

## The relative ineffectiveness of Criminal Network Disruption: Properties of hard- and soft- datasets

Paul A.C. Duijn<sup>1,2</sup>, Victor Kashirin<sup>2,3</sup> and Peter M.A. Sloot<sup>3,4,5,6</sup>

The data collection process is described in section 5.1 of the main manuscript; here we present additional information on some of the characteristics of the datasets.

### *Featured properties of the datasets*

We studied a cumulative dataset of persons involved in criminal activity built with arrest registrations and informants data that contains 85192 records. Not all criminals participated in organized crime; some of them are not a part of a criminal network. In Figure S-1 we depict the overlap between hard- and soft- data connections within the network.

In Table S-1 the distribution of ages between genders and a summary of gender populations is listed. Not all records in the database have information on gender and age of criminals, but most of them have.

**Table S-1. Gender and age distribution in cumulative hard and soft records database**

Age interval/ /Gender	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	Total Amount
<b>Male</b>	5185	19810	14708	13455	8432	4029	1203	301	53	4	<b>67180</b>
<b>Female</b>	1485	4660	3139	3046	2069	944	343	96	34	0	<b>15816</b>

**Table S-2. Distribution of person registrations by country of origin**

Country of origin	Amount of registrants	Country of origin	Amount of registrants	Country of origin	Amount of registrants
Nederland	45253	Tunisia	157	Canada	37
Suriname	4405	China	141	Syria	37
Turkey	2878	Romania	127	Germany	36
Morocco	2846	Iraq	113	South Africa	33
Netherlands	2384	USA	105	Ukraine	33
Antilles					
Poland	2240	Panama	99	Hong Kong	32
Bulgaria	791	Algeria	96	Italy	32
Sudan	446	Yugoslavia	81	Angola	30
Namibia	444	Indonesia	77	Lebanon	30
Iran	425	Liberia	70	USSR	27
Afghanistan	391	Russia	61	Australia	25
Great Britain	290	Kuwait	52	East Germany	23
		Turks and			
Colombia	252	Caicos Islands	51	Congo	22

<sup>1</sup> Department of Research and Analysis, Unit The Hague, Dutch Police

<sup>2</sup> P.A.C. Duijn and V. Kashirin share first authorship

<sup>3</sup> National Research University ITMO, Saint Petersburg, Russian Federation.

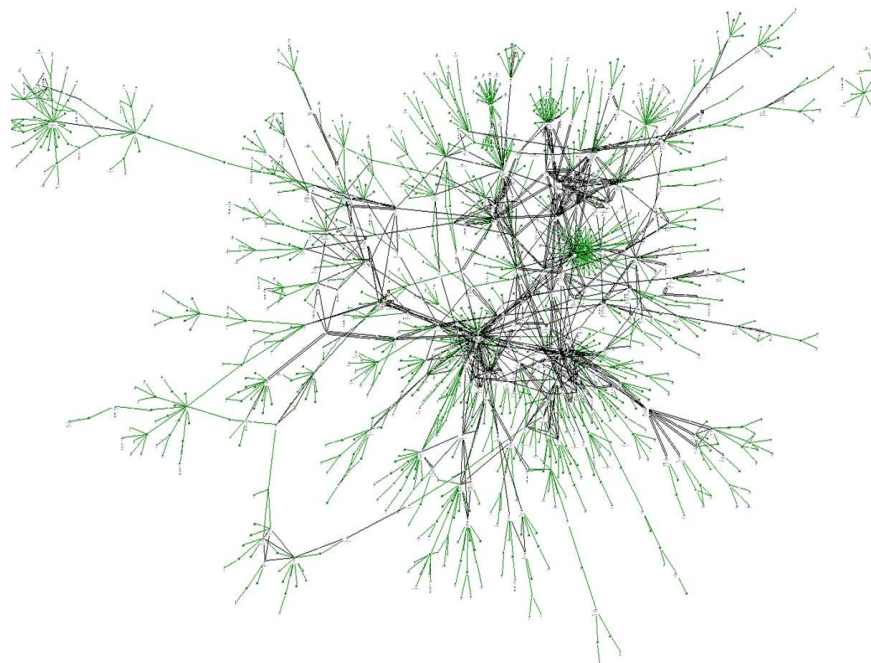
<sup>4</sup> The University of Amsterdam, Faculty of Science, The Netherlands

<sup>5</sup> Complexity Institute, Nanyang Technological University, Singapore

<sup>6</sup> Corresponding Author: E-mail: P.M.A.Sloot@uva.nl

Dominican Republic	241	Egypt	50	Rwanda	22
Ethiopia	222	Cape Verde	45	Hungary	21
India	207	Nigeria	44		
Ghana	204	Aruba	43		
Pakistan	186	Belgium	40		
Somalia	165	Mongolia	40		
Lithuania	160	Thailand	38		

The data in Table S-2 describes the distribution of person records by the countries of origin. The triad that gives the biggest contribution to the cannabis criminal situation is The Netherlands, Suriname and Turkey.



**Fig. S-1** Example of the overlap between hard and soft data connections within the network. The black lines correspond with soft data connections. The green lines correspond with hard data connections.

### **Comparison of linking preference between roles within the value chain and the full network**

The difference between practical and theoretical production chain setups is considered in Table S-3. Real data setup was collected by considering all the links between actors involved in cannabis production, and theoretical setup was built by filtering all the links which do not fit the theoretical setup of a cannabis production value chain as shown in Fig.3 of the main text. The column *Role of node* indicates that we consider all the actors with this role, and column *Number of links with adjacent nodes of particular role* indicates how many links within a particular setup (real data or theoretical) there were between actors with roles we consider and actors with roles listed in these columns. Bold fonts distinguish roles, which are present in a theoretical setup as adjacent to this role. Grey background color shows parts that match both setups.

**Table S-3. Appearance of links between actors of specific roles within the full network and theoretical VC**

Role of node	Number of links with adjacent nodes of particular role			
	Real data setup	Theoretical setup		
International trade	<b>Coordinator</b>	83	<b>Coordinator</b>	83
	<b>International trade</b>	61	<b>International trade</b>	61
	<b>Transporting</b>	51	<b>Transporting</b>	51
	<b>Selling to coffeeshops</b>	36	<b>Selling to coffeeshops</b>	36
	Financing	23	<b>Growshop owner</b>	8
	Taking care of plants	17		
	Adding weight to the toppings	14		
	Supply of cuttings for plants	12		
	Arranging location for plantation	8		
	<b>Growshop owner</b>	8		
Financing	<b>Coordinator</b>	63	<b>Coordinator</b>	63
	<b>Taking care of plants</b>	26	<b>Financing</b>	25
	Financing	25		
	International trade	23		
Transporting	<b>International trade</b>	51	<b>International trade</b>	<b>51</b>
	<b>Coordinator</b>	34	<b>Coordinator</b>	<b>34</b>
	<b>Transporting</b>	17	<b>Transporting</b>	<b>17</b>
	Financing	12	<b>Selling to coffeeshops</b>	<b>12</b>
	<b>Selling to coffeeshops</b>	12	<b>Growshop owner</b>	<b>4</b>
	Taking care of plants	7		
	Arranging location for plantation	6		
	Arranging fake owners of property	4		
	<b>Growshop owner</b>	4		
	Growshop owner	<b>Supply of cuttings for plants</b>	18	<b>Supply of cuttings for plants</b>
<b>Growshop owner</b>		11	<b>Growshop owner</b>	<b>11</b>
<b>Supply of growth necessities</b>		11	<b>Supply of growth necessities</b>	<b>11</b>
<b>International trade</b>		8	<b>International trade</b>	<b>8</b>
Financing		7	<b>Selling to coffeeshops</b>	<b>5</b>
Taking care of plants		7	<b>Transporting</b>	<b>4</b>
<b>Selling to coffeeshops</b>		5	<b>Adding weight to the toppings</b>	<b>4</b>
<b>Adding weight to the toppings</b>		4	<b>Arranging storage</b>	<b>2</b>
<b>Transporting</b>		4	<b>Drying toppings</b>	<b>1</b>
Coordinator		3		
<b>Arranging storage</b>		2		
Arranging location for plantation		2		
<b>Drying toppings</b>		1		

Supply of growth necessities	<b>Coordinator</b>	13	<b>Coordinator</b>	13
	<b>Growshop owner</b>	11	<b>Growshop owner</b>	11
	Financing	9	<b>Supply of growth necessities</b>	6
	<b>Supply of growth necessities</b>	6	<b>Building a plantation</b>	3
	Arranging fake owners of property	3	<b>Diverting electricity</b>	1
	International trade	3		
	Transporting	3		
	Taking care of plants	3		
	<b>Building a plantation</b>	3		
	Arranging location for plantation	2		
	Selling to coffeeshops	2		
	Protection of plantation	2		
	<b>Diverting electricity</b>	1		
Selling to coffeeshops	<b>Coordinator</b>	43	<b>Coordinator</b>	43
	<b>International trade</b>	36	<b>International trade</b>	36
	<b>Selling to coffeeshops</b>	24	<b>Selling to coffeeshops</b>	24
	Taking care of plants	14	<b>Transporting</b>	12
	Supply of cuttings for plants	13	<b>Growshop owner</b>	5
	<b>Transporting</b>	12		
	Financing	8		
	Building a plantation	7		
	Adding weight to the toppings	6		
	<b>Growshop owner</b>	5		
Supply of cuttings for plants	<b>Supply of cuttings for plants</b>	20	<b>Supply of cuttings for plants</b>	20
	<b>Growshop owner</b>	18	<b>Growshop owner</b>	18
	Financing	15		
	Taking care of plants	15		
Taking care of plants	<b>Coordinator</b>	85	<b>Coordinator</b>	85
	<b>Taking care of plants</b>	52	<b>Taking care of plants</b>	52
	Financing	26	<b>Protection of plantation</b>	18
	Arranging location for plantation	24		
	<b>Protection of plantation</b>	18		
Arranging location for plantation	<b>Coordinator</b>	55	<b>Coordinator</b>	55
	<b>Arranging location for plantation</b>	24	<b>Arranging location for plantation</b>	24
	Taking care of plants	24	<b>Arraging fake owners of property</b>	14
	Building a plantation	15	<b>Fake owner of a company or house</b>	11
	<b>Arraging fake owners of property</b>	14		
	<b>Fake owner of a company or house</b>	11		
	Financing	10		

Diverting electricity	<b>Coordinator</b>	5	<b>Coordinator</b>	5
	<b>Building a plantation</b>	3	<b>Building a plantation</b>	3
	<b>Diverting electricity</b>	3	<b>Diverting electricity</b>	3
	Protection of plantation	3	<b>Supply of growth necessities</b>	1
	<b>Arranging location for plantation</b>	3		
	Taking care of plants	3		
	Drying toppings	2		
	Financing	2		
	<b>Supply of growth necessities</b>	1		
Arranging storage	<b>Coordinator</b>	21	<b>Coordinator</b>	21
	<b>Adding weight to the toppings</b>	21	<b>Adding weight to the toppings</b>	21
	Taking care of plants	17	<b>Drying toppings</b>	16
	<b>Drying toppings</b>	16	<b>Arranging storage</b>	11
	Financing	16	<b>Growshop owner</b>	2
	<b>Arranging storage</b>	11		
	Arranging location for plantation	6		
	Arranging fake owners of property	5		
	Building a plantation	3		
	<b>Growshop owner</b>	2		
Fake owner of a company or house	<b>Coordinator</b>	21	<b>Coordinator</b>	21
	<b>Arranging location for plantation</b>	11	<b>Arranging location for plantation</b>	11
	Taking care of plants	10	<b>Fake owner of a company or house</b>	2
	Building a plantation	6	<b>Arranging fake owners of property</b>	1
	International trade	3		
	Transporting	2		
	Supply of cuttings for plants	2		
	<b>Fake owner of a company or house</b>	2		
	Protection of plantation	2		
	Cutting toppings	2		
	Arranging storage	1		
	<b>Arranging fake owners of property</b>	1		
	Protection of plantation	<b>Coordinator</b>	19	<b>Coordinator</b>
<b>Taking care of plants</b>		18	<b>Taking care of plants</b>	18
Financing		11	<b>Protection of plantation</b>	7
Arranging location for plantation		10		
Arranging fake owners of property		8		
<b>Protection of plantation</b>		7		

Coordinator	<b>Taking care of plants</b>	85	<b>Taking care of plants</b>	85
	<b>International trade</b>	83	<b>International trade</b>	83
	<b>Financing</b>	63	<b>Financing</b>	63
	<b>Arranging location for plantation</b>	55	<b>Arranging location for plantation</b>	55
	<b>Coordinator</b>	53	<b>Coordinator</b>	53
	<b>Selling to coffeeshops</b>	43	<b>Selling to coffeeshops</b>	43
	<b>Transporting</b>	34	<b>Transporting</b>	34
	<b>Adding weight to the toppings</b>	31	<b>Adding weight to the toppings</b>	31
	<b>Building a plantation</b>	26	<b>Building a plantation</b>	26
	<b>Arranging storage</b>	21	<b>Arranging storage</b>	21
	<b>Fake owner of a company or house</b>	21	<b>Fake owner of a company or house</b>	21
	<b>Cutting toppings</b>	20	<b>Cutting toppings</b>	20
	<b>Protection of plantation</b>	19	<b>Protection of plantation</b>	19
	<b>Drying toppings</b>	14	<b>Drying toppings</b>	14
	<b>Controlling cutters</b>	14	<b>Controlling cutters</b>	14
	<b>Supply of growth necessities</b>	13	<b>Supply of growth necessities</b>	13
	<b>Arranging fake owners of property</b>	11	<b>Arranging fake owners of property</b>	11
	Supply of cuttings for plants	8	<b>Diverting electricity</b>	5
	<b>Diverting electricity</b>	5		
	Growshop owner	3		
Retail trade within the Netherlands	2			
Building a plantation	<b>Coordinator</b>	26	<b>Coordinator</b>	26
	<b>Financing</b>	15	<b>Building a plantation</b>	9
	Arranging location for plantation	15	<b>Supply of growth necessities</b>	3
	Arranging fake owners of property	10	<b>Diverting electricity</b>	3
	<b>Building a plantation</b>	9	<b>Growshop owner</b>	1
	Taking care of plants	7		
	Selling to coffeeshops	7		
	International trade	6		
	Fake owner of a company or house	6		
	Arranging storage	3		
	Adding weight to the toppings	3		
	Supply of cuttings for plants	3		
	<b>Supply of growth necessities</b>	3		
	<b>Diverting electricity</b>	3		
	Protection of plantation	2		
	<b>Growshop owner</b>	1		

### Roles statistics

In Table S-4 statistical analyses for the roles are listed. The calculated characteristics are: amount of actors with particular role, average degree  $\overline{C}_{deg}$  of actors with this role within full network and average VC degree  $\overline{D}_{VC}$  of actor with this role within value chain network. Both degrees are given with 95% confidence interval.

**Table S-4: Statistics for actors with specific roles**

Role	N	$\overline{C}_{deg}$		$\overline{D}_{VC}$	
Drying toppings	18	8.89	±5.06	10.94	±7.5
Arranging fake owners of property	8	15.38	±10.29	10	±6.31
Coordinator	104	9.26	±2.58	9.06	±2.46
Adding weight to the toppings	31	9.19	±4.14	8.52	±2.17
Cutting toppings	12	5.42	±2.17	7.83	±3.98
Transporting	42	9.05	±3.43	7.62	±4.06
Selling stash to other int. CO	80	11.01	±3.26	7.22	±2.36
Arranging storage	32	6.78	±3.13	6.66	±2.66
Controlling cutters	10	5.3	±2.06	6.4	±4.75
Financing	49	14.84	±6.77	6.12	±2.94
Selling to coffeeshops	52	7.06	±2.33	5.81	±2.44
Growshop owner	23	5.91	±3.45	5.09	±2.73
Arranging location for plantation	67	7.58	±2.4	4.9	±1.87
Supply of growth necessities	22	8.14	±4.35	4.73	±2.9
Supply of cuttings for plants	38	6.29	±2.85	4.55	±2.03
Protection of plantation	21	7.95	±3.33	4.14	±1.71
Taking care of plants	139	6.12	±1.72	3.08	±0.71
Building a plantation	48	4.15	±1.18	3.02	±1.16
Fake owner of a company or house	27	3.63	±1.67	2.04	±0.8
Diverting electricity	15	2.87	±1.15	1.47	±0.88
Disposing waste and leftovers	2	4	±4.16	1	±1.39