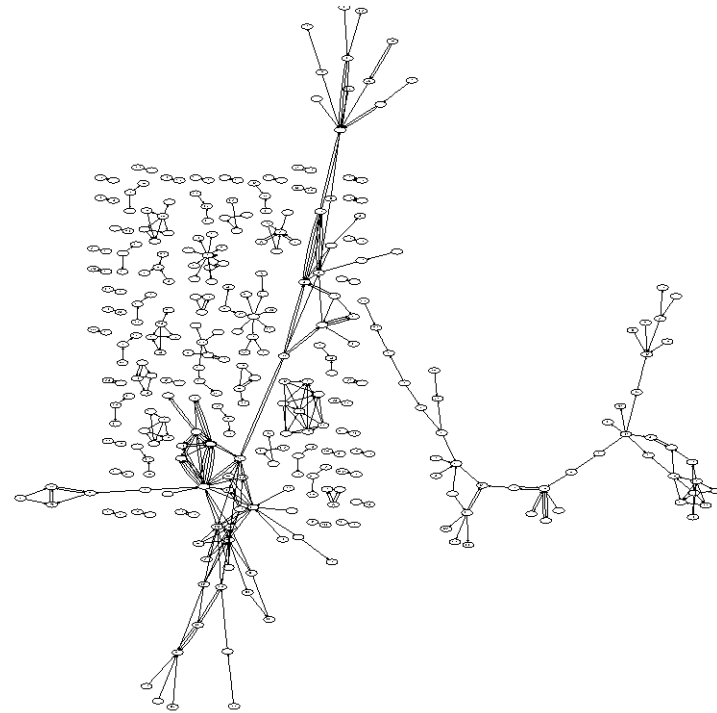
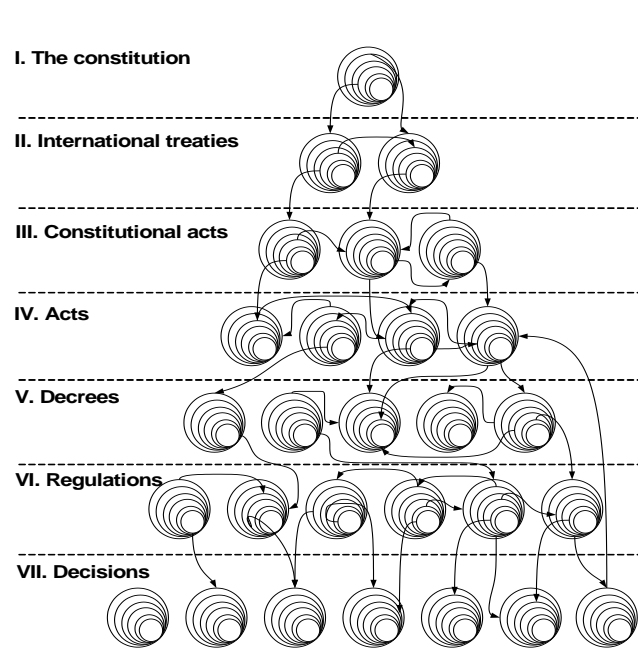


IDK0310
AUTOMATED AND
SYSTEMATISED LEGAL
PROCESS

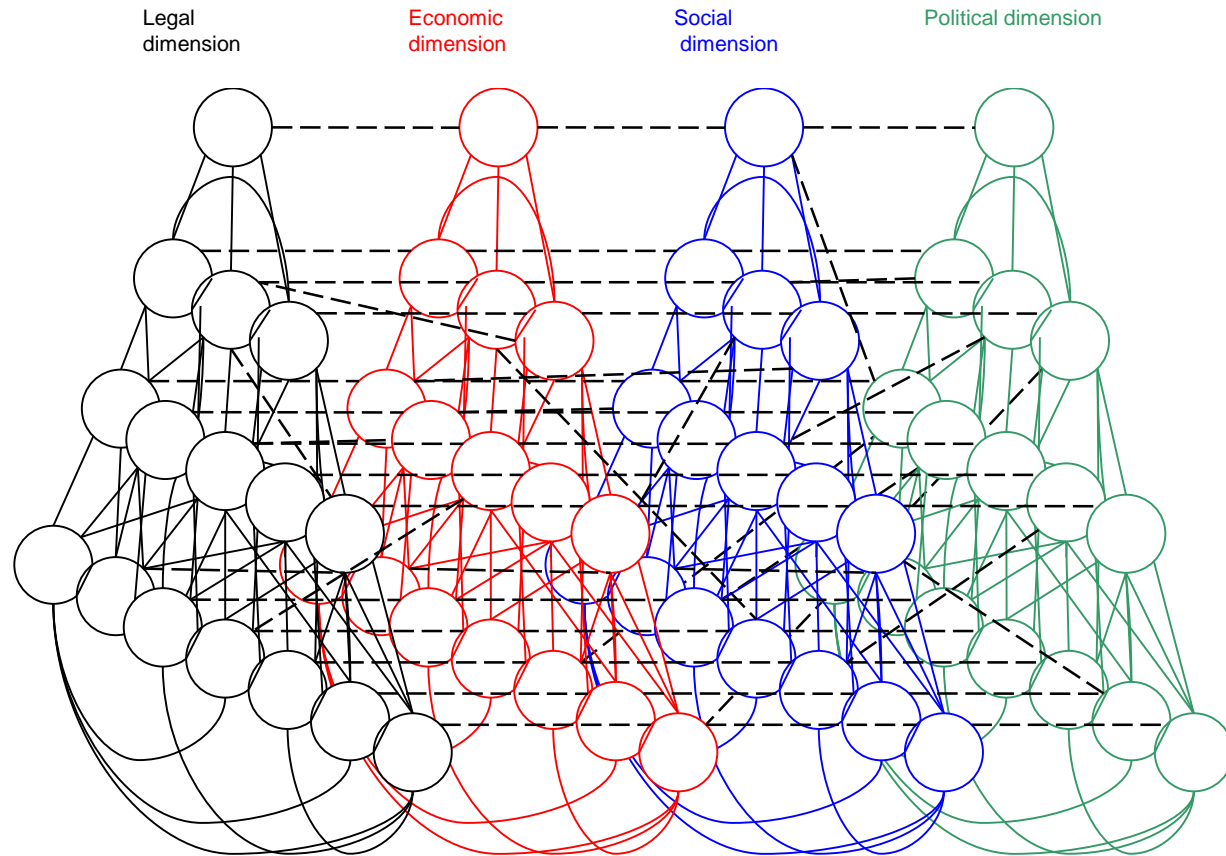
Estonian normative system

- Collection of text legal documents
- Hierarchically structured
- Vaguely determined
- Internally interlinked
- Not systematic enough to create a connected graph

Ideal versus reality



Regulatory impact assessment

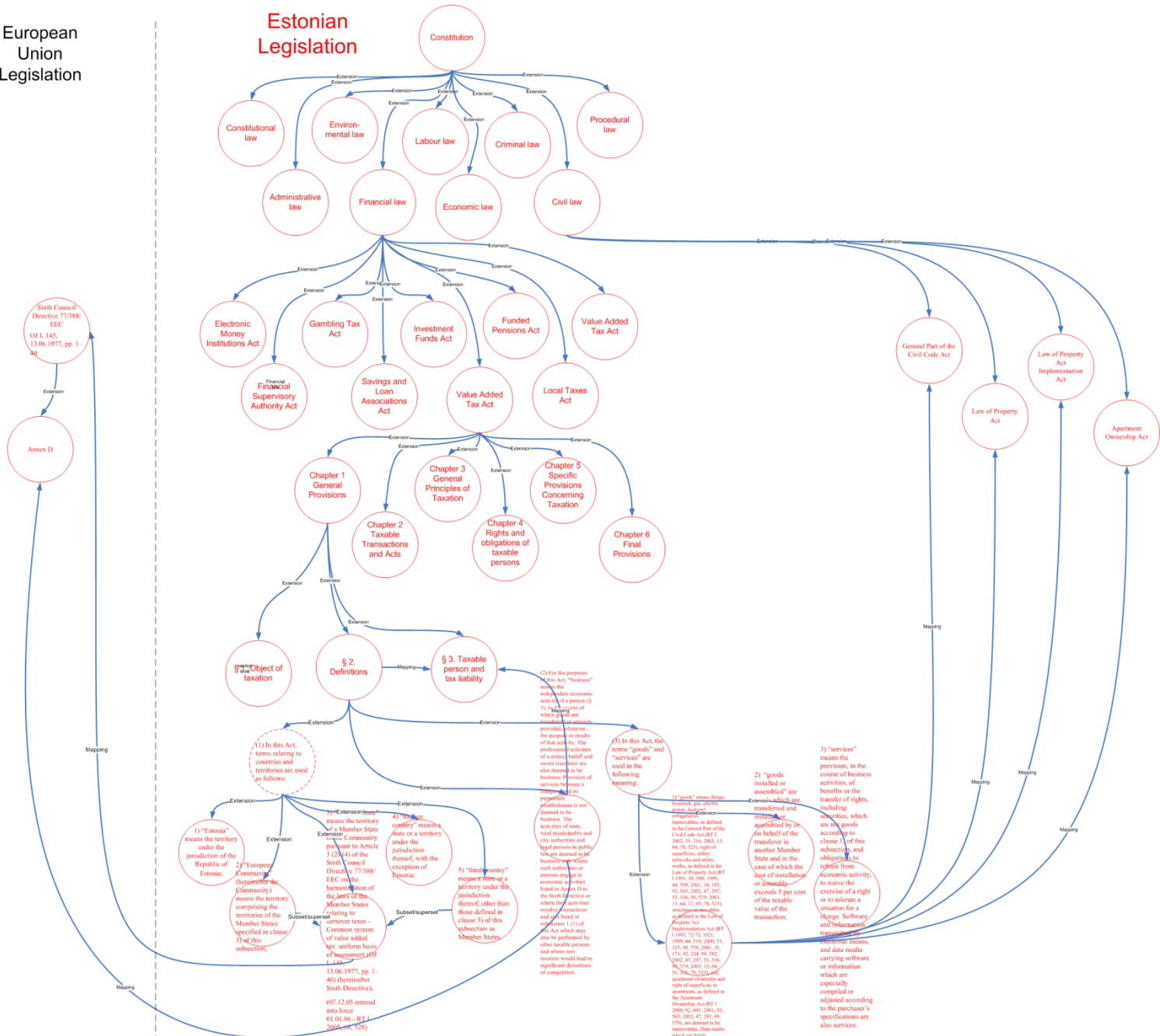


The legislation as set of connections

- Legislation is set of interlinked documents:
 - ▣ Direct links, written and visible in legal texts
 - Yet it is not allowed to refer for example to the constitution or to the lower level legal act...
(Normitehnika eeskiri, §14. Otsene viide)
 - ▣ Indirect links, connecting legal documents based on content
 - Such kind of links are not easily found and estimated with 100% of correctness.

European Union Legislation

Estonian Legislation



Is there a way to overcome these limitations?

- Our research has given some positive results
- Is unique
- Is scalable
- Is objective (based on quantitative analysis methods)
- Complements existing legal system instead of contradicting
- Is a key to further legislative structure analysis yet to be performed

Method description

- encompasses
 - ▣ system analysis,
 - ▣ natural language processing
 - ▣ graph theory methods.

System analysis

- reverse engineering
 - ▣ Conceptual method used in Information Science
 - ▣ Identifies the smallest system components and their interrelationships
 - ▣ Result: transforms the system into another form
- business process modeling
 - ▣ Analysis technique used in Information Science
 - ▣ Based on three wales: objects, events and processes
 - ▣ Result: describes systems visually for communication purposes

Natural language processing

- basis for text segmentation
 - ▣ Extraction of subclauses: “Everyone has the right to liberty and security of person. “
- text compression
 - ▣ Extraction of verbs and nouns: *Everyone, has, right, liberty, security, person*

Natural language processing

- content capture

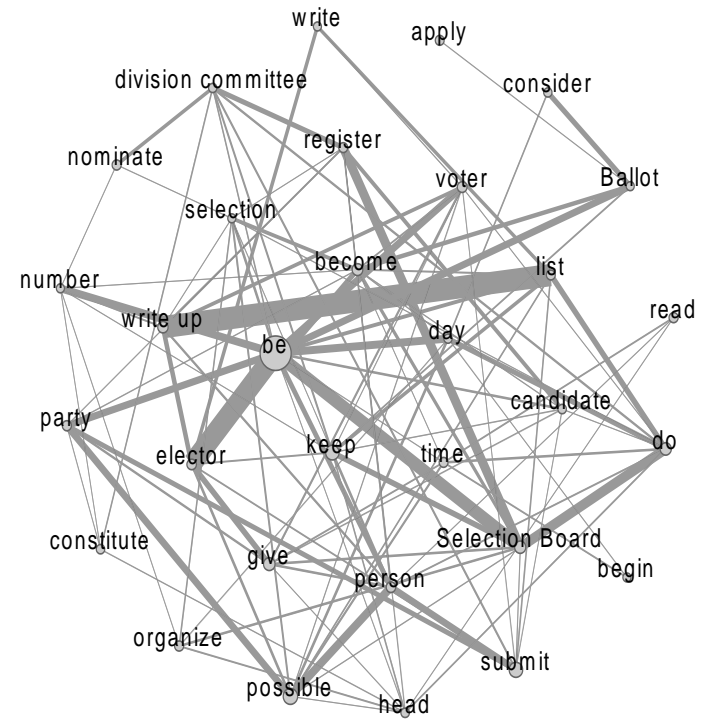
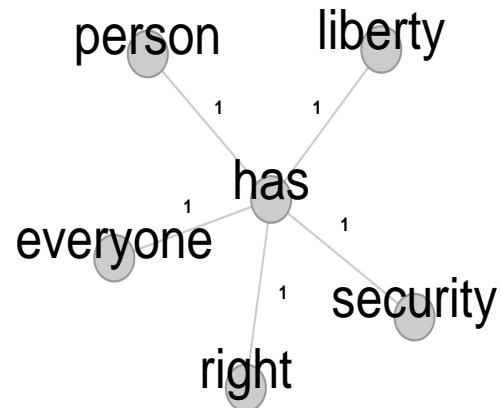
- Counts for verb and noun pairs found within the same subclause:

- *Everyone, has*
 - *has, right*
 - *has, liberty*
 - ...

Nouns\verbs	be/is	submit	carry/ enter	do	write up	give	keep
Electoral Committee	21	2	2	16	0	4	9
elector	34	3	5	0	9	10	3
list	6	3	3	10	34	0	2
Appeal	4	20	0	0	0	0	0

Graph theory

□ Text visualization



Values of such transformation

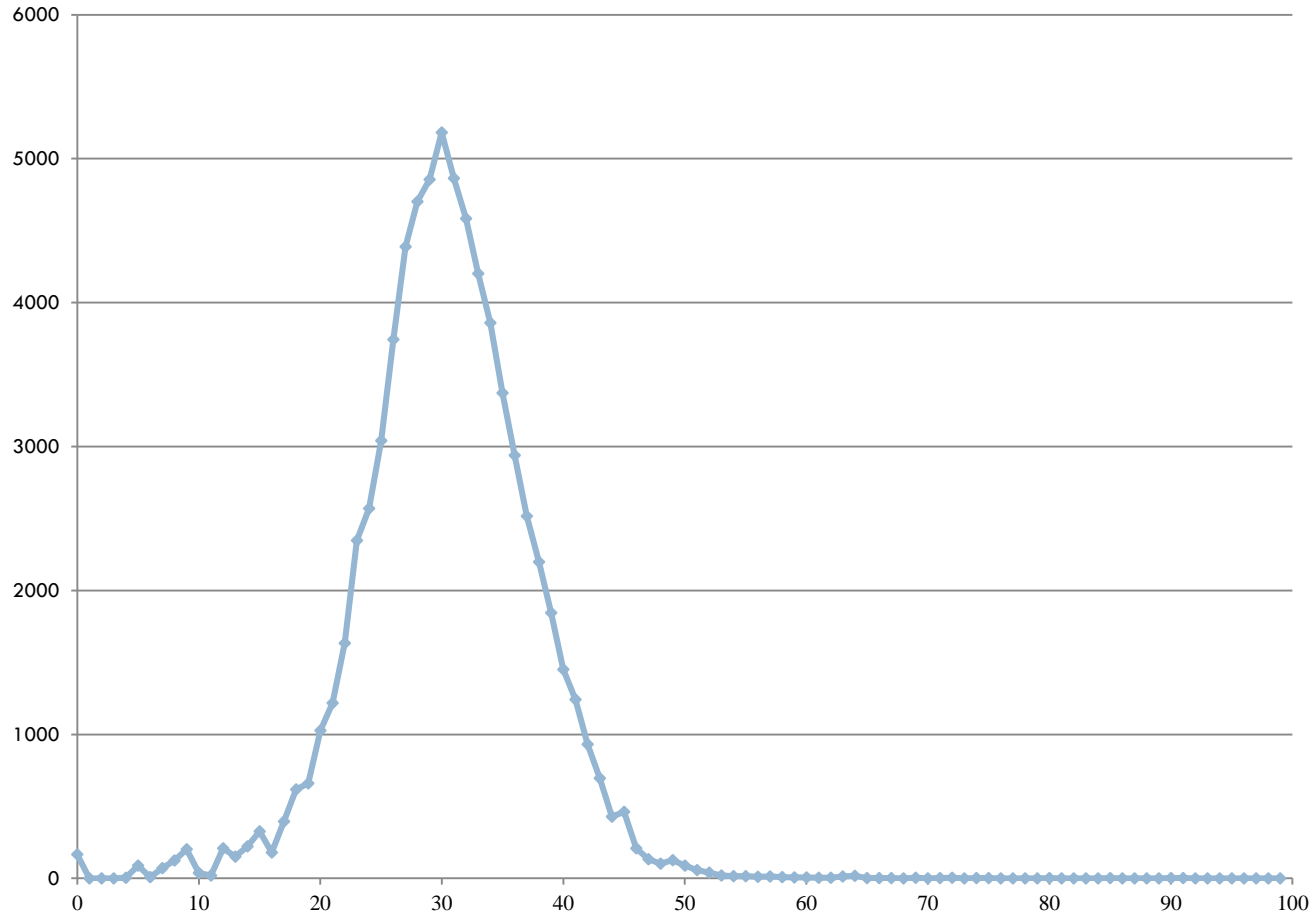
- Complements to the existing system by adding easily computable layer
- Visualises and maintains the content
- Supports an access to content
- Can be valuable entry to ontology and business modeling (has to be proven)
- Promising base for different kind of legislation related quantitative analysis

Examples of use

- 386 Estonian legal acts randomly chosen
- Subclause specific noun-verb pairs counted
- Similarity search performed
 - Inexact graph matching
 - Shared verbs account for 45%;
 - Shared nouns connected to specific verbs 45%;
 - Concordance frequency 10%.

Act ID	13360508	13360557	13360674	13360776
1014238	27	27	10	11
12732218	38	23	22	15
12755417	64	36	37	19
12833542	39	28	29	14
12857270	64	22	32	14
12861944	64	36	31	21

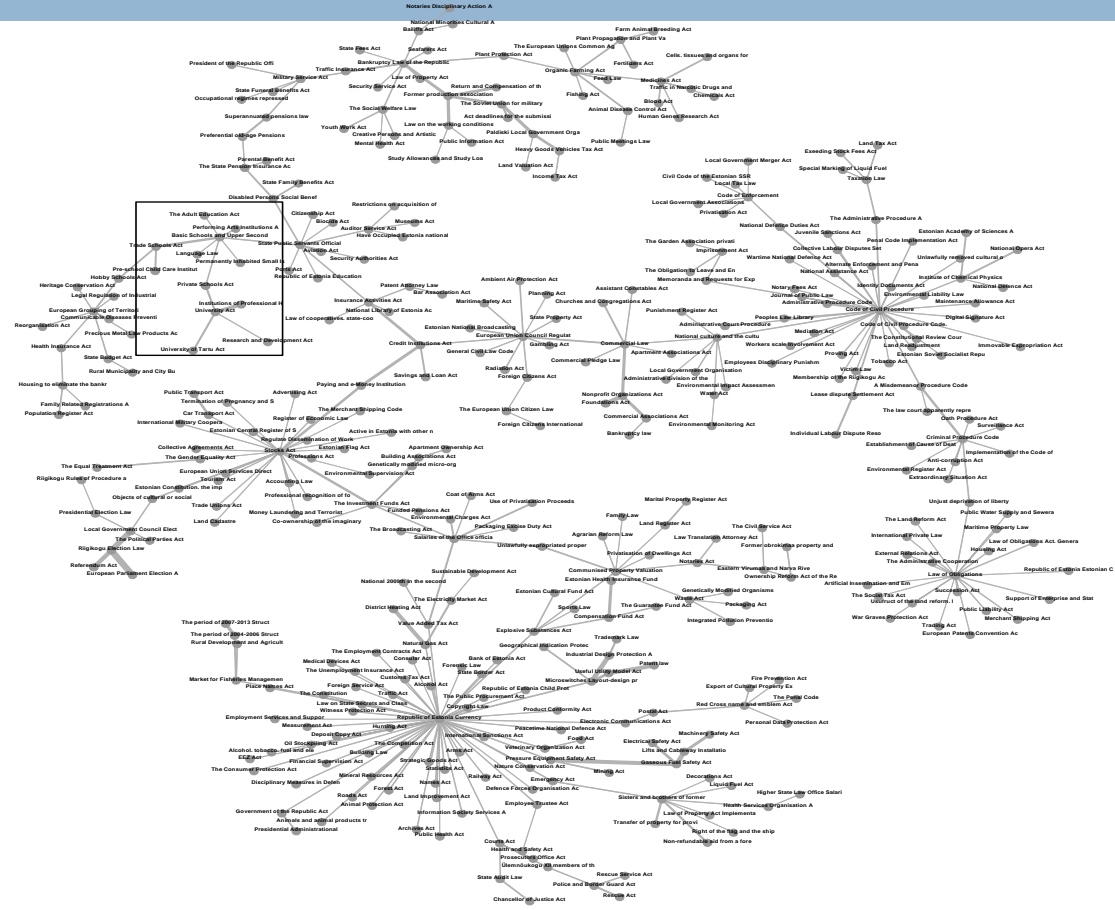
Distribution of similarities measurement results



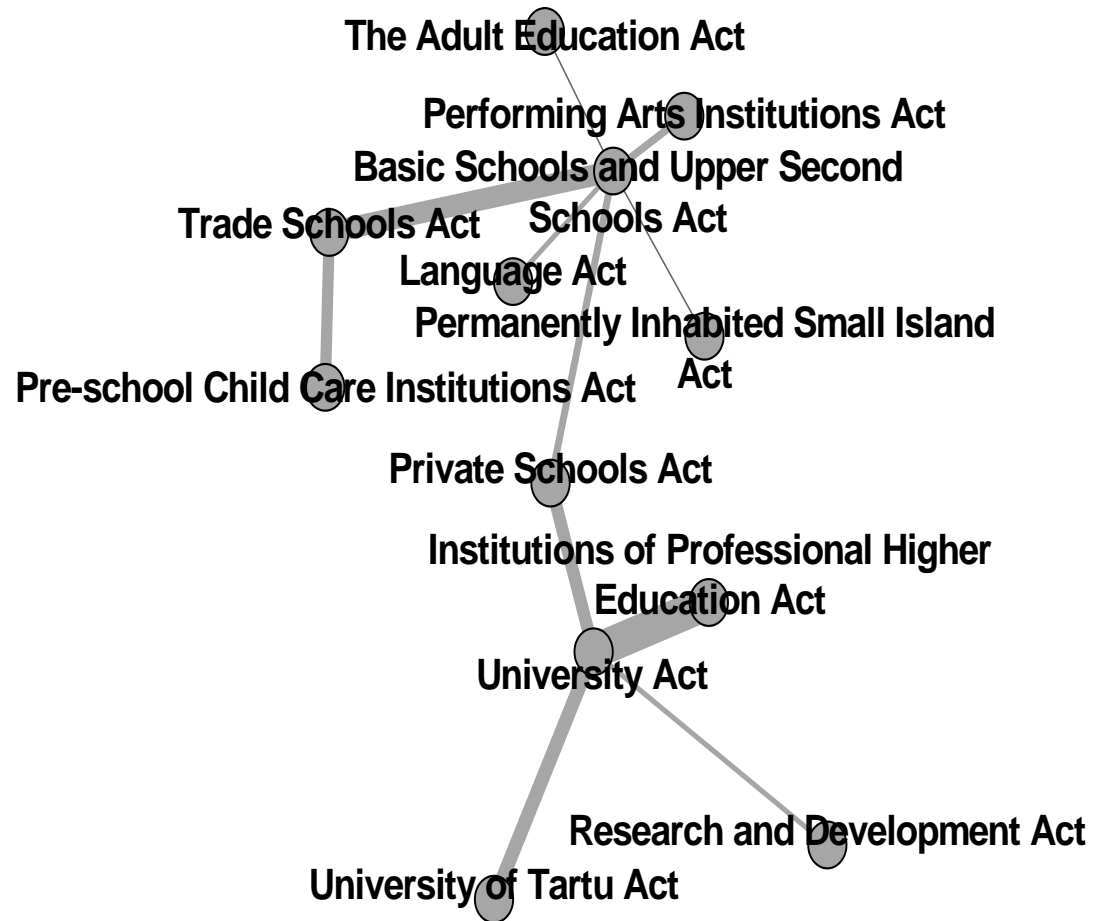
Some similarity characteristics

Charateristic	Value
Lowest minimal similarity per act	0
Highest minimal similarity per act	33,1
Lowest maximal similarity per act	39,7
Highest maximal similarity per act	91
Medium similarity	29,9
Lowest medium similarity per act	12,6
Highest medium similarity per act	42,9

Maximal connectivity tree



Part of maximal connectivity tree



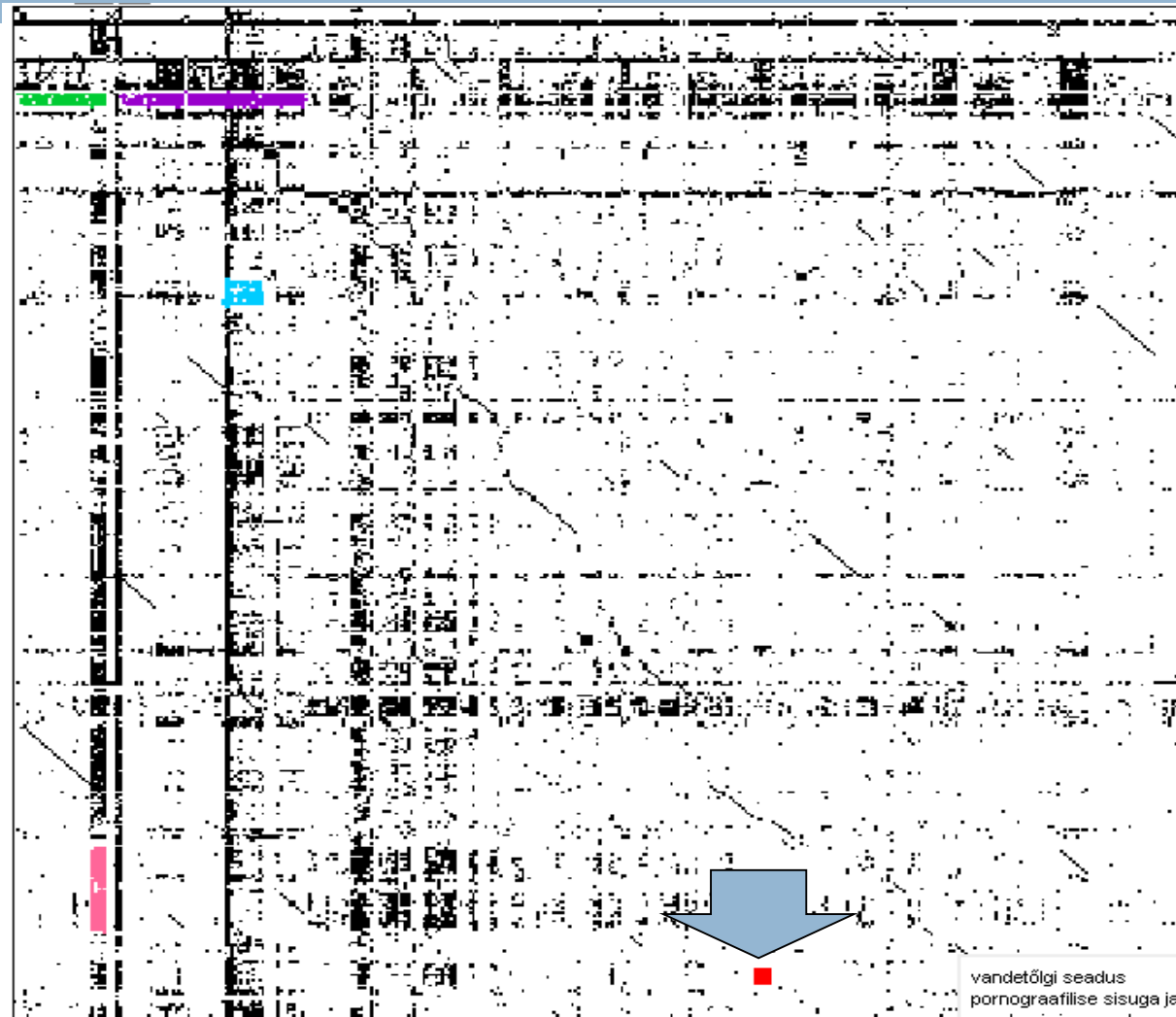
Most dense part of the graph constructed from the strongest connections



Deeper structural research

- Similarity measurement symmetric table was transformed into a 0/1 matrix
 - ▣ Treshold value: 39,7% (strongest similarity measurement value of most weakly tied legal act)
- Several matrix permutation was performed:
 - ▣ 13 different methods
 - ▣ Zodiac method considered to deliver the best results
- First results available

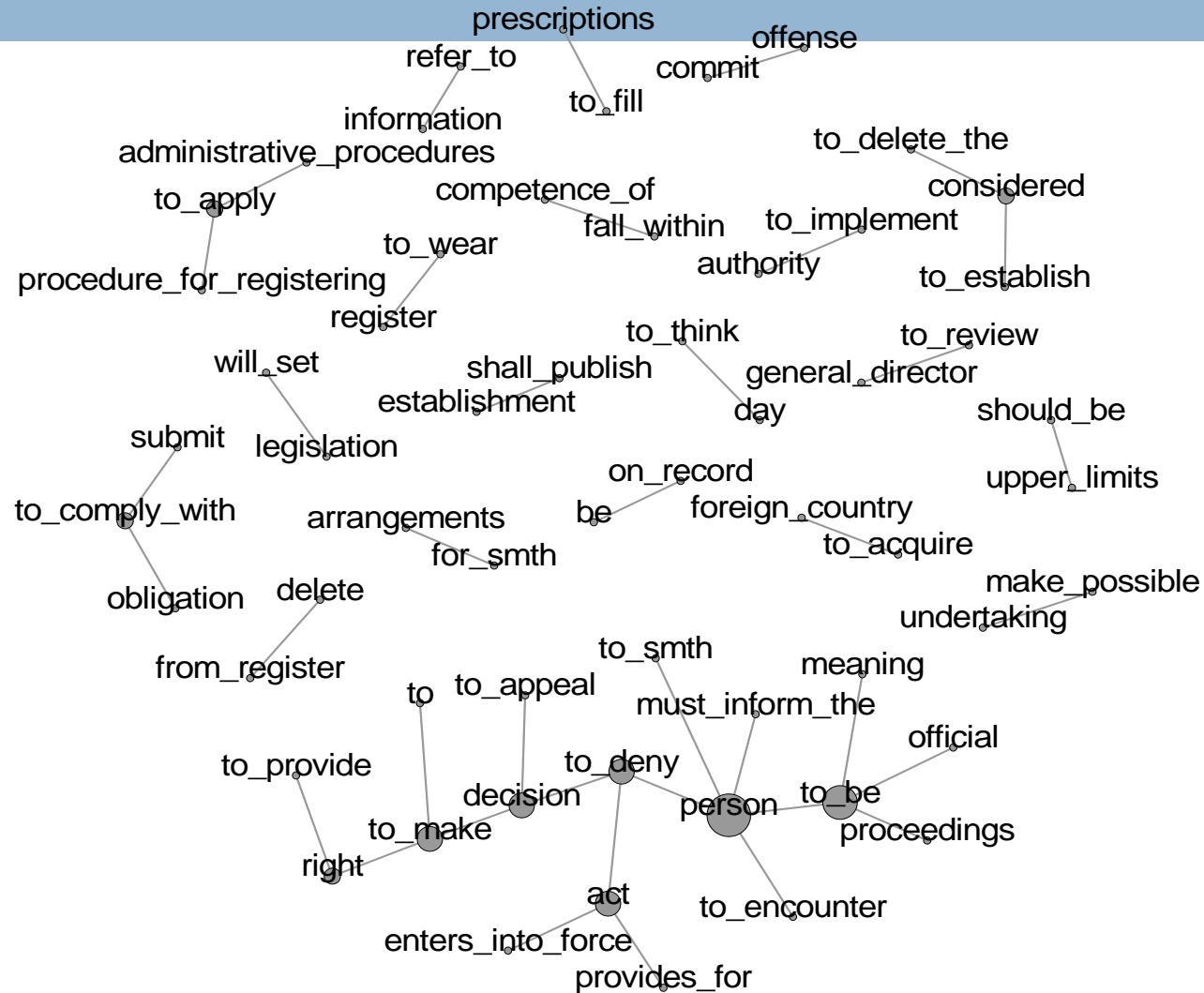
Transformation into 0/1 matrix and using matrix permutations



Matrix permutation results chunk analysis

	Lifts and Cableway Installations Safety Act	Electrical Safety Act	Mine Safety Act	Gaseous Fuel Safety Act	Machinery Safety Act	Pressure Equipment Safety Act
Lifts and Cableway Installations Safety Act	1	1	1	1	1	1
Electrical Safety Act	1	1	1	1	1	1
Mine Safety Act	1	1	1	1	1	1
Gaseous Fuel Safety Act	1	1	1	1	1	1
Machinery Safety Act	1	1	1	1	1	1
Pressure Equipment Safety Act	1	1	1	1	1	1

Drilldown to establish shared parts of the legal acts



Legislation structure: tree- or flower-like

