

The use of patent analysis in foresight

A data-driven review



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Motivation

In technology foresight we often assume, that new technologies are created in the laboratories around the world, then published in scientific literature and finally patented as soon as they are advanced enough. Although this is a simplified idea of a complex process, it highlights, why patents are an important source for technology foresight. Here we present a synoptic overview over this topic by addressing the following questions:

- How** is patent data used in foresight?
- Who** uses patent analysis for foresight purposes?
- In **which steps** of the foresight process is patent data used?
- Where are **further possibilities** for the use of patent data in foresight?

Methodology

We created a dataset of 3225 publications in the Web of Science that address the usage of patents in foresight utilizing the KATI system developed at Fraunhofer. Next, we extracted three information dimensions from the data:

- The **process dimension** by mapping each publication to one (or more) process steps in foresight [1]: *search, preprocessing, actor analysis, topic analysis, industry analysis, anticipation, evaluation, visualization, other*
- The **topic dimension** by performing a topic modelling utilizing LDA.
- The **disciplinary dimension** by extracting the Web of Science Categories [2] of all publications.

Finally we plotted the pairwise information flow between all dimensions. For the sake of clarity, not all connections are plotted, instead only the three largest connections starting from the left-hand side are plotted.

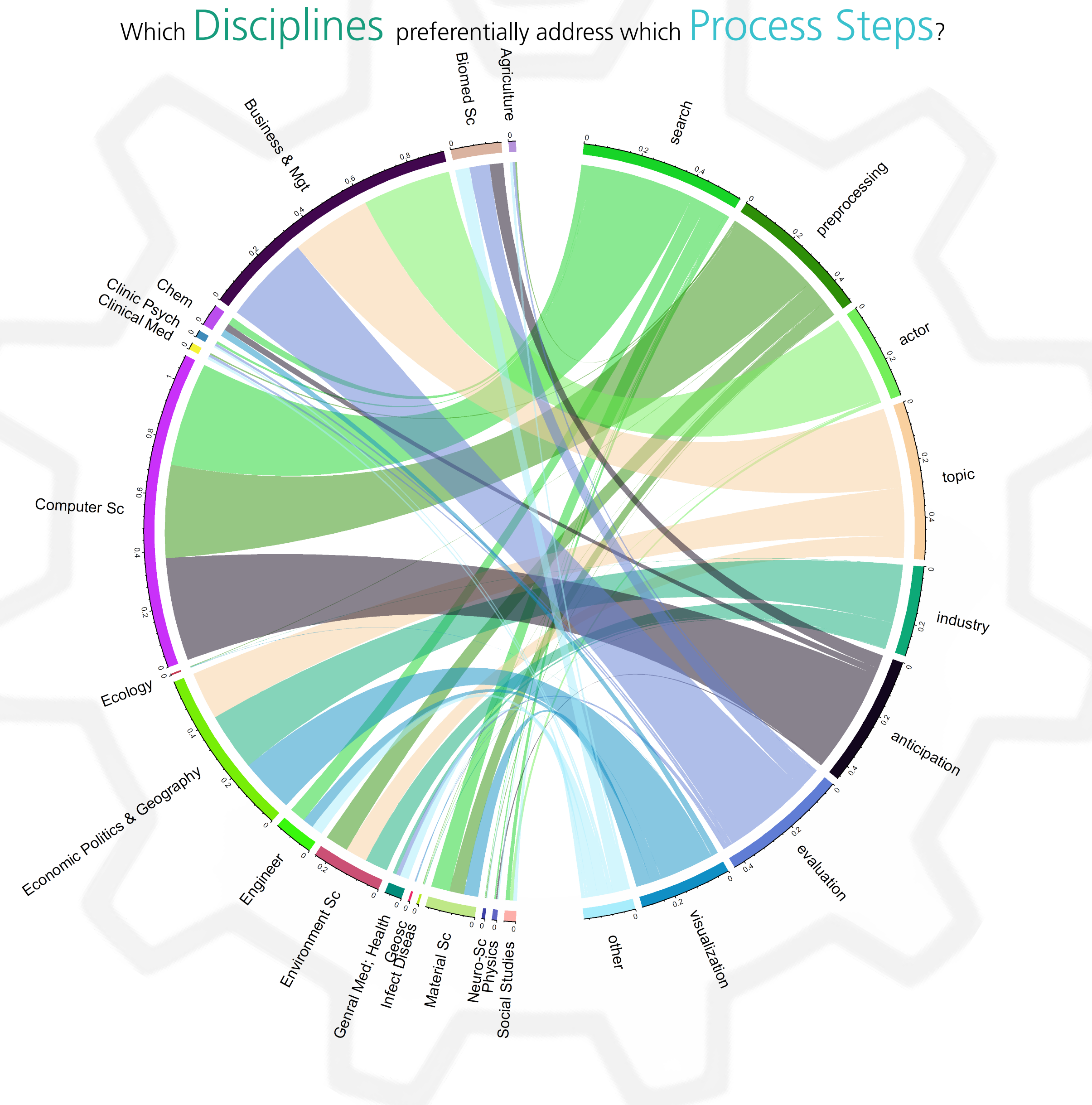
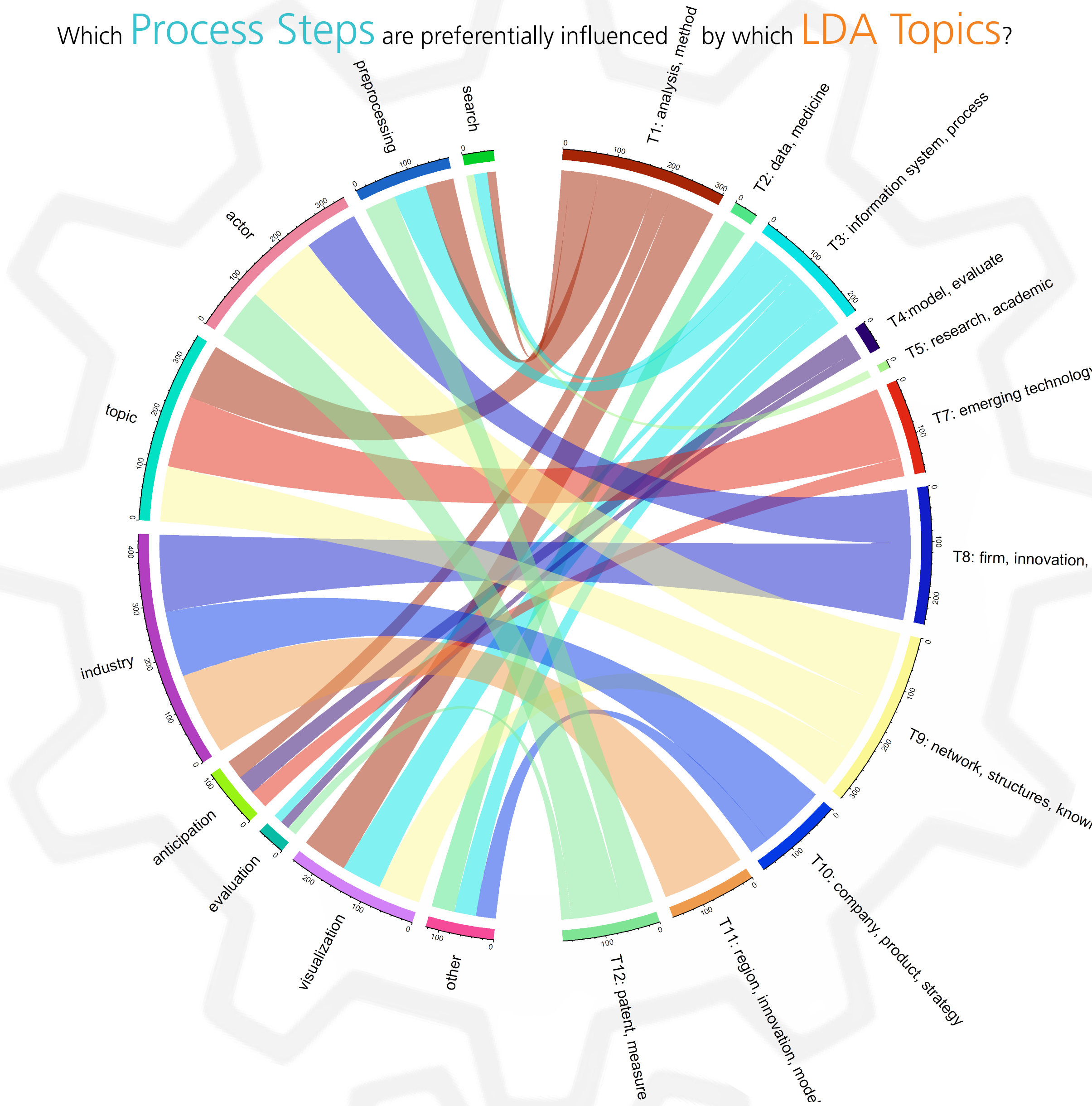
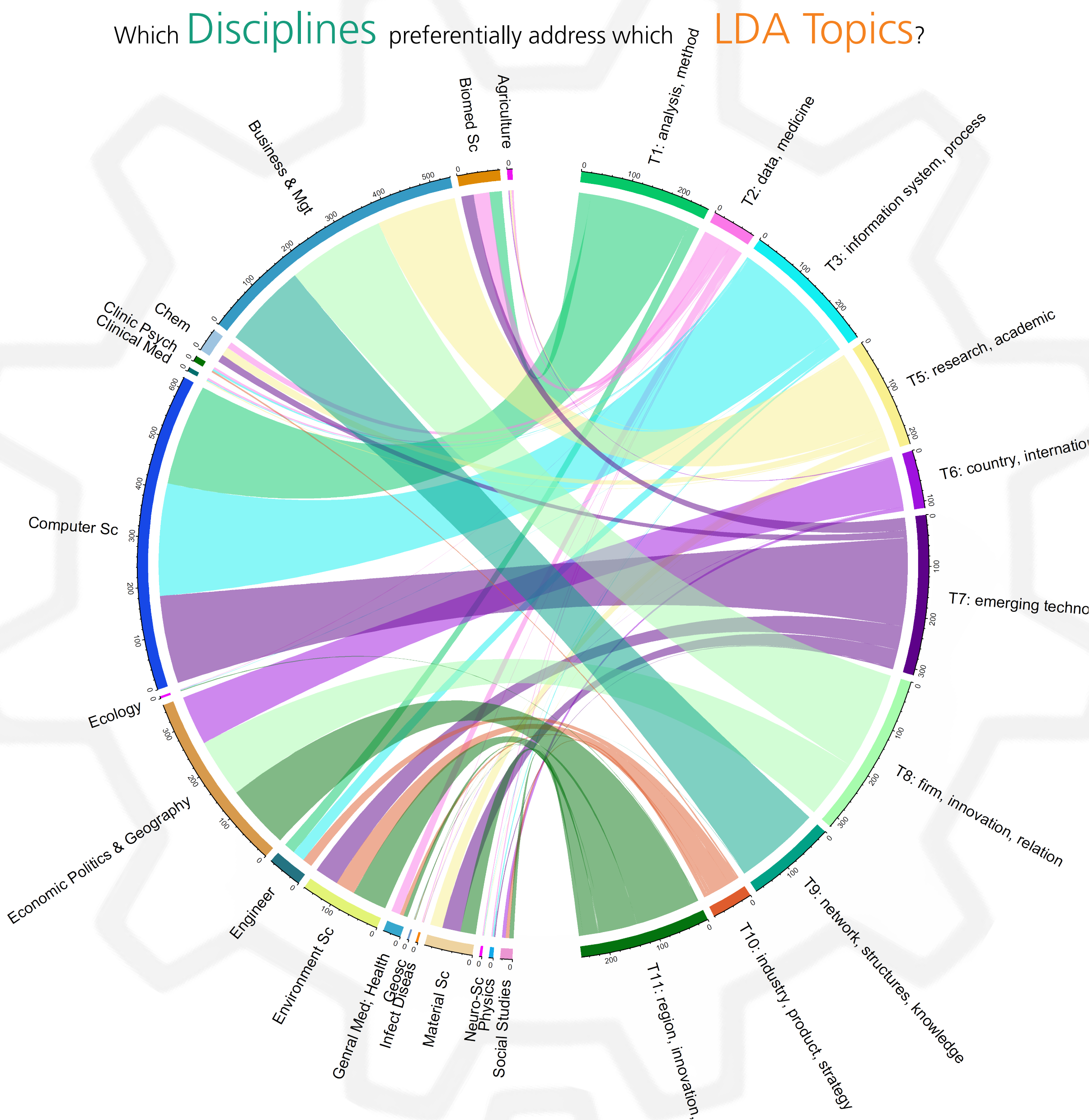
Patents in foresight – great and undiscovered potential

Future work:

- Connect the data to actors (authors, institutions, countries) to find communities.
- Research the significance of foresight and patents in the disciplines which have not appeared much to identify white spaces.
- Focus on the evaluation of foresight methods.

Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
analysis	data	system	model	research	country
method	develop	inform	measur	paper	activ
approach	research	process	data	public	univers
propos	project	design	indic	scienc	intern
identifi	drug	document	time	scientif	institut

Topic 7	Topic 8	Topic 9	Topic 10	Topic 11	Topic 12
technolog	innov	network	industri	innov	patent
develop	firm	knowledg	product	region	citat
emerg	perform	collabor	compani	effect	applic
analysis	relationship	structur	market	econom	analysis
trend	find	social	intellectu	growth	studi



Results

How is patent data used in foresight?

- 12 **topics** found with LDA (see table).
- T7** (*emerging technology, trend*) is a main topic, since the identification of emerging technologies is one of the main use cases in technology foresight.
- T8** (*firm, innovation, relation*) is taken up by **Business & Management** and **Economic Politics & Geography**, so two of the biggest disciplines in the dataset.
- T9** (*network, structures, knowledge*) is only prioritized by **Business & Management**, which is surprising, since it comprises common methods.
- T12** (*patent, measure*) is not preferentially addressed by any research field. This is surprising as well, since the dataset focusses on the use of patents.

Who uses patent analysis for foresight purposes?

- Mainly the obvious fields: **Business & Management**, **Computer Science**, **Economic Politics & Geography**.
- Surprisingly, **Environmental Science** is on the fourth place, which might be connected to the recent increase in research on sustainable technologies.
- In the last years, the topic also began to slowly spread to non-typical disciplines such as **Clinic Psychology**, **Geoscience**, **Neuro-Science** and **Social Studies**.

In which **steps** of the foresight process is patent data used?

- Process step with most publications is the **analysis** (actor, topic, industry).
- Process steps with least publications are **search** and **evaluation**, probably because they are not often addressed as main topics of a paper.
- All **steps** connect to a different combination of **topics**, meaning they are somewhat distinct in terms of content.
- The analysis on **industry** level is the only step which preferentially deals with economic innovation (**T11**).
- Search** is the only step which preferentially addresses academic research (**T5**).
- In **Computer Science**, specific use cases are less important, the focus lies on the processing of data (**search, preprocessing and evaluation**). Thus in CS the groundwork for analysing patent data is laid.

Where are **further possibilities** for the use of patent data in foresight?

- Many fields do not use patent data for foresight much yet, there might be a lot of use cases which are not addressed so far.
- T9** (*network, structures, knowledge*) is mainly addressed by **Business & Management**. This raises the question, why T9 is not as relevant for other fields.
- There is not much work on the non-analytic steps (**search, anticipation, evaluation**) yet, while the **evaluation** of methods is especially intriguing.

[1] Lee, Changyong (2021): A review of data analytics in technological forecasting. In: *Technological Forecasting and Social Change* 166, S. 120646. DOI: 10.1016/j.techfore.2021.120646.
[2] Leydesdorff, Carley, Rafols (2013): Global maps of science based on the new Web-of-Science categories. In: *Scientometrics* 94, S. 589–593. DOI: https://doi.org/10.1007/s11192-012-0784-8

