Indicators of (organized) crime and subversion in industrial areas:
A pilot study in the municipality of Tilburg

Management summary

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The objective of this study was to determine whether indicators could be found that illustrate at what stage an industrial area is in the development or presence of (organized) crime and subversion. Put differently: which indicators can predict where an industrial area finds itself on a 'sliding scale' of crime and subversion?

Research reason and context
The integrated approach to organized crime has evolved over the past 20 years. In order to arrive at safe and livable neighborhoods, vital industrial areas and sound business sectors, a broad approach is needed in which criminal law, disruption, enforcement and social policy are combined. This integrated approach requires closer cooperation at a local, regional and national level between the authorities involved, their private and social partners and citizens.

Preventive measures play an increasingly prominent role in the integrated approach to organized crime and subversion, with a great deal of attention being for tackling areas. An area approach and the approach to subversive crime are two sides of the same coin (Tops and Van der Torre, 2015). The accumulation of problems in vulnerable neighborhoods and industrial areas creates a breeding ground for criminal activities. There is a continuum with on the one hand the legitimate society and on the other hand the hard criminal underworld; in between there are many other forms ranging from consciously looking away and getting one's share to lending a hand to criminals.

Definitions and framing
In this study, an industrial area is defined as a work location of at least 1 ha gross that is suitable for use by trade, the manufacturing sector and industry. Areas that fall outside this definition include seaport areas, economic zones and office locations. For the identification of potentially relevant indicators and the data collection, we focused on drug-related crime (production of and trade in hemp and synthetic drugs). In addition, in this pilot study, the data collection was geographically limited to 30 industrial areas in the municipality of Tilburg. This means that, although the approach and analyses could be tested, the results of the analyses are less reliable due to the small sample of 30 industrial areas only.

Research approach
The research started with the identification of potential indicators of (organized) crime and subversion in industrial areas. This was done in a preliminary study consisting of a literature study, an expert meeting and interviews. Subsequently, data relating to the possible indicators were collected from various sources. In order to identify the degree of organized crime and subversion for each industrial area, a small questionnaire was set out in which respondents could assess the industrial areas. Data on the potential indicators and the degree of (organized) crime and subversion in the industrial area were aggregated and then merged if necessary, after which we could analyze which potential indicators actually have predictive value for (organized) crime and subversion in industrial areas. We used the data science method Random Forest to find the most important indicators, after which we ran several decision trees based on the 15 most important indicators to better understand the results. Below, we briefly explain the answers to the six research questions.

1. What are potential indicators of (organized) crime and subversion in industrial areas?

Firstly, in the preliminary study possible indicators have been identified with regard to the physical environment (including maintenance, ageing and empty buildings) and supervision, enforcement and cohesion in the industrial area. Other possible indicators of organized crime and subversion in industrial areas that came forward in the preliminary investigation are related to the location of the industrial area, the type of companies (sectors) that are present, the development, real estate, reports to the police and Meld Misdaad Anoniem[1], reports to the municipality and other information known to the municipality, for example about incidents in the past.

2. Which data sources are available and can be merged to examine the predictive value of potential indicators?

Characteristics of industrial areas (such as the presence of park management and the access to the area) were available in the Integraal Bedrijventerreinen Informatie Systeem (IBIS).[2] In addition, we received the number of reports to the police and Meld Misdaad Anoniem. Whether an industrial area has a Keurmerk Veilig Ondernemen[3] could be found online. The municipality of Tilburg has delivered the number of reports to the Centraal Meldpunt[4] (e.g. about drug nuisance), the number of cleared buildings where hemp was being produced, the number of Damocles closures[5] and data related to the real estate in the industrial areas. In addition, data from the BAG[6] and the company register[7] (based on the Chamber of Commerce) were made available. Finally, grid operator Enexis provided data on the presence and refusal of smart meters, the capacity of electricity connections and historical cases of fraud. The result was a comprehensive dataset with possible indicators of (organized) crime and subversion in industrial areas.

3. How can the extent of (organized) crime and subversion on an industrial area be operationalized as a dependent variable that can be used to test the predictive value of potential indicators?

Different ways of obtaining an estimate of the likelihood of organized crime and subversion per industrial area were taken into consideration during the investigation. Ultimately, the choice was made to 'label' the industrial areas (i.e. to classify them in low, medium or high likelihood) by setting up a small questionnaire and asking respondents (working for example at the municipality, the police or park management) for an estimate whether the likelihood of (organized) crime and subversion in the industrial areas is low, medium or high. Subsequently, the answers of the respondents were combined into a final score for each industrial area. This resulted in eight industrial areas having a low likelihood, fifteen areas with an average likelihood and seven areas with a high likelihood of (organized) crime and subversion. This approach also had limitations: there were only eleven respondents and there may be

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[1] With Meld Misdaad Anoniem, people can report crime anonymously.
[2] IBIS is a national database with information about industrial areas, see https://www.ibis-bedrijventerreinen.nl/
[3] The 'Keurmerk Veilig Ondernemen' is a quality mark for safe entrepreneurship in industrial areas issued when certain measures are taken to prevent crime and make the area safe.
[4] Central Reporting Center, where citizens can report crime and nuisance to the municipality.
[5] Damocles closures refer to the buildings that were closed based on the Damocles Law. According to article 13b of the Opium Law (also called the Damocles Law) mayors are authorized to close buildings if drugs are being produced there.
[6] The BAG is the registration of addresses and buildings in the Netherlands.
[7] The municipality of Tilburg has a register of the companies that are present in the industrial areas. This register is based on the Chamber of Commerce, but verified, adapted and expanded based on contact they have with the companies.

subjectivity, a lack of knowledge and/or self-interest, something that we have tried to reduce by approaching as many respondents as possible from as many different organizations as possible, and with different roles and areas of expertise. The results were also compared with signals that resulted from integral government cooperation.

4. Which potential indicators actually have predictive value for (organized) crime and subversion in industrial areas?

To find the most important indicators we used the data science method Random Forest (RF). In the ranking of the 15 most important indicators we find the 'usual suspects' that also came forward in the preliminary investigation. For example, a combination of factors relating to the physical environment such as ageing and empty buildings, the value of the real estate, the degree of supervision (caused by buildings with a public function or the presence of many temporary employees), including the number of reports to the police and the development of an industrial area is important. The type of companies also seems to play a role, for example the legal form and size. Finally, the presence of many additional branches in the company register of the municipality, such as additional Chamber of Commerce registrations, came forward as a risk indicator.

In order to gain insights into the direction of the effect of a certain variable, we have also run decision trees with the top 15 risk factors in addition to the RF. This information cannot be retrieved directly from a RF. The decision trees also give us more insight into the most important combinations of risk factors. This "toxic cocktail"[8] on an industrial area is a mix of the following indicators:

1. *Average year of construction*: the lower the average construction year in an industrial area, the higher the likelihood of organized crime and subversion. This means that there is a higher risk in industrial areas with, on average, older buildings.
2. *High-capacity connections*: here we look at the percentage of buildings in the industrial area where the capacity of the energy connection is more than 35 groups (3x50, 3x63, 3x80). It seems that if there are fewer high-capacity connections in an industrial area, the likelihood of organized crime and subversion increases. There may be a relationship between the capacity of the electricity connection and the size of a company or the type of company.
3. *Share of buildings with a low WOZ value*[9]: the higher the percentage of buildings in an industrial area with a WOZ value lower than € 160k, the higher the likelihood of organized crime and subversion.
4. *Company size (small companies)*: the higher the percentage of companies with fewer than five employees, the higher the likelihood of organized crime and subversion.
5. *Additional branches yes*: the more additional branches are present in an industrial area, the higher the likelihood of organized crime and subversion. Additional branches are branches that are not included in the company register because they do not meet the conditions (there is not at least 1 person working, e.g. additional Chamber of Commerce registrations and storage sheds).
6. *Police reports with reference to drugs and subversion*: the more incidents related to drugs and subversion in an industrial area, the higher the likelihood of organized crime and subversion.

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[8] With the toxic cocktail we refer to the combination of indicators that results into a higher likelihood of (organized) crime and subversion in the industrial area.
[9] Value of the building under the Valuation of Immovable Property Act (WOZ).

Although the results of this exploratory study are less reliable due to the limited sample of 30 industrial areas in the municipality of Tilburg, we do show that it is technically possible to carry out such analyses. From these results we can imply that the application of data science methods can help to find indicators for (organized) crime and subversion in industrial areas. Follow-up research on a larger scale is needed to confirm this.

5. **How can the indicators that actually have predictive value be used to provide insights in practice about which industrial areas have an increased likelihood of (organized) crime and subversion?**

Insights about important predictors could be used in applied analyses on which industrial areas have an increased likelihood of (organized) crime and subversion. However, it is necessary to carry out research on a larger scale first, i.e. for more industrial areas, in order to estimate a reliable model. Subsequently, based on the indicators, it could be predicted for other industrial areas for which no label is known yet whether the area has a low, average or high likelihood of (organized) crime and subversion. In addition, it would be possible to see how changes in the predictors change the likelihood of (organized) crime and subversion. This makes it possible to run different scenarios, which can help in policy making.

The added value of data science methods can be proven even more in the future by carrying out analyses on larger datasets. However, there will also be limitations in the use of data science methods, which in particular relate to the existence and availability of data and the merging of data sets (which, for example, have different aggregation levels). Moreover, creating an integrated dataset with many possible indicators is not only a time-consuming task, but also involves many legal aspects (such as privacy considerations).

Besides conducting research on a larger scale and developing a reliable model, another option is to do research on a smaller scale. Municipalities and regions that want an assessment of their industrial areas can also, like in this study, ask a number of experts to assess the industrial areas using a questionnaire and then this could be supplemented with qualitative research to clarify which industrial areas are in the danger zone.

6. **To what extent is it feasible to apply the same methodology as in this study in the future to find indicators of (organized) crime and/or subversion in residential areas?**

In the future, the same methodology could also be applied to look more broadly at indicators of (organized) crime and subversion, for example in residential areas. This has not been investigated specifically, but should be possible with some modifications, mainly in the data sources used. Additionally, different methods will have to be tested again to determine which method is most suitable for this new application. It would also be interesting to look at the relationship between industrial areas and the surrounding residential areas. Industrial areas that are close to residential areas have a relationship with these areas. For example, Tops and Van der Torre (2015, p.41) found in one of the cases that they investigated that *"... on (nearby) industrial areas drug seizures are frequently being carried out in which residents are involved in one way or another."* According to them, criminal money is invested partly at a great distance, in other parts of the world, but criminals are still investing locally in companies and premises. The Digitalization and Safety research group and the Subversion research group of Avans University of Applied Sciences are currently conducting research into mapping out risk areas in the municipality of Tilburg using data analysis. It would be interesting to compare the results of Avans' research to the results of this research to see whether the industrial areas

with a high likelihood of (organized) crime and subversion are also surrounded by residential areas with a higher risk.