented for the needs of sporting stables, together with an indication of the factors determining their efficient management and to propose methods to improve the process.*
Design/Approach: *The research was conducted using qualitative methods. As part of the research procedure, process analysis was carried out using the method of mapping processes in the horse feed supply chain. To analyse and evaluate the examined processes were presented in the form of graphical maps developed using the iGrafx software.*
Findings: *The results of the study indicate that the coordination and integration of logistics processes has a significant impact on the efficiency of the feed supply chain. It is necessary to focus process management on building partnerships in the supply chain to ensure high quality horse nutrition.*
Practical Implications: *The results can be used to improve the supply chain, which is important for owners, breeders, trainers, and animal caregivers - as well as sports, insurance, or veterinary institutions. Nutritional issues are subject to detailed analysis in the event of success and at the time of occurrence of health problems ending with surgical intervention or death of the horse.*
Originality/Value: *Due to the growing importance of these issues for the efficient operation of the feed chain for horses, it is necessary to understand and promote the aspect of coherent, integrated process management in the scientific and practical dimension. An important element of breeding and training activities is the proper recognition of individual elements and relationships in feed supply chains, as well as the factors determining them.*

Keywords: *Food supply chain, horse feed supply chain, process management.*
JEL codes: *M20, Q10, Z20.*

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1. Introduction

The development of system concepts and process approach has contributed to the thesis about the superiority of cooperative systems over the concept of "lonely struggle", which resulted, among others, in the development of the concept of the supply chain. It can be defined as cooperating in various areas entities that obtain raw materials, processing companies, trade and service, and their clients, between which flow streams of products, information, and funds (Witkowski, 2010). The supply chain concept is dominated by the philosophy of close integration of the producer with suppliers and customers in order to achieve market successes (Kisperska-Moroń, 2009). Supply chain flows are dynamic and constantly evolving elements for which the customer is particularly important (Chaberek, 2002). It determines the shape of the entire system because its needs determine activities in the chain between raw material supply, production and distribution.

According to the guidelines of Food and Agriculture Organization of the United Nation (FAO) food safety is a core area of the collaboration of all actors, private and public, for the protection of the product chain from the farm to the consumer. Given the direct links between animal feed and the safety of foods, it is essential that feed production and manufacture are considered as an integral part of the food production chain (FAO, 2010). The consequence of this approach is the integration of feed supply chains into a system of international regulations imposing safety standards and procedures (EU feed and food law) (Regulation 178/2002), (Regulation 2017/625).

The structure of animal feed supply chains is diverse, ranging from simple production units producing their own feed, or depending predominately on communal feed resources, to more complex feed production units where a variety of producers and industries contribute to the production, mixing, and distribution of feed ingredients and complete feed products (FAO, 2014).

In the area of horse industry, one of the basic supply chains is the feed supply chain (next to the horse creation chain, slaughter destination supply chain and bedding supply chain) (Wincewicz-Bosy, 2012). The design of the horse feed supply chain also depends on the horse's intended use. One of the most interesting and popular forms of horse use is sport.

The essence of equestrian sport is to grow the unique and mutually beneficial bond between horse and man (FEI, Mission) in various distinct disciplines, both amateur and professional. To be able to implement the idea of sport competition, it is necessary to properly prepare both athletes and horses.

A special place in this system is proper preparation of animal nutrition processes, carried out both during preparation for the competition and during participation in the competition. Considering the specific requirements of horses, it should be stated that

horse nutrition has a significant impact on their condition and results. Ensuring efficient functioning in the field of horse nutrition is a significant challenge for a large group of entities forming the feed chain for horses. To this end, it is necessary to identify the factors affecting the implementation of the processes of its supply chain participants. Therefore, the purpose of this article is to identify processes in the feed supply chains for sport horses implemented for the needs of sporting stables, together with an indication of the factors determining their efficient management of them.

2. Literature Review

2.1 Horse Nutrition

By feed should be understood any single or multiple materials, whether processed, semi-processed or raw, which are intended to be fed directly to animals (FAO and IFIF, 2010). Feed ingredient means a component part or constituent of any combination or mixture making up a feed, whether or not it has a nutritional value in the animal's diet, including feed additives. Ingredients are of plant, animal, or aquatic origin, or other organic or inorganic substances (O/WHO, 2004). Feed additive is any intentionally added ingredient not normally consumed as feed by itself, whether or not it has nutritional value, which affects the characteristics of feed or animal products. Micro-organisms, enzymes, acidity regulators, trace elements, vitamins and other products fall within the scope of this definition depending on the purpose of use and method of administration.

The purpose of feeding horses is to provide them with the nutrients necessary for normal development, use and maintenance in good health (Pruski *et al*., 2006). Horse instincts and behaviour as a nomadic, gregarious herbivore, its appetite, and its digestive system, have not altered since it became Equus caballus, an established plains dweller living by grazing and browsing. It is still constructed and 'programmed' to survive by eating vegetation, and although the vegetation to which it has access has changed (The BSH, 2003).

According to natural conditions, horses as steppe animals should be in motion and be able to eat non-stop feed for 14-16 hours a day. Over 3000 years, the forms of horse use and their living conditions have changed. Modern sport horses are animals living in stables, subordinated to the training program and the regime of competitions. The physiological conditions of horses make feeding systems a special area of care. The capacity of the horse's stomach is only 10 litres, and its specific design and arrangement prevent the return of food to the oesophagus and problems with the release of gases resulting from fermentation processes. The process of digestion is relatively short, which is why a horse needs almost constant nutrition (Prawocheński, 2010). In contrast, an overfilling stomach causes breathing problems. Since the horse's digestive system needs the right amount of undigested fibre parts derived from hay, the rest of the diet must be sufficiently energetic and contain a concentrated amount

of protein (Hawcroft, 2001). Fodder for horses should contain water, organic substances (carbohydrates, protein, fibre, fat, vitamins) and minerals (Pruski *et al*., 2006).

Horses are animals with a sensitive digestive system and in order to keep them healthy, special attention should be given to both the selection and the feeding process itself. The administration of improper nutrients or in the wrong quality leads to severe disease states and even death. This is a consequence of the structure of the digestive system. Therefore, certainty as to the quality of the products delivered is a basic condition. It also causes special care for the manufacturing process and the components used in it, as well as the quality of storage and transport processes. In addition to controlling supply, an important element is trust created based on the information flow system and long-term cooperation, i.e. the system of relations between links (Wincewicz-Bosy, 2012).

The extremely delicate psyche of the horse creates the need for great care and service, and its violations affect the digestive and immune systems. The stable feeding times are set in the stables. The stable employee is obliged to feed in accordance with the information appearing on special information cards placed on the boxes, they reflect the arrangements under the nutrition plan. Creating individual nutrition plans can be implemented based on Nutrient Composition Tables according to Nutrient Requirements of Horses (Sirois, 2018). The employee collects appropriate amounts of individual feeds and feed additives from storage in the stable. The basis for feeding horses is roughage and forage. Roughage is structured feed mainly in the form of hay or chopped straw. The concentrated feed is mainly cereals (in the form of grains, muesli or granules). Concentrated feeds may be complete served as the only food within balanced feeding doses (2-5 kg per day). They can also occur as concentrated feed - balancers (0.2-0.7 kg per day), requiring supplementation with an additional portion of roughage.

Hay is the most commonly used roughage. Lack of roughage in the diet has been implicated in behavioural problems (McCall, 2018). Depending on the individual characteristics and condition of the animal, it is served in dry form or as soaked hay. Before the appropriate amounts of hay are allocated, the stable staffs check its condition. It must be well dried, with the right colour and aroma, which testify to its condition. The hay composition is also checked before the new batch is split. Particular attention is paid to the presence of poisonous plants and the addition of herbs. Although the procedure for checking the condition and content of hay is carried out before the batch is accepted into the warehouse, it is repeated every time before feeding. Feeding horses requires from stable employees not only knowledge and skills related to interaction with animals and physical strength, knowledge of the basics of nutrition and food safety of horses is also necessary.

Therefore, the nutrition process requires from the person who implements it, not only the ability to create desired feed mixtures, but also knowledge and skills regarding the proper handling of animals. All activities must be carried out in such a way that the feed is as safe as possible, also for the employee. Given the psychophysical conditions of horses, this is a necessary and necessary condition for performing this work. The order of feeding individual individuals is a permanent, repeatable element. Any changes cause horses' nervousness, which may affect the processes of food absorption and strengthen undesirable (dangerous) behaviours. Horses as animals in large spaces react to all threats by escaping, which in conditions resulting from being in a box can threaten the health and life of the animal and staff. The basic principles of horse nutrition are:

(1) food must contain the necessary nutrients for the body in the right amount and fill the digestive system so that the animal is full and has adequate strength - the horse cannot be hungry;
(2) the horse must have permanent access to water;
(3) plant fibre should form the basis of horse nutrition;
(4) feed doses should be adjusted individually to each horse - doses should be adjusted according to the season of the year, air temperature, type of feed, age and condition of the animal, body weight and race as well as type, metabolic rate (including feed absorption rate), and also according to the type of work (type, length and intensity);
(5) all feed given to horses should be fresh, not mouldy, not too old, not fermented (not foddered), clean and of the highest quality;
(6) horses should always be fed at the same time of day due to better use of the feed by the body and for psychological reasons - horses like rituals, and any changes cause stress;
(7) the horse should receive food at a constant size, divided during the day - little but often - due to the small size of the stomach;
(8) any changes in nutrition should be done gradually and carefully;
(9) special attention should be given to feeding immediately before and after work - especially intensive use;
(10) a hungry horse should not be fed concentrated food; feed with fibre should be given first.

All these conditions mean that the creation of a feed delivery and feeding system takes the form of a supply chain. The basic links forming it include: entities involved in the cultivation and sourcing of plants, specialised entities implementing the processes of support of cultivation and harvest as well as transport and storage, as well as producers of feed and feed additives, distribution system and specialised entities running stables in which consumption is carried out. An important link in the modern chain is recycling, especially because of the amount of post-consumer waste generated. Depending on the specific requirements, the links of the chain are also suppliers of medicines and veterinary supplements.

2.2 Sport Horse Nutrition

Feeding horses during training and outside the starting and training seasons takes place stationary in the sports stable. However, the period of participation in competitions is associated with the need to provide food during movements. Therefore, during the start season, competitors switch to feeding ready-mixed mixtures of concentrated and volumetric feeds. This allows you to increase control of the feed actually consumed, both in quality and quantity. It also creates the possibility of timely and appropriate selection of feed additives in accordance with the starting plan and the psychophysical condition of the horse.

There is no question that commercially processed feeds have provided a convenience for horse and barn owners. It is easy to rip open feed bags and pour it in the bucket. Many feed companies maintain that there is no need to add more vitamins and minerals to their complete feed formulas. In addition, feed companies provide many different formulas, giving horse owners a choice of which formula to feed each horse (Introduction to…). Particular attention should be given to feeding from various production batches. Especially with regard to concentrated feeds, remember that the transition should take place in a gentle way - mixing in the right proportions the previous and next batch - so as not to cause gastrointestinal problems.

The sensitive digestive system of horses also necessitates feeding with constant parameters, and because their changes can lead to disease states. Animals, which for various reasons often change their whereabouts, are fed most often with ready-made mixtures produced by international companies. Their advantage is, among others, availability in various markets and a rich composition created to meet the needs of various customer groups. Among the barriers to the widespread use of ready-made mixtures are their fairly high price and individual preferences and needs of individual horses. Horses in parent stables are most often fed products from local markets under short supply chains. For climatic reasons (seasonality), there is a need to safely store feed ingredients between harvest periods.

Theoretically, it is possible to bring them from other climate zones, but such procedures are rarely carried out. This is due to the need to properly prepare and secure the transport process in such a way that it guarantees the preservation of the proper condition of the goods delivered. This increases the transport costs, and thus the final price. Considering that even a slight change in the condition of the good (e.g. smell) may be the reason why horses refuse to consume, therefore the purchase of this type of goods from geographically distant places is a high-risk element. Accordingly, the importance of storage processes is increasing. They must be implemented using appropriate technical means guaranteeing appropriate quality and suitability for consumption. With regard to entities conducting their activities in urban or suburban areas, due to limited space, these sentences are delegated to suppliers or specialised entities conducting this type of activity.

There are many challenges facing equine nutrition, in particular understanding the potentially differing nutritional needs of the competition horse in the various disciplines from rodeo to 3-days eventing (Harris, 2020). Sports horses require increased energy supply - in the form of cereal grains in a dose of up to 30%. The grain should be of adequate quality and in a form that gives increased digestibility, for example, grain refinement increases its digestibility by up to 90%. The sports horse eats 4-6 kg of concentrated feed per day, and even with 10-12 kg for intensive training and frequent starts (Szulga, 2005). For sports horses, the right content is particularly important: protein (especially amino acids - which affect muscle regeneration), carbohydrates (with a certain level of glycaemia, their type affects, among others, the rate of energy release), vegetable fats in foods with long-released energy, and vitamins, microelements and electrolytes (sodium, potassium, chlorine, magnesium ions) - as compensation for losses arising in the process of sweat excretion. The sport horses spend much of their time traveling and competing and are often under stressful conditions. At this level of performance, adequate nutrient balance and supplementation to the rations to prevent illness and enhance performance becomes even more important (Martin, 2010).

Due to the specificity of horses, it is extremely important to provide feed that will guarantee an adequate level of feeding safety. Ensuring the appropriate quality of services rendered as well as the suitability and safety of the products provided is the basis for creating supply chains based on the primacy of the good of the horse. It is also necessary to protect feed and additives against hostile human activity, related for example to unsportsmanlike behaviour or criminal activity.

3. Research Approach

3.1 Methodology

For the purposes of the analysis, it was assumed that the supply chain consists of activities (processes) and infrastructure whose purpose is to deliver products from the place of origin to the place of consumption (Snyder and Shen, 2011). In identifying individual elements of the supply chain, the concept of M. Christopher was used, among others, recognizing that it is a specific system of interrelated organisations involved in various processes and activities, whose aim is to provide the final recipient with a full range of products and services (Christopher, 1998).

In relation to the horse industry, the basic condition for the operation of the system is efficient management, both in relation to the supply chain as a whole and the individual process. Supply chain efficiency is achieved if customer satisfaction increases thanks to optimal combinations of reliability, speed, and cost (Janvier-James, 2012). With regard to horse industry, the basic condition for system operation is reliability both in relation to the supply chain as a whole and individual process. The concept of reliability is defined as “probability that a system or a product will

perform in a satisfactory manner for a given period of time when used under specified operating conditions" (Blanchard, 2004). Reliability is the ability of an item (any component, subsystem or system that can be considered as an entity) to perform the required function (necessary to provide a specific service), under given environmental and operational conditions for a stated period of time (Rausand and Hsyland, 2004). The reliability of the horse feed supply chain plays a key role in maintaining horses in good health and fitness and in creating conditions for success in the sports arena.

In the article, the authors attempted to answer the following research questions:

(1) what is the specifics of the supply chain of horse nutrition, including sport horses;
(2) what processes are implemented in the horse feed supply chain;
(3) what are the key factors determining efficient process management in the horse feed supply chain, including sports horses.

The article has a conceptual and research character and aims to analyse the key factors, determining their efficient management of processes in the feed supply chain, taking into account the specificity of the horse industry system on the example of sport horses. Specific objectives include the presentation of the nature and conditions of the horse feed supply chain, analysis and evaluation of supply chain processes and identification of critical areas for efficient process management. The research procedure consisted of the following steps:

(1) a description of the nature and nature of the horse's feed supply chain, including sports horses,
(2) identification of processes implemented in the horse feed supply chain, mapping of processes and analysis of their course and conditions,
(3) formulation of conclusions and recommendations regarding key processes of the analysed supply chain to ensure its efficient functioning.

The following research methods were used to achieve the adopted goals: literature study (a review and in-depth analysis of scientific literature), document analysis (review and analysis of documents, reports and legal acts), and to explore the research problem - preliminary individual semi-structured interviews with experts, a case study method and an observation method (participating observations carried out during international equestrian competitions and in equestrian centres). The iGRAFX program was used to analyse the feeding process of horses within the supply chain.

3.2 Processes in the Sport Horse Feed Supply Chain

The efficient functioning of the supply chain requires consistent management of processes necessary to create and maintain the expected value. In this context, it is particularly important to identify key processes and strive for their coordination and integration. According to Sweeney (2007) "Supply Chain Management is the

systemic, strategic coordination of the traditional business function and tactics across these business functions within a particular company and across business within the supply chain, for the purpose of improving the long term performance of the individual companies and the supply chain as a whole". As emphasised by van der Vorst (2004), supply chain management means "the integrated planning, co-ordination and control of all business processes and activities in the supply chain to deliver superior consumer value at less cost to the supply chain as a whole whilst satisfying requirements of other stakeholders in the supply chain (e.g. government and NGO's)".

The analysis of processes implemented in the supply chain requires an appropriate research approach. The tool enabling in-depth, multi-faceted analysis of the supply chain is modelling and mapping, in which processes are presented graphically. The main components of the process model are project decisions regarding the identification of entities involved in operations, operational activities, contractors of individual activities, inputs and outputs of activities, establishing the order of activities (dependence of activities, possibility of parallel implementation) (Pietroń, 2011).

The following entities participate in the implementation of processes in the supply chain: sport stables (managers, staff operating in horse's box, storage space and stable technical service), veterinarians, feed distributors (warehouses, representatives), feed producers, feed additives producers, farms, recycling and waste firm and transport providers. The subjects of the analysis are processes in the supply chain of sport horses feeding (Figure 1).

The input of the process is the assumption that for all activities in the supply chain for horse feed the best value is the good of the horse. Therefore, the result of the processes (outputs) should be a healthy horse achieving successes in sport as a result of consuming the right products obtained as a result of the efficient and effective functioning of the equine industry sports system.

As part of the activities implemented in the chain, three basic stages can be distinguished:

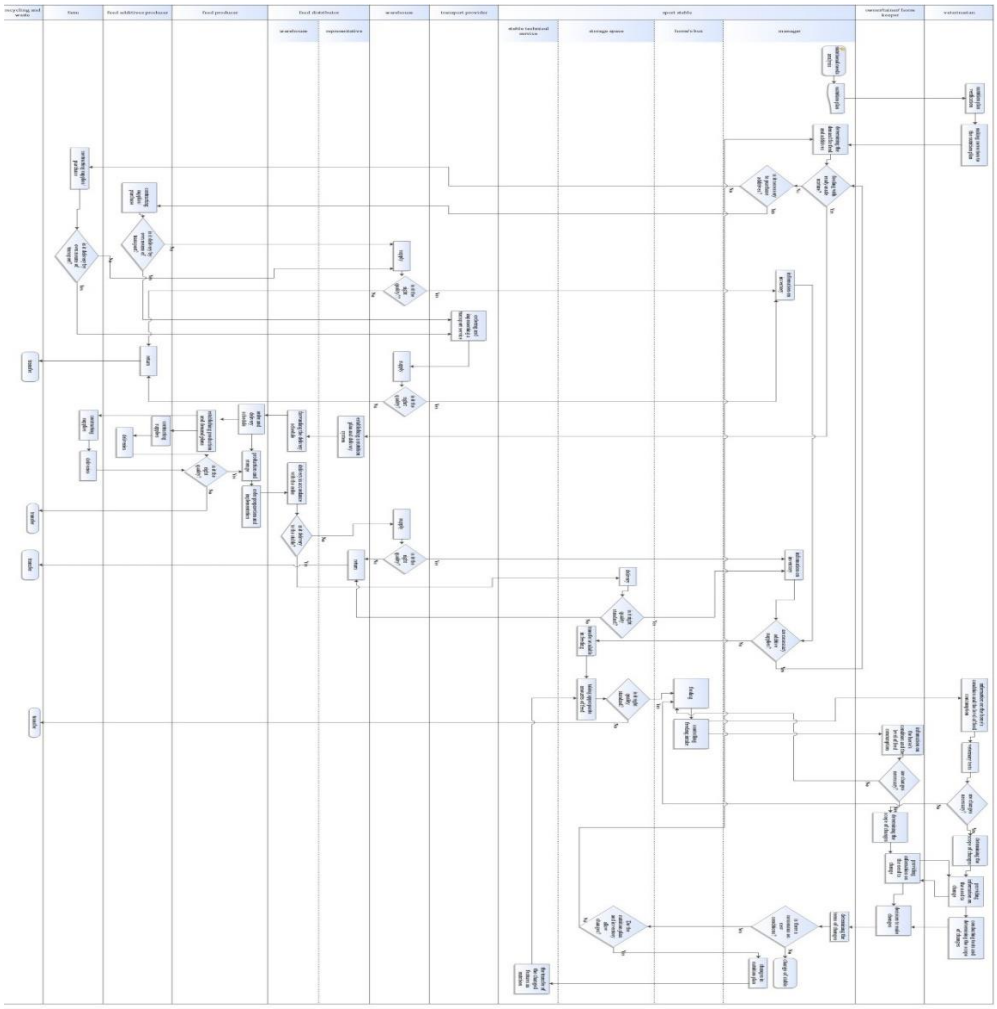
(1) identifying and planning the needs for sports horse nutrition, qualitative and quantitative analysis of demand;
(2) the process of finding suppliers, negotiating, submission and execution of orders;
(3) monitoring and assessment of compliance with the quality and quantity requirements of the feed supplied.

In the case of the decision to feed ready-made compound feeds, it is necessary to contact the representative of the producer or distributor who will choose the appropriate combination of types of feed and their quantity and additives. He should stay in touch with the player and stable manager to control and adjust feeding on a

regular basis. Determining the type and dose of feed, its administration and any changes in the horse's feeding program should be done under the supervision of a veterinarian and with the knowledge of the horse's breeder.

The sport stables are the basic place where horses are fed. Before determining the appropriate nutritional dose, it is necessary to determine the starting state of the animal through examinations carried out by a veterinarian. The next step is to answer the question - what is the goal - what do we want to achieve by creating a nutrition program for a given horse. Based on the arrangements with the trainer, player and owner, the stable manager sets the initial conditions for the horse feeding plan.

Figure 1. *The map of processes in the supply chain of sport horses feeding*



Source: *Own.*

Depending on whether the horse will be fed ready feed mixtures or feed supplied in the form of unprocessed or low-processed raw materials, it is necessary to contact the representative of the distributor or producer of ready feed or directly with the supplier of feed components. There are from a dozen to several dozen sport horses in the sports stable for whom individual feeding plans are created. Based on the information obtained, the stable manager makes appropriate orders with individual suppliers. Due to the fact that some sports centres are located in urban areas, many of them have additional storage space or cooperate with storage entities that store feed and feed additives in appropriate conditions. Feed production is seasonal, so it is necessary to safely store the right amount of feed components to ensure permanent access throughout the year.

Important links in the supply chain are entities implementing transport processes. They must guarantee not only certainty and timeliness of services rendered, but an important element here is to ensure appropriate transport conditions as well as loading and unloading.

4. Results

Analysis of horse feeding processes in the feed supply chain system identifies various problems affecting the reduction of the efficiency of the entire system. They can result in a weaker condition of the horse, preventing the desired sport results. They can also lead to various diseases and even death of the animal. Emotional problems are the most common and fastest appearing effect in problems in the feeding system. Hyperactivity, aggression, but also a lack of willingness to cooperate, lethargy, and lack of energy are important signals that should result in an immediate reaction.

The inefficiency of the feed supply chain can result from the very essence of the supply chain concept. The necessity to integrate actions in relation to entities occurring within the supply chain often causes various types of conflicts (Kisperska-Moroń, 1998). They usually result from the following reasons:

(1) lack of convergence of the goals of individual members of the system - although the overriding goal is the good of the horse, the partial goals of individual partners may be significantly divergent, partners may also not disclose the true goals, therefore trust is an important element of cooperation, and infringers are eliminated from the system;
(2) inconsistencies regarding the dominant position and division of roles in the system;
(3) improper communication between system members;
(4) divergent understanding of reality;
(5) ideological divergences and different value systems.

The reasons for these conflicts may be cultural, organisational, and administrative differences derived from the location in various state systems. That is why it is so important to strive to ensure coordination of processes in the supply chain. According Simatupang *et al.* (2002) four coordination modes can be distinguished as key:

(1) logistics synchronisation meaning recognition and coordination of improvement initiatives that significantly contribute to creating value in the purchase, consumption and sale of products;
(2) information exchange - coordinating the collection, processing and dissemination of information between chain members in order to provide decision makers with relevant, accurate and timely information;
(3) adaptation of incentives; to enable you to influence the behaviour of individual members and their interaction with other partners;
(4) joint learning to expand the capacity of each partner, which is useful for continuous improvement, developing ways to solve the problem of coherence associated with initiating and disseminating knowledge across organisational boundaries (practical learning from each other to understand and build capacity in implementing specific initiatives to improve logistics).

The basis of coordination is to understand the needs, their specificities and adjusting activities so that it is possible to ensure value. Feeding of inadequate quality feeds causes unnecessary ballast in the horse's body and health problems, e.g. ulcer diseases, colic, fluctuations in condition and weight, emotional instability. The better the quality of the feed ingredients, the less need for feed additives and other supplements. Therefore, an extremely important element is the appropriate quality of services and products provided by individual partners. These is only possible if all processes in the cooperating entities and between them are properly organised, including constant supervision and control of both individual processes as well as supplied components and used components. Feed and feed additives that do not meet the quality requirements should be treated as waste.

As a result of consumption, post-consumer products are created, which may be of interest to the recycling system or create a waste component. Their classification and further handling depend on national regulations and standards. Feed production must be subject, in the same way as food production, to the quality assurance of integrated food safety systems (FAO, 2010).

Typical problems of production systems reliability, based on the multi-dimensional approach, are presented in Nowakowski *et al.* (2018; 2016), Chlebus *et al.* (2016), Werbińska-Wojciechowska *et al.* (2019). The presence in feed and feed ingredients of undesirable substances such as industrial and environmental contaminants, pesticides, radionuclides, persistent organic pollutants, pathogenic agents, and toxins such as mycotoxins should be identified, controlled and minimised. A specific factor determining the incorrect quality of feed ingredients provided are natural and in

particular weather conditions, which affect, for example, the quality of grain and straw during vegetation and harvesting. Even the most advanced technical treatments cannot replace suitable climatic conditions. It happens, therefore, that despite previously concluded agreements, the transaction is not finalised, and it is necessary to search for other subcontractors. Therefore, an important element is information flows, which, even if they are not beneficial for the transaction party, are implemented for the sake of horses, which are the highest value for people associated with horse business and the basis of relationships created. An important factor that should be considered in analysing the efficiency of the feed supply chain is seasonal production associated with limited access to feed ingredients resulting from harvest seasonality. This increases planning uncertainty and ensures access to them throughout the year.

Lack of access to food contributes too many ailments, diseases, and narrows. Both long-term ones requiring a change of feed as well as short-term ones causing excessive interruptions in access to feed. Particularly dangerous is nervous food in reserve, which can result in a serious illness or even death of the animal. Both the shortage of feed and its excess increase the incidence of horses, worse mental condition, and weaker physical form.

An inadequately balanced feed can be the cause of serious muscular and skeletal disorders. The most common problems resulting from improper nutrition of horses include laminitis, musculoskeletal inflammation, colic, overweight, underweight, skin problems, inflammation and degeneration of the joints, swelling of the legs, weak hooves, dental problems, and behavioural problems.

Feed ingredients should be obtained from safe sources and be subject to a risk analysis where the ingredients are derived from processes or technologies not hitherto evaluated from a food safety point of view. The procedure used should be consistent with the Working Principles for Risk Analysis for Application in the Framework of the Codex Alimentarius (FAO, 2010). Manufacturers of feed additives in particular should provide clear information to the user to permit correct and safe use.

It is indicated that the following problems may occur at the distribution stage: risk of stealing, physical damage, and high interest for long transport times (Janvier-James, 2012). Hazards in transport are associated with the need to secure the right means of transport as well as the conditions of transport. Appropriate preparation of the loading area, including disinfection processes, is of particular importance here. Horses as animals with an overly sensitive sense of smell and taste will not eat something that smells or tastes inadequately. It is also worth noting in the context of storage processes by organising the appropriate storage conditions. Important elements of the system are specialised warehouses that guarantee quality and proper condition throughout the entire storage period. It must be equipped with appropriate devices, e.g. for drying hay, straw, or grain. It is also important to protect against pollution and rodents as well as access by other animals that can contaminate stocks. Traceability of feed and feed

ingredients, including additives, should be enabled by proper record keeping for timely and effective withdrawal or recall of products if known or probable adverse effects on health are identified.

5. Conclusion

The empirical research conducted shows that for most entities undertaking activities in the horse feed supply chain the best value is the good of the horse. This allows the use of the concept of homo sociological, in which the performer refers in his actions more to values rather than to interests (Morawski, 2001). That is why trust, based on reliability, and forms the basis of the relationship between the links of the feed supply chain. The reliability, as a fundamental element of efficiency of the feed supply chain for sport horses, can be defined as a system providing appropriate feed ingredients and additives in accordance with an established horse nutrition program that does not adversely affect the health, mental and physical condition of the horse and does not reduce its ability to achieve sporting results.

According to Janvier-James (2012), reliability is generally more important than speed in the supply chain. Consequently, it can be considered that reliability is more relevant than costs, and thus a key dimension of the efficiency of the food supply chain. The product obtained as a result of an efficient and effective system of sport equine industry is a healthy horse of successful sports.

The production, processing, storage, transport, distribution and feeding of safe and suitable feed and feed ingredients is the responsibility of all participants in the feed supply chain, including farmers, feed ingredient manufacturers, feed compounders, feed storages, truckers, stable managers, vets, trainers, riders, etc. Each participant in the feed supply chain is responsible for all activities that are under their direct control, including compliance with any applicable statutory requirements and creating conditions for success achieving. Therefore, as proposed by Croxton *et al.* (2001) as key processes in the supply chain, it should be primarily recognised that customer relationship management, demand management, order fulfilment and returns.

Each horse should have properly prepared individual food doses that are the basis of his good condition and development. Feed should be in good condition and meet quality standards. Food safety hazards associated with animal feed can be biological, chemical, or physical. Each hazard is associated with particular sources and routes of contamination and exposure. Risk management must be based on a thorough understanding of these characteristics. Hazards may be introduced with source materials or via carryover or contamination of products during handling, storage and transportation or feeding. The presence of a hazard may also result from accidental or deliberate (e.g. fraud or bioterrorism) human intervention (FAO, 2010).

Therefore, taking into account the above arguments, wanting to achieve sporting successes, while maintaining care for the good of the horse, it is so important to properly recognize the conditions of the feed supply chain operation and ensure the efficiency of process management.

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