TOBACCO PRODUCTS CONTRABAND & COUNTERFEIT RISK IDENTIFICATION

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Introduction

Illicit trade of tobacco and tobacco products causes many negative effects over economy, the health and the overall security of the society. The volume of the illegal trade in some countries reaches up to 40-50% of the market and 11,6% on average of the world's legal market. The illegal trade give access to cigarettes at lower prices to young and price-sensitive smokers, which in other cases will quit smoking. Illegal trade costs billions of euro in taxes and budget loss annually to the governments.

The illegal trade of tobacco products is a topical international issue. Negative effects of the illegal trade can be studied from different perspectives.

First, this trade brings huge losses to governments' budgets, as well as diminishing legal tobacco products market sales. Uncontrolled trade undermines public health, motivating young people and people with lower income levels to smoke and to smoke often. In addition, this has a negative effect on expenditures for public health. The lack of quality and production control is another important aspect and the illegal products can contain harmful ingredients for peoples' health.

Secondly, a strong opinion exists within scholars and in the literature on the topic that the illicit tobacco product trade is closely connected and related to other crimes, such as organised crime, corruption, contraband, drug trafficking, human trafficking, etc. Some authors and government officials also find a connection with the financing of terrorism.

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Illicit trade depends on the demand and the supply of tobacco and tobacco products. Customers are motivated by lower prices. The suppliers expect bigger profit in relation to lower production costs and to price margin with legal products.

The research project *Contraband & Counterfeit Risk Identification (Business Process Analysis and Spatial Aspect)* is focused on the description and analysis of trafficking routes through countries from Turkey to Western Europe, emphasising the impact on countries like France, United Kingdom, Germany and Italy – all of which suffer major losses from illicit trade of cigarettes – and paying particular attention to Bulgaria, since it is situated on the Balkan route and could become a key factor in reducing the level of illicit trade.

In order to raise awareness about the problem of illicit trade in cigarettes, and to clarify its relationships with other crimes, the project determines the methods of operation (modus operandi) and the territorial and timing aspects of the illicit tobacco trade and related crimes. It further attempts to identify the gaps and deficiencies in European and national legal frameworks, and suggests improvements regarding the methods of combating illicit trade of cigarettes.

The project sheds light on illicit tobacco trade and its relations to other crimes, particularly by examining key factors and processes involved in the illegal trade. The project also reveals the impact of these activities on the socio-economic environments of the studied regions, and it provides solid ground for improving the fight against tobacco trafficking and related crimes. Among other methods, the project uses a risk identification methodology to focus on counteracting contraband and counterfeits in the most vulnerable places, thus indicating where interdiction and enforcement activities might be most effectively concentrated.

The project team includes 20 specialists from many areas: Project and Risk management, Business Process Analysis, GIS, Spatio-temporal Analysis and Clustering, as well as Legal and Communication experts. The project leader, Professor Dimitar Dimitrov, PhD, is the Dean of Economics of Infrastructure at the UNWE and heads the Department of National and Regional Security.

The project is funded by PMI IMPACT, a global grant initiative from Philip Morris International that supports the fight against illicit tobacco trade and related crimes. Selection for funding was made by a council of independent experts in the fields of law, anti-corruption and the fight against organized crime and illicit trade. This council reviewed and selected projects from more than 200 applications submitted by private and public organizations from over 40 countries.

Opportunities for Business Process Modelling Application to Identify the Risk of Tobacco Products Illegal Production and Smuggling

In the initial phase of the study, it was hypothesized that modelling business processes to analyse the illicit production and smuggling of tobacco products could provide reliable information on the characteristics of the processes and identification of links between them and other crimes.

Business process modelling is a powerful tool widely used by researchers and business consultants to identify problems in the production of a variety of products and services and to find ways to deal with them. The research of the project team is oriented towards the idea that the application of business process modelling and simulations with the built models can also be used in the analysis of tobacco products illegal production and smuggling. We accepted the idea that cases of illegal production and smuggling can be analysed as business processes.

Initially, the team's efforts were aimed at identifying a sufficient number of cases of tobacco products illegal production and smuggling. To this end, numerous sources from so-called Balkan Route countries have been examined, as well as the practice of national and international institutions dealing with counteracting such processes. At the same time, textual processing tools for large amounts of data published on the websites of official government institutions (e.g. UK HM Revenue & Custom's) have were used.

As a result, over 1,200 cases of tobacco products illegal production and smuggling were identified. These cases were carefully analysed and grouped into ten groups. A specific business model was developed for each of the identified case groups. The accents in developing the models are as follows: key performed activities, participants, critical implementation points, level of risk and cost to participants, expected benefits for participants. At the next stage of the study, the models were analysed. On this basis, simulation models have been developed and tested. The overall logic of this part of the study is presented in Fig. 1.

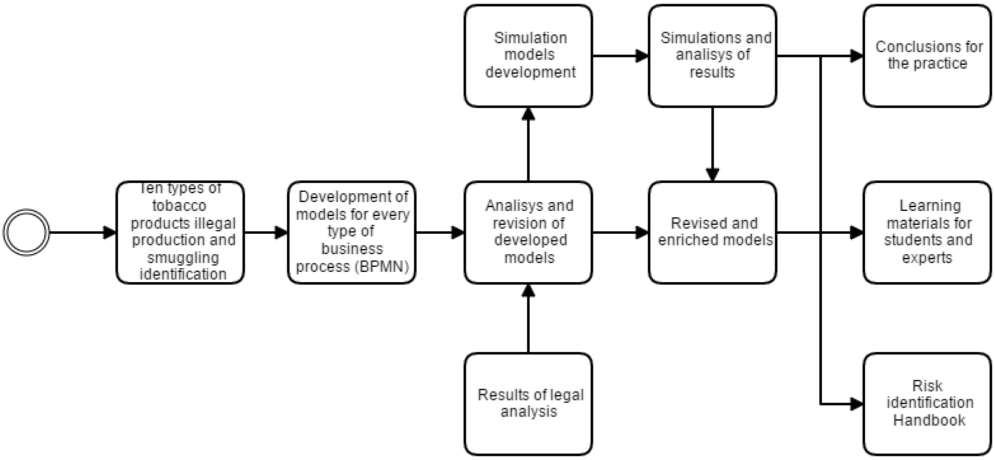


Fig. 1. Logic of the Methodology for Analysis and Simulation of Business Processes

The study identified the following typical cigarette smuggling models:

A. Smuggling by persons with diplomatic immunity. Tobacco products are exported to another country by persons with diplomatic immunity who take advantage of the fact that they are not subject to control by the control authorities when crossing borders. In this way, they may illegally carry significant quantities of cigarettes.

B. Fictitious export. Tobacco products are exported to another country and subsequently imported illegally or exported only on paper without real export. At the same time, tobacco products are sold domestically, usually without payment documents and thus – without payment of taxes and excise duties.

C. Smuggling by "Mules". The cigarettes are purchased from the source country and are supplied to many "mules" – persons that carry across the border permitted number of cigarettes packs. These cigarettes are provided to a third person waiting in the final destination. The third person sells the smuggled cigarettes on the local market.

D. Smuggling of cigarettes by large vessels. Tobacco products are loaded onto large vessels where they are hidden well. The sailing vessel sets off to a certain destination. Before reaching the port the illegal goods are redistributed in many small vessels which depart in different directions. Thus the capture of tobacco products is avoided.

E. Smuggling in which cigarettes remain in an intermediate state. Cigarettes are purchased from the country of origin and loaded in trucks where they are well disguised (for example in plush toys). Departing from the country of production, they are unloaded in the country of destination. The rest of the cargo, already without cigarettes, moves to the destination indicated in the loading documents.

F. Sale at a depreciated value. The buyer at the final destination pays the cigarettes at a lower than the real price with the purpose to evade part of the taxes and excise duties. Then the rest of the price is paid to the manufacturer via a buyer's offshore firm.

G. Smuggling through delivery services. Smuggling is done through courier/delivery services, including postal services. This method is applied to the supply of tobacco and tobacco products in EU countries as well as from non-EU to EU countries. Internet communication capabilities support and facilitate this type of smuggling.

H. A model for smuggling through a tourist company using tourist buses. A travel company illegally purchases cigarettes from a supplier and arranges regular trips to a specific location in a neighbouring country. The company arranges passenger trips at slightly lower than the market price in order to fill up the bus. The tour is legal, so all travel payments are legal and documented.

The study also identified the following typical models of counterfeit cigarette production:

A. Production in legal and illegal factories. This type of production requires a lot of costs and time. This business is highly profitable, but the risk is also high. There are many critical points in which the detection of illegal production may also be a problem for the perpetrators.

B. Domestic/Home production as a type of illegal factory. This type of production requires low costs and little time. Profit is not great in this production, but the risk is also not high. The problems for the perpetrators are mainly related to the supply of raw materials and finding a market for the manufactured goods.

As a result of the research conducted during the project and the development and analysis of business process models, the research team arrived at the following conclusions:

- The analysis and modelling of business processes can be successfully applied to the study of the illicit manufacture and smuggling of tobacco products. To this end, it is necessary to identify, group and analyse a large number of specific cases of illegal production and smuggling. Such data can be found on specific sites, by keyword search or by using text extraction tools.
- Case identification can be greatly facilitated by the use of advanced data processing tools.
- There are software products that can facilitate and accelerate the development of models for various typical business processes.

Opportunities for Application of Structural Equation Modelling in Tobacco Products Contraband & Counterfeit Risk Identification

The successful implementation of countermeasures to the contraband and counterfeit of tobacco products depends to a large extent on risk identification. It allows appropriate preventive measures to be taken in order to influence the favourable environment for development of these illicit practices.

Given the complexity of the processes and the complex influence of various factors on them, the study of tobacco products contraband and counterfeit risk is an extremely challenging task.

The review of the research publications on the topic done within the project and the study of indicators relating to tobacco products contraband and counterfeit showed that there are very few sources that directly provide data on these two illegal practices. Therefore, some methods, which may indirectly describe contraband and counterfeit, are very suitable for the needs of the study of these processes. One of them is Structural Equation Modelling (SEM), which gives the opportunity to examine hidden, unobserved, or so-called "latent" processes. On this basis, several models, which apply "multidimensional interrelationship between multiple variables" or "multidimensional analysis" the so-called MIMIC – Multiple Indicators – Multiple Causes), were developed and tested (Penchev, 2017, pp. 118-119).

Structural-Equation Modelling (SEM) allows the identification of relationships between measurable (observable) processes and hidden (latent, potential, unobservable) processes.

Modelling goes through the following steps:

1. Developing a theoretical model of interrelated hypotheses between observed and latent variables, based on well-known and well-defined dependencies within the general theory of the problem.
2. Gathering, summarizing and preparing data on observed variables. If the data are in different units, they must be scaled without changing its variation. Furthermore, for the calculation of the model it matters whether there are variables containing data measured with non-interval scales. This affects the choice of calculation method. There is no such data in the models tested within the project.
3. Choosing a method for work with missing data. Missing data classification is usually presented in two variants: Missing at Random (MAR) and Missing Completely at Random (MCAR). They are based on the presence of some kind of dependency (such as a legal constraint on data provision) in case of missing data. The models developed within the project use the

model known as Full Information Maximum Likelihood (FIML), which produces good results even in cases when the lack of data cannot initially be ignored (i.e. there is a factor determining missing data) and missing data is below 25% of the total sample volume (Asparouhov and Muthen, 2005).

4. Determining the type of data distribution for the observed variables. The choice of method to be used in the model calculation depends on the type of data distribution. The basic model of SEM requires a multinormal (normal for each variable) distribution. The modern development of SEM methods allows the model to be calculated in other data, which is different from normal distribution.
5. Calculation of the created theoretical model on the basis of the model of maximum similarity with the selected methods from the previous steps.
6. Estimating model convergence. Six basic evaluation indicators are known. The requirement is at least one of them should be in standard evaluations for the indicator. One of the project requirements was all six indicators to be within the required limits. Root Mean Square Error of Approximation (RMSEA) was defined as the most important indicator.
7. Testing the hypotheses of the theoretical model. If all previous steps are correct and the model convergence is estimated, any hypothesis from the theoretical model can be estimated on the basis of the calculated p-values from the model for statistical significance.

The MIMC model, which is based on SEM, consists of two sides. The left side includes the so-called causes, and the right side – the so-called indicators – Fig. 2. The causes affect hidden, latent, unobserved processes or phenomena. The indicators account for the results of the presence and activity of these hidden processes or phenomena.

The model has the following matrix notation:

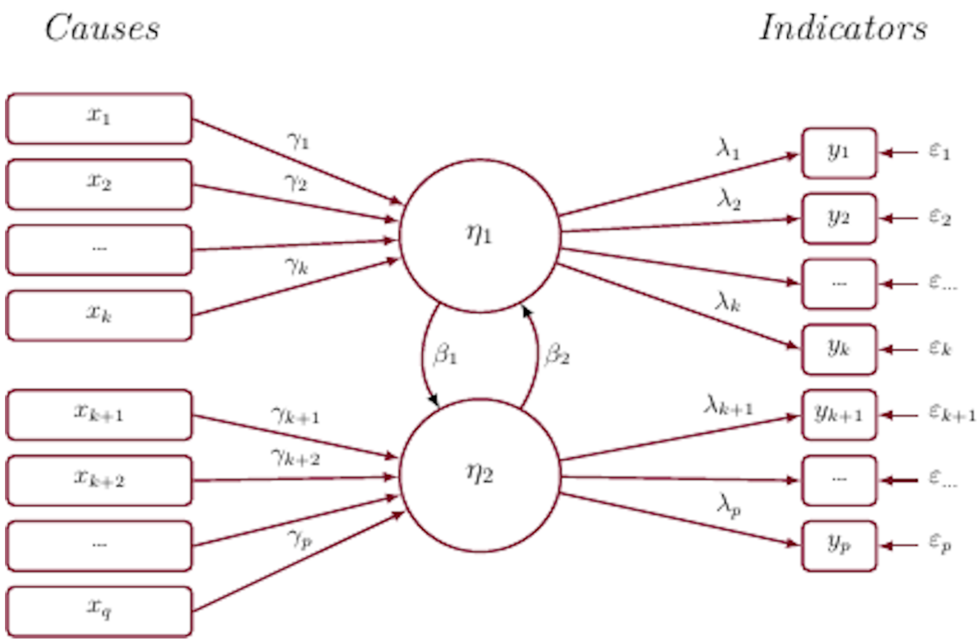


Fig. 2. Theoretical MIMIC Model

$$\begin{pmatrix} y_{i_1} \\ y_{i_2} \\ \vdots \\ K \\ \vdots \\ y_p \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 1 & 0 \\ \vdots & \vdots \\ 1 & K \\ \vdots & \vdots \\ 1 & p \end{pmatrix} \begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} \begin{pmatrix} \varepsilon_{i_1} \\ \varepsilon_{i_2} \\ \vdots \\ \varepsilon_K \\ \vdots \\ \varepsilon_p \end{pmatrix} \tag{E.1}$$

$$\begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} = \begin{pmatrix} 0 & \beta_1 \\ \beta_2 & 0 \end{pmatrix} \begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} + \begin{pmatrix} \gamma_1 & \gamma_1\gamma_2 & \cdots & 0 & \cdots & 0 \\ 0 & 0 & \cdots & \gamma_k - 1\gamma_K & \cdots & \gamma_q \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_K \\ \vdots \\ x_q \end{pmatrix} + \begin{pmatrix} \zeta_1 \\ \zeta_2 \end{pmatrix} \tag{E.2}$$

where η_1 and η_2 are the latent variables for the counterfeit intensity and contraband intensity, respectively. Equations (E.1) and (E.2) represent *the structural* and *measurement* models, respectively. The estimation of the parameters β_1 and β_2 in the MIMIC model explain the relationship between the two latent variables η_1 and η_2, i.e., between the Counterfeit Intensity and Contraband Intensity. β_1 describes the effect of η_1 on η_2, while β_2 describes the effect of η_2 on η_1.

The latent variables are denoted by η1 and η2 in Fig. 2 (e.g. Counterfeit Propensity and Contraband Propensity). The coefficients γ and λ are important for risk identification because they indicate the power of impact of the various factors affecting hidden, latent variables.

Within the project of Department National and Regional Security two main MIMIC models were developed and tested with different indicators.

The first MIMIC model has two latent variables: *Counterfeit Intensity (CFI)* and *Contraband Intensity (CDI)*. The data sample, used in the model, consists of data about 186 countries all over the world.

Taking into account the results of the application of MIMIC model by countries and using the same methodology and data sources, the second MIMIC model with one latent variable – *Illicit Trade of Tobacco Products Indicator* (ITTPI) was developed and tested at NUTS 3 level [1] for 30 European countries.

The second model aims to reveal the main social and economic characteristics, which stimulate the tobacco and tobacco product contraband in the European countries and especially those of them, which are situated on the Balkan route – Fig. 3.

The data sample, used in the model at NUTS 3 level in 30 European countries, includes 9 variables, chosen by the researchers based on literature review and expert evaluations during the team discussions, such as:

Causes – 1) GDP (PPS) (1369 regions), 2) Employment (total) (1493 regions), 3) Employment in Agriculture (1204 regions), 4) Road Freight (1636 regions) and 5) Tax Burden (1705 regions) and 6) Growth (1734 regions).

Indicators or dependent variables – 1) Crimes (1100 regions), 2) Number Smokers (1493 regions), 3) Tax Revenues (1507 regions). (Fig.3)

The main sources of information were different databases at international level, among which: UN’s and its structures’ databases (https://unstats.un.org/home/, www.who.int, www.unodc.org etc.), World Bank’s database (https://data.worldbank.org/), OECD’s database (http://stats.oecd.org/), Fund of Peace (http://global.fundforpeace.org/), EUROSTAT (http://ec.europa.eu/Eurostat) as well as different databases at national level.

The ITTPI is the calculated latent variable through MIMIC model at NUTS3 level. It shows the propensity of tobacco products contraband. The ITTPI can be considered as a measure for the illegal market demand for cigarettes and other tobacco products. It is characterized by:

- ITTPI is not measured in specific units (e.g. meters, kilograms etc.);
- ITTPI is standardized through the process of calculation and the ITTPI values are comparable among regions;

- ITTPI varies within the interval [-5,30]. Lower levels of ITTPI mean lower contraband propensity for the region and vice versa. This also means that the socio-economic environment is not appropriate for the development of contraband processes;
- In order to be more explicable, ITTPI is also calculated as rank within the 1744 EU regions at the model. The lowest level of ITTPI [-5] is taken for 0 and other higher values are distributed to 100 (the highest level is 30). Therefore, the rank can be used for comparison of ITTPI levels among the regions.

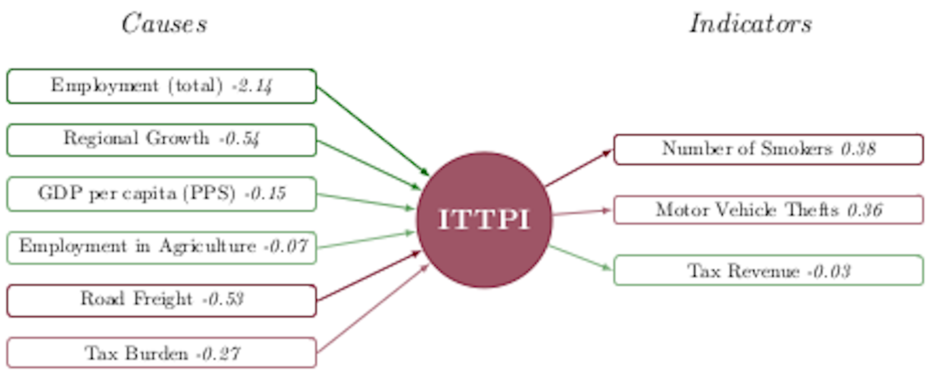


Fig. 3. MIMIC model at NUTS3 Level

After passing all the steps for testing the model, the hypotheses described below were considered statistically significant for the influence of the causes on the latent variables.

Model tests showed that the indicator "*Employed Persons (total)*" has the strongest impact on the ITTPI at NUTS3 level – Fig. 2, left side of the model. The strength of the relationship is [- 2,141], which means that the change in employment with a 1% in a certain direction (e.g. increase) will be followed by a change in the ITTPI in the opposite direction (in this case decrease) by 2,141%.

The indicator "*Regional Economic Growth*" has a negative impact on the ITTPI at regional level. The increase of the economic growth by a 1% will be followed by a decrease of the ITTPI by 0.538% and vice versa. The decrease in growth will increase the tendency of people to participate in the process of contraband of tobacco products.

As it can be seen in Fig. 3, the increase in the "*Tax burden*" indicator is followed by an increase in the ITTPI. There is a tested positive relationship between the two factors. This means that a 1% increase in the tax burden ratio will be followed by 0.272% increase in the ITTPI, while a decrease in the tax burden will be followed by a decrease in the ITTPI.

The positive value of the *"Road Freight (ratio)"* indicator means that the presence of well-developed transport infrastructure facilitates the illicit trade in tobacco. The increase of this factor by 1% will be followed by an increase in the propensity to tobacco and tobacco products contraband by 0.53%.

The right side of the developed MIMC model shows the impact of the ITTPI indicator on the other three indicators. An increase in the ITTPI by 1% will be followed by an increase in the number of smokers by 0.38% and vehicle theft by 0.36%. The *"Tax Revenue"* indicator will decrease by [-0.03%] as a result of a 1% increase in the ITTPI indicator.

The ITTPI indicator at NUTS3 enables comparison with other indicators. e.g. its level was compared with the KPMG Project SUN results about consumption of Non-Domestic (ND) products (assessed by the method of ND incidents in EPS) and the results of TRANSCRIME's study about the size of illicit cigarette market (prevalence) – Fig. 4. The comparison of data was done for some states located on the Balkan route, such as Bulgaria, Croatia, Italy, Germany, France, the United Kingdom. As a result of the comparison, the levels of indicators of tobacco contraband from the three studies showed a coincidence.

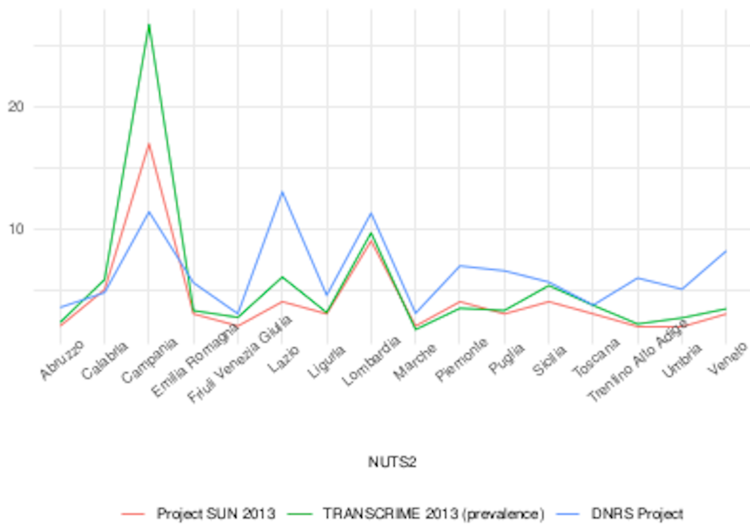


Fig. 4. Comparative Data on Consumption of ND products (KPMG), Size of Illicit Cigarette Market (TRANSCRIME) and ITTPI (DNRS) in Italy

In order to visualize the data on the obtained indicator, an interactive map was developed – Fig. 5. The map is a software application that runs in a web environment and can be open in a web browser without installing additional software.

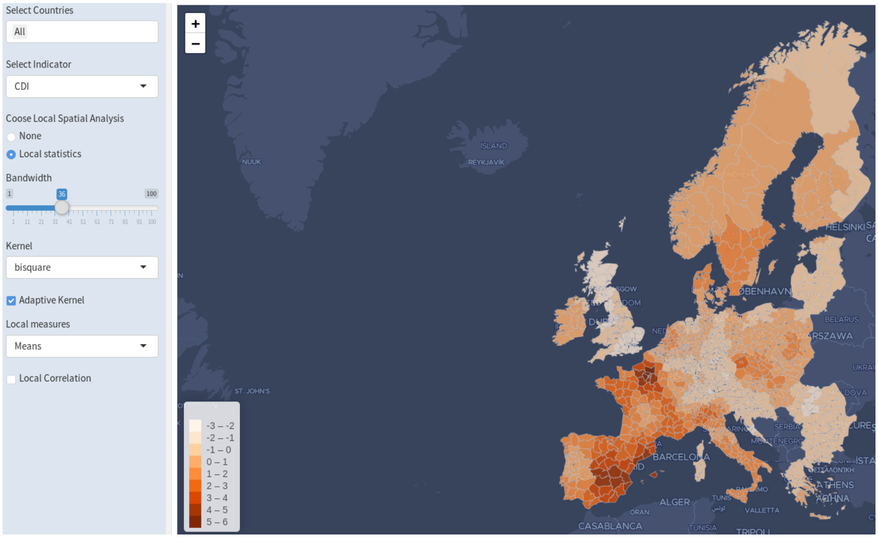


Fig. 5. Interactive Map

The interactive map enables spatial visualization of propensity of tobacco products illegal trade. The higher the value of indicator at regional level, the darker the colour of the region.

Development of Monte Carlo Simulation Models

The case studies identified during the project were considered to be a sufficiently representative sample of cases of illicit manufacturing and smuggling of tobacco products. Researchers are aware that there are many other cases of smuggling that have not been identified by the study or have not been detected by the authorities. The perpetrators use a variety of methods and avoid repeating the same. Therefore, it can be assumed that the variations for the implementation of the processes are too diverse and difficult to summarize in a limited number of case types.

In such situations, it is appropriate to use a specific method that allows reproducing repeatedly a situation with different inputs each time. This is the Monte Carlo simulation method. It is widespread and has great potential for application. The method is based on the construction of a model that reflects the relationship between a set of input variables (inputs) and a set of output variables (outputs). The values of outputs will depend on the value of a set of deterministic and a set of random input variables. The simulation model calculates the value of the outputs if the values of all inputs are specified. (See Fig. 6).

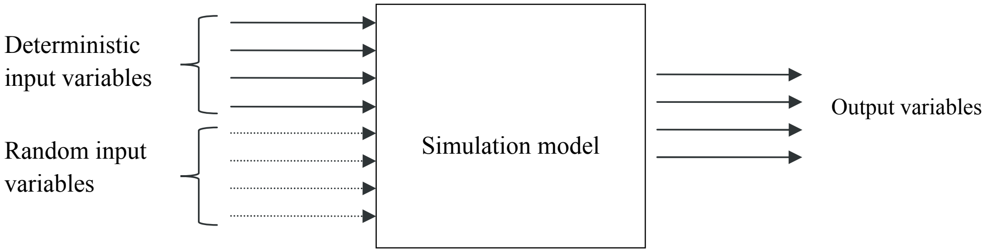


Fig. 6. Monte Carlo simulation model

The type of probability distribution as well as some of their other probabilistic characteristics for the random input variables must be determined. This can be done using the analysis of historical data or by collecting and summarizing expert opinions. Numerous types of probability distributions are usable, for example: triangular, beta, uniform distribution, as well as various discrete distributions.

After developing the model and setting the parameters of the input variables, a simulation can run. A random value is assigned to each of the random inputs using a specific random number generator. The deterministic inputs keep their fixed values. The outputs' values are calculated using the model. These values are stored for further processing. This procedure is repeated multiple times, and the results are stored each time. The number of runs depends on the nature of the random variables and can reach up to ten thousand times or more. The aim is to be able to make a statistical analysis of the results with high degree of confidence.

Simulation results can be used in a variety of ways. For example, it is possible to calculate the mean values of the outputs and their standard deviation, the mode and median of the results, as well as other statistical values. All these values provide valuable information for the evaluation and analysis of the simulated processes.

There are a variety of software products to use for Monte Carlo simulations, for example: Specialized Simulation Software BIMP, Excel, @Risk, Crystal Ball, among many other. The team decided to carry out the simulations using two approaches – using BIMP and using the Excel software with specially designed simulation models. The models include variables such as: average time to complete the illegal activities, average implementation costs, expertly assessed potential benefits to the perpetrators, expertly assessed risks to the perpetrators (caused by the amount of the penalty if the perpetrator is caught, time risk, and cost risk).

The analyses of business process simulation models led to a series of conclusions, the main of which are:

- Simulation of business process models can produce very useful information about the implementation of different business models of contraband of tobacco and tobacco products. This is a good basis for useful for the practice comparative analyses.

- It is possible to apply simulation models of tobacco smuggling business processes in order to identify some of their additional features.
- Part of the information to feed the simulation models (such as estimating the amount of the penalty if the perpetrator will be captured, evaluating the benefits to the perpetrator if the process is successfully completed, etc.) is impossible to collect directly from practice. It can be generated using expert opinions. An important methodological issue is that these opinions should be carefully verified and be as close to reality as possible.

Assuming that the perpetrators are rational actors (this is an issue that requires serious additional discussions), some assumptions can be made about the characteristics of individuals who would choose different models, for example:

- "Smuggling of cigarettes by large vessels" and "Fictitious export" models are characterized by high risk and high benefits. They would most likely be selected from perpetrators who are prepared to take a high risk and expect high benefits.
- "Smuggling by mules" model is expected to be selected by people who are not willing to take a high risk and are satisfied with a lower benefit.
- "Smuggling by persons with diplomatic immunity" will be selected by persons with appropriate posts and capacities.
- Most likely, "Sale at a depreciated value" and "Smuggling in which cigarettes remain in an intermediate state" will be selected by organizations that already have some criminal background and have built the appropriate infrastructure.

Opportunities for Spatio-temporal Analysis and Clustering in Tobacco Products Contraband & Counterfeit Risk Identification

The spatial analysis is used for the identification of the spatial impact of neighboring regions on the studied indicator.

Software application for spatial analysis was developed during the Project. It also allows for the study of the spatial impact of all the causes for the indicator (e.g. GDP, Employment, Tariffs etc.). The interactive map serves the following purposes:

- Spatial visualization of present levels of contraband intensity;
- Analyses of the spatial influence of the neighbouring regions;
- Contraband channels identification;
- Indication of illicit markets demand;
- Fake production centres identification;
- Contraband trends, development and forecasting.

- Possible Contraband Routes – see Fig. 7

Two approaches of spatial analysis were used – Geographically Weighted (GW) Statistics and Geographically Weighted Correlation.

The core of the GW is the selection of a certain number of the neighbouring regions of a given region. After that the value of the studied indicator for this region is weighted by the distance to the neighbouring regions and the values of the studied indicators for these regions. The value of the indicator for the neighbouring regions is summed and weighed using the so-called "kernel", which is the formula for using local weight of distance.

The number of the neighbouring regions or local distance could vary, but for the identification of the optimal number of the neighbouring regions the cross-validation method is used. Through the validation procedure scores are calculated and are assigned to each region. The scores depend on the so-called "bandwidth" parameter. Bandwidth is the number of neighbours used for whitening the variables. If this number is too small, we can omit the possible distance effect. If it is too big, the results will become global rather than local. So, when the sum of cross-validation scores is minimal the number of used neighbours – the bandwidth – will be optimal.

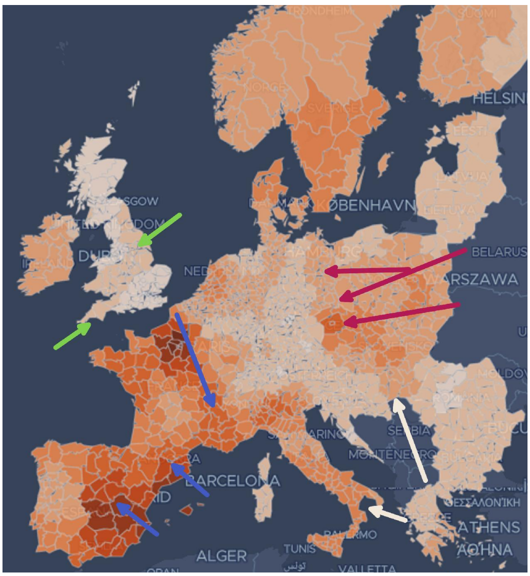
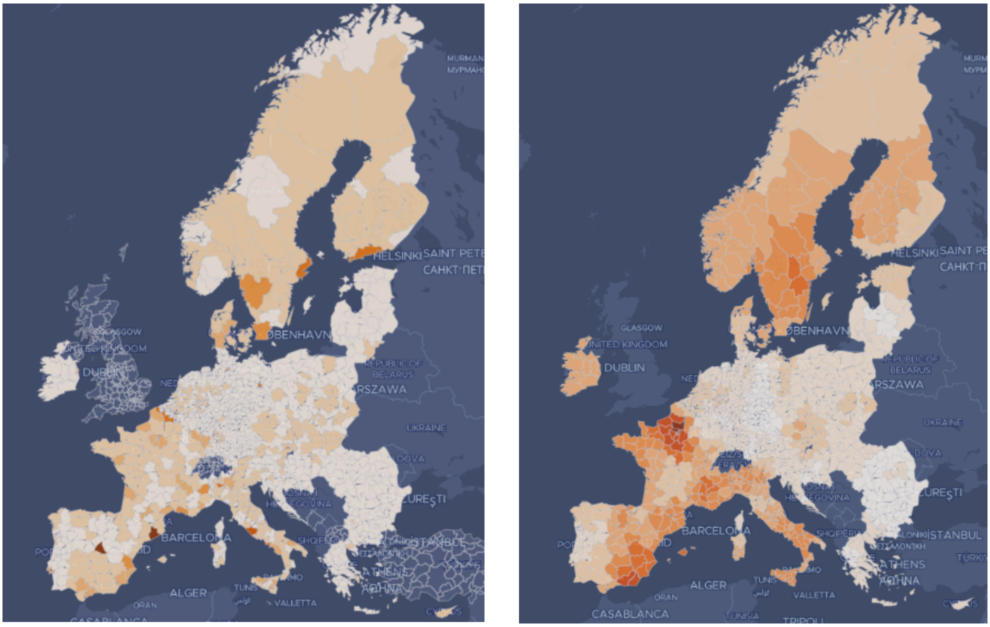


Fig. 7. Possible Routes of Tobacco Products Contraband

The following measures are included in software application:

- Means – indicates the studied parameter with locally (geographically) weighted values.

- Standard Deviation – shows the level of differences (dispersion) among neighbours.
- Variance – also shows differences, but in "raw", non-standardized values (standard deviation is the variance divided on the mean).
- Skewness – shows the asymmetry of distribution, that is to say, the rate of change of local values depending on the distance.
- Cross-validation – allows the selection of optimal number of neighbouring regions.



(a) (b)

Fig. 8. Application of GW methods to MIMIC model output

The propensity to illicit tobacco trade was studied over 1,700 EU NUTS3 regions during the UNWE Project "Contraband & Counterfeit Risk Identification". The MIMIC model output was mapped to the regions (see Fig. 8a). The application of descriptive GW statistics give additional information and inside about possible formation of the illicit trade routes (see Fig. 8b)

An interactive map was developed for the purposes of the project. It is a web-based application, which can be opened in a web browser without installing any additional software.

The results of the MIMIC methods applications are visualized through an interactive web-based map, which allows selecting and analysing different regions, as well as the spatial distribution of the defining factors.

Interactive web-application in the study of illicit trade has the following advantages:

- The study of the regional influences by including geographically weighted statistical data in the calculation of the method's results.
- The identification of potential channels used for illicit trade. Based on certain socio-economic conditions illicit trade channels can be pinpointed in geographically clustered regions by applying the spatial analysis visualized on the map.
- Crime mapping.

The predictions within the model and software application are done for ITTI by changing the values of the socio-economic factors (Causes part of the MIMIC model). The changes are given as percent of existing values. The new values of ITTIL are re-calculated with model coefficients for each region, and then are visualised on the map. (see Fig. 9).

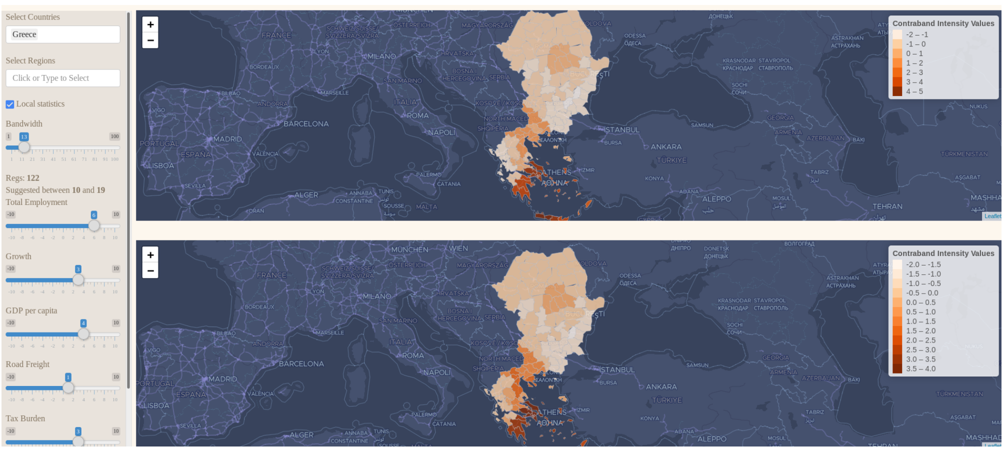


Fig. 9. The Prediction Page

The Interactive Map and other web-applications attracted the attention of both officials and experts on Project's events and training courses.

Conclusion

The interactive map and other web applications, which were developed within the project, have attracted the attention of the employees and experts from different stakeholders to the events and the training courses have been highly appreciated by them.

Many useful contacts have been established and a lot of ideas have been exchanged with representatives of the National Assembly, the Ministry of Interior, Border Police, the Customs Agency, the General Directorate for Combating Organized Crime, the National Association of Tobacco Manufacturers and other interested stakeholders. The contacts with some of the leading international research organizations from all over the world have helped for the validation of the results.

The statistical model for data analysis, developed and implemented by the project team, is a big step ahead because it may be successfully applied in other spheres. On the one hand, this model, together with Europe's interactive map with GIS, provides reliable information on the relationships between illicit trade in tobacco and other crimes such as corruption, organized crime, shadow economy, human trafficking, etc., and on the other it shows different methods of effective counteraction.

The main socio-economic factors influencing this illegal activity have been identified. The team has analysed 320 cases, out of which 10 criminal business processes have been developed. In addition, the legal team has also conducted an appropriate analysis of the legislation and proposed a number of changes and recommendations for changes in the regulatory framework. The results of the project have been widely discussed during various public events, as well as in numerous interviews and articles published in the media. The basic package of research materials is going to be published soon.

The method, developed by our research team, for measuring the propensity to trade in tobacco products on the basis of statistical models is unique. It can easily be applied and used for other types of criminal activity. The results have been obtained entirely on the basis of publicly available information. This makes them much easier to apply and verify.

On this basis a new indicator for measuring illegal tobacco trade have been developed. It has been named ***Illicit Trade of Tobacco Products Indicator (ITTPI).*** This is one of the most significant achievements of the project.

ITTPI is visualized on the interactive map and it may be used everywhere in the world. It can be applied in the day-to-day work of institutions dealing with the countering of illicit trade and manufacturing of tobacco and tobacco products. By visualizing certain regions, the model allows forecasting, which significantly distinguishes it from other known methods for detecting illegal trade. The method has been tested for 186 countries and for 1,744 EU regions (EUROSTAT NUTS3 classification). Model data has been verified by comparison with other studies conducted by global research centres. The interactive map visualizes the regions where there is a bigger propensity to contraband. This supports the activities of the institutions by showing where to focus their efforts on combating tobacco contraband.

Notes

[1] The NUTS classification (Nomenclature of Territorial Units for Statistics) is a hierarchical system for dividing the economic territory of the EU for the purpose of collection, development and harmonization of European regional statistics. Socio-economic analyses of the regions by NUTS 3 are small regions for specific diagnoses (1480 regions for 2015 and 1744 for 2018).

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TOBACCO PRODUCTS CONTRABAND & COUNTERFEIT RISK IDENTIFICATION

Abstract

This article presents the results of a research project "Contraband & Counterfeit Risks Identification (Analysis of Business Processes and Spatial Aspects)", funded by PMI IMPACT. The project has been developed by the team of Department "National and Regional Security" at the UNWE. It is focused on states located on the Balkan route of trafficking from Turkey to the Western Europe, including France, the UK, Germany and Italy. The main focused is on Bulgaria due to its key geographical location.
Within the project a unique illicit tobacco trade identification indicator has been developed. It is so called – Illicit Trade in Tobacco Products Indicator (ITTPI). ITTPI can be visualized on an interactive map and could be implemented all over the world. It can be used in the daily work of institutions dealing with the counteractions of the illicit tobacco and tobacco products trade. Despite other methods the model can forecast and detect centers and channels of illicit tobacco trade by visualizing certain regions. The method has been tested in 186 countries and separately for 1744 EU regions (EUROSTAT NUTS3). Model data have been validated by comparison with several studies of other international research centers.

Key words: Tobacco Products, Contraband & Counterfeit, Risk Identification, Modus Operandi, Business Process Analysis, Structural Equation Modelling, Spatial-Temporal Analysis

JEL: C15, L66, K10