Kastamonu Uni., Orman Fakültesi Dergisi, 2019, 19(1): 57-71 Research Article
Kastamonu Univ., Journal of Forestry Faculty
Doi:10.17475/kastorman.543528

The Driving Force Effect of Standardisation and Accreditation in Medicinal and Aromatic Plants Industry

Armando ALIU[1*], Hakkı CILGINOGLU[2], Dorian ALIU[3]

[1]Istanbul Commerce University, Faculty of Business, Istanbul, TURKEY
[2]Kastamonu University, Faculty of Tourism, Kastamonu, TURKEY
[3]Canakkale Onsekiz Mart University, Institute of Social Sciences, Department of Business Administration, Canakkale, TURKEY
*Corresponding author: aaliu@ticaret.edu.tr

Received Date: 01.12.2018 Accepted Date: 21.01.2019

Abstract

Aim of study: The purpose of this study is to examine the standardisation and accreditation processes of the corporations and suppliers operating in the Medicinal and Aromatic Plants (MAPs) industry.

Material and methods: Case study research, market research, sectoral observations and document analyses were conducted within the scope of research methodology. Primarily, micro and meso-level comparative analyses were performed and then macro-level comparative analyses were made by taking into consideration the arguments in MAPs industry. Dominant design approach was applied to the investigation in a systematic manner.

Main results: One of the main objectives of this investigation is to take a look at the transformation that occurred in the MAPs industry which has a significant share in the global markets by taking into consideration the advanced technology and innovation of the "Historical Spice Road." Thus, the route that is extending from India to the Balkans was taken into account. The strategic importance of Central and Eastern European Countries and South-Eastern European Countries in this route was emphasised in a systematic manner. Technology transfer and trade volumes amongst corporations operating in the "Modern Spice Route" were included in the study.

Research highlights: The study highlights the effects of standardisation and accreditation processes on intellectual and industrial property rights while technology transfer is being carried out. Many applications in various countries were compared with operations and actions in MAPs industry in the Balkans.

Keywords: Medicinal and aromatic plants industry, standardisation, accreditation, technology transfer, intellectual and property rights, sustainability, stakeholders, dominant design

Tıbbi ve Aromatik Bitkiler Endüstrisi'nde Standardizasyon ve Akreditasyonun İtici Güç Etkisi

Öz

Çalışmanın amacı: Bu çalışmanın amacı, Tıbbi ve Aromatik Bitkiler Endüstrisi'nde (TABE) faaliyet gösteren firma ve tedarikçilerin standardizasyon ve akreditasyon süreçlerinin incelemesini yapmaktır.

Materyal ve yöntem: Araştırmanın yöntemi kapsamında örnek olay araştırması, piyasa araştırması, sektörel gözlemler ve belge analizleri gerçekleştirilmiştir. Araştırmada öncelikle mikro ve mezo düzeyde analizler gerçekleştirilmiş ve daha sonra makro düzeyde kıyaslamalı araştırmalar TABE'deki argümanlar dikkate alınarak yapılmıştır. Baskın tasarım yaklaşımı araştırmaya sistematik bir şekilde uygulanmıştır.

Sonuçlar: Araştırmanın ana hedeflerinden birisi "Tarihi Baharat Yolu"nun çağın ileri teknolojisi ve inovasyon dikkate alınarak küresel piyasalarda önemli bir paya sahip olan TABE'de gerçekleşen dönüşümü mercek altına almaktır. Dolayısıyla, Hindistan'dan Balkanlara uzanan bu rota dikkate alınmıştır. Orta ve Doğu Avrupa Ülkeleri ile Güney-Doğu Avrupa Ülkeleri'nin bu rotadaki stratejik önemine sistematik bir şekilde vurgu yapılmıştır. Modern Baharat Yolu rotasında faaliyet gösteren firmalar arasındaki teknoloji transferi ve ticaret hacimlerine çalışmada yer verilmiştir.

Araştırma vurguları: Bu çalışmada, TABE'de teknoloji transferi gerçekleştirilirken standardizasyonun ve akreditasyonun fikri ve sınai mülkiyet haklarına etkisini araştırmaktır. Bu kapsamda, farklı ülkelerdeki birçok uygulamanın Balkanlarda TABE'deki işleyişler ve eylemler ile kıyaslanması yapılmıştır.

Anahtar kelimeler: Tıbbi ve aromatik bitkiler endüstrisi, standardizasyon, akreditasyon, teknoloji transferi, Fikri ve sınai mülkiyet hakları, sürdürülebilirlik, paydaşlar, baskın tasarım

Citation (Atıf): Aliu, A., Cilginoglu, H. & Aliu, D. (2019). The driving force effect of standardisation and accreditation in medicinal and aromatic plants industry. *Kastamonu University Journal of Forestry Faculty*, 19 (1), 57-71.

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Introduction

It is known that 50.000 to 70.000 plant species are used in conventional and contemporary medical systems worldwide. Additional varieties that have not been counted are used in the rapidly growing cosmetic and botanical industries. Most of these materials are maintained by the collection of wild plant species that exist in nature (Leaman, 2006). The usage of aromatic plants, starting with the simple form of in-house use, is quite wide, including the pharmaceutical industry, the food industry, the tobacco-smoking industry, the alcoholic and non-alcoholic beverages, the varnish and the paint industry, and the chemical industry. Their essence is not merely used in the foreground, but its own components are used, as well (Asllani, 2004; Máthé, 2015).

Many Scholars argued that some MAPs have the power to change the physiological functioning in humans, create a transformation in medicine, and provide wealth to those who grow, work and use these plants (Máthé, 2015; Negi et al., 2018; Roosta, Moghaddasi, and Hosseini, 2017). Developing technology and innovation have affected the MAPs industry. It is essential to create a solid environment that is supported by technology transfer, which has become quite crucial and a basic necessity for the MAPs industry, and cooperation of companies in frame of innovation, standardisation, accreditation and intellectual property rights with partner firms operating in the same sector. International financial instruments (e.g. grants, funds etc.) may facilitate creating this kind of fruitful ecosystem. Within the scope of market research, the companies make contact with each other and strive to expand the innovative perspective in products and services that meet the standards demanded by large–scale companies operating in the market in order to optimally evaluate future feedbacks. In this context, strategic importance is given to the development of the product range that can be commercialised in the sector with analyses of necessities and technology transfer in frame of cooperation in MAPs industry.

Thus, organic and cultivated products, biodiversity, ecosystem management, food health and safety, the standardisation of environmental products, environmental quality management and certification and patent rights are the issues that were taken up to better conceive how to overcome the excessive production of MAPs products. Likewise, innovative strategies, lean manufacturing processes, industrial success factors, the roles of new generation entrepreneurs in the MAPs industry were argued within the scope of investigation to reveal the ways in which the Small and Medium-sized Enterprises (SMEs) can compete more effectively with Multinational Corporations (MNCs).

Furthermore, it was claimed that scientific and professional support presented to SMEs in frame of standardisation, accreditation and commercialisation of knowledge has directly a substantial contribution to SMEs' foreign trade performance.

It is necessary to restructure the supply channels of farmers and collectors in MAPs industry within the context of international standardisation studies and to implement ecological, environment-friendly strategies and achieve the holistic growth and development of the industry as a whole. Likewise, it is necessary to concentrate on the interactions in the "Business World – Academic Sector – Civil Society" mechanism, to make cluster analysis of all active farmers and suppliers and to create network databases in MAPs industry. Through the participation of local stakeholders, it can be ensured that farmers and suppliers at local levels are able to deal with poverty (He, Yang, Dong & Wang, 2018), increase welfare levels, provide a cleaner environment and sustainable development at local level, and enforce mutual strategic interests by taking into account universal business ethics. Moreover, directing and encouraging young people in MAPs industry can lead to a more dynamic and healthy development of the whole industry. In this framework, various scholarships, research grants and financial instruments can be offered to young researchers and graduate students. In this manner, young researchers can be oriented to research fields; such as, technology transfer, innovation, production processes, intellectual and industrial property

rights, social and environmental responsibility standardisation, commercialisation of knowledge in MAPs industry.

Material and Methods

Case study method, market research, sectoral observations and document analysis were carried out within the context of the research methodology. In this study, initially micro and meso level analyses were performed and then comparative analyses at macro level were made by taking into consideration the arguments in MAPs industry. Regions that were selected are threefold. These are Central and Eastern European Countries (CEECs), South-East European Countries (SEECs) and Western Balkan Countries (WBCs).

Figure 1. CEECs, WBCs and SEECs Intersection Cluster

Source: Aliu, Ismail, Aliu & Cilginoglu, 2018

Figure 1 indicates the CEECs[1], WBCs[2] and SEECs[3] intersection cluster. The data on agriculture in these countries have been compiled under the title of "medicinal and aromatic plants (medicinal and pharmaceutical plants)" for the period of 2013-2017 on Comtrade database – i.e. a database of the UN Statistics Division. The medicinal and aromatic plants are classified under the pharmaceutical plants coded as "STIC.3 292.4" of the commodity group "HS 1211" of the Comtrade database (Lange, 2006).

Three phases of the design and implementation of the case study are as follows: (1) the objectives, design and structure of the research; (2) conducting each case in accordance with the design; (3) arranging the case study according to the findings and evaluating the scientific contribution for the purpose of the study (Aliu, Ismail, Aliu & Cilginoglu, 2018; George and Bennett, 2005). Market research, sectoral observations and document analysis were conducted in MAPs industry. In this framework, MAPs Industry's import and export data were examined worldwide. Similarly, the data of MAPs industry in countries of selected three regions were analised comparatively. Therefore, the MAPs industry scale of the countries in selected three regions includes trade flows, trade structure, trade volume and trade values. Furthermore, the widespread use of MAPs in a large number of sectors may require a cross-sectoral comparison in the commercial

[1]*CEECs*; Bulgaria, Croatia, Chekia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia (11 EU Member States); and Albania, Bosnia and Herzegovina, Macedonia, Montenegro, and Serbia.
[2]*WBCs*; Albania, Bosnia and Herzegovina, Macedonia, Kosovo, Montenegro, and Serbia. In the Comtrade database, Kosovo is not included in the study because there is no data for this country in the title of medicinal and pharmaceutical plants.
[3]*SEECs*; Albania, Bosnia and Herzegovina, Macedonia, Kosovo, Montenegro, Serbia, Bulgaria, Croatia and Greece.

sense. When evaluated from this point of view, it is possible to observe significant correlations not only at firm (micro) level or country (macro) level but also at intersectoral (meso) level.

Dominant design approach was used in frame of the investigation in a systematic manner. As widely used in the literature, dominant design is described as "a single architecture that is broadly adopted as the industry standard (Anderson & Tushman, 1990; Tegarden, Hatfield, & Echols, 1999)." Dominant design preference is a crucial anticipation of a corporation's achievement. Dominant design constitutes competitive advantage by using particular assets and prevents product technology imitation (Tegarden et al., 1999).

Dominant design creates dominance between competing design ways that are specific in a sector's design hierarchy. In addition, dominant design has an effect of enforcing standardisation (Suárez & Utterback, 1995).

Dominant design notion contains a quasi-paradigmatic status for linking linkages amongst technological and industrial dynamics. Empirical observation relevant to technology and development is a driving force for dominant design. The rise of dominant design causes an innovative effect in production and development and balances technological development and growth in market structure (Murmann & Frenken, 2006).

The development of a dominant design has a substantial influence on supply/ demand of economics. It decreases product-class uncertainty and allows producers to discover larger scale economies. Such advantages generally can be proliferated to both up-stream (e.g. standard and interchangeable parts) and down-stream markets (e.g. after-sales market). A dominant design can decrease the risk relevant to selecting amongst competing systems, for both producers and consumers.

A dominant design has a direct impact on competitiveness by means of making products more competitive in terms of price, R&D development process and innovation (Lee, O'Neal, Pruett, & Thomas, 1995).

Considering high technology developments, the dominant design is an impact factor in progression of innovation process and accumulative technological improvements (Lee et al., 1995).

Competing designs have a high dependence level on wide variety of networking; such as, international standardisation bodies.

The appearance of de facto or de jure product standards may have a substantial impact on the dominant design. Standards might be affected by dominant producers, strong users, sectors, and governments (Lee et al., 1995).

In supplier-dominated activities (e.g. agriculture, forestry, manufacturing and so on) innovative actions are managed by suppliers of technological tools. Corporations performing in such actions are engaged in R&D operations and progressions (Niosi, 2000).

Dominant design has a positive role in market acceptance by serving in classification of products' standards. However, there are two dimensions which separate dominant design from standards: (1) containing plentiful standards; (2) having competitive aspects of many designs (Srinivasan, Lilien & Rangaswamt 2006).

A dominant design is effective if markets adopt a particular design for a product that is valid as a standard for a particular sector or product type. In this context, corporations ought to take into account up-to-date dominant designs that include innovative and technological developments (Brem, Nylund, & Schuster, 2016).

Abernathy and Utterback (1978) see a dominant design as a critical juncture which advances a standardised production system in a sector. Dominant design transforms a product type by harmonising R&D actions, innovative steps in production process and technological progressions. Dominant design strengthens standardisation in production and innovation processes. Thus, the cost and accomplishment of a product shape rivalry ecosystem and efficiency (Abernathy and Utterback, 1978).

In light of these considerations, dominant design structures technology advancements, accumulated developments, innovations in

standardisation processes and generalisation and acknowledgement of a particular product category in a specific sector. Thus, dominant design approach is applicable in development of many kinds of technologies which are considered as free patent interference. Dominant design enhances impact factors of competitions in the process of innovation, standardisation and product development (Anderson and Tushman, 1990).

Results and Discussion

In the study, the advanced technology and innovation of the "Historical Spice Road", the transformation in MAPs industry, which has a significant share in the global markets, has been taken into consideration. Therefore, CEECs, WBCs and SEECs were analyzed in this route from India to the Balkans. In today's modern economic system, the technology transfers and trade volumes between the companies in the "Spice Road" route are on an increasing trend.

WBCs, which are located at the intersection of CEECs and SEECs have shown a significant improvement in the MAPs industry between the years 2013-2017. According to a sectoral report published by Hexa Research, MAPs Industry's total market volume in 2016 is around USD 71.19 billion. This rate is anticipated to achieve USD 117.02 billion in 2024. Total market volume of herbal extracts reached in 2016 was USD 27.1 billion. It is estimated that this ratio will reach USD 44.6 billion in 2024 (Hexa Research, 2017a, 2017b).

According to the International Trade Center, exporters in underdeveloped countries aim to ensure sustainable production and foreign trade development, especially with the export of extracts (International Trade Centre, 2018). However, these rates include not only MAPs Industry, but also other sectors covered and influenced by this industry. This study was based on the data published in the Comtrade database prepared by UN Statistics Unit (see Figure 2).

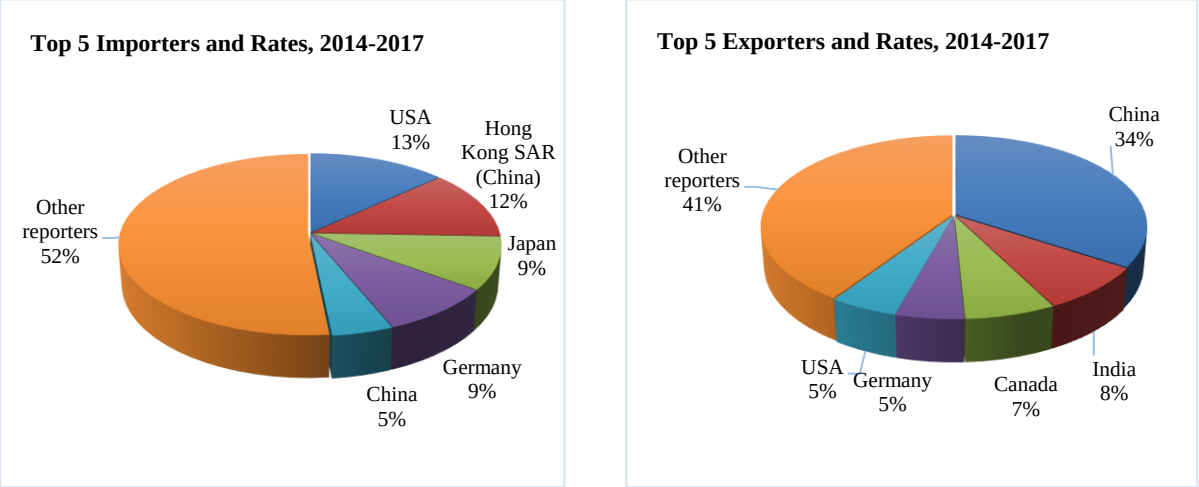
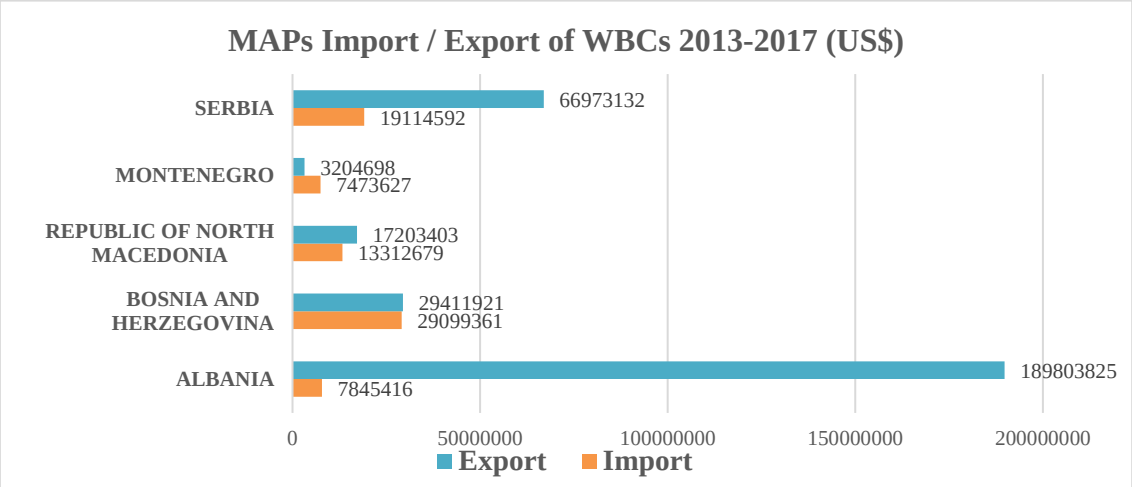


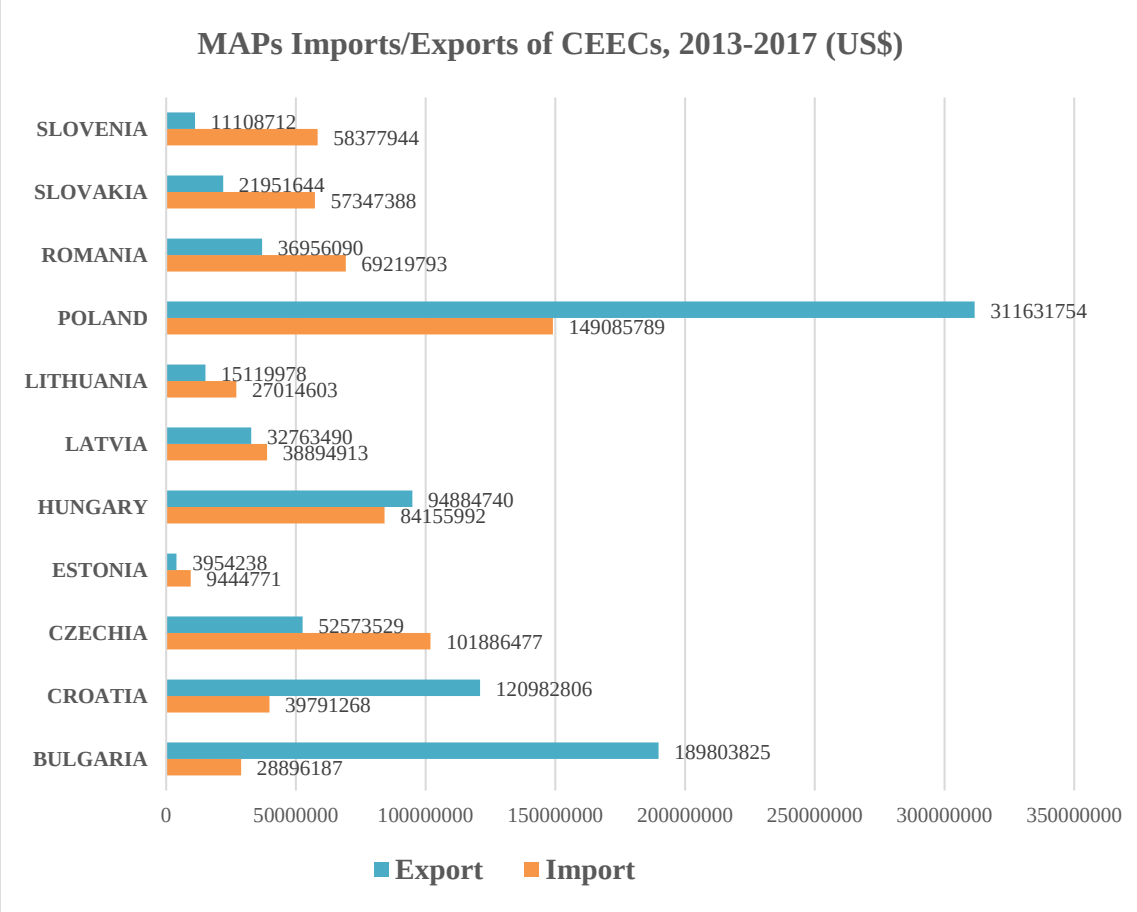
Figure 2. Top 5 Importers and Exporters and Rates in MAPs Industry, 2014-2017

Source: UNSD COMTRADE, 2018

On a global scale, the total import volume between 2014-2017 was $12.11 billion. Top 5 importers; the USA ($1.60 billion), Hong Kong SAR China ($1.48 billion), Japan ($1.13 billion), Germany ($1.06 billion), and China ($562 million). These 5 importers cover about 1/2 of total import volume in global market. On a global scale, the total export volume between 2014-2017 was $12.49 billion. Top 5 exporters; China ($4.27 billion), India ($1.02 billion), Canada ($847 million), Germany ($639 million), and the USA ($633 million) (Aliu and Aliu, 2018). These 5 exporters account for approximately 60% of the total export volume in the global market. On a global scale, there is a certain

decrease in both import and export rates between 2014-2017. In general, when the last 4-year period is taken into consideration, it is seen that the exports in MAPs industry are higher than imports. Between 2013-2017, Albania has a leading position in the export of MAPs with value of $189.80 million into WBCs. In this region, Bosnia and Herzegovina has the highest import rate in MAPs industry (Aliu and Aliu, 2018; UNSD COMTRADE, 2018). Moreover, the volume of trade between these countries in MAPs industry is also rising in this region. (For comparative data of imports and exports in WBCs, CEECs and SEECs, see Figure 3).





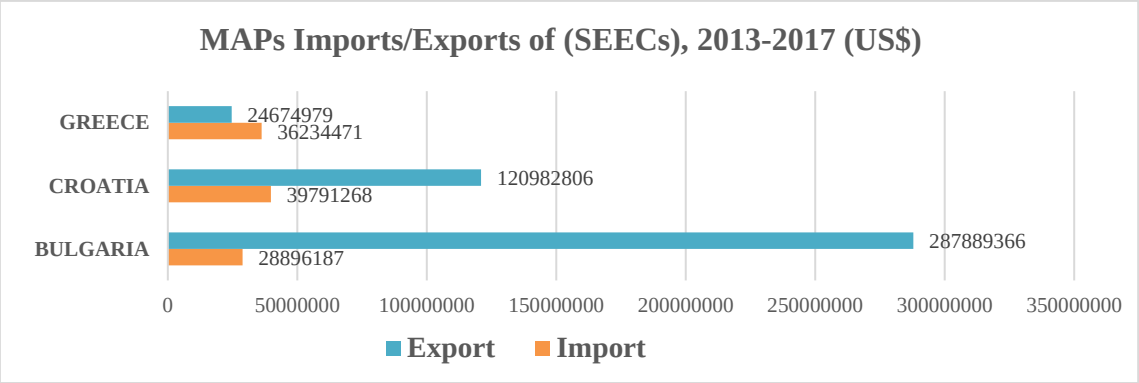


Figure 3. MAPs Imports/Exports of WBCs, CEECs and SEECs, 2013-2017 (US$)

WBCs are covered by CEECs and SEECs. However, the difference between these two regions is that; although Bulgaria and Croatia are located in both regions, Greece is only included in the SEECs category. Poland has the highest export and import ratio in CEECs. In SEECs, the highest export rate belongs to Bulgaria, while the highest import rate belongs to Croatia.

Turkey imports the majority of MAPs from Albania. Turkey's total imports from Albania in the period of 2013-2017 was around $19.83 million. Considering the expectations for the future, Albania is expected to be the number one in importer ranking list of Turkey in this sector (UNSD COMTRADE, 2018).

Concerning with the production technologies, technology transfer and innovation, the following topics have become increasingly interesting and attract quite considerable attention of researchers working in the MAPs industry: distillation of MAPs for extraction of essential oils (Munir et al., 2014), production of MAPs on the farm with solar distillation system (Munir and Hensel, 2010), the impact of technological processing and vaccination on the antioxidant capacity of MAPs from harvest to packaging (Giao, Pereira, Pintado & Malcata, 2013), the effect of heavy metals on secondary metabolite biosynthesis, oxidative status and phyto-extraction in MAPs in polluted environment (Lajayer, Ghorbanpour and Nikabadi, 2017), Hyperspectral Imaging (HSI) as a non-destructive technique in MAPs industry (Kiani, van Ruth and Minaei, 2018), establishing the global volatile profile of commercial virgin olive oil and virgin olive oils flavoured with MAPs (garlic, rosemary, oregano and thyme), using two various analytical methods, liquid-liquid microextraction (LLME) and headspace solid-phase microextraction (HS-SPME) mixed with gas chromatography-quadrupole mass spectrometry (GC-qMS) (Perestrelo, Silva, Silva & Câmara, 2017), the effect of intercropping of MAPs with organic approach on resource use efficiency in arecanut based intercropping system (Sujatha, Bhat, Kannan & Balasimha, 2011), epigenetic and epigenomic regulations in MAPs (Hao and Xiao, 2018), the growth of cultivated crops, irrigation, fertilization and plant protection; washing, cooling, cutting, distillation, steam, irradiation, drying, fumigation, sorting, packaging and storage after harvesting (Maikhuri et al., 2017; Novak, 2014; Sharma and Kala, 2018), volatile organic compounds (VOCs), gas chromatography and mass spectroscopy, signal processing with sensors and advanced data processing algorithms (Kiani, Minaei & Ghasemi-Varnamkhasti, 2016), use of synthetic insecticides such as organophosphates, carbamates, pyrethroids and neonicotinoids in the protection of MAPs (Gahukar, 2018), the seasonal effect of MAPs on the polyphenolic composite of antioxidant and anti-inflammatory properties (Piccolella, Crescente, Pacifico & Pacifico, 2018) etc.

Patent protection is available for genetically modified MAPs, plant cells and seeds supposing that the subject matter meets the standards of novelty, inventive step and

industrial applicability. (Overwalle, 2006). Therefore, some arrangements have been made in this framework in the development of commercial relations in MAPs industry (European Commission and TRAFFIC, 2013).

Information producers and consumers in MAPs industry can create added value in strategic technological integration. In this context, the integration of academic technology transfer into sectoral technology transfer through the commercialisation of knowledge can lead to innovation in MAPs industry (Carayannis, Rozakis & Grigoroudis 2018; McNett, 2017).

Development and standardisation of environmental products to prevent over production of MAPs, including biodiversity, ecosystem management, food health and safety, organic and cultivated products (Lubbe and Verpoorte, 2011), and the need to provide training to companies and suppliers on issues related to certification, and nowadays, patent rights related to environment are becoming more apparent (Miho, 2011). The growth and improvement of the MAPs market in the coming years can be accelerated by carring out more scientific research and R&D studies, granting financial support and implementing practical projects.

In order to compete with the MNCs, SMEs that operating in MAPs industry should develope innovative strategies, introduce lean manufacturing process, sectoral success factors, and also should add new generation entrepreneurs to MAPs industry. Scientific support to SMEs in the context of commercialisation of knowledge has a significant effect on foreign trade (Aliu and Aliu, 2017).

Providing cooperation with joint companies operating in the same sector and establishing the necessary solidarity environment in the context of technology transfer, innovation, standardisation, accreditation and intellectual property rights that are transformed into a basic need in MAPs industry can cause a productivity increase in general. For the sustainable development of MAPs industry as a whole, taking into account the sustainability of enterprises operating in the field, there is a need for growing high demanded and threatened species. In this context, it is useful to draw attention to the functionality of the appropriate technology to the companies operating in the industry and the functionality of certain international standards (Chandra and Sharma, 2018; Kala, 2015; Roy, Mir, Gangwar & Gangwar, 2018; Silvius, Schipper, Planko, Brink & Köhler, 2017; The Rainforest Standard, 2017).

Standards can be defined as "the inevitable requirements for technical specifications of products resulting from the interdependence amongst several components." Standards are basically applied in industrial norms. In this manner, 3 dimensions diversify standards from dominant designs (Brem et al., 2016):

(1) Standards have functional aim to link various constituents of a product or service, irrespective of its producer, supplier or its market acceptance, whereas market acceptance is a core precondition of a dominant design;

(2) Dominant designs arise from competition in the product life cycle;

(3) Standards may involve plenty of dominant designs. Thus, a dominant design is attained when a market adopts a specific standard describing the characteristics of a specific product in the whole sector.

Standardisation is likely to enhance innovative actions. In this context, dominant design enforces innovation performances that are strongly affected by technological developments, product diversification, and demand / supply-oriented interactions (Brem et al., 2016).

Standardisation is considered to be a core issue in the process of innovation constructions in terms of micro and macro-economic development (Brem et al., 2016).

The "standards" notion is generally used to point out the technical characteristics for quality, reference, compatibility, adaptability, and connectivity (Srinivasan et al., 2006).

Table 1. Classification of Stakeholders which are in Contact with ISO in Decision-making in the Field of MAPs Industry

	Internal Stakeholders	*External Stakeholders*
ISO	ISO/IEC Technical committees: ISO/TC 34, Food products; ISO/TC 54, Essential oils; ISO/TC 84, Devices for administration of medicinal products and catheters; ISO/TC 215, Health informatics; ISO/TC 217, Cosmetics; ISO/TC 249, Traditional Chinese Medicine; ISO/TC 276, Biotechnology; ISO/TC 34/SC 7, Spices; ISO/TC 34/SC 8, Tea.	WFAS (World Federation of Acupuncture and Moxibustion Societies); WHO (World Health Organization); FAO (Food and Agriculture Organization); UNESCO (UN Economic and Social Council); UNDP (United Nations Development Program); UN (United Nation); WFPMM(World Federation of Propertary Medicine Manufactures); WWF(World Wild Fund for Nature); IUCN(International UNION for Conservation of Nature and Natural Resources); IHTSDO (International Health Terminology Standards Development Organization).

Source: ISO 2018

Considering the types of corporations operating in the regions evaluated within the scope of this investigation, the acquisition of international standards and use of international certificates are considered in this respect due to the majority of these corporations having SME status. International Organisation for Standardisation (ISO), Hazard Analysis at Critical Control Points (HACCP), Food and Drug Administration (FDA), HALAL and KOSHER certificates and the criteria, rules and standards that corporations ought to pay attention in MAPs industry were clarified in a systematic and effective manner. Prior to the standardisation process on the basis of organisations and illustration of the intricate nature of the MAPs industry, Table 1 indicates that the ISO has been in contact with other international organisations including committees and sub-committees.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies. The work of preparing International Standards is managed by ISO technical committees. International organisations, governmental and non-governmental, in liaison with ISO, also take part in the work. The acceptance of a food safety management system (FSMS) is a strategic decision for an organisation that tends to improve its overall performance in food safety.

HACCP is a systematic approach that sets, develops and applies quality assurance of food products by means of using a system of identification, assessment, and control of hazards, that are substantial for food safety. HACCP is a broadly recognised food safety QA system. The HACCP system is a QA system consisting of the following 7 principles (Will, 2003):

(1) conduct a hazard analysis;

(2) determine the Critical Control Points (CCPs);

(3) establish critical limits;

(4) establish a system to monitor control of the CCPs;

(5) establish corrective action;

(6) establish procedures for verification;

(7) establish documentation (Will 2003).

With the increase in the fact that many natural MAP species are exploited in extreme terms, some active institutions in this sector emphasize that some functional systems should be developed for growing organic plant instead of cultivated products. In this context, considering the contribution of sustainable harvest (Barata, Rocha, Lopes & Carvalho, 2016) to the local economies and the long-term contribution to collectors, the more sustainable development model in the sector and the need to develop the production system become evident. Therefore, it may focus on the lack of information on sustainable harvest rates and practices, undefined land use rights, lack of legal and policy guidance, and the extent to which lean manufacturing process is affected by innovation and advanced technology (Schippmann, Leaman and Cunningham, 2006). In this way, despite the increasing interest in cultivated plants, it can be emphasized that the collection of natural wild plants can contribute to the preservation of the diversity of many MAP species based on biological, economic and social factors (Leaman, 2006).

Food-based commercial disagreements have been materialised due to food safety concerns and discrepancies in biotechnology ethics, practices, and standards. There are many instances associated with the impact of

dominant design on food industry and more specifically on wild plants. For instance, Genetically Modified (GM) foods offer a systematic pattern to rapidly develop crop components. Genetic modification approaches tackle with unanticipated allergic responses, pest resistance, herbicide tolerance, wild plants, inadvertent toxicity, biotechnology and so on. Labrecque, Charlebois and Spiers highlighted that there is a strong nexus amongst GM foods as a technological dominant design. They claimed that "GMOs allowed for a reduction of the use of pesticides or herbicides, increased productivity, and the capacity to grow stress-resistant and water-frugal plants" (Labrecque, Charlebois & Spiers, 2007). In MAPs industry, it is likelihood to be conceived that other by-products (i.e. pesticides and fertilizers) mainly created by the power of gene technology and intellectual property, may leverage the dominance status by enhancing collateral dependency (Labrecque et al., 2007).

Another striking example of a potential dominant design effect in the MAPs industry is the proliferation of the wide-usage of drones.

Aerialtronics, located in the Netherlands, ensures inspection services to identify maintenance issues in wind farms or in hard-to-achieve telecommunication antennas. In 2014, it commenced to improve customised drones with more proper video data, flight reliability, and tolerance for a range of weather conditions; standard commercial solutions would just fail in these duties. Considering some future anticipations concerning with the value of drone applications, experts recommended that agriculture and other industries could account for most of the 127 billion USD of value annually captured by drone applications industry in the near future (Giones and Brem, 2017). In other words, specialised flying cameras and cloud-based data analytics can ensure farmers to constantly monitor the quality of crop growth (Floreano and Wood, 2015).

From the capability and capacity to image, stimulate and examine individual leaves on a plant from 120 meters height, to collect information on the water-holding capacity of soils to variable-rate water applications, agricultural practices are transformed due to drones delivering agricultural intelligence for both farmers and agricultural specialists. In the next few years, a rapid incline in smart farming, crop intelligence and drone service providers will facilitate MAPs industry in more effective way (Tripicchio, Satler, Dabisias, Ruffaldi & Avizzano, 2015; Veroustraete, 2015: 325). Thus, future studies may take a particular focus to the usage of drone applications in MAPs industry by means of taking into consideration dominant design, standardisation, accreditation, satellite technology and innovation.

Conclusion

The production of high value-added products, using high-tech products developed to get out of the middle income trap, also applies to MAPs industry, which is common in developing countries (CEECs, WBCs and SEECs). In this framework, the situation analysis of the production technologies used by the firms should be done and the use of high technology should be aimed at finding products in global market with higher added value products and high standards in MAPs industry. Therefore, it will be possible for the firms operating in MAPs industry to benefit from the customer portfolio arising from the partnership with the win-win principle and from the joint venture with the company that needs high technology and contribute to the production process at international standards.

Furthermore, the increasing competition environment encourages companies to cooperate with universities and public institutions in order to be more effective in the market. It is seen that such collaborations are beneficial for both economic and environmental problems. These collaborations include active companies (SMEs, Startups, Spin-offs etc.) in MAPs industry; entrepreneurs who are interested in MAPs industry; companies in search of business potential such as investment and partnership and a wide range of stakeholders.

Nowadays, the rapid development of high technology has boost the capacity of corporations in terms of standardisation of

products and diversity in accreditation. The fact that consumers are primarily oriented to get healthy and high quality organic products and services in a more conscious manner, has naturally led the corporations seeking appropriate international standards, producing their products in frame of the criteria of these standards and increasing their competitive advantage by means of using international certificates.

Dominant design approach is highly associated with technology, innovation and standardisation. It constitutes a competitive advantage, technological and industrial dynamics. MAP's industry is significantly influenced by dominant design.

MAPs industry is a part of the food industry at global level that provides raw materials for cosmetic and pharmaceutical industry on the basis of particular and diversified products. The MAPs industry has become quite strategic and indispensably this industry is abruptly growing and disseminating worldwide.

Although the importance attached to standardisation and accreditation in MAPs industry is assumed as directly proportional to economic development, there is a fact that in many developing countries various efforts have been shown by both private and public sectors to produce and serve international standards in an ecosystem of SMEs.

Acknowledgements

This investigation was written in the framework of a large-scale practical research project that is entitled 'The Influences of Technology Transfer and Innovation on Standardisation, Accreditation and Patent Rights of Corporates' Manufacturing Processes in Medicinal and Aromatic Plants Industry (Project Grant No: ICU-TTO_KOSGEB-EUREKA/EU-2018-0002)' and conducted at Istanbul Commerce University. The authors are very grateful to Prof Dr. Abdul Halim ZAIM who is a Coordinator at Technology Transfer Office at Istanbul Commerce University and Prof. Dr. Mehmet MELEMEN (Marmara University) for their support and encouragement. Furthermore, this research is an extended and updated version of the symposium proceeding that is titled "The Effects of Innovation and Technology Transfer on the Patent Rights, Accreditation and Standardisation during Companies' Productions Processes. The proceeding was developed for the 4th International Symposium of Medicinal and Aromatic Plants (2-4 October 2018, Cesme, Izmir, Turkey)."

References

Abernathy, W.J. & Utterback, J.M. (1978). Patterns of Industrial Innovation. *Technology Review*, 80(7), 1-9.

Aliu, A. & Aliu, D. (2017). Collaborations and sustainability in medicinal and aromatic plants industry: Examining the business communication amongst stakeholders in MAPs industry. International Congress on Political, Economic and Social Studies, 2, 14-34.

Aliu, A. & Aliu, D. (2018). Comtrade medicinal and aromatic plants (MAPs) statistics of western balkan countries (WBCs), central and eastern european countries (CEECs) and south-eastern european countries (SEECs) in a comparative perspective. Scholars Portal Dataverse, V1, https://doi.org/10.5683/SP2/Z3CAKE

Aliu, A., Ismail, A., Aliu, D. & Cilginoglu, H. (2018). Küresel ekonomik yönetisim ve cokmerkezli yönetisimde devlet disi aktörlerin etkilesimleri: Güneydogu Avrupa ülkeleri ve Cin'de küresel isbirliği, 423-442. In: Ogurlu, Y., Karakaya, G. & Aliu, A. (Eds.) (2018). *Cin Halk Cumhuriyeti'nde Ticaret, Ticaret Hukuku ve Idare Hukuku Iliskileri: Türkiye Icin Dersler*. (1st ed.) Istanbul: Istanbul Ticaret Üniversitesi Yayinlari.

Anderson, P., & Tushman, M.L. 1990. Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly*, 35, 604-633.

Asllani, U. (2004). *Esencat e Bimeve Aromatike e Mjekesorete Tretave Shqiptare*. Stepia Botuese 8 Nentori, Tirane, Albania.

Barata, A.M., Rocha, F., Lopes, V., Carvalho, A.M. (2016). Conservation and sustainable uses of medicinal and aromatic plants genetic resources on the worldwide for human welfare. *Industrial Crops and Products*, 88, 8-11.

Brem, A., Nylund, P.A., & Schuster, G, (2016). Innovation and de facto standardization: The influence of dominant design on innovative performance, radical innovation, and process innovation. *Technovation, 50*, 79-88.

Carayannis, E.G., Rozakis, S. & Grigoroudis, E. (2018). Agri-science to agri-business: The technology transfer dimension. *Journal of Technology Transfer*, 43(4), 837-843.

Chandra, P. & Sharma, V. (2018). Strategic marketing prospects for developing sustainable medicinal and aromatic plants businesses in the Indian Himalayan region. Small-scale Forestry, DOI: https://doi.org/10.1007/s11842-018-9396-3

European Commission and TRAFFIC, (2013). *Reference Guide to the European Union Wildlife Trade Regulations*. Brussels, Belgium.

Floreano, D., & Wood, R.J. (2015). Science, technology and the future of small autonomous drones. *Nature*, 521(7553), 460-466.

Gahukar, R.T. (2018). Management of pests and diseases of important tropical/subtropical medicinal and aromatic plants: A review. *Journal of Applied Research on Medicinal and Aromatic Plants*, 9, 1-18.

George, A.L. & Bennett, A. (2005). *Case Studies and Theory Development in the Social Sciences*. Cambridge, MA: MIT Press.

Giao, M.S., Pereira, C.I., Pintado, M.E. & Malcata, F.X. (2013). Effect of technological processing upon the antioxidant capacity of aromatic and medicinal plant infusions: From harvest to packaging. *LWT – Food Science and Technology*, 50, 320-325.

Giones, F., & Brem, A. (2017). From toys to tools: The co-evolution of technological and entrepreneurial developments in the drone industry. *Business Horizons*, 60(6), 875-884.

Hao, D.C. & Xiao, P.G. (2018). Deep in shadows: Epigenetic and epigenomic regulations of medicinal plants. *Chinese Herbal Medicines*, 1-10.

He, J., Yang, B., Dong, M. & Wang, Y. (2018). Crossing the roof of the world: Trade in medicinal plants from Nepal to China. *Journal of Ethnopharmacology*, 224, 100-110.

Hexa Research, (2017a). Herbal Medicine Market Size and Forecast, By Product (Tablets & Capsules, Powders, Extracts), By Indication (Digestive Disorders, Respiratory Disorders, Blood Disorders), And Trend Analysis, 2014 – 2024. https://www.hexaresearch.com/research-report/global-herbal-medicine-market (30.12.2018)

Hexa Research, (2017b). Herbal Medicine Market Size To Reach USD 117.02 Billion By 2024. September 2017 https://www.hexaresearch.com/press-release/herbal-medicine-market (30.12.2018)

International Trade Centre, (2018). Medicinal and Aromatic Plants and Extracts. August 2018 http://www.intracen.org/itc/sectors/medicinal-plants/ (30.12.2018)

International Organization for Standardization (ISO), (2018). https://www.iso.org/iso-forms-model-agendas-standard-letters.html (30.12.2018)

Kala, C.P. (2015). Medicinal and aromatic plants: Boon for enterprise development. *Journal of Applied Research on Medicinal and Aromatic Plants*, 2, 134-139.

Kiani, S., Minaei, S. & Ghasemi-Varnamkhasti, M. (2016). Application of electronic nose systems for assessing quality of medicinal and aromatic plant products: A review. Journal of *Applied Research on Medicinal and Aromatic Plants*, 3, 1-9.

Kiani, S., van Ruth, S.M. & Minaei, S. (2018). Hyperspectral imaging, a non-destructive technique in medicinal and aromatic plant products industry: Current status and potential future applications. *Computers and Electronics in Agriculture*, 152, 9-18.

Labrecque, J., Charlebois, S., & Spiers, E. (2007). Can genetically modified foods be considered as a dominant design? An actor-network theory investigation of gene technology in agribusiness. *British Food Journal*, *109*(1), 81-98.

Lajayer, B.A., Ghorbanpour, M. & Nikabadi, S. (2017). Heavy metals in contaminated environment: Destiny of secondary metabolite biosynthesis, oxidative staus and phytoextraction in medicinal plants. *Ecotoxicology and Environmental Safety*, 145, 377-390.

Lange, D., (2006). International trade in medicinal and aromatic plants. In: Bogers, R.J., Craker, L.E., Lange, D. (eds.). *Medicinal and Aromatic Plants*, Springer, the Netherland. 155-170.

Leaman, D.J. (2006). Sustainable wild collection of medicinal and aromatic plants. In: Bogers, R.J., Craker, L.E., Lange, D. (eds.). Medicinal and Aromatic Plants, Springer, the Netherland. 97-107.

Lee, J.R., O'Neal, D.E., Pruett, M.W., & Thomas, H. (1995). Planning for dominance: a strategic perspective on the emergence of a dominant design. *R & D Management*, 25(1), 3-15.

Lubbe, A. & Verpoorte, R. (2011). Cultivation of medicinal and aromatic plants for speciality industrial materials. *Industrial Crops and Products*, 34: 785-801.

Maikhuri, R.K., Phondani, P.C., Rawat, L.S., Jha, N.K., Maletha, A., Bahuguna, Y.M. & Kandari, L.S. (eds.) (2017). Conservation and

management strategies of medicinal plant resources through action research approaches in Indian Himalaya. *Iranian Journal of Science and Technology Transactions of Electrical Engineering*, 41, 771-777.

Máthé, Á., (ed.). (2015). *Medicinal and Aromatic Plants of the World: Scientific, Production, Commercial and Utilization Aspects – Vol.1*. Springer, Dordrecht, the Netherlands.

McNett, J., (2017). Barriers and bonds to communication and knowledge transfer. In: Cooper, C.L., (ed.) 2017. *The Blackwell Encyclopedia of Management.* Blackwell Publishing. Blackwell Reference Online. 24 February 2017 http://www.blackwellreference.com/subscriber/tocnode.html?id=g9780631233176_chunk_g97806312349375_ss1-17 (30.12.2018)

Miho, A., 2011. *Monitorimi Biologjik Mjedisor*. Julvin 2, Tirana, Albania.

Munir, A. & Hensel, O., (2010). On-farm processing of medicinal and aromatic plants by solar distillation system. *Biosystems Engineering*, 106, 268-277.

Munir, A., Hensel, O., Scheffler, W., Hoedt, H., Amjad, W. & Ghafoor, A. (2014). Design, development and experimental results of a solar distillery for the essential oils extraction from medicinal and aromatic plants. *Solar Energy*, 108, 548-559.

Murmann, J.P., & Frenken, K.. (2006). Toward a systematic framework for research on dominant designs, technological innovations, and industrial change. *Research policy*, 35(7), 925-952.

Negi, V.S., Kewlani, P., Pathak, R., Bhatt, D., Bhatt, I.D., Rawal, R.S., Sundriyal, R.C. & Nandi, S.K. (2018). Criteria and indicators for promoting cultivation and conservation of medicinal and aromatic plants in Western Himalaya, India. *Ecological Indicators*, 93, 434-446.

Niosi, J. (2000). Science-based industries: a new Schumpeterian taxonomy. *Technology in Society*, 22(4), 429-444.

Novak, J., (2014). EUROPAM statement on requirements for a batch certification of medicinal and aromatic plants (MAPs). *Journal of Applied Research on Medicinal and Aromatic Plants*, 1, 70-71.

Overwalle, G., (2006). Intellectual property protection for medicinal and aromatic plants. In: Bogers, R.J., Craker, L.E., Lange, D. (eds.). Medicinal and Aromatic Plants, p. 121-128, Springer, the Netherland.

Perestrelo, R., Silva, C., Silva, P. & Câmara, J.S. (2017). Global volatile profile of virgin olive oils flavoured by aromatic/medicinal plants. *Food Chemistry*, 227, 111-121.

Piccolella, S., Crescente, G., Pacifico, F. & Pacifico, S. (2018). Wild aromatic plants bioactivity: A function of their (poly)phenol seasonality? A case study from Mediterranean area. *Phytochemistry Reviews*, DOI: https://doi.org/10.1007/s11101-018-9558-0

Roosta, R.A., Moghaddasi, R.& Hosseini, S.S., (2017). Export target markets of medicinal and aromatic plants. *Journal of Applied Research on Medicinal and Aromatic Plants*, 7, 84-88.

Roy, S., Mir, R.A., Gangwar, A.K. & Gangwar, R., (2018). Herbs for health: Communicating for conservation, cultivation and sustainable utilisation of medicinal and aromatic plants. In: Payyappallimana, U., Fadeeva, Z. (eds.). Ensure Healthy Lives and Promote Well-Being For All: Experiences of Community Health, Hygiene, Sanitation and Nutrition. Learning Contributions of the Regional Centres of Expertise on Education for Sustainable Development, 62-71, The United Nations University, Tokyo, Japan.

Schippmann, U., Leaman, D. & Cunningham, A.B., (2006). A comparison of cultivation and wild collection of medicinal and aromatic plants under sustainability aspects. In: Bogers, R.J., Craker, L.E., Lange, D. (eds.). Medicinal and Aromatic Plants, 75-95, Springer, the Netherland.

Sharma, N. & Kala, C.P., (2018). Harvesting and management of medicinal and aromatic plants in the Himalaya. *Journal of Applied Research on Medicinal and Aromatic Plants*, 8, 1-9.

Silvius, G., Schipper, R., Planko, J., Brink, J. van der & Köhler, A., (2017). *Sustainability in Project Management*. Farnham: Taylor and Francis.

Srinivasan, R., Lilien, G.L., & Rangaswamt, A., (2006). The emergence of dominant designs. *Journal of Marketing*, *70*(2), 1-17.

Suárez, F. F., & Utterback, J. M. (1995). Dominant designs and the survival of firms. *Strategic Management Journal*, *16*(6), 415-430.

Sujatha, S., Bhat, R., Kannan, C. & Balasimha, D., (2011). Impact of intercropping of medicinal and aromatic plants with organic farming approach on resource use efficiency in arecanut (areca catechu l.) plantation in India. *Industrial Crops and Products*, 33, 78-83.

Tegarden, L. F., Hatfield, D. E., & Echols, A. E., (1999). Doomed from the start: What is the value of selecting a future dominant design?

Strategic Management Journal, 20(6), 495-518.

The Rainforest Standard, (2017). RFS executive summary. 24 May 2017 http://cees.columbia.edu/therainforeststandard (30.12.2018)

Tripicchio, P., Satler, M., Dabisias, G., Ruffaldi, E., & Avizzano, C. A., (2015). Towards smart farming and sustainable agriculture with drones. In Intelligent Environments (IE), *2015 International Conference* on IEEE, 140-143.

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Albania, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=8 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Bosnia and Herzegovina, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=70 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Republic of North Macedonia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=807 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Montenegro, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=499 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Serbia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=688 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Bulgaria, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=100 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Croatia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=191 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Czechia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=203 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Estonia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=233 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Hungary, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=348 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Latvia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=428 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Lithuania, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=440 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Poland, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=616 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Romania, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=642 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Slovakia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=703 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Slovenia, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=705 (30.12.2018)

UNSD COMTRADE, (2018). 'Import and Export Indicators of the Medicinal and Aromatic Plants (MAPs) in Greece, 2017.' Date Accessed: 1 September 2018; available at: https://comtrade.un.org/db/dqBasicQueryResults.aspx?px=H3&cc=1211&r=300 (30.12.2018)

Veroustraete, F., (2015). The rise of the drones in agriculture. *EC Agriculture*, 2(2), 325-327.

Will, M., (2003). Food Quality and Safety Standards as required by EU Law and the Private Industry With special reference to the MEDA countries' exports of fresh and processed fruit & vegetables, herbs & spices. 30 November 2018 http://www.underutilized-species.org/Documents/PUBLICATIONS/02_Glossary_of_relevant_terms.pdf (30.12.2018)