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Questionnaire Example on Production and Problems of Feed Mills: The Case of Diyarbakır

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ABSTRACT

This study examines the production status and other characteristics of animal feed manufacturers in Diyarbakır during 2021. For this purpose, data were collected through face-to-face using a questionnaire consisting of 58 questions, completed by six business owners. The responses obtained from producers were statistically analyzed. The study determined the annual animal feed production capacities, production volumes, mill capacity utilization rates, , raw material supply regions and electricity per ton of feed produced, and the annual production capacities of the mills. Among the cattle feeds produced, finishing feed for fattening was identified as the most produced type, while sheep/goat feeds primarily consisted of sheep fattening and sheep dairy feeds. The data revealed that most of the raw materials used in animal feed production were sourced from outside region and abroad It was also determined that the majority of the feed produced was sold on credit, with electricity and water costs amounting to 12.45 TL and 0.28 TL per ton of feed produced, respectively. Raw material purchases accounted for 71.67% of total product costs, while personnel expenses constituted 12.86% of total costs. Additionally, transportation and electric energy costs represented 7.67% and 5.67% of total costs, respectively. The research highlighted that animal feed mills operated at insufficient capacity utilization levels and produced a limited variety of feed types. Due to the reliance on raw material procurement from outside region and abroad, the transportation distances for raw materials were long, resulting in high raw material costs. It was concluded that the mills operating in the region had weak competitive power, limited market opportunities in the face of competition, and high feed production costs.

Yem Fabrikalarının Üretim ve Sorunlarına İlişkin Anket Örneği: Diyarbakır Örneği

MAKALE BİLGİSİ

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ÖZ

Bu çalışmada, 2021 yılında Diyarbakır ilinde hayvan yemi üreticilerinin üretim durumu ve diğer özellikleri incelenmiştir. Bu amaçla, altı işletme sahibi tarafından doldurulan 58 sorudan oluşan bir anket kullanılarak yüz yüze görüşme yoluyla veri toplanmıştır. Üreticilerden alınan yanıtlar istatistiksel olarak analiz edilmiştir. Bu verilerden fabrikaların yıllık üretim kapasiteleri, üretim miktarları, kapasite kullanım oranları, üretilen yem miktarları, hammadde temin bölgeleri, üretilen ton başına elektrik giderleri ve fabrikaların yıllık üretim kapasiteleri tespit edilmiştir. Üretilen sığır yemleri arasında en çok üretilen yem türü besi

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Yem fabrikaları
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bitirme yemi olarak belirlenmiş, koyun/keçi yemleri ise ağırlıklı olarak koyun besi ve koyun süt yemlerinden oluşmuştur. Veriler, hayvan yemi üretiminde kullanılan hammaddelerin çoğunun bölge dışından ve yurtdışından temin edildiğini ortaya koymuştur. Ayrıca üretilen yemin büyük çoğunluğunun kredili olarak satıldığı, üretilen yem tonu başına elektrik ve su maliyetlerinin sırasıyla 12,45 TL ve 0,28 TL olduğu belirlenmiştir. Hammadde alımları toplam ürün maliyetlerinin %71,67'sini oluştururken, personel giderleri toplam maliyetlerin %12,86'sını oluşturmuştur. Ayrıca, ulaştırma ve elektrik enerjisi maliyetleri sırasıyla toplam maliyetlerin %7,67'sini ve %5,67'sini temsil etmektedir. Araştırmada, hayvan yemi fabrikalarının yetersiz kapasite kullanım seviyelerinde çalıştığı ve sınırlı çeşitlilikte yem türü ürettiği görülmektedir. Hammadde temininin bölge dışından ve yurt dışından yapılması nedeniyle, hammaddeler için ulaşım mesafelerinin uzun olması, bunun sonucunda yüksek hammadde maliyetlerine yol açmaktadır. Bölgede faaliyet gösteren fabrikaların rekabet gücünün zayıf olduğu, rekabet karşısında pazar fırsatlarının sınırlı olduğu ve yem üretim maliyetlerinin yüksek olduğu sonucuna varılmıştır.

Introduction

As a result of the increasing rural-to-urban migration in Turkey, the country has shifted from being self-sufficient in feed production and food to becoming dependent on foreign imports (Yalçın and Kara, 2016). According to data from the Turkish Statistical Institute (TÜİK), the Beverage Sector, as part of the Turkish Food and Beverage Industry Associations Federation (TFDF) Digital Data Panel (2022), has become reliant on foreign imports for agricultural products and food. In 2020, one-quarter of total imports in the agriculture, food, and beverage sectors was allocated to the purchase of animal feed. The import of animal feed, which was $3.8 billion in 2020, increased to $5.26 billion by 2022 (Anonymous, 2022).

In many countries around the worldwide, the livestock sector is a leading industry that increases national income, provides employment, and contributes to the development of the national economy. As a sector, livestock provides inputs for animal food, leather, wool, cosmetics, and pharmaceuticals while contributing to rural livelihoods, reducing rural-to-urban migration, and thus preserving the social structure. This sector plays a significant role in the national economy. However, it has entered a vicious cycle, with a reduction in rural populations leading to a decrease in production, and a growing urban unemployed population becoming the main consequence (Akbay et al., 2000; Karakuş, 2012; Aral et al., 2020; Ahsan and Duman, 2022). Improving the quality of animal food production, increasing output, and consequently raising producers' incomes depend on the sufficient production of both coarse and concentrated feeds. In our country, where significant issues arise in coarse feed production, the production of concentrated feeds faces similar challenges (Akdeniz et al., 2005; Yalçın and Kara, 2016; Somuncu, 2021; Anonymous, 2022).

Studies on the issues in the compound feed sector reveal that it faces significant challenges. As in all sectors, success in the compound feed industry is primarily achieved by adhering to the general economic principles of production. In Turkiye, where input prices are high and output prices are low, various issues arise regarding the quality of the product. According to a fundamental economic principle, sectors that are unprofitable or have very low profitability tend to weaken due to negative balances, leading investors to withdraw from these industries. Livestock producers, who are the buyers of low-quality products produced with low

profit margins, are also affected by this unfavorable situation in the feed sector (Akdeniz et al., 2005; Özek, 2020; Somuncu, 2021; Anonymous, 2022).

The causes of low-quality feed production include issues related to capital accumulation in mills, raw material costs, skilled labor, operational and personnel management, profit margins, knowledge of animal feeding and feed, utilization of technological machinery, marketing strategies, and capacity utilization rates (CUR). These challenges, negatively affect the success, sustainability, and profitability of businesses (Bayraktar, 1999; Çelik et al., 2003; Akdeniz et al., 2005; Akbay and Ak, 2018; Kuvat and Abatay, 2020; Aral et al., 2020; Karadağ and Okur, 2022).

For various reasons, identifying the current state of compound animal feed mills in many provinces of our country and determining solutions for the identified problems will significantly enhance the success of both the feed sector and the animal production enterprises that are closely tied to it. Implementing these solutions at local and national levels, will lead to a more profitable sector (Karabulut et al., 2000; Karahocagil and Ege, 2004; Demir and Aral, 2009; Budağ, 2011a; Sıkar and Çimrin, 2020; Özek, 2020).

This study aims to reveal the current status of feed animal mills in the Diyarbakır province in 2021. However, it also identifies certain conditions of these mills during the second year of the COVID-19 pandemic, which began in 2020 and continued in the year the study was conducted.

Materials and Methods

The material of the study was based on the responses to 58 questions in a prepared questionnaire (survey form) completed by six individuals from six compound feed factories located in the Diyarbakır province (data set). The questions in the survey form aimed to identify the financial, structural, personnel, production, problems, and marketing conditions of the mills. The survey questions were designed based on those used in previous similar studies (Tekerli, 2010; Denli et al., 2015; Özek, 2020; Sıkar and Çimrin, 2020). Information regarding the mills where the surveys were conducted was obtained through an official request to the Diyarbakır Provincial Directorate of Agriculture and Forestry. According to these records, there were 11 active mills in Diyarbakır province, however as of April 2021, two of them had ceased operations due to the COVID-19 pandemic and economic reasons. Based on this information, interviews with mill owners revealed that one of the nine mills producing in the region in 2021 was excluded from the scope because it produced pet food, and two mill officials declined to participate in the survey. Consequently, the survey was conducted in six feed mills. Two mills did not respond to the question regarding the types and proportions of feed produced. In this research, CUR were considered as 1/300 year/workday (8 hours, single shift). The data sets obtained from all the mills in the province six mills) were summarized and analyzed using arithmetic averages in Microsoft Excel (Microsoft Office) computer program.

Since the period during which the research was conducted did not require ethics committee approval and no live material was used that would require an ethics committee, no ethics committee approval certificate was obtained.

Results and Discussion

In the study conducted in Diyarbakır in 2021, it was reported that the oldest mill in the province was established in 1972, while the newest was established in 2020. Among the mill managers participating in the study, two are mill owners, two are professional managers, one is an agricultural engineer, and one is a veterinarian. The total number of employess in these mills is 125, with an average of 15.33 employees per mill. Of the 92 workers employed in the mills, 55 are unskilled laborers, while 26 are skilled workers. Eleven of the workers are assigned to marketing. Among the 33 technical personnel working in the mills, 26 are technicians/technologists, (four are agricultural engineers, and three are veterinarians). The average number of technical personnel per mill for the six mills is 5.50 (Table 1).

Table 1. Number of employees working in mills in Diyarbakir province.
Tablo 1. Diyarbakır ilindeki fabrikalarda çalışan işçi sayısı.

Mill	Unskilled worker	Qualified personal	Marketing staff	Tecnical personnel	Total personnel
1	18	1	1	4	24
2	11	1	3	3	18
3	12	4	2	3	21
4	9	10	2	6	27
5	4	9	1	13	27
6	1	1	2	4	8
Total	55	26	11	33	125

The number of employees working in mills in Diyarbakır has been found to differ from some other studies (Denli et al., 2015; Tekerli, 2010; Özek, 2020). Indeed, in Tekerli's (2010) study, it is reported that in the Aegean Region, 41 mills across 8 provinces had a total of 1,339 employees, with an average of 32.66 employees per mill. Özek (2020) reported this number as 38.30, while Denli et al. (2015) found it to be 6.86. The differences in the number of employees in the mills are stated to be due to factors such as the workflow in the mill, the types of feed produced, the number of shifts in the mills, and regional differences (Anıç, 2006). All the mills in Diyarbakır are fully automated. It has been reported that, in parallel with the increase in automation in animal feed mills, the number of employees should decrease; otherwise, profitability would decline. In fully automated mills, the number of employees required for production is reported as 5 people in developed countries. Data from studies conducted in Türkiye show that amımal feed mills do not take the requirements of this industry into account in terms of staffing, and the data regarding personnel operations differ (Bayraktar, 1999). This situation is also reflected in the present study. While it was reported that there were 14 mills in Diyarbakır in 2014, this study shows that the number of mills in the region has decreased.

Table 2. Production capacities (tons), and quantities and CUR (%) of mills in Diyarbakir province.
Tablo 2. Diyarbakır ilindeki fabrikaların üretim kapasiteleri (ton) ve kapasite kullanım oranları (%).

Mill	Annual Capacity	Annual Production	Monthly Capacity	Monthly Production	CUR
1	30 000	27 600	2 500	2 300	92.00
2	60 000	24 000	5 000	2 000	40.00
3	84 000	12 000	7 000	1 000	14.29
4	180 000	48 000	15 000	4 000	26.67
5	180 000	84 000	15 000	7 000	46.67
6	194 400	194 400	16 200	16 200	100.00
Total	728 400	390 000	60 700	32 500	53.54

In the study, the total annual compound feed production was determined to be 390,000 tons. The annual installed capacity of these mills is 486,000 tons, and their overall annual capacity utilization rate (CUR) was calculated as 53.27%. The annual production of the mills ranges from 12,000 tons to 194,000 tons (Table 2). Data from the mills in Diyarbakır in 2021 reveal that the low CUR is due to factors such as high raw material prices, the location of some raw material sources outside the region, difficulties in collections, unfair competition, consumer awareness, transportation, difficulties in raw material supply, market narrowness, and low demand (Table 3). Operating expenses in the mills are as follows: raw material purchases 71.67%, personnel 12.83%, transportation 7.67%, energy 5.67%, and other expenses 2.83% (Table 4). In mills with higher production volumes, personnel expenses are lower, while raw material costs are higher, and energy and transportation costs are also increased (Table 5). In mill 3, which has relatively lower production, both raw material costs and electricity and water expenses have risen. The CUR in this mill is also low (14.29%). In mill 5, which has a similar annual production capacity to mill 3, electricity and water costs per ton are lower,whereas personnel expenses are high. The energy and water expenses of the mills are provided in Table 5. In mills with high capacity utilization and production volumes, electricity and water costs are low, whereas in mills with low capacity utilization and production volumes, these expenses tend to be higher (Table 4).

Table 3. Reasons for low capacity utilization of mills in Diyarbakir province[1]
Tablo 3. Diyarbakır ilindeki fabrikaların düşük kapasite kullanım nedenleri[1]

M	DPR	HRW	SRW	UC	MS	DC	CA	T	LD
1	+	+	+	+		+		+	+
2	+	+	+	+	+	+	+		
3		+	+			+	+		
4		+	+	+		+			
5		+	+	+		+		+	
6		+	+		+	+	+	+	+
%	33.33	100.00	100.00	66.66	33.33	100.00	50.00	50.00	33.33

[1] M: Mill, DPR: Difficulty in procuring raw materials, HRW: High raw material prices, SRW: Some raw material sources are outside the region), UC: (unfair competition), MS: (market shortage), DC: (difficulties in collection), CA (consumer awareness), T: (transportation), LD: (low demand)

The study reports that the primary factors contributing to the low capacity utilization rate (CUR) (Table 3) are high raw material prices, some raw material sources being located outside the region, and difficulties in collections. It was also found that the secondary factor contributing to the low CUR is unfair competition. Demir and Elmalı (2011) reported that the primary reason for the low CUR in the Eastern Anatolia Region is insufficient demand (62.50%). Similarmy other studies also indicate that the main cause of low CUR is insufficient demand largely driven by excessive price increases (Demir and Elmalı, 2011; Sıkar and Çimrin, 2020).

Table 4. Distribution table of production expenses of mills in Diyarbakir province (%).
Tablo 4. Diyarbakır ilindeki fabrikaların üretim giderlerinin dağılım tablosu (%).

Mill	Raw material	Personnel	Energy	Transportation	Other
1	60.00	20.00	5.00	10.00	5.00
2	70.00	5.00	10.00	13.00	2.00
3	90.00	2.00	5.00	3.00	0.00
4	75.00	20.00	2.00	5.00	3.00
5	70.00	20.00	2.00	5.00	2.00
6	65.00	10.00	10.00	10.00	5.00
Average	71,67	12,83	5,67	7,67	2,83

Table 5. Energy and water costs per ton of mills in Diyarbakir province.
Tablo 5. Diyarbakır ilindeki fabrikaların ton başına enerji ve su maliyetleri.

Mill	Production month/ton	Electricity TL/month	Electricity TL/ton	Water TL/month	Water TL/ton
1	7000	70000	10.00	2500	0.36
2	16200	50000	3.09	800	0.05
3	2300	60000	26.09	1500	0.65
4	4000	62000	15,50	1500	0.38
5	2000	10000	5.00	60	0.03
6	1000	15000	15.00	200	0.20
Average	5416,67	44500	12.45	6560	0.28

As seen in Tables 4 and 5, in mills with a higher number of employees, the share of other expenses in total costs decreases. This situation is similar to other studies conducted, except for mill number 3 (Budağ, 2011a; Demir and Elmalı, 2011; Sıkar and Çimrin, 2020). It has been reported that increasing feed production reduces the energy and other expenses per unit of feed produced, but after a certain level, however, beyond a certain production level, energy and water costs begin to rise in parallel with production (Tekerli, 2010; Başer and Bozoğlu, 2021). Generally, the highest portion of expenses in animal feed mills consists of raw material purchase costs and personnel expenses (Budağ, 2011a; Demir and Elmalı, 2011; Sıkar and Çimrin, 2020). In the Mill 6 which has the highest annual feed production (Mill 6, CUR 100%), raw material expenses (%65) were relatively low, while personnel (%10), energy

(%10), transportation (%10), and other (%5) expenses were high. This finding contradicts the literature, whereas in Mill 3, which has the lowest annual feed production, raw material expenses accounted for a high share of total costs (%90), while personnel (%2), energy (%5), transportation (%3), and other (%0) expenses were low. This situation in Mill 3 is consistent with the literature (Tekerli, 2010; Özek, 2020; Başer and Bozoğlu, 2021; Demir and Elmalı, 2011). Özek (2020) reports that the average share of raw material purchase expenses in total costs in Balıkesir province is 79%. The data indicate that transportation costs are high in Mill 2. It has been reported that in mills with high production, if rational solutions are not implemented, transportation costs will increase (Tekerli, 2010; Özek, 2020; Başer and Bozoğlu, 2021). There are no significant differences in the expense ratios among feed mills in Türkiye, and this is also reflected in the findings of this study. Demir and Elmalı (2011) report that in mills in Eastern Anatolia, raw material costs account for an average of 60%, labor costs for 10%, electricity costs for 8%, other expenses for 7%, and transportation costs for 15% (Akdeniz et al., 2005). The electricity and water costs in the mills subject to this study (Table 4) are similar to the data of Sıkar and Çimrin (2020). Similarly, these values are close to the upper limits of the figures provided by Tekerli (2010) for the Aegean Region. However, they are lower than the electricity costs reported by Başer and Bozoğlu (2021) for Samsun.

As can be seen in the related literature, data on the CUR in Türkiye are quite variable and low. Özerk (2020) reports the CUR in Balıkesir province as 41.5%, Demir and Elmalı (2011) in Eastern Anatolia as 44.64%, Tekerli (2010) in the Aegean Region as 117%, and in the Southeast Anatolia Region as 22.2%, and Başer and Bozoğlu (2021) in Samsun as 55.43%. Akdeniz et al. (2005) report CURs for various years in Türkiye: 87% in 1980, 75% in 1990, and 53% in 2000. This situation aligns with the data obtained in this study. Denli et al. (2015) report a CUR of 50.3% for the mills in Diyarbakır. The findings from this study (Table 2) show that, over time, the feed production per mill and the CUR in the province have increased but are still not high enough (Tekerli, 2010).

Table 6. Types of feed produced in mills in Diyarbakir province[1].
Tablo 6. Diyarbakır ilindeki fabrikalarda üretilen yem çeşitleri[1].

Type of feed	%
Cattle feed	
Calf starter feed	8.00
Calf grower feed	19.00
Cattle fattening development feed	20.00
Cattle fattening feed finishing	21.00
Cattle fattening feed standard	12.00
Cattle milk feed	12.00
Cattle development	8.00
Total	100.00
Small cattle feed	
Lamb growing feed	6.00
Lamb fattening feed	9.00
Sheep milk and fattening	85.00
Total	100.00

1 Two mills did not answer the question regarding the determination of the type and proportions of feed produced.

The mills subject to this study produce seven types of feed for cattle and four types of feed for sheep (Table 6). None of the mills that participated in the survey produces poultry feed. Among the cattle feeds produced, the most commonly produced feeds are fattening feeds, which account for 53.00% of the total cattle feed. Milk feed accounts for 12.00% of the total feed produced. Regarding sheep feed, the most frequently produced type is sheep milk and fattening feed (85.00%) (Note: this expression refers to a feed type outside the standard classification of feeds). The findings regarding the types of feed produced in the mills are similar to those of Denli et al. (2015) but show a lower number of types compared to other studies (Budağ, 2011a; Özek, 2020). Özek reports 24 types of feed in Balıkesir, while Budağ (2011a) reports 20 types in Van. The types of feed produced by animal feed mills are significantly influenced by the prevalent animal breeding and feeding habits in the region, as demonstrated in Tekerli (2010). The literature indicates that, as of 2008, the highest poultry feed production occurred in the Marmara, Black Sea, and Aegean regions, while the highest cattle and sheep feed production took place in the Marmara, Aegean, and Central Anatolia regions.

Regarding the challenges in raw material procurement (Table 7), it was found that the majority of factories (83.33%) experience difficulties in obtaining raw materials (83.33%), with the main issue being product availability (83.33%), followed by financial issues (33.33%) and transportation difficulties (33.33%). The sources of the raw materials used by the mills in compound feed production are presented in Table 8. As shown in the table, mills source 22% of their raw materials from Diyarbakır, 26% from the Southeastern Anatolia region, 32% from regions outside Southeastern Anatolia, and 20% from abroad. Producers source all of their hazelnut cake from abroad, while other cakes, feed additives, oils, and molasses are sourced domestically (Table 8). Hazelnut cake (100%) and soybean cake (80%) have a high proportion of imports. Although Türkiye is among the world's leading hazelnut producers, the importation of hazelnut cake indicates that the domestically produced hazelnut cake is insufficient. It was also determined that all of the feed additives used by the mills in the region are sourced from Southeastern Anatolia, indicating the existence of feed additive production in the region.

An analysis of the challenges faced by producers in Diyarbakır province in procuring raw materials, this situation is found to align with the findings of other researchers (Tekerli, 2010; Demir and Elmalı, 2011; Özek, 2020; Başer and Bozoğlu, 2021). Numerous studies indicate that the mills obtain raw materials from both domestic and international sources (Budağ, 2011a; Başer and Bozoğlu, 2021). Türkiye is not only an importer of raw materials but also of compound feed (Şirin, 2006; Anonymous, 2022). Consequently, animal feed mills operating in different regions source their raw materials in varying proportions from abroad or from different regions of Türkiye (Tekerli, 2010; Sıkar and Çimrin, 2020; Özek, 2020; Anonymous, 2022). This situation is also reflected in the data of this study.

Table 7. Difficulties in supplying raw materials to mills in Diyarbakir province.
Tablo 7. Diyarbakır ilindeki fabrikalara hammadde temininde yaşanan sıkıntılar.

Mill	Financing	Transport	Product finding	None
1	+	-	+	-
2	+	+	+	-
3	-	+	+	-
4	-	-	+	-
5	-	-	-	+
6	-	-	+	-
Average %	33.33	33.33	83.33	16.67

+ Yes, - No

Table 8. Supply locations of raw materials used in mills in Diyarbakir province (%).
Tablo 8. Diyarbakır ilindeki fabrikalarda kullanılan hammaddelerin temin yerleri (%).

Raw Material	Diyarbakır	Southeast	Outyside the region	Outyside the country
1. Corn	40.00	40.00	10.00	10.00
2. Barley	36.00	45.00	9.00	9.00
3. Wheat	56.00	22.00	11.00	11.00
4. Soybean meal	00.00	00.00	20.00	80.00
5. Cottonseed meal	50.00	25.00	25.00	00.00
6. Sunflower meal	11.00	33.00	44.00	11.00
7. Hazelnut meal	00.00	00.00	00.00	100.00
8. Other meal	00.00	00.00	100.00	00.00
9. Feed additives	00.00	100.00	00.00	00.00
10. Molasses	00.00	17.00	83.00	00.00
11. Feed oil	50.00	00.00	50.00	00.00
General	22.00	26.00	32.00	20.00

The percentage distribution of feed sales on a cash or credit basis, as reported by the mills, is presented in Table 9. According to this, there are varying percentages of credit and cash sales. However, in general, credit sales exceed cash sales by approximately 15%, with credit terms ranging from 2 to 6 months. Specifically, 46.91% of sales are conducted on credit, while 53.09% are made via checks. Regarding marketing methods, it was determined that 83.33% of the mills sell through distributors, but 50% of them also sell directly to producers, while one mill does not engage in any distributor sales (Table 9). According to the data, the mill with the highest proportion of credit sales (90%) uses open accounts, while other mills that sell on credit use 100% check-based sales and do not engage in open account sales. The literature on cash and credit sales of feed in Turkey is relatively limited, and sales terms vary across provinces and mills (Karabulut et al., 2000; Tekerli, 2010; Özek, 2020). From this small body of literature, Karabulut et al. (2000) report that in Türkiye, 50% of cattle and sheep feed is sold on a cash basis, and the remaining 50% is sold on credit. Özek (2020) reports that in Balıkesir, producers sell their products 4.2% for cash and 95.8% both on a cash and credit basis. Tekerli (2010), based on data from 11 mills in İzmir, indicates that the proportion of credit and cash sales varies, with one mill having 20% cash sales and another having 80% cash sales.

Table 9. Cash and credit sales rates of feed produced in factories in Diyarbakır province (%).
Tablo 9. Diyarbakır ilindeki fabrikalarda üretilen yemlerin peşin ve vadeli satış oranları (%).

	Mill						
	1	2	3	4	5	6	General
Sales type							
Cash	40.00	30.00	50.00	10.00	70.00	57.00	42.83
Deferred	60.00	70.00	50.00	90.00	30.00	43.00	57.17
Deferred sales type							
Open term	66.00	75.00	0.00	90.00	0.00	50.00	46.91
Check term	33.00	25.00	100.00	10.00	100.00	50.00	53.09
Feed marketing type							
Direct sales	+	-	+	-	+	-	50.00
Sales through dealers	-	+	+	+	+	+	83.33

An analysis of feed formulation methods in the factories reveals that two factories rely on manual calculations. These mills do not use any feed preparation software. However, in situations requiring more complex processes, two of the mills use the Microsoft Excel program, while the other two use different commercial software packages. The existing literature includes records on the use of software for feed formulation in Turkish feed mills. According to Tekerli (2010), the choice of feed preparation software in these mills is largely influenced by their purchasing power, with some opting for domestic solutions while others prefer foreign software.a key factor in the calculation CUR. In Türkiye, it is considered inaccurate to use calculations based on 250 working days, so CUR are calculated based on 8-hour workdays and 300 working days (Akdeniz et al., 2005; Özek, 2020). The number of shifts in Türkiye varies by province and region (Tekerli, 2010). In the study, it was determined that all the mills in the province have full automation systems and operate with a single shift. The automation type and number of shifts reported for the mills in Denli et al. (2015) for the year 2014 are also similar to the situation in 2021.

Table 10. Problems faced by mills in production and marketing in Diyarbakır province (%).
Tablo 10. Diyarbakır ilinde fabrikaların üretim ve pazarlamada karşılaştıkları sorunlar (%).

	Mill						
Problems	1	2	3	4	5	6	%
1. Problems due to insufficient capital	+	+	-	-	-	-	33.33
2. Problems in the supply of raw materials	+	+	+	+	+	+	100.00
3. Problems due to high raw material prices	+	+	+	-	+	+	83.33
4. Problems due to price instability	-	-	+	-	+		33.33
5. Problems due to transportation	+	+	+	+	+	+	100.00
6. Marketing problems	+	+	+	+	+	+	100.00
7. Problems encountered in the collection	+	+	+	+	+	+	100.00
8. Problems arising from unfair competition	+	+		+		+	66.67
9. Problems due to insufficient storage space	+	-	-	+	-	-	33.33
10. Problems due to storage conditions		+	+	+	-	-	50.00
11. Problems arising from consumer awareness	+	+	+			+	66.67
12. Problems due to a lack of qualified labor	-	-	-	+	-	+	33.33
13. Quality problems caused by the price of the produced feed	-	-	-	+	-	-	16.67

+Yes, - No

In terms of distribution, it was determined that 66.66% of the mills use their own distribution vehicles, 16.50% purchase external services, and 16.50% use both methods. Regarding the issues encountered in marketing, 33.33% of the problems are related to financing, 16.5% to transportation vehicles, and 16.5% to qualified marketing personnel (Table 10). There is no specific literature on marketing and distribution in Türkiye (Tekerli, 2010; Denli et al., 2015; Sıkar and Çimrin, 2020; Başer and Bozoğlu, 2021). Başer and Bozoğlu (2021) report that %88.80 of the produced feed is sold, Sıkar and Çimrin (2020) report 100%, and Denli et al. (2015) report varying percentages. The findings of this study are similar to those of Denli et al. (2015).

In animal feed mills, steam is mostly used during the pellet feed production phase after powdered feed production (Akdeniz et al., 2005). None of the mills in this study use steam, which is inconsistent with the literature (Tekerli, 2010). According to respondents, this discrepancy is due to the ‘lack of pellet production in the mills." Nearly all animal feed mills in Türkiye have a molasses unit (Tekerli, 2010; Akbay and Ak, 2018). According to the survey responses, all mills have a molasses unit, and two mills have an oil addition unit, which is consistent with other studies (Tekerli, 2010; Akbay and Ak, 2018). In animal feed mills, bulk products are mostly sold to producers who buy in high quantities (Tekerli, 2010). In Diyarbakır, however, most mills sell finished products in packages, and only 16.5% also sell bulk products. This is consistent with other studies, but a mismatch was found in terms of quantity (Sıkar and Çimrin, 2020).

In the feed factories, raw materials can be ground either separately or together depending on the mills’ operational setup (Akbay and Ak, 2018). In this study, grinding is done using hammer mills in the mills, although one mill also has a roller mill. The findings regarding the mills in the mills are in line with the literature (Akdeniz et al., 2005; Tekerli, 2010; Akbay and Ak, 2018). However, it was found that some of the mills do not conduct any grinding process. This is a significant problem because it can lead to undigested particles being discarded due to unbroken grains in the mixed feed (Akdeniz et al., 2005).

Half of the mills in this study have a feed analysis laboratory, while the other half do not. The findings on feed analysis align with some studies in the literature but differ from others (Denli et al., 2015; Demir and Elmalı, 2011; Tekerli, 2010). The findings about feed analysis laboratories in feed mills in Türkiye vary regarding the presence of laboratories. Mills without a laboratory carry out their feed analyses in laboratories located in their province, if available, or in laboratories in other provinces (Tekerli, 2010; Demir and Elmalı, 2011; Denli et al., 2015). Similarly, in this study, mills without a laboratory conduct their feed analyses at the Diyarbakır Commodity Exchange Laboratory and the Provincial Directorate of Agriculture and Forestry.

Table 11. Some situations of mills in Diyarbakır province during the Covid-19 process.
Tablo 11. Covid-19 sürecinde Diyarbakır ilindeki fabrikaların bazı durumları.

	Mill						
Problems	1	2	3	4	5	6	%
1 Has any cash aid been received from the state?	+	+	+	+	+	+	100.00
2 Has any rent aid been received from the state?	+	+	+	+	+	+	100.00
3 Has any short-time work allowance been received from the state?	+	+	+	+	+	+	100.00
4 Has there been a decrease in collection?	+	+	+	+	+	+	100.00
5 Has any technical staff been laid off?	+	+	+	+	+	+	100.00
6 Has any workers been laid off?	+	+	+	-	+	+	83.33
7 Has the production amount decreased?	-	+	+	+	-	-	50.00
8 Has the sales amount increased?	-	-	-	+	-	-	16.67

+Yes, - No

Standards such as HACCP and ISO 22000 play crucial roles in eliminating risk factors associated with animal feed and, consequently, in ensuring the safety of animal-derived products for human consumption (Budağ, 2011b). The quality certifications held by animal feed mills in Türkiye and the proportion of mills holding these certificates vary by province (Budağ, 2011a; Özek, 2020). According to Özek (2020), in the province of Balıkesir, mills have HACCP, ISO 2200 Food Safety Management System, ISO 2200, ISO 9001, and K-Q TSE-ISO-EN 9000 Quality Management System certificates. Similary, Budağ (2011a) reported that most active animal feed mills in Van province possess at least one quality certificate. In line with these findings, this study determined that two factories hold only HACCP certification, one holds TSI-EURO GAP-ISO, another holds HACCP-TSI, one has ISO 9001-2015/ISO 22000-2018, while one factory lacks any quality certification...

Three-quarters of the mills have sufficient storage capacity, yet half of them experience storage issues in their warehouses, and all mills have silo-type storage. One mill uses open space (covered/uncovered piles) and warehouse-type storage. These findings are similar to studies on silo adequacy, silo issues, and storage types in animal feed mills (Tekerli, 2010; Denli et al., 2015; Özek, 2020; Sıkar and Çimrin, 2020).

Transportation costs are a significant expense item, directly impacting business profitability. Therefore, businesses that operate at full capacity handle transportation themselves, while businesses operating below full capacity use transport companies. It is reported that mills with low capacity utilization use transport companies because purchasing vehicles for distribution would result in higher costs (Demir and Elmalı, 2011; Başer and Bozoğlu, 2021). In this study, most of the mills operating in Diyarbakır distribute the feed they produce with their own vehicles (Table 10). This contradicts the situation associated with capacity utilization (Başer and Bozoğlu, 2021).

In studies on the problems of animal feed mills, the priority of issues varies by region and province (Anonymous, 2011; Demir and Elmalı, 2011; Denli et al., 2015; Özek, 2020). The priority order of issues in production in this study is as follows: First, raw material supply issues, transportation-related problems, marketing problems, and issues with collections. Second, issues related to high raw material prices. Third, problems arising from unfair competition and consumer awareness, fourth, problems related to storage conditions, fifth, issues caused by insufficient capital, price instability, insufficient storage space, and problems finding qualified labor, and sixth, quality concerns arising from feed price fluctuations (Table 10). The findings

of this study are not consistent with those of Denli et al. (2015), but they are similar to the studies of Demir and Elmalı (2011) and Özek (2020).

During the pandemic, most feed mills reduced their workforce; however, none of themlaid off technical staff (Table 11). As seen in Table 11, in half of the mills, production volumes decreased, in one-third they remained unchanged, and in one-sixth, production increased. However, in 5 out of 9 mills, product sales volumes decreased. The Covid-19 pandemic triggered a global crisis that significantly impacted all sectors, including animal production. Feed producers were clearly affected by the negative effects seen in both social and economic life. Similar to other commercial sectors, the negative impacts on various aspects were also reflected in the feed industry (ILO, 2020). The difficulties identified in the study include reduced demand, decreased production, worker layoffs, and difficulties in collecting payments (ILO, 2020). Additionally, all surveyed mills reported that they did not receive any form of financial support, including cash aid, rent assistance, or short-term employment allowances from the government during the Covid-19 process.

Conclusion

In the study, the issues observed in the animal feed mills in Diyarbakır province include a high number of workers but a lack of technical personnel, non-homogeneous distribution of personnel, low CUR, difficulties in raw material procurement, high raw material prices, limited variety of feed products, low demand for mill produced feed despite the region's animal population, feed quality issues, problems with payment collection, unfair competition, high transportation costs, low capital, and price instability. On the positive side, the mills have sufficient installation capacities, face minimal storage issues, and do not experience general staffing shortages, except for technical personnel.

An analysis of the issues faced in the province, reveals that these problems are similar to those experienced by the feed industry in other regions of Türkiye. Therefore, it seems inevitable to establish a nationwide organization to address the problems of animal feed mills. The structure of the organization to be created should include universities, research institutions, the Ministry of Agriculture and Forestry, the Türkiye Feed Industrialists Union, and large feed producer companies. Through collaboration and identification of problems by these institutions, the issues in the sector should be addressed through macro policies. Moreover, the problem areas identified by various researchers and research institutions should be addressed individually, and realistic and sustainable solutions should be developed.

In this context, for example, efforts should focus on increasing raw material production and/or reducing costs while faciliting access to alternative raw material sources. Additionaly, iniatives implemented to enhance the knowledge level of industry producers and consumers. Measures should also be taken to increase both the quantity and variety of production while exploring new market opportunities domestically and internationally. For instance, opening the way for product sales to consumers in countries close to Diyarbakır and facilitating the sales process should be considered. Moreover, to prevent unfair competition, quality-related issues must be resolved, and unregistered operations must be prevented.

In all production processes, including raw material procurement, production processes, and marketing, technical personnel deficiencies should be addressed to increase quality. In particular, technicians, technical staff, and engineers should specialize in feed production.

Ethics Committee

Since the period during which the research was conducted did not require ethics committee approval and no live material was used that would require an ethics committee, no ethics committee approval certificate was obtained.

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