

Inspira Crea Transforma

PhD IN

MATHEMATICAL ENGINEERING

SNIES 103604 Medellín - Resolution 13045 of August 13, 2014 valid for seven years

►Duration: 8 semesters

Foresight to dismantling criminal networks

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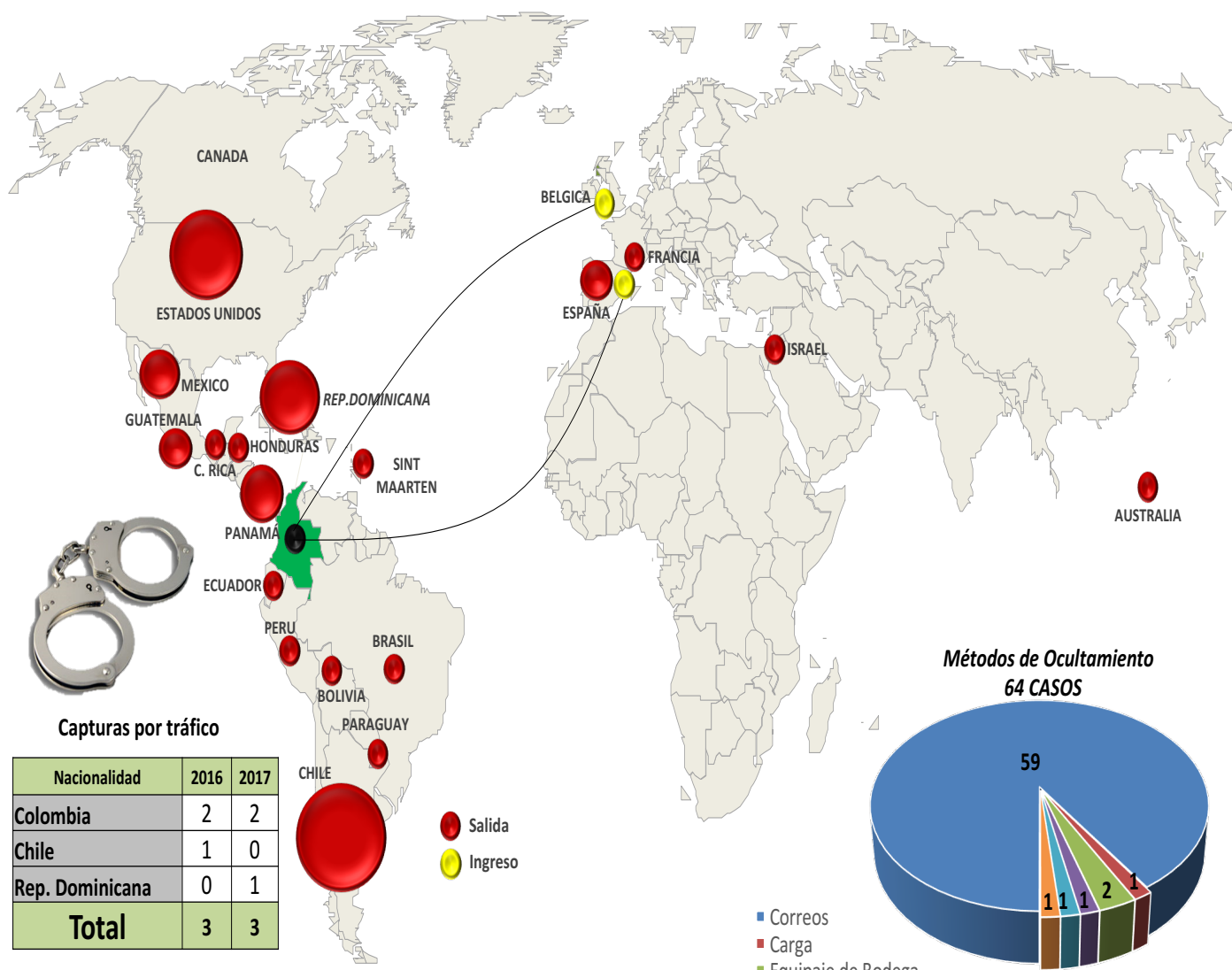
HENRY LANIADO

Thesis advisors

The genesis is the security problem generated by organized crime in Colombia, which has not been study in detail from a quantitatively point of view.

An econometric model brings together math, statistic and networks analysis to understand transnational organized crime. So, from the citizen security, reducing the victimization of violence and crime.

TRAFFICKING OF SYNTHETIC DRUGS FROM AND TO COLOMBIA



Capturas por tráfico

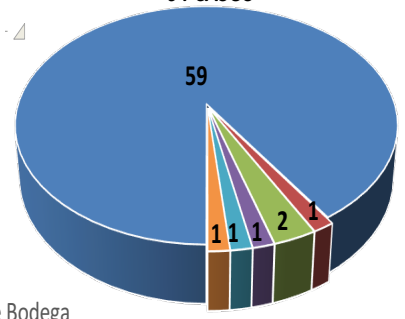
Nacionalidad	2016	2017
Colombia	2	2
Chile	1	0
Rep. Dominicana	0	1
Total	3	3

Fuente : ARPAE-DIRAN

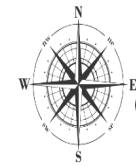
SALIDA INTERNACIONAL (SIN IDENTIFICAR)					
PAÍS	No CASOS		Total	Cantidad en dosis	Cantidad en Gr
	2016	2017			
CHILE	21	2	23	13.776	1.728
ESTADOS UNIDOS	7	7	14	3.570	7.002
REP.DOMINICANA	3	4	7	2.740	580
PANAMÁ	3	1	4	1.395	966
MÉXICO	2	0	2	497	1.140
ESPAÑA	1	1	2	500	5.834
GUATEMALA	0	2	2	2.000	0
BOLIVIA	1	0	1	493	0
BRASIL	1	0	1	500	0
COSTA RICA	1	0	1	500	0
HONDURAS	1	0	1	126	0
PERÚ	1	0	1	590	0
SINT MARTTEN	1	0	1	225	0
AUSTRALIA	0	1	1	1.000	0
ECUADOR	0	1	1	1.000	0
FRANCIA	0	1	1	500	0
ISRAEL	0	1	1	1.000	0
Totales	43	21	64	30.412	17.250

Fuente : ARPAE-DIRAN

Métodos de Ocultamiento
64 CASOS



- Correos
- Carga
- Equipaje de Bodega
- Equipaje Doble Fondo
- Adheridos



CIENA
Centro Internacional de Estudios Estratégicos
Contra el Narcotráfico

The research a unique dataset that will be build from confidential information of the Colombian Police and Social Media.

- **Intelligence reports**
- **Criminal investigations of sentenced cases**
- **Crime statistics**
- **Social media analysis**
- **Operations against organized crime**

Outlook of the contributions

- **Academic field, mathematical methodologic advance in comprehension of organized crime. And producing literature, for the scarce on the subject.**
- **Public policy field, offer a law enforcement agencies tools to prevent activities of criminal organizations.**
- **Social field, reducing victims and cost of crime.**

1. Introduction

- ✓ Literature review:
 - Criminal network analysis
 - Social media for predicting crime

2. Doctoral proposal

- ✓ Problem statement
- ✓ Justification
- ✓ Main objective
- ✓ Methodology

3. Deliverables

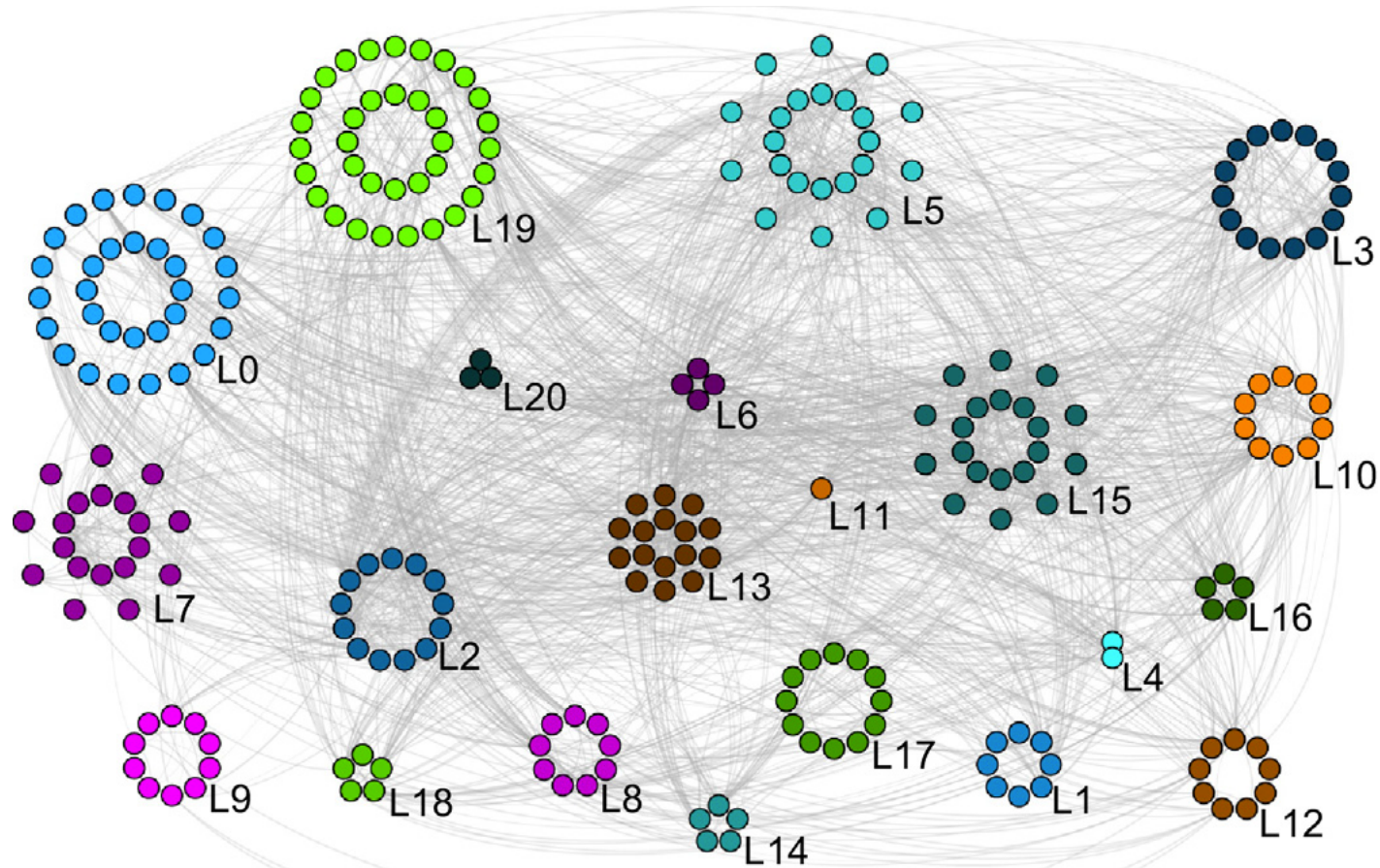
- ✓ Scientific journals
- ✓ Simulation of model
- ✓ Thesis

The image shows a modern office environment. In the center, there is a circular area with a white pillar and a circular light fixture. The ceiling is white with several square recessed lights. In the foreground, there are two curved, light-colored desks with white partitions, where several people in business attire are seated and working. The background shows a large window with a view of the outdoors and some office equipment.

Introduction

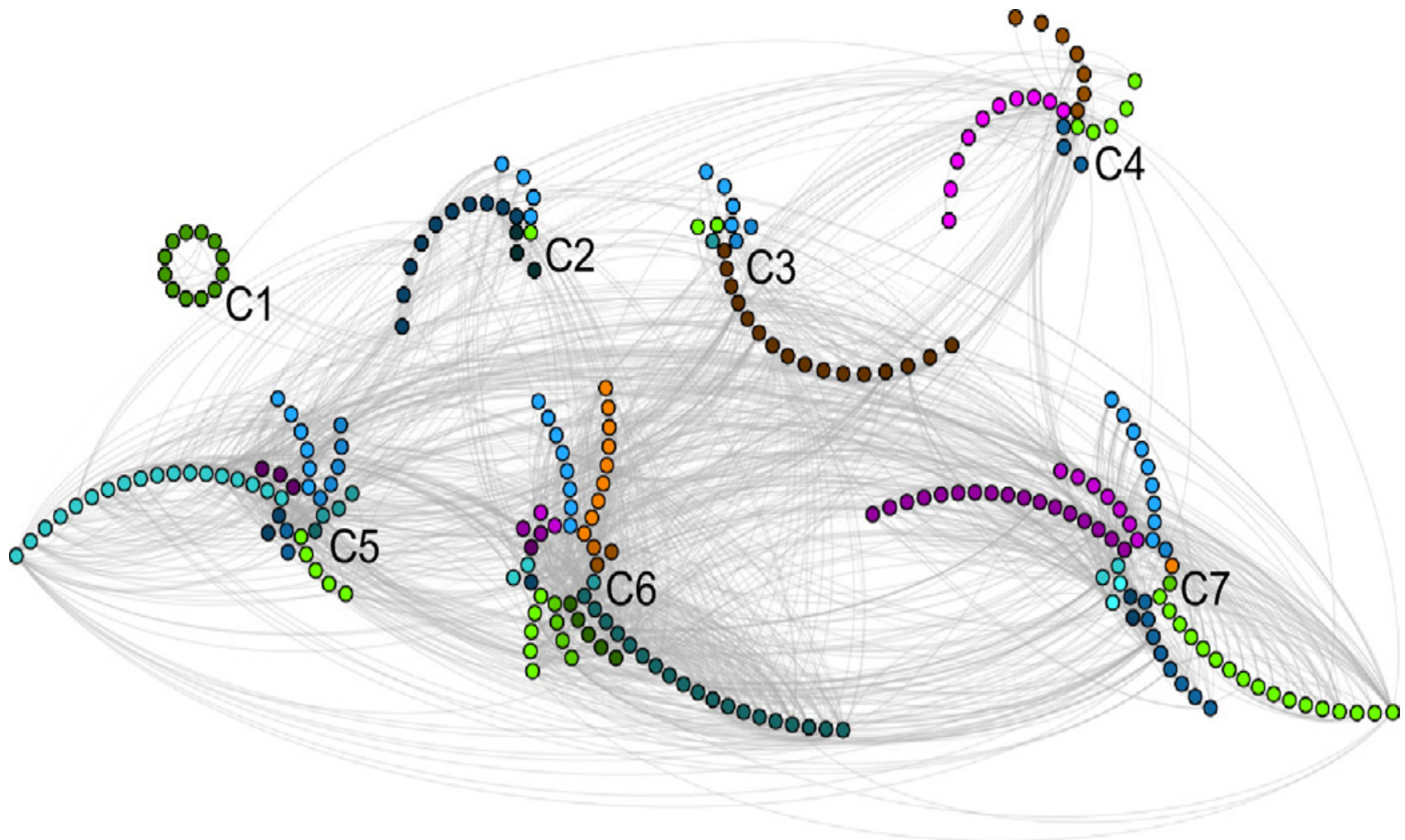
Criminal networks analysis

Community analysis in social networks



Source: Calderoni, F., Brunetto, D., & Piccardi, C. (2017). Communities in criminal networks: A case study. *Social Networks*, 48, 116–125. <https://doi.org/10.1016/j.socnet.2016.08.003>

Criminal networks analysis



Source: Calderoni, F., Brunetto, D., & Piccardi, C. (2017). Communities in criminal networks: A case study. *Social Networks*, 48, 116–125. <https://doi.org/10.1016/j.socnet.2016.08.003>

Predicting crime using Twitter

$$\Pr_I(\text{Label}_p = T, W) = \sum_{i=1}^{|N(p,W)|} \frac{W - D(p, n_i)}{\sum_{j=1}^{|N(p,W)|} W - D(p, n_j)} * \Pr(\text{Label}_{n_i} = T).$$

T= crime type

P= spatial point from Twitter

W= is a windowing parameter

N(p,W)= is the set of p's neighbors within a distance of W (this set includes p itself)

D(p,ni) = is the straight-line distance between p and one of its neighbors ni.

Source: Gerber, M. S. (2014). Predicting crime using Twitter and kernel density estimation. *Decision Support Systems*, 61(1), 115–125. <https://doi.org/10.1016/j.dss.2014.02.003>

Predicting crime using Twitter

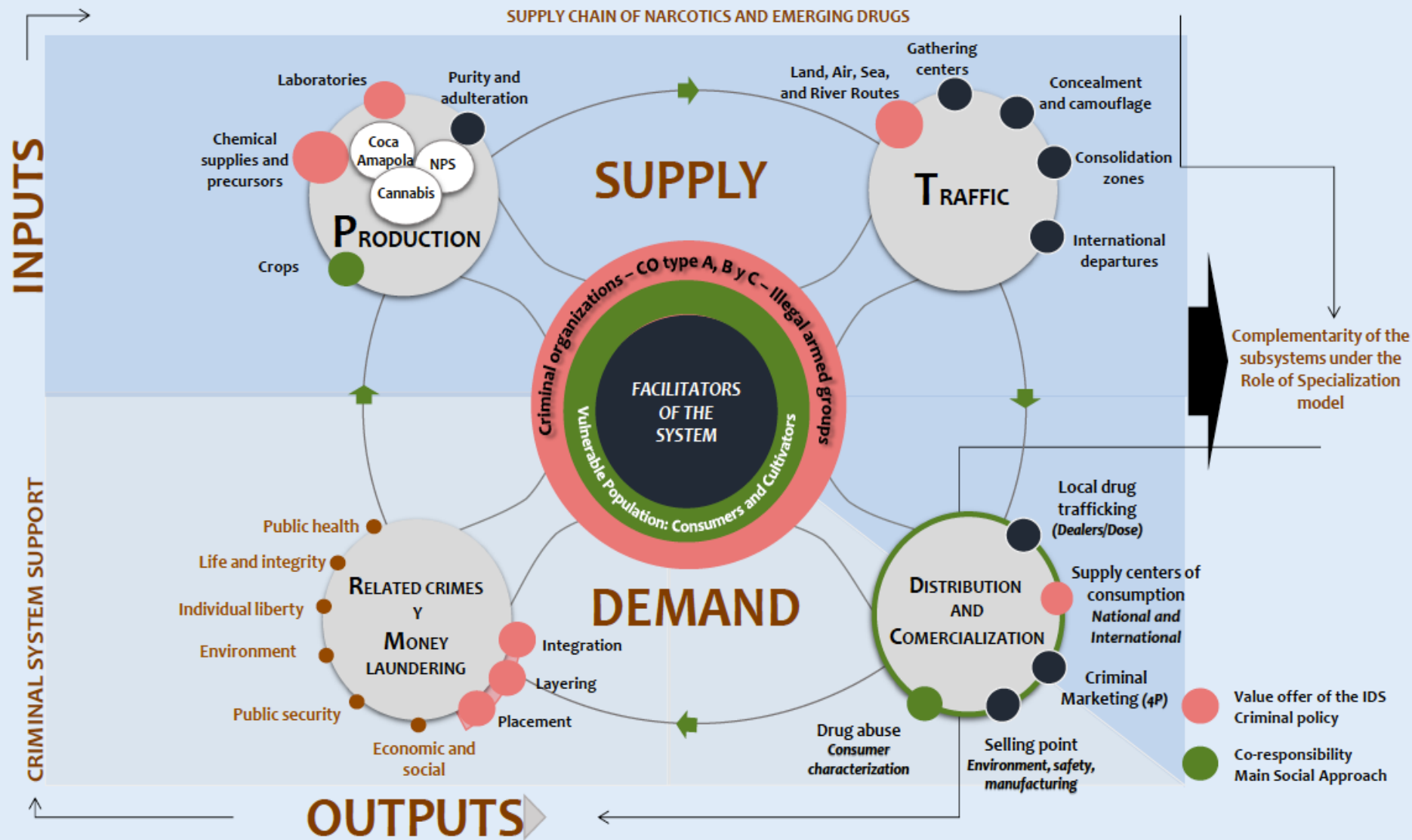
common noun, pronoun, proper noun, nominal
+ possessive, proper noun + possessive, verb,
adjective, adverb, interjection, hashtag*,
emoticon*, nominal + verbal, proper noun +
verbal, existential “there” + verbal.

Source: Gerber, M. S. (2014). Predicting crime using Twitter and kernel density estimation. *Decision Support Systems*, 61(1), 115–125. <https://doi.org/10.1016/j.dss.2014.02.003>

Doctoral proposal

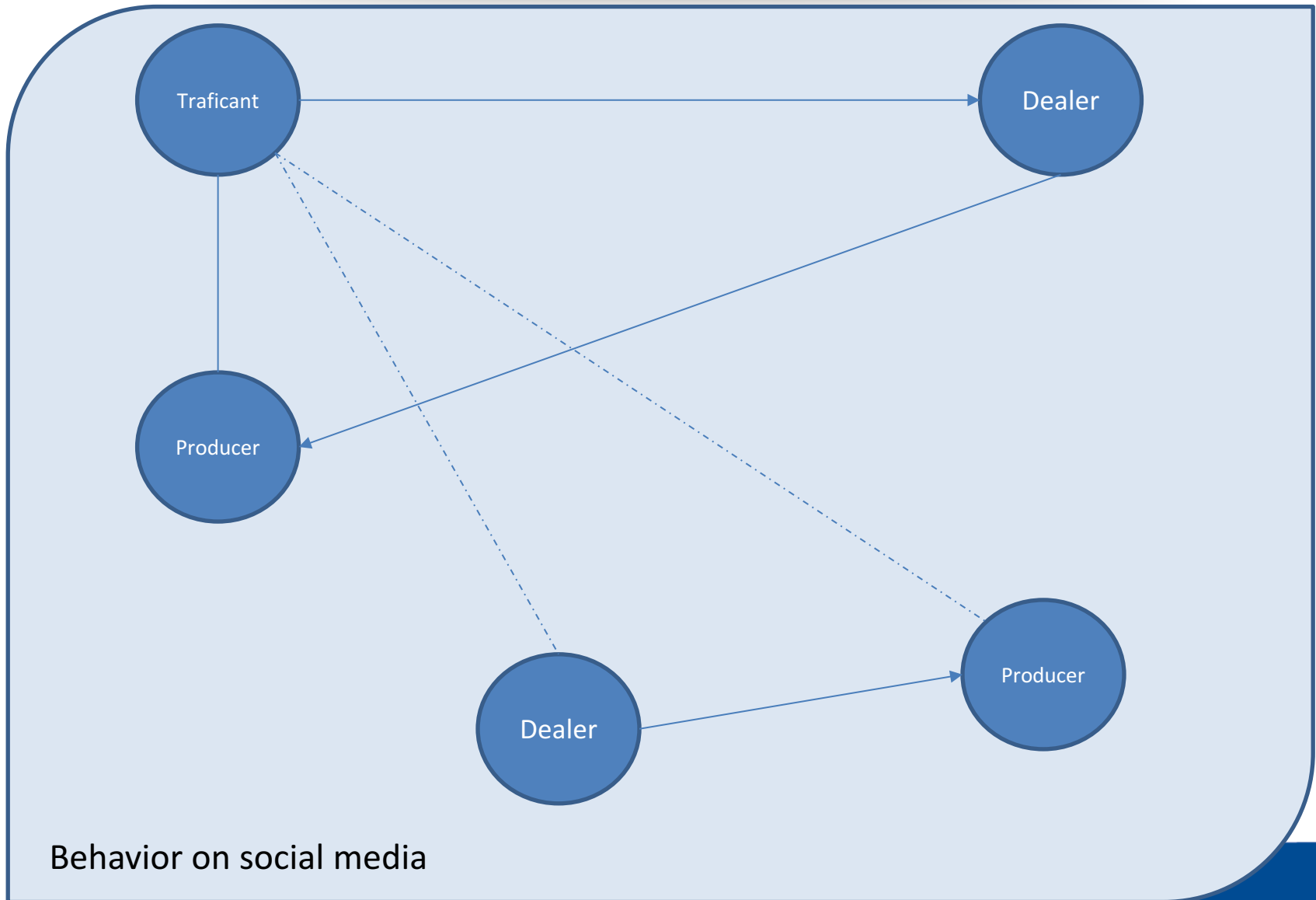


Research problem: System of Illicit Drugs



Source: National Police of Colombia –Direction of Counterdrugs

Research problem

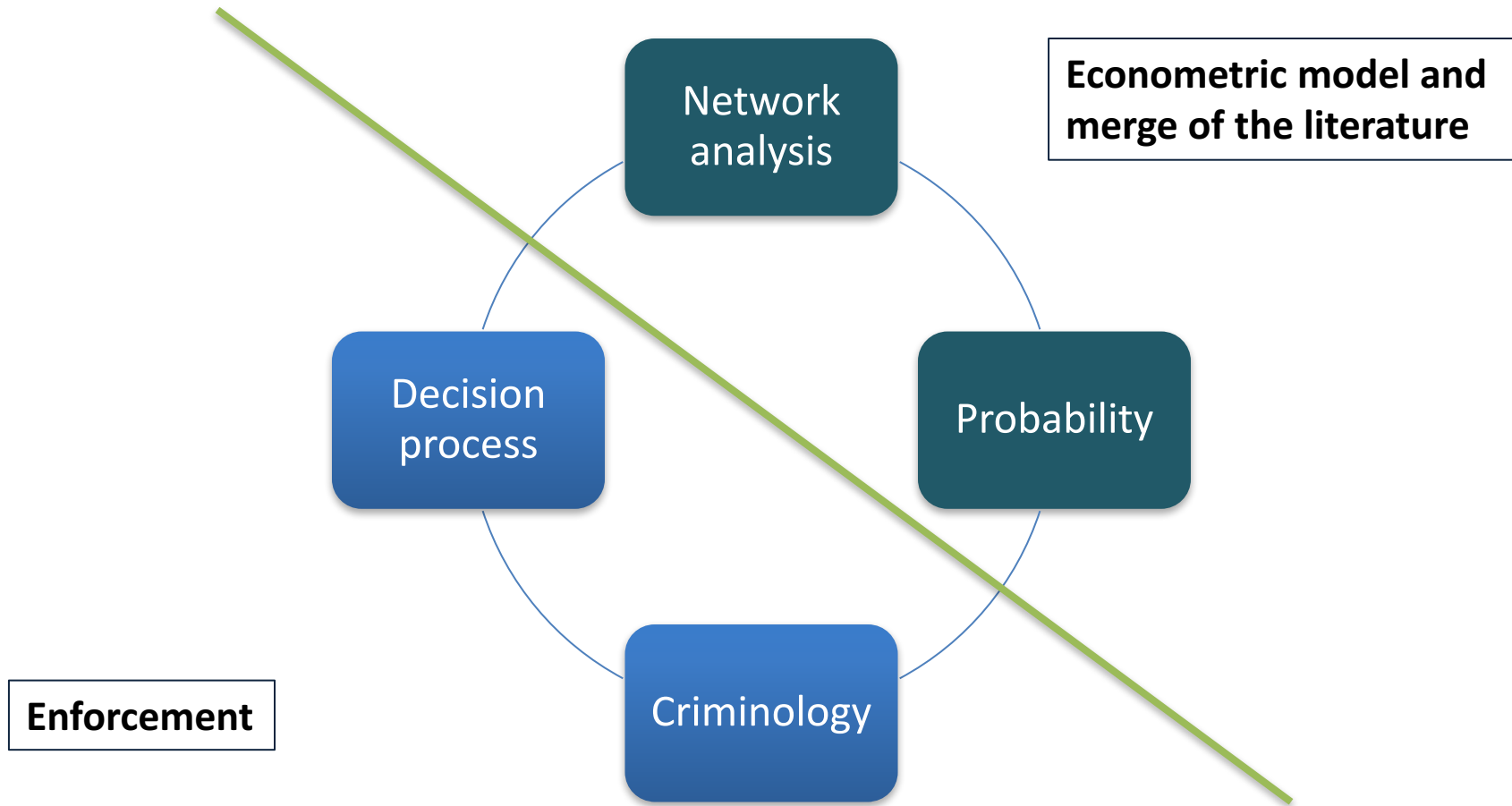


Behavior on social media

The research proposes a mathematical methodologic approximation, based on social network analysis, probability, statistic and social media to design a foresight model and dismantle organized crime, with confidential information.

The non existence of this kind of approximations in math and social science methods, justifies the construction of a new knowledge.

To design a spatial-temporal econometric model to anticipate how criminal networks must be dismantling.



A close-up photograph of a person in a dark business suit and blue patterned tie, holding a large stack of white papers and a spiral-bound notebook. The person's hands are visible, with the left hand gripping the bottom of the stack and the right hand holding the top edge of the notebook. A semi-transparent blue horizontal band is overlaid across the middle of the image, containing the word "Deliverables" in white, bold, sans-serif font.

Deliverables

Ph. D., thesis through 3 kind of scientific papers:

- **Probabilistic model for foresight of organized crime, linked with social media.**
- **Network analysis to predict organized crime transformations.**
- **Foresight making decision process in law enforcement.**

Conclusions

- **Bringing together police information and social media, using an econometric model, it could be a huge breakthrough in mathematics methodology to contribute solving a social problem.**
- **Network analysis is a powerful tool, to understand criminal networks and to dismantle them, reducing negative impacts for the society.**
- **The transdisciplinary approach of the thesis offers several approximation to develop scientific research for Colombian real problems.**

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