

# A quantitative analysis of the truffle market in the Western Mediterranean Region using the R'WOT Technique

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## Abstract

Speciality food products are part of a market that has attracted attention in recent years. The demand for these products is growing. Forests are also the source of different types of special food products. Among them, truffles (genus Tuber) are a kind of specially grown forest product and edible mushrooms with a complex life cycle. The aim of this study is to carry out SWOT analyses for the development of the truffle market in the Western Mediterranean region, and then to ensure that the strategies to be followed for this market are prioritized in a participatory manner. In the study, "snowball (chain) sampling" was applied. The participants of the study consisted of representatives of the following interest groups, consisting of a total of 113 people: master chefs, distributors, truffle collectors and growers (producers), representatives of the Forestry Organization, restaurateurs, retailers and truffle experts. In this study, the "R'WOT Technique" was used as a method. When the findings and results of the research are examined, according to all the participants included in the study and the R'WOT Technique analysis, "Application of environmentally friendly cultivation methods" and "Advantages" are the most prominent factors of the SWOT group. All participants of the study prioritized the factor of "Lack of experienced staff" in the "Weaknesses" SWOT group. Again, among the factors in the "Opportunities/Possibilities" SWOT group, the factor of "having the potential to be used in tourism" was determined as the most priority factor for all participants. Finally, according to all respondents, the "Challenges encountered in the truffle market" factor was the highest priority factor of the "Threats/Hazards" SWOT group.

**Keywords:** Western Mediterranean, R'WOT Technique, Truffle, Türkiye

## Turkish Abstract (Özet)

Özel gıda ürünleri, son yıllarda dikkat çeken bir piyasa kapsamında yer almaktadır. Bu ürünlere yönelik talep giderek büyümektedir. Ormanlar da farklı özel gıda ürünleri çeşitlerine kaynaklık etmektedir. Bunlar arasında yer alan trüfler (Tuber cinsi), bir çeşit özel biçimde yetişen orman ürünü olup karmaşık bir yaşam döngüsüne sahip yenilebilir mantarlardır. Bu çalışmanın amacı; Batı Akdeniz bölgesi trüf piyasasının geliştirilmesine yönelik SWOT çözümleri gerçekleştirmek, sonrasında bu piyasaya yönelik izlenecek stratejilerin katılımcı şekilde önceliklendirilmesini sağlamaktır. Çalışmada "kartopu (zincir) örnekleme" uygulanmıştır. Çalışmanın katılımcılarını toplam 113 kişiden oluşan şu ilgi grubu temsilcileri oluşturmuştur: usta aşçılar, dağıtım yapanlar, trüf toplayıcıları ve yetiştiricileri (üreticileri), Orman Teşkilatı temsilcileri, lokanta sahipleri, perakendeciler ve trüf uzmanları. Bu çalışmada yöntem olarak "R'WOT Tekniği" kullanılmıştır. Araştırmanın bulguları ve sonuçları incelendiğinde, çalışmaya dahil olan tüm katılımcılara ve R'WOT Tekniği çözümlerine göre "Çevre dostu yetiştirme metotlarının uygulanması", "Üstünlükler" SWOT grubunun en öne çıkan faktörüdür. Çalışmanın tüm katılımcıları tarafından "Zayıflıklar" SWOT grubunda yer alan "Tecrübeli elemanların yeterince olmaması" faktörü ön plana alınmıştır. Yine

tüm katılımcılar için "Fırsatlar/Olanaklar" SWOT grubundaki faktörlerden "Turizmde kullanım potansiyelinin olması" faktörü en öncelikli faktör olarak belirlenmiştir. Nihayet yine tüm katılımcılara göre "Trüf piyasasında karşılaşılan zorluklar" faktörü, "Tehditler/Tehlikeler" SWOT grubunun en yüksek öncelikli faktörü olmuştur.

**Anahtar kelimeler:** *Batı Akdeniz, R'WOT tekniği, Trüf, Türkiye*

## 1. Introduction

The Food and Agriculture Organization of the United Nations (FAO) estimates that 80% of developing countries depend on non-wood forest products for their nutrition, health, material and income needs (FAO, 2002). However, the place of non-wood forest products in the livelihoods of rural households is not well understood.

Some of the non-wood forest products, such as truffles, have not been important for years, even though they have a high economic value (Gold et al., 2004). But, non-wood forest products have many direct benefits in terms of income generation, employment creation and foreign exchange savings. With the multifaceted benefits they provide, these products can provide greater income to rural areas in some regions than wood raw material production. In fact, in many cases, this income is even greater than that generated by growing traditional agricultural crops. For this reason, the protection and sustainable management of non-wood forest product resources is important.

Commercial mushrooms collected and sold from forests are also considered as non-wood forest products by forest resources managers. The collection of mushrooms in the forest within the scope of non-wood forest products, whether for subsistence or commercial purposes, has played an important role throughout human history. The collection of mushrooms for food, medicine, etc., has been indispensable in the life of rural communities.

Considering the growing environmental requirements and environmental factors (climatic and soil factors) of truffles, which are one of the non-wood forest products, it is seen that they grow naturally mainly in the Mediterranean, Aegean and Marmara regions. In addition, although it is not well known, truffles are naturally available in Central Anatolia and the Black Sea regions.

When we look at the differences of truffles from other edible mushrooms, first of all, it is seen that their taste and smell, that is, their aroma, are different. On another hand, while other types of edible mushrooms are cooked, truffles are not cooked. Truffles are a kind of fresh spice and are used as a condiment with meals.

People primarily prefer fresh truffles, and the demand for processed truffles is not intense. Approximately 30% of the fresh truffles collected and grown in our country go to the processing industry. Truffles that are shredded and seem to be of no use are processed. More truffle oil is obtained from processed truffles. In addition, honeys, butters and creams with truffle taste and smell are also produced as processed truffles.

Collecting wild truffles can be a relatively profitable activity. Because in this case, only the cost of the trained dog and the cost of collection will be in question. The cultivation of truffles in the garden, on the other side, is not very profitable in the short term, but is a profitable venture in the long term. For this reason, horticulture is not suitable for small farmers who rely only on this business, but is more suitable for large operators.

In order to reduce the cost of truffle cultivation and increase its profitability in the Western Mediterranean region, lavender oil is obtained and sold by planting lavender seedlings between truffle seedlings. As another cost-reducing activity, it can be stated that the truffle garden should be established in barren land, not in fertile land. It is important to establish the truffle garden in the barren land, thus reducing the cost of establishment and therefore the cost of investment.

The truffle sector is a promising sector for our country and therefore for the Western Mediterranean region. Because the tourism sector has developed in the Western Mediterranean region. In the tourism sector, local tastes are important. Since truffles are extracted in this region, they are a local food. In other words, truffles have the potential to be used in the form of local flavors in terms of gastronomy in the tourism sector. On the other contrary, our country, and therefore the Western Mediterranean region, has a great development capacity in the truffle sector if the right truffle type or species are chosen. Another promising issue is that as

the truffle sector develops in the Western Mediterranean region, the truffle-oriented industry will also develop. Thus, the truffle-oriented industry will contribute to the development of the region.

There are no official records due to the low amount of truffle collection in the Western Mediterranean region and the fact that domestic trade is generally carried out through unregistered and unofficial ways. On the other side, truffles are also sold abroad from the region and our country. Furthermore, this sale is also mostly made through unregistered, illegal ways. Especially in Bulgaria and Greece, truffles are sold illegally. In addition, truffles are sold abroad through official means, that is, in a registered form, albeit a little. Whereas it is not possible to reach reliable sales figures in this regard.

Conscious collection of truffles and protection of their habitat is another priority issue. In this context, first of all, those who collect truffles and trained dogs should not tear the truffle apart. In case of fragmentation, the quality of the truffle decreases, and the unit price decreases. All truffles are high-quality truffles and have a high unit price. Afterwards, it is important to collect the truffle on time (in season). If the truffle is picked early, it will be unripe, and if it is picked late, it will deteriorate. Another issue is that not all truffles in the area are collected. Some truffles should be left for wild animals such as pigs and squirrels in the vicinity, so that these animals spread the truffle to the environment, and the possibility of abundant truffles in the next year increases.

Their mycelia establish a mycorrhizal interaction in the form of symbiosis with the roots of oak, poplar, willow and hazel trees, as well as some shrubs. They are known all over the world as a commercially valuable and scarce food item. This food has a distinctive odor that results from a mixture of hundreds of volatile chemicals (Mello et al., 2006). Its special qualities with its distinctive features such as scarcity, limited availability and pleasant properties, cause truffles to be priced as an unusual, luxurious and expensive source of pleasure in international food markets (Tsitsipati and Athanasios 2014, with reference to Ciani et al., 1992). Despite this, it is worth mentioning the opinions that may lead to debate and disagreement regarding truffles. The optimistic of these is that this work is evaluated positively for the rural economy. The other view is related to the fact that truffle cultivation and trade are seen as high-risk activities, although they are in demand all over the world. In addition, the lack of market knowledge and limited experience in production methods may cause problems and disorder among the relevant groups.

The value of truffles, which is increasing every day around the world, is expected to reach a value of \$6 billion in terms of trade volume over the next ten years. If the established truffle gardens yield produce and the number of hunters gathering them from nature increases, our country aims to capture a \$1 billion share of the world market during this period. Truffle species grow in a limited geographical area around the world and in limited quantities. However, the growing global demand cannot be met. Today, cultivating truffles and harvesting them from natural areas has become a global industry. Known as the 'black diamond' worldwide, truffles grow naturally in the Mediterranean climate zone, which includes Spain, France, Italy, and Türkiye. Due to their limited natural distribution and low harvest quantities, their prices vary between 100 and 1,500 euros depending on the variety and quality. Despite the increasing global demand for truffles, the continuous decline in production is causing prices to rise. Fifty percent of the truffles offered on the world market are Fresh Black Summer Truffles (*Tuber aestivum* and *Tuber uncinatum*), while the other 50% are Winter Black Truffles (*Tuber melanosporum*) and Bianchetto truffles (White Truffles = *Tuber*). Globally, 60% of truffles are sold fresh, while the remaining 40% are sold in processed form (Özkan, 2021).

In this study, the truffle mushroom sector in the Western Mediterranean Region was examined in terms of various factors affecting the sector, such as production, marketing, and management. Data was obtained through techniques such as face-to-face surveys and in-depth individual interviews conducted with interest groups. SWOT and RWOT techniques were used in the evaluation of the study data. These techniques are shared in detail in the relevant section. This technique has been used in scientific studies in the literature (Sezgin et al., 2020; Yılmaz et al., 2020; Kayacan et al., 2020; Acar and Önalın, 2019; Şimga, 2019; Öztekin, 2019; Köse et al., 2018; Dönmez et al., 2015; Öztürk, 2015; Öztürk and Tönük, 2014; Gürbüz and Öztürk, 2013; Kılıçaslan et al., 2012; Öztürk, 2011; Yılmaz et al., 2009b; Sönmezler, 2008).

The aim of this research; To carry out SWOT analyses related to the development of the truffle market in the Western Mediterranean region, and then to ensure that the strategies related to this market are determined and prioritized in a participatory manner.

## 2. Materials and Methods

### 2.1. Material

The material of the study was the "R'WOT Information Forms" prepared for the participants in order to determine the suitability of the truffle market for the Western Mediterranean region. In the development of these forms, the findings obtained in another study on the subject (Yılmaz, 2024) have been guiding. Thus, it was ensured that the R'WOT Information Forms prepared were filled in by each of the interest groups participating in the study.

Interest groups in the Regional Directorates of Forestry (Isparta, Antalya, Denizli and Muğla) within the borders of the Western Mediterranean Forestry Research Institute participated in this research. A total of 113 people participated in the research, including 3 people from truffle collectors and growers, 34 people from professional chefs, 14 people from restaurant owners, 3 people from distributors, 25 people from retailers, 30 people from Forestry Organization representatives and 4 people from truffle experts.

### 2.2. Method

#### 2.2.1. Sampling method

In the study, "snowball (chain) sampling" (Baltacı, 2018), which is within the scope of "non-probability-based sampling" methods (Koç Başaran, 2017), was applied.

#### 2.2.2. Evaluation method

In this study, "R'WOT Technique" was used as the evaluation method (Yılmaz, 2006). In this technique, the "Ranking technique (ST)" used to determine the priority values of the decision elements and the "Linear Combination technique (SLT)" used to solve multi-criteria decision-making problems are integrated with "SWOT Analysis". Thus, the R'WOT Technique helps to make correct, effective and realistic decisions by supporting the decision-making process.

In this approach, the 'Ranking Technique (ST)' used to determine the priority values of decision elements and the 'Linear Combination Technique (DKT)' used to solve multi-criteria decision-making problems are integrated with the 'SWOT Analyses' described above. Thus, the R'WOT Technique, created by incorporating ST and DKT into SWOT Analyses, enables the numerical determination of priorities for SWOT groups and SWOT factors within each SWOT group, making them measurable. Ultimately, the R'WOT Technique reveals the order of importance of SWOT groups and SWOT factors within each SWOT group. Thus, the R'WOT Technique supports the decision-making process, helping to make accurate, effective, and realistic decisions.

It is considered useful and necessary to briefly explain the principles of using the techniques that constitute the R'WOT Technique within the scope of the R'WOT Technique. As mentioned above, in the R'WOT Technique, RT and DKT are used within the framework of SWOT Analyses. Since SWOT Analyses have been discussed previously, there is no need for further explanation. Therefore, the techniques used within the R'WOT Technique, excluding SWOT Analyses, namely ST and DKT, have been explained first. Subsequently, the solution stages that should be followed in the R'WOT Technique have been discussed.

Ranking Technique (ST): Within the R'WOT Technique, this technique is used to determine the relative priority values of SWOT groups and SWOT factors within each SWOT group. For this purpose, SWOT groups and SWOT factors within each SWOT group are assigned relative priority levels. Subsequently, the SWOT groups and the SWOT factors within each SWOT group are ranked accordingly. This ranking process is carried out using a 'nine-point scale.' In this scale,

- 1- Weakly important
- 3- Less important
- 5- Moderately important
- 7- More important
- 9- Extremely important

has been accepted. In addition, the values '2, 4, 6, and 8' can also be used as intermediate values. Thus, the relative priority values of SWOT groups and SWOT factors within each SWOT group are calculated based on the order assigned to each SWOT group or SWOT factor (Yilmaz, 2006).

For example, let us assume that a (k) decision-maker assigns a ranking of  $rkj1, rkj2, \dots, rkjm$  to the SWOT factors belonging to the jth SWOT group. According to this, the relative priority value  $X_{ji}$  of the ith SWOT factor in the jth SWOT group can be calculated using ST as follows when  $m \leq 9$ :

$$X_{ji} = \frac{\sum_k r_{kji}}{\sum_k \sum_i r_{kji}} \quad 1$$

Linear Combination Technique (LCT): In the analysis process using the R'WOT Technique, this technique multiplies the relative priority values of each SWOT factor by the relative priority value of the SWOT group to which these factors belong. This allows the relative priority values of SWOT factors to be placed on the same scale, making them comparable with each other. Ultimately, the order of importance of a SWOT factor within a specific SWOT group is obtained by multiplying the relative priority value of the SWOT factor by the relative priority value of the SWOT group to which this factor belongs. Thus, a mathematical 'linear combination' operation is performed.

The linear equation used in this technique can be represented as follows (Yilmaz, 2006):

$$P_{ji} = W_{ji}X_{ji} \quad 1$$

in this formula,

$P_{ji} = j$ . The final priority value of the i. SWOT factor in the SWOT group,

$W_{ji} = i$ . The relative (and also final) priority value of the j. SWOT group that includes the SWOT factor,

$X_{ji} = j$ . The relative priority value of the i. SWOT factor in the SWOT group.

$X_{ji} = j$ . The relative priority value of the i. SWOT factor in the SWOT group

Solution Stages of the R'WOT Technique: To help understand the R'WOT technique, the analysis process that should be followed when using this technique can be divided into the following stages (Yilmaz, 2006):

Stage 1. SWOT Analyses are Conducted: For SWOT analyses, SWOT groups consisting of four main headings, namely Strengths, Weaknesses, Opportunities/Possibilities and Threats/Dangers, are first determined. Then, for each of these SWOT groups, SWOT factors are listed as objectively as possible. The SWOT groups obtained and the SWOT factors in each SWOT group are then included in the SWOT Analysis. However, it is stated that the human brain can compare a maximum of  $7 \pm 2$  elements at the same time (Schmoltd et al., 1995). Therefore, care should be taken to ensure that the number of SWOT factors within each SWOT group does not exceed nine.

Stage 2. Comparisons are made for the four SWOT groups: In this stage of the R'WOT technique, the decision-maker(s) are asked to make comparisons between the SWOT groups. While these comparisons are being made, the following questions are asked: (1) Which of the four SWOT groups (Strengths, Weaknesses, Opportunities/Possibilities, and Threats/Dangers) is/are more preferred (important)? and (2) How much more preferred is the more preferred SWOT group/groups compared to the other/others? Through these questions, the decision-maker(s) is/are asked to indicate a judgement regarding the priority of each SWOT group. The responses obtained will then be used as data in calculating the relative priority values of the SWOT groups using ST. Ultimately, the sum of the relative priority values of the SWOT groups calculated using ST will equal one.

Stage 3. Comparisons are made for the SWOT factors in each SWOT group: In the R'WOT technique, at this stage, the decision-maker(s) is/are asked to make comparisons between the SWOT factors belonging to each SWOT group. For this purpose, the decision-maker(s) are asked, separately for each SWOT group, questions similar to those in Stage 2 of the R'WOT Technique: (1) Which of the SWOT factors identified in the SWOT Analysis of the first stage of the R'WOT Technique do they prefer more? and (2) How much more do they prefer the SWOT factor/factors they prefer more than the other/others? Based on the responses provided, the relative priority values of the SWOT factors are calculated for each SWOT group using ST. These relative priority values reflect the relative advantages of the decision-maker(s) regarding the SWOT factors. At this stage, the sum of the relative priority values of the SWOT factors obtained using ST is equal to one for each SWOT group.

4. Stage. The Final Priority Value of Each SWOT Factor is Determined: In this stage of the R'WOT technique, numerical calculations within the scope of DKT are performed. Here, the relative priority value of each SWOT group calculated based on the comparisons made in Stage 2 is multiplied separately by the relative priority value of each SWOT factor in this group found according to the comparisons in Stage 3. Thus, the final priority value of each SWOT factor within the relevant SWOT group is obtained. This process must be performed separately for each of the four SWOT groups. As a result, the priority values of all SWOT factors with a total value of one are obtained.

As a result of the R'WOT Technique, the SWOT groups identified in SWOT Analyses and the priorities of each SWOT factor within each group are determined numerically. Thus, both SWOT groups and all SWOT factors are ranked in order of importance. This allows for a more realistic and detailed interpretation of SWOT Analyses.

### 3. Discussion

Some key assessments for the truffle mushroom sector are presented below under main headings.

- The Unique and Luxurious Qualities of Truffles; Opinions on the quality of truffles in the Western Mediterranean region; There is a preference for harvesting truffles whole. Therefore, training for truffle harvesters is necessary. It has been determined that truffles differ from other edible mushrooms in terms of taste and aroma and are classified as gourmet foods.
- The Profitability of Truffle Harvesting from Nature and Its Contribution to Rural Development; This mushroom species is primarily harvested from forest areas. Participants noted that the harvesting of truffles from rural areas and the high market price of truffles are significant as they provide a new income source for those living in rural areas.
- The priority of local and fresh consumption of truffles in market conditions; in cases where this product is processed and imported; it has been determined that processed truffles do not use real truffles, but only chemical aromas, making the use of local products advantageous and more economical.
- The truffle mushroom sector is not sufficiently recognised, there is a lack of experienced and trained workers, and truffle cultivation in gardens is not very profitable in the short term, as the product can only be harvested after 6-7 years. This means that it is a long-term investment and is not considered a profitable investment in the short term.
- The high price of truffles in the market means they are not widely or highly demanded by consumers. As a result, their various uses in households are not sufficiently known. The lack of awareness during the collection process from nature, and the inability to use dogs with sufficient training during collection, leads to a decrease in the market value of the product obtained.

#### 3.1. SWOT groups are to be provided with identification of evaluation criteria that will contribute to the management and marketing of the truffle mushroom sector.

To determine the potentials and constraints for the development of truffle market opportunities in the Western Mediterranean region, firstly, SWOT Analysis was carried out (Yılmaz, 2024a). For this purpose, individual in-depth interviews with the participants involved in the research, observations and investigations in the field, and the literature on the subject were used. While performing SWOT Analysis, first of all, all possible SWOT factors were determined, then some factors were removed and some were collected under a single factor.

Thus, the SWOT groups to be considered for the development of truffle market opportunities in the Western Mediterranean region and the SWOT factors under each SWOT group were determined. In other words, with the SWOT Analysis, the current situation of the truffle market in the Western Mediterranean region, namely its "Advantages" and "Weaknesses", "Opportunities/Possibilities" and "Threats/Dangers" were determined (Yılmaz, 2024b).

Accordingly, the SWOT factors to be included in the "Advantages" group of the SWOT Analysis to be considered in the evaluation of the truffle market opportunities in the Western Mediterranean region have emerged as reflected in Table 1.

**Table 1.** Strengths Identified for the Development of the Truffle Market in the Western Mediterranean Region

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|                                               |                                                                                   |
|-----------------------------------------------|-----------------------------------------------------------------------------------|
| SWOT Factors in the "Superlatives" SWOT Group |                                                                                   |
| 1.                                            | Special and luxurious qualities of truffles                                       |
| 2.                                            | Collecting truffles from nature is a profitable business                          |
| 3.                                            | Supporting rural development                                                      |
| 4.                                            | Application of environmentally friendly cultivation methods                       |
| 5.                                            | Preferring domestic truffles rather than imported truffles                        |
| 6.                                            | Preventing deterioration by processing and obtaining various products in this way |
| 7.                                            | The lower price of domestic truffles                                              |

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The SWOT factors in the "Weaknesses" group of the SWOT Analysis regarding the truffle market opportunities in the Western Mediterranean region are presented in Table 2.

**Table 2.** SWOT Factors in the SWOT Group of "Weaknesses" in the SWOT Analysis for the Development of Truffle Market Opportunities in the Western Mediterranean Region

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|                                             |                                                                                                  |
|---------------------------------------------|--------------------------------------------------------------------------------------------------|
| "Weaknesses" SWOT Factors in the SWOT Group |                                                                                                  |
| 1.                                          | Lack of experienced staff for the truffle industry                                               |
| 2.                                          | The fact that the cultivation of truffles in the garden is not very profitable in the short term |
| 3.                                          | Not widely adopted by consumers due to its high selling price                                    |
| 4.                                          | Not selective harvesting the truffle                                                             |
| 5.                                          | Consumer awareness of truffles remains limited Inadequate truffle promotion                      |
| 6.                                          | Being one of the high-risk activities                                                            |

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The SWOT factors that are considered appropriate to be included in the "Opportunities/Possibilities" group of the SWOT Analyzes used to evaluate the truffle market potential of the Western Mediterranean region are given in Table 3.

**Table 3.** SWOT Factors in the SWOT Group of "Opportunities/Possibilities" in the SWOT Analysis for the Development of Truffle Market Opportunities in the Western Mediterranean Region

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|                                                              |                                                                                           |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| SWOT Factors in the "Opportunities/Possibilities" SWOT Group |                                                                                           |
| 1.                                                           | Growing interest in truffles                                                              |
| 2.                                                           | High economic value                                                                       |
| 3.                                                           | Existence of the "Truffle Promotion and Research Association"                             |
| 4.                                                           | Be a promising business activity                                                          |
| 5.                                                           | Increasing national and international demand                                              |
| 6.                                                           | A new truffle-oriented industry is emerging                                               |
| 7.                                                           | Its potential to be integrated into new gastronomic experiences within the tourism sector |

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In the "Threats/Hazards" group of SWOT Analysis for the truffle market potential in the Western Mediterranean region, there are SWOT factors listed in Table 4.

**Table 4.** SWOT Factors in the SWOT Group of "Threats/Hazards" in the SWOT Analysis for the Development of Truffle Market Opportunities in the Western Mediterranean Region

| <i>SWOT Factors in the "Threats/Hazards" SWOT Group</i> |                                                                                                 |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1.                                                      | Lack of detailed market information                                                             |
| 2.                                                      | Difference in quality and production volume                                                     |
| 3.                                                      | Having a small group of consumers                                                               |
| 4.                                                      | The price of truffles is variable                                                               |
| 5.                                                      | Lack of a national framework law                                                                |
| 6.                                                      | Availability of truffles from other countries with close competition                            |
| 7.                                                      | Challenges in truffle harvesting, marketing, cultivation and new entrants to the truffle market |

As a result of the SWOT Analysis, an examination of the issues related to the truffle market in the Western Mediterranean region was provided. The positive aspects in terms of the truffle market in the Western Mediterranean region are shown by "Strengths". "Weaknesses" are issues that negatively affect the development of the truffle market in the Western Mediterranean region. "Opportunities" are factors that are worth developing in terms of the truffle market in the Western Mediterranean region. "Threats/Dangers" are the limiting issues of the truffle market in the Western Mediterranean region. Thus, within the framework of SWOT Analysis, the characteristics of the Western Mediterranean region that are suitable for the truffle market are classified within the scope of "Advantages" and "Opportunities/Possibilities", and the unsuitable ones are classified within the scope of "Weaknesses" and "Threats/Dangers".

Once the SWOT Analysis is complete, it is important to take advantage of the information gathered. It should be acted on the basis of "superiorities" and using their full potential. The risks of "weaknesses" must either be minimized or modified to overcome them. "Weaknesses" should be transformed into "Advantages" as much as possible. Then, it should be aimed to take advantage of every "Opportunity" in front of the truffle market in the Western Mediterranean region. Afterwards, it is necessary to be aware of the existing "Threats/Dangers" in order to achieve the goals and to try to transform these "Threats/Dangers" into "Opportunities/Possibilities".

### **3.2. Participants' assessment of the priority levels of criteria in the management and marketing of the truffle mushroom sector**

#### ***3.2.1. Participants' assessment of criteria for the management and marketing of the truffle mushroom sector according to SWOT priority levels***

In this study, a total of 113 participants consisting of master chefs, truffle collectors and producers, distributors, restaurateurs, retailers, Forestry Organization representatives and truffle experts in the Western Mediterranean region were made to compare the SWOT groups and the SWOT factors within each SWOT group. The comparison data obtained in this way constituted the inputs of the R'WOT Technique analyses. Thus, with the help of the R'WOT Technique, the SWOT groups and the priority values of the SWOT factors in each SWOT group were reached for each participant. In this study, there was equal priority (importance, weight) for the participants. For this reason, the arithmetic averages of these priority values of the participants were calculated. Thus, the overall priority values presented in Table 5 for the SWOT groups and the SWOT factors within each SWOT group were obtained.

Looking at the general priority values in Table 5, as a result of this study, it was determined that the SWOT group with the highest priority was the "Superiority" group with a priority value of 0.27662. This was followed by the "Opportunities/Possibilities" SWOT group with a priority value of 0.26629 and the "Weaknesses" SWOT group with a priority value of 0.22877, respectively. conversely, the "Threats/" SWOT group was found to have relatively low importance compared to other SWOT groups with a priority value of 0.22832.

**Table 5.** Analysis of the "R'WOT Technique" for All Participants

| SWOT GROUPS                  | PRIORITY              | SWOT FACTORS                                                                                                  | PRIORITY              |
|------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Superlatives</b>          | <b><u>0.27662</u></b> | Special and luxurious qualities of truffles                                                                   | 0.04045               |
|                              |                       | Collecting truffles from nature is a profitable business                                                      | 0.03711               |
|                              |                       | Supporting rural development                                                                                  | 0.04056               |
|                              |                       | <b><u>Application of environmentally friendly cultivation methods</u></b>                                     | <b><u>0.04136</u></b> |
|                              |                       | Preferring domestic truffles rather than imported truffles                                                    | 0.04072               |
|                              |                       | Preventing deterioration by processing and obtaining various products in this way                             | 0.03832               |
|                              |                       | The lower price of domestic truffles                                                                          | 0.03811               |
| Weaknesses                   | 0.22877               | <b><u>Lack of experienced staff for the truffle industry</u></b>                                              | <b><u>0.03450</u></b> |
|                              |                       | The fact that the cultivation of truffles in the garden is not very profitable in the short term              | 0.03054               |
|                              |                       | Not widely adopted by consumers due to its high selling price                                                 | 0.03290               |
|                              |                       | Not selective harvesting the truffle                                                                          | 0.03408               |
|                              |                       | Truffles are not widely known among consumers                                                                 | 0.03276               |
|                              |                       | Inadequate truffle promotion                                                                                  | 0.03381               |
|                              |                       | Being one of the high-risk activities                                                                         | 0.03019               |
| Opportunities/<br>Facilities | 0.26629               | Growing interest in truffles                                                                                  | 0.03705               |
|                              |                       | High economic value                                                                                           | 0.03897               |
|                              |                       | Existence of the "Truffle Promotion and Research Association"                                                 | 0.03621               |
|                              |                       | Be a promising business activity                                                                              | 0.03793               |
|                              |                       | Increasing national and international demand                                                                  | 0.03829               |
|                              |                       | A new truffle-oriented industry is emerging                                                                   | 0.03799               |
|                              |                       | <b><u>Its potential to be integrated into new gastronomic experiences within the tourism sector</u></b>       | <b><u>0.03983</u></b> |
| Threats/                     | 0.22832               | Lack of detailed market information                                                                           | 0.03342               |
|                              |                       | Difference in quality and production volume                                                                   | 0.03232               |
|                              |                       | Having a small group of consumers                                                                             | 0.03202               |
|                              |                       | The price of truffles is variable                                                                             | 0.03216               |
|                              |                       | Lack of a national framework law                                                                              | 0.03318               |
|                              |                       | Availability of truffles from other countries with close competition                                          | 0.03141               |
|                              |                       | <b><u>Challenges in truffle harvesting, marketing, cultivation and new entrants to the truffle market</u></b> | <b><u>0.03381</u></b> |

(The SWOT Group with the Highest Priority and the SWOT Factor within each SWOT Group are shown in bold black letters and underlined)

All participants ranked the SWOT factors in the "Advantages" SWOT group in order of importance as follows:

1. Application of environmentally friendly cultivation methods (0.04136)
2. Preferring domestic truffles rather than imported truffles (0.04072)
3. Supporting rural development (0.04056)
4. Special and luxurious qualities of truffles (0.04045)
5. Preventing deterioration by processing and obtaining various products in this way (0.03832)
6. Lower price of domestic truffles (0.03811)
7. Collecting truffles from nature is a profitable business (0.03711)

*The SWOT factors in the "Opportunities/" SWOT group were prioritized by all participants as follows:*

1. Potential for use in the form of new flavors in the tourism sector (0.03983)
2. High economic value (0.03897)
3. Increasing national and international demand (0.03829)
4. A new truffle industry is emerging (0.03799)

5. Promising business activity (0.03793)
6. Growing interest in truffles (0.03705)
7. Existence of the "*Truffle Promotion and Research Association*" (0.03621)

*The SWOT factors in the "Weaknesses" SWOT group for all participants had the following order of priority:*

1. Lack of experienced personnel for the truffle industry (0.03450)
2. Lack of deliberate collection of truffle (0.03408)
3. Insufficient truffle promotion (0.03381)
4. Not widely adopted by consumers due to high selling price (0.03290)
5. Truffles are not widely known among consumers (0.03276)
6. Truffle cultivation in the garden is not very profitable in the short term (0.03054)
7. Being one of the high-risk activities (0.03019)

*The SWOT factors in the "Threats/Hazards" SWOT group were ranked in order of importance by all participants as follows:*

1. Challenges in truffle harvesting, marketing, cultivation and new entrants to the truffle market (0.03381)
2. Lack of detailed market information (0.03342)
3. Lack of a national framework law (0.03318)
4. Difference in quality and production volume (0.03232)
5. Truffle price fluctuates (0.03216)
6. Have a small group of consumers (0.03202)
7. Availability of truffles from other countries with close competition (0.03141)

### ***3.2.2. Participants evaluated the criteria for the management and marketing of the truffle mushroom sector for all SWOT priority levels.***

Based on the comparisons made by all participants included in the study for the truffle market potential and constraints in the Western Mediterranean region, the priority order of all SWOT factors is given in Table 6 according to the overall priorities revealed with the help of the R'WOT Technique.

Accordingly, when the "Advantages", "Weaknesses", "Opportunities/Possibilities" and "Threats/Dangers" determined in terms of the truffle market of the Western Mediterranean region and the judgments and priorities given by all participants regarding them are evaluated as a whole, the priority factors to be taken into account in the strategies, planning and management for the development of the truffle market have been determined.

Accordingly, when Table 6 is taken into account, it is seen that the following six "Advantages" SWOT factors are among the ten SWOT factors with the highest priority, according to the priority order showing the top ten SWOT factors of all participants:

1. Application of environmentally friendly cultivation methods (0.04136)
2. Preferring domestic truffles rather than imported truffles (0.04072)
3. Supporting rural development (0.04056)
4. Special and luxurious qualities of truffles (0.04045)
5. Preventing deterioration by processing and obtaining various products in this way (0.03832)
6. Lower price of domestic truffles (0.03811)

Therefore, all participants believe that the truffle market development strategy to be followed in the Western Mediterranean region should be based mainly on the SWOT factors in the "Advantages" SWOT group.

In addition, all participants included in the study included the factors in the "Opportunities" SWOT group among the first important factors in the development of the truffle market in the Western Mediterranean region. As a matter of fact, the following four "Opportunities/Possibilities" SWOT group factors are among the other factors that are predominantly important in the truffle market development strategy in the Western Mediterranean region:

1. Potential for use in the form of new flavours in the tourism sector (0.03983)

2. High economic value (0.03897)
3. Increasing national and international demand (0.03829)
4. A new truffle industry is emerging (0.03799)

**Table 6:** Priority ranking of SWOT factors according to overall priority values for all participants

| SWOT Factors                                                                                     | Priority Value | Order of Precedence |
|--------------------------------------------------------------------------------------------------|----------------|---------------------|
| Application of environmentally friendly cultivation methods                                      | 0.04136        | 1                   |
| Preferring domestic truffles rather than imported truffles                                       | 0.04072        | 2                   |
| Supporting rural development                                                                     | 0.04056        | 3                   |
| Special and luxurious qualities of truffles                                                      | 0.04045        | 4                   |
| Its potential to be integrated into new gastronomic experiences within the tourism sector        | 0.03983        | 5                   |
| High economic value                                                                              | 0.03897        | 6                   |
| Preventing deterioration by processing and obtaining various products in this way                | 0.03832        | 7                   |
| Increasing national and international demand                                                     | 0.03829        | 8                   |
| The lower price of domestic truffles                                                             | 0.03811        | 9                   |
| A new truffle-oriented industry is emerging                                                      | 0.03799        | 10                  |
| Be a promising business activity                                                                 | 0.03793        | 11                  |
| Collecting truffles from nature is a profitable business                                         | 0.03711        | 12                  |
| Growing interest in truffles                                                                     | 0.03705        | 13                  |
| Existence of the "Truffle Promotion and Research Association"                                    | 0.03621        | 14                  |
| Lack of experienced staff for the truffle industry                                               | 0.03450        | 15                  |
| Not selective harvesting the truffle                                                             | 0.03408        | 16                  |
| Inadequate truffle promotion                                                                     | 0.03381        | 17                  |
| Challenges in truffle harvesting, marketing, cultivation and new entrants to the truffle market  | 0.03381        | 18                  |
| Lack of detailed market information                                                              | 0.03342        | 19                  |
| Lack of a national framework law                                                                 | 0.03318        | 20                  |
| Not widely adopted by consumers due to its high selling price                                    | 0.03290        | 21                  |
| Truffles are not widely known among consumers                                                    | 0.03276        | 22                  |
| Difference in quality and production volume                                                      | 0.03232        | 23                  |
| The price of truffles is variable                                                                | 0.03216        | 24                  |
| Having a small group of consumers                                                                | 0.03202        | 25                  |
| Availability of truffles from other countries with close competition                             | 0.03141        | 26                  |
| The fact that the cultivation of truffles in the garden is not very profitable in the short term | 0.03054        | 27                  |
| Being one of the high-risk activities                                                            | 0.03019        | 28                  |

In addition, all participants included in the study included the factors in the "Opportunities" SWOT group among the first important factors in the development of the truffle market in the Western Mediterranean region. As a matter of fact, the following four "Opportunities/Possibilities" SWOT group factors are among the other factors that are predominantly important in the truffle market development strategy in the Western Mediterranean region:

1. Potential for use in the form of new flavours in the tourism sector (0.03983)
2. High economic value (0.03897)
3. Increasing national and international demand (0.03829)
4. A new truffle industry is emerging (0.03799)

## 4. Conclusions

In this study, the results obtained from individual in-depth interviews were analyzed using SWOT Analysis and R'WOT Technique by considering them in four thematic groups as "Advantages", "Weaknesses", "Opportunities/Possibilities" and "Threats/Dangers". Some important results in this context are mentioned below.

According to all the participants involved in the study and the R'WOT Technique analysis, the most prominent factors of the SWOT group are "Application of environmentally friendly cultivation methods", "Preference of domestic truffles rather than imported truffles" and "Supporting rural development". Accordingly, strategies for the development of the truffle market in the Western Mediterranean region should make full use of these high-priority "Advantages" factors, that is, strengths, and try to develop them further.

All participants of the study prioritized the factors "Weaknesses", "Lack of experienced staff for the truffle industry", "Lack of conscious collection of truffle" and "Insufficient truffle promotion" in the "Weaknesses" SWOT group. Therefore, in the truffle market development strategies in the region, these "weaknesses", that is, the negative factors, should be aware, tried to be eliminated or the risks they carry should be minimized. Thus, ways should be sought to transform each "Weakness" into "Superiority".

Again, among the factors in the "Opportunities/Possibilities" SWOT group, "Having the potential to be used in the form of new tastes in the tourism sector", "Having high economic value" and "Increasing national and international demand" factors were determined as the top priority factors for all participants. In the truffle market strategies in the Western Mediterranean region, all "Opportunities/Possibilities" worth developing should be evaluated and tried to be taken advantage of.

Finally, according to all respondents, "Difficulties encountered in truffle harvesting, marketing, cultivation and new participation in the truffle market", "Lack of detailed market information" and "Lack of a national framework law" are the highest priority factors of the "Threats/Hazards" SWOT group. Thus, all "Threats/Dangers" in the truffle market strategies in the region should be taken into consideration, these situations that may adversely affect the truffle market should be avoided, and each "Threat/Danger" should be tried to be turned into an "Opportunity/Opportunity".

The results showed that there are many opportunities for future research. The database derived from the multi-methodology review is extensive enough for a broader analysis. First of all, more analysis is needed to identify and evaluate marketing opportunities for truffles in the Western Mediterranean region. Although the findings of this study highlight the areas in which managers and professionals should concentrate, a broad baseline survey should address a slice of consumers that encompasses a larger sample of consumers from more parts of the country.

Second, it is necessary to demonstrate consumer opinions and behaviors, which are of great importance for special products to achieve significant market growth. This research should also include estimating consumers' purchase intentions and identifying the variables that influence this. This research will provide decision-makers with the opportunity to facilitate the promotion of truffles and increase their demand. At the same time, there is a need to determine methods that will enable more consumers to be included in this product group. The more people know about the truffle product and its qualities (and therefore the more aware they are of its value), the more likely they are to become truffle consumers.

Finally, this research has shown that specialized markets, such as the truffle market, can be effectively studied using numerical SWOT Analyses such as the R'WOT Technique. Nonetheless, the analysis of this method, based on experience and observation, needs to be extended to the specific area of food management strategy. This method allows for a systematic analysis of internal and external environmental factors that interact with each other.

This study contributes to the literature by encouraging other researchers who study strategic relationships in forestry, agriculture and the food industry to use numerical SWOT Analysis, such as R'WOT Technique, more intensively in their studies.

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Note 2: The abstract of this article was presented at the V. Congress on Socio-economic Problems in Forestry organized by the "Forestry Economic Social Working Group (ORMIS)" on 30-31 October-01 November 2024 at Isparta University of Applied Sciences, Faculty of Forestry

### **Author Contributions**

Since the research was written by a single author, all stages of the study were carried out by the author.

### **Conflicts of Interest**

The authors declare no conflict of interest.

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