Over two decades of GORE

age of majority

Research Questions

- RQ1 How can we classify the type of publication?
- RQ2 Do GORE publications contain evaluation? Of what type?
- RQ3 What are the topics covered by GORE publications?
- RQ4 What goal modeling frameworks have been used in the publications?

J. Horkoff et all : Goal-Oriented Requirements Engineering: A Systematic Literature Map. Requirements Engineering Conference 2016.

Research Questions

- RQ5 In what journals or conferences do approaches typically appear?
- RQ6 What techniques are most widely cited? Are citations equally distributed?
- RQ 7 Is interest in GORE increasing or decreasing?

J. Horkoff et all : Goal-Oriented Requirements Engineering: A Systematic Literature Map. Requirerements Engineering Conference 2016.

Systematic Literature Map

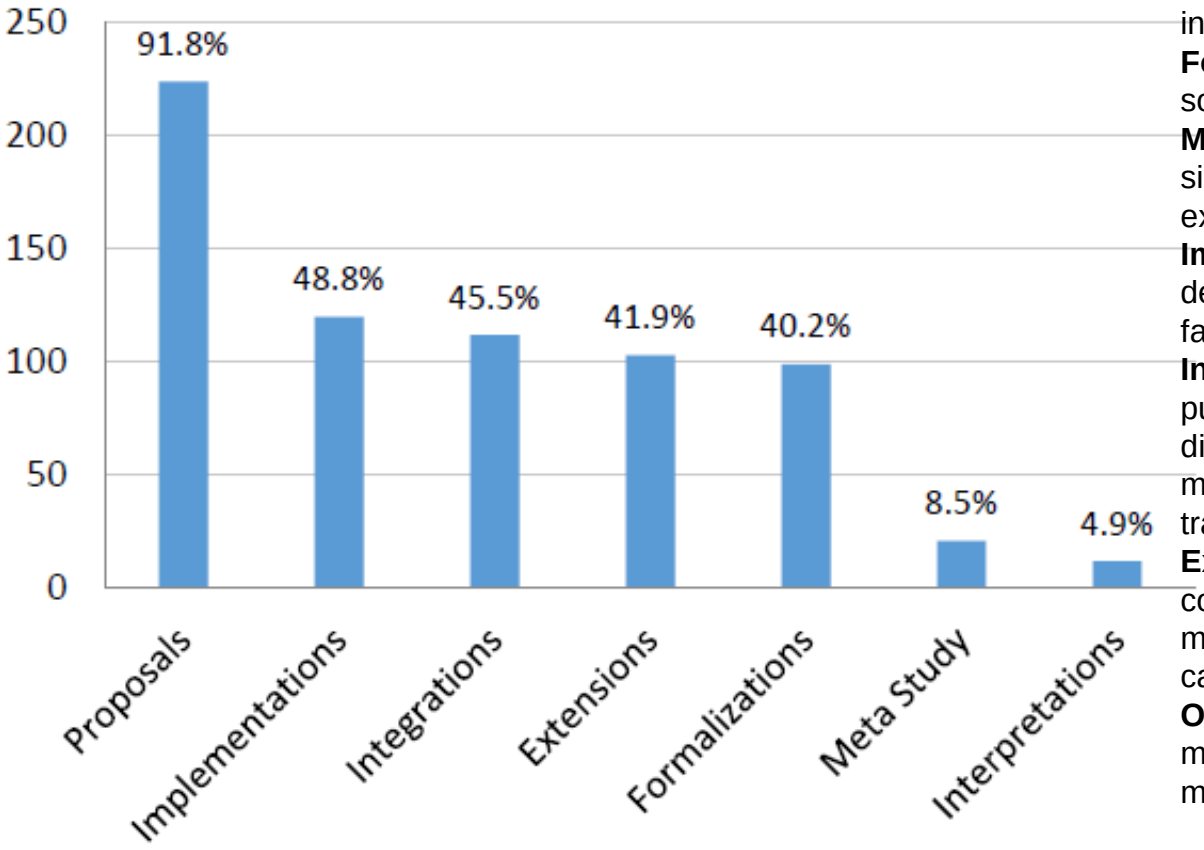
- **Systematic search:** Scopus (includes IEEE, Springer, ACM)
- ("goal-oriented" OR "goal model" OR "goal modeling" OR "goal modelling") AND "requirements" = 966 results
  - Cut-off of 3 or more citations = 350 publications
  - 104 papers out of scope, final inclusion: 246
- 246 papers (up 16 December 2015)

Inclusion and exclusion criteria

Inclusion Criteria
Has a significant component that deals with GORE
In conference, journal, or in/is a book, and
Is published in English, and
Is more than 3 pages.

Exclusion Criteria
Does not significantly relate to GORE or
Is a thesis, workshop or regional conference, or
Is published in another language, or
Is 3 pages or less.

RQ1 How can we classify the type of GORE approach?



Proposal: Any publication that proposes something new: e.g., a language, extension, integration, algorithm, etc

Formalization: If the publication contains axioms, some formal logical language

Meta study. Publications which provided a significant overview of existing work or a study of existing research.

Implementation. Publications that mention the development of a tool or implementation which facilitates the contribution of the work.

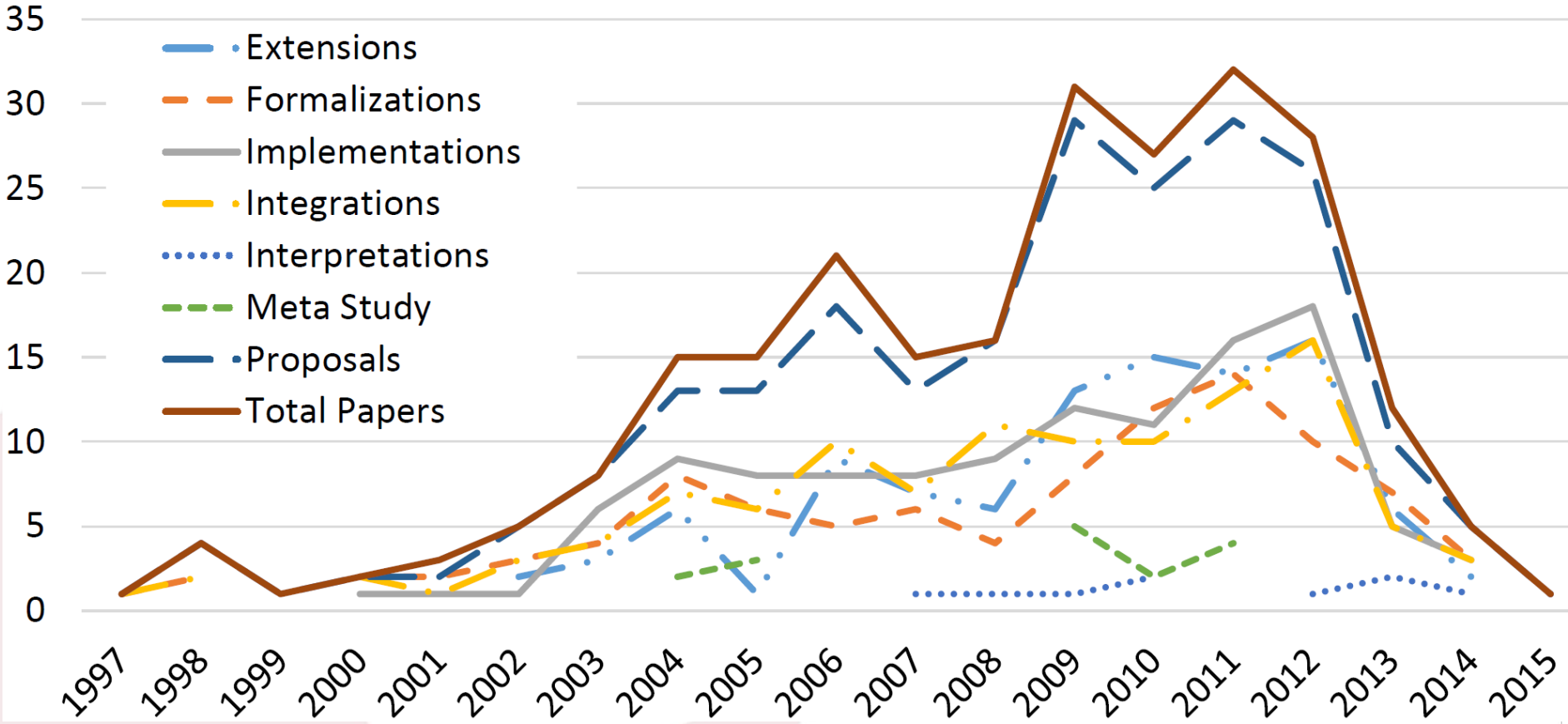
Integration/Transformation/Mapping. if the publication contribution described two different, distinct, named things, one of which was a goal model, and this goal model was integrated, transformed, or mapped to the other thing.

Extension. Publications which focus on some concept(s) which is not a named language or method being added to goal model, (e.g., capabilities, commitments).

Ontological Interpretation. A publication which maps ontologies onto some aspects of goal models.

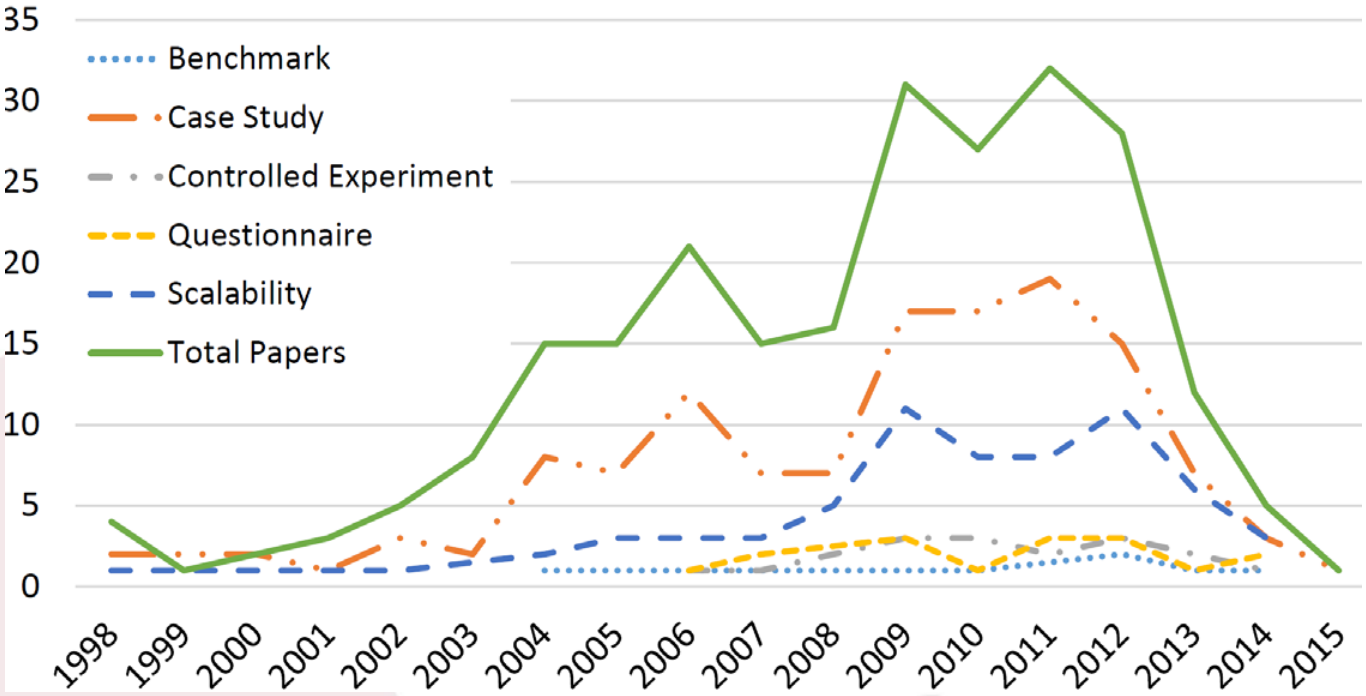
RQ1 Classification over time

- RQ1 How has this changed over time ?



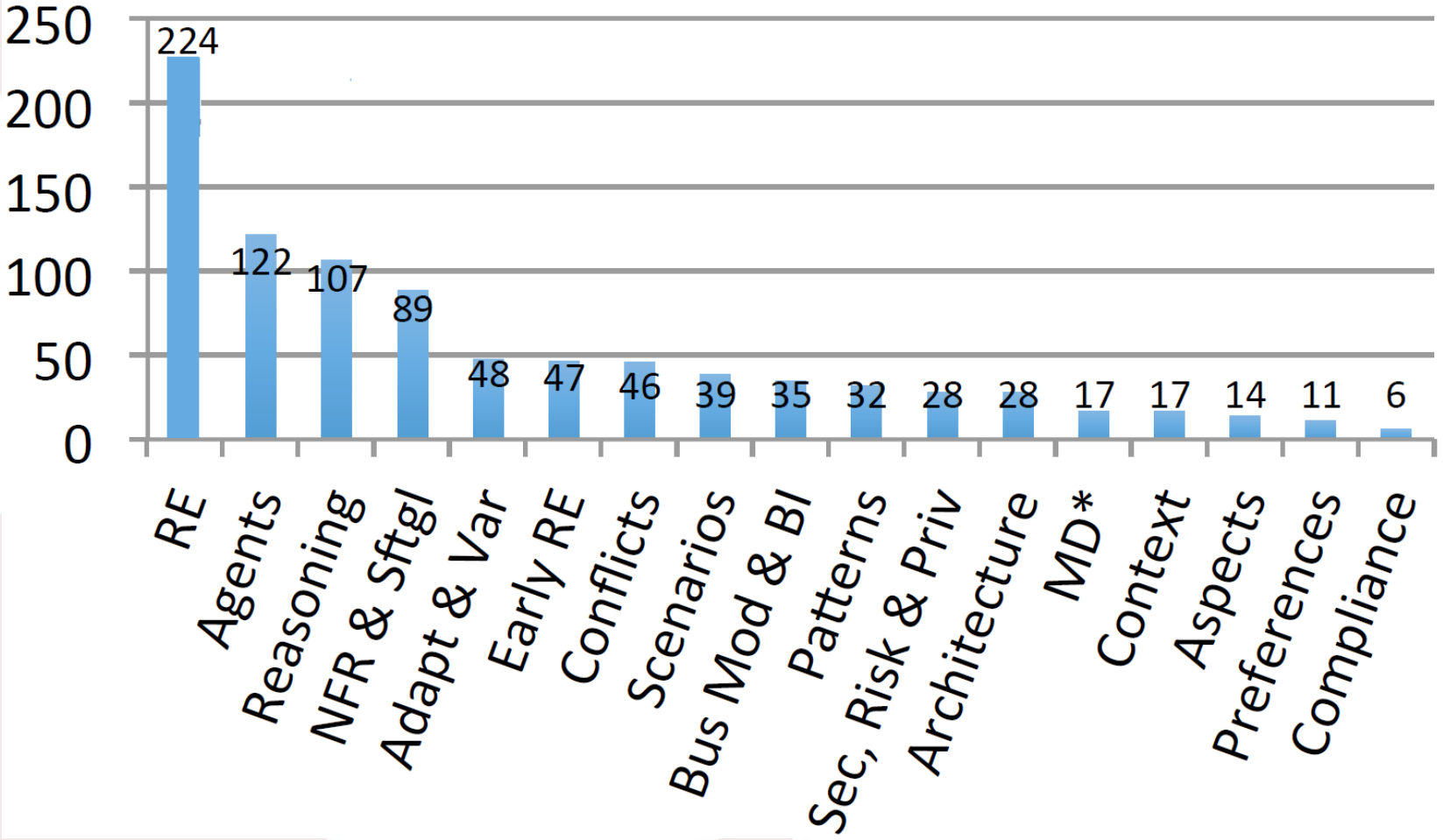
RQ2 Do GORE publications contain evaluation?

- 53% of the 246 papers contain a case study, 27% some evaluation of scalability, 7% a controlled experiment, 7% questionnaires,and 4% contain some type of benchmark

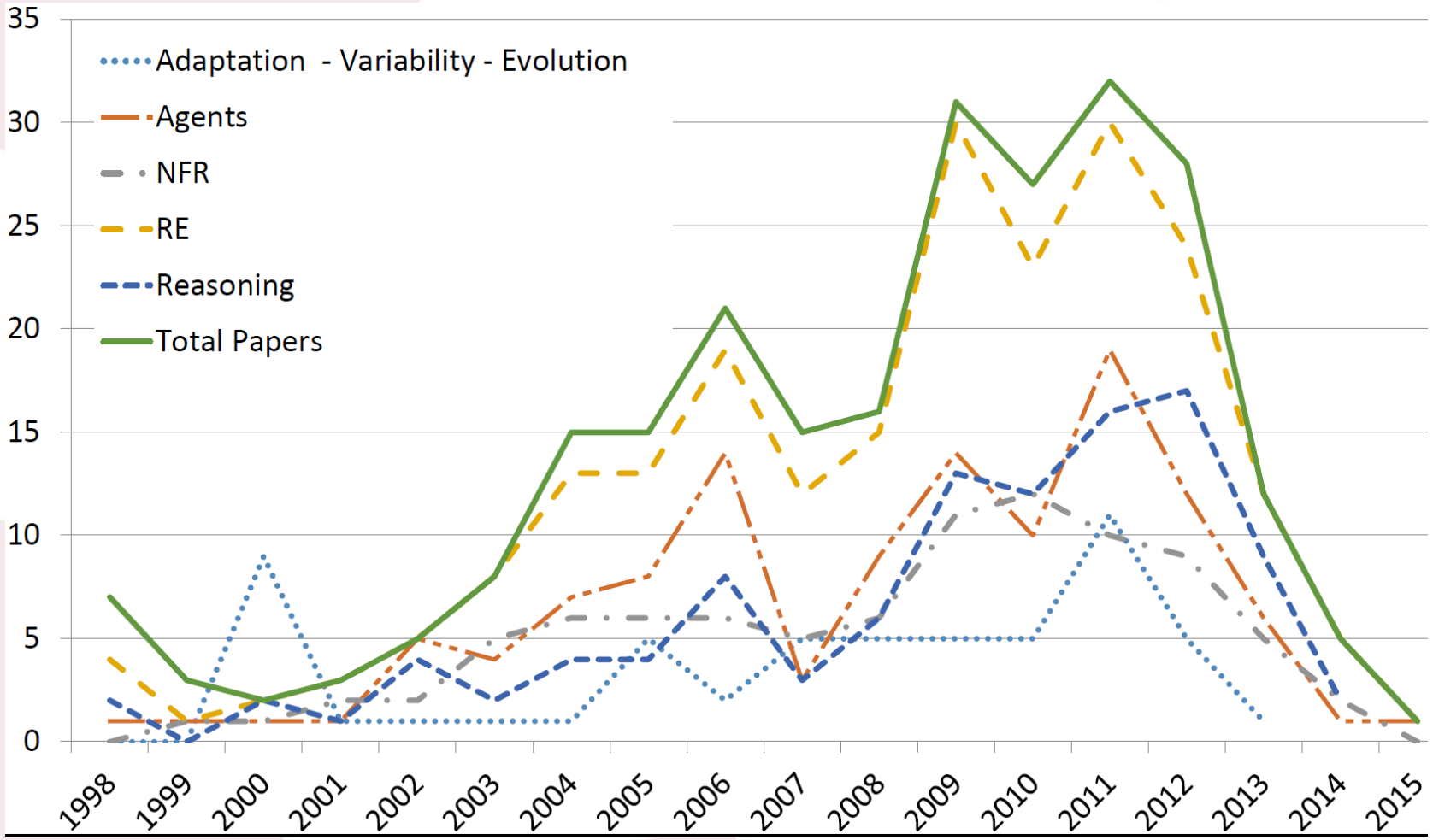


Benchmark. Evaluating a contribution using an established and shared measure or example.
Controlled Experiment. The publication includes a controlled study in order to evaluate their contribution.
Questionnaire. The evaluation includes a questionnaire collecting answers from some target group and evaluating the results.
Case Study. The publication includes a case study which evaluates the contribution. Whether the case study is a case study or only an illustrative example depends on depth and realness.

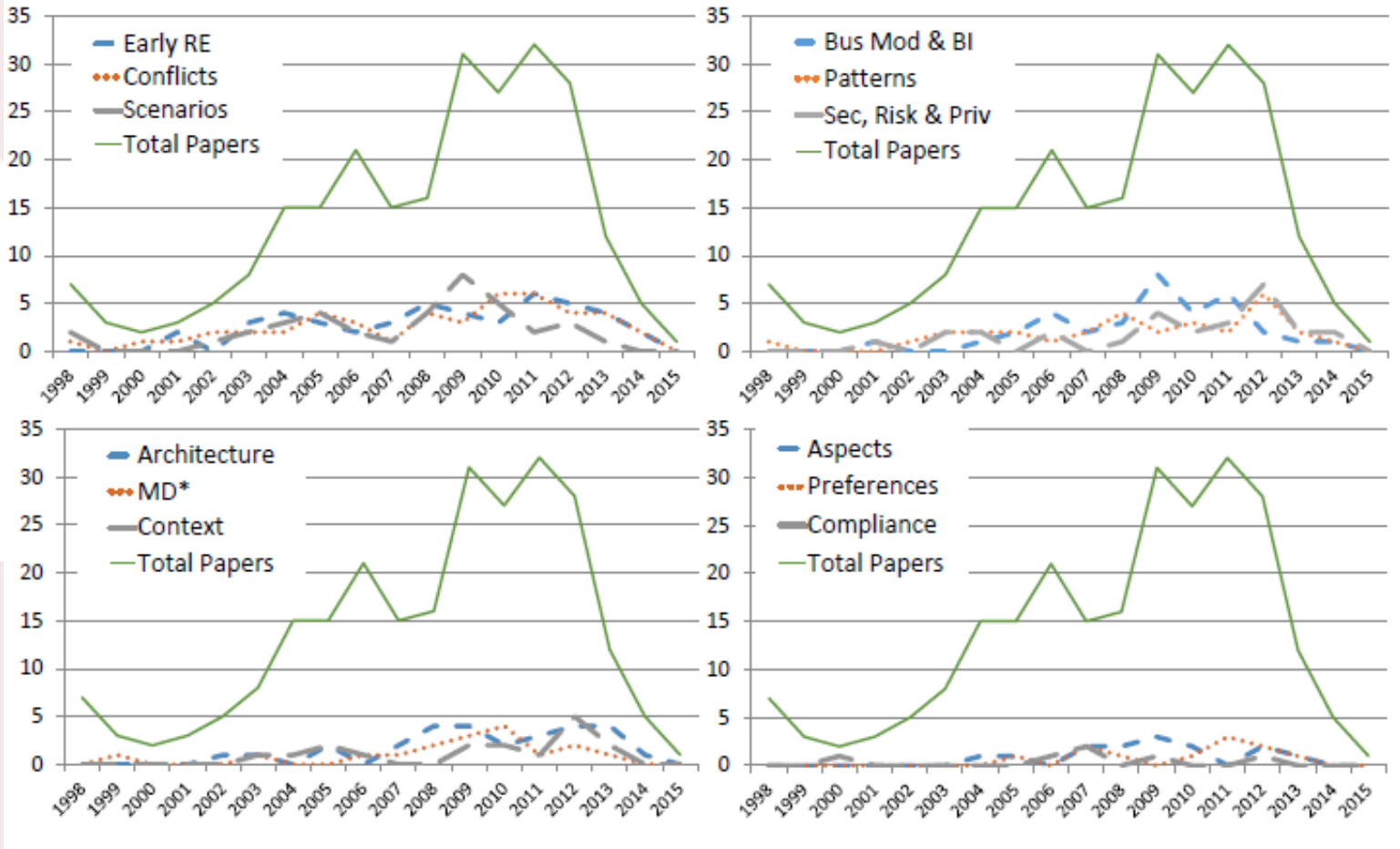
RQ3 What are the topics covered by GORE publications?



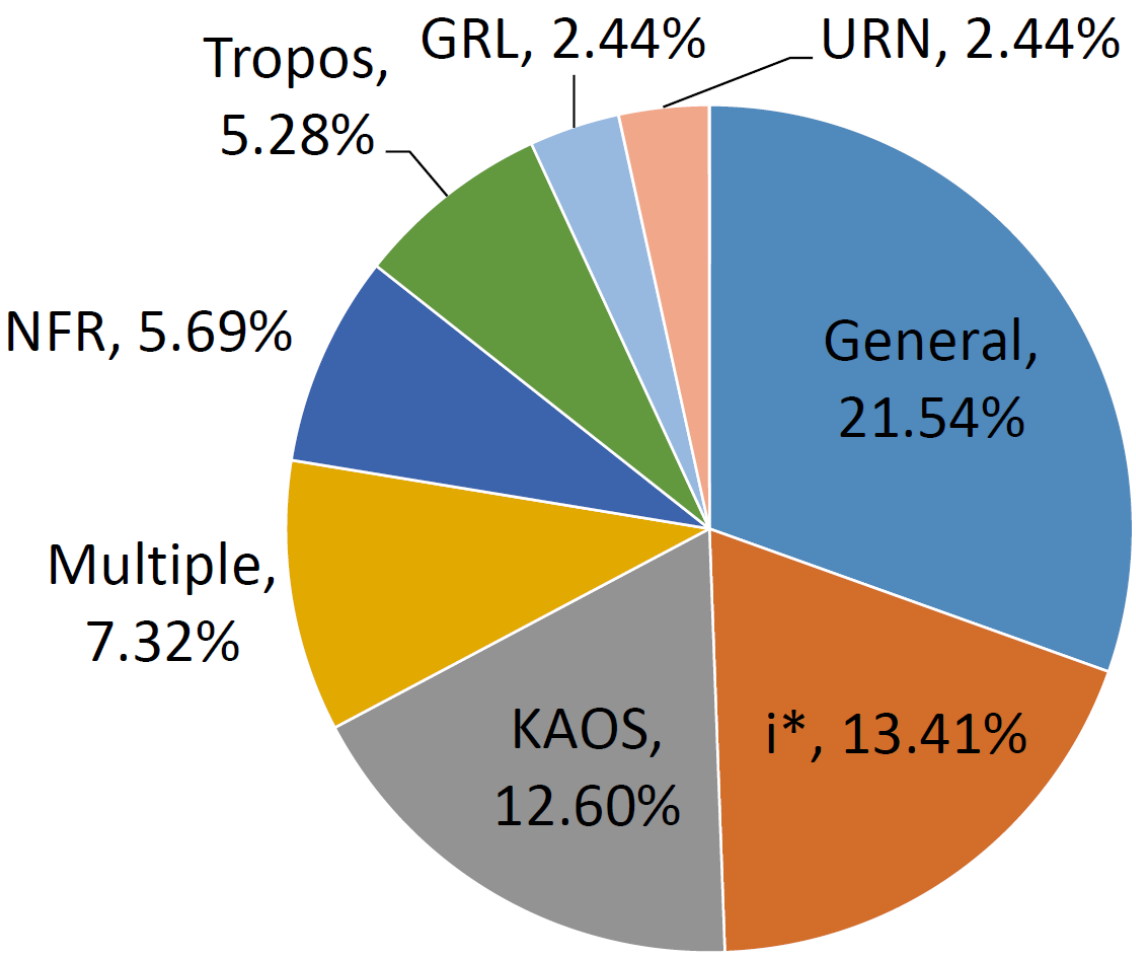
RQ3 Top five topics over time



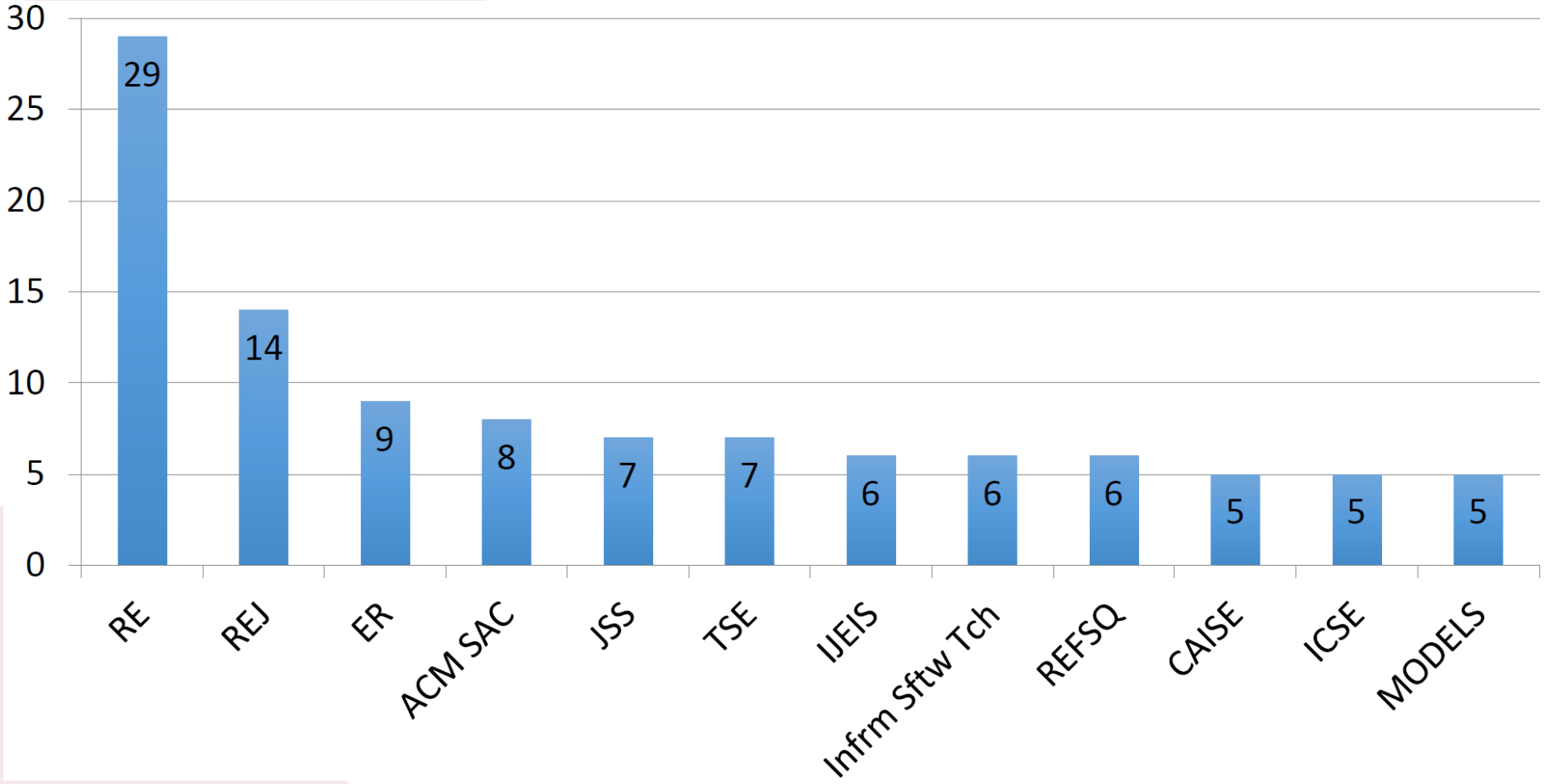
RQ3 Remaining topics per year



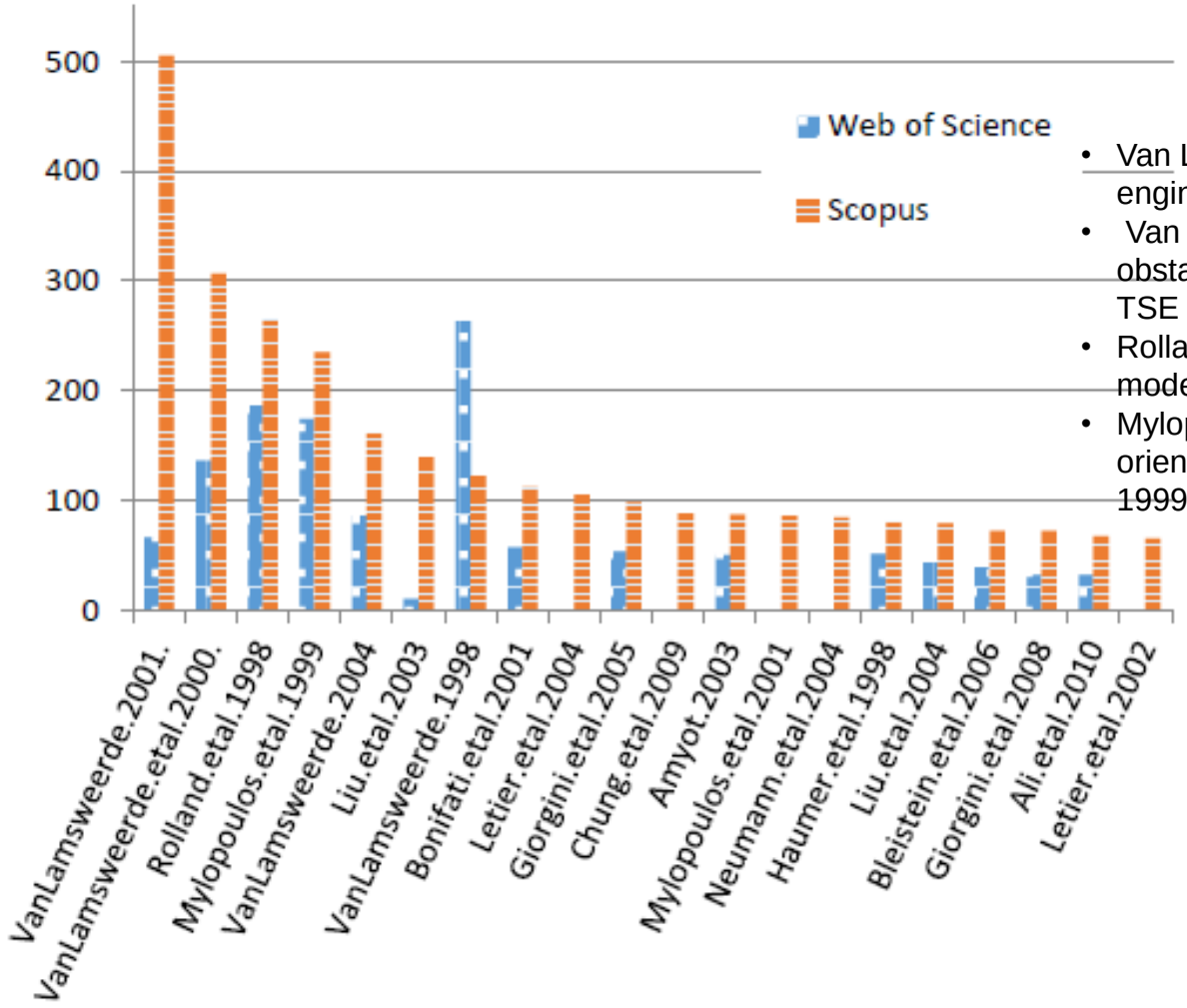
RQ4 GORE Frameworks used in the publication



RQ5 In what journals or conferences do approaches appear?

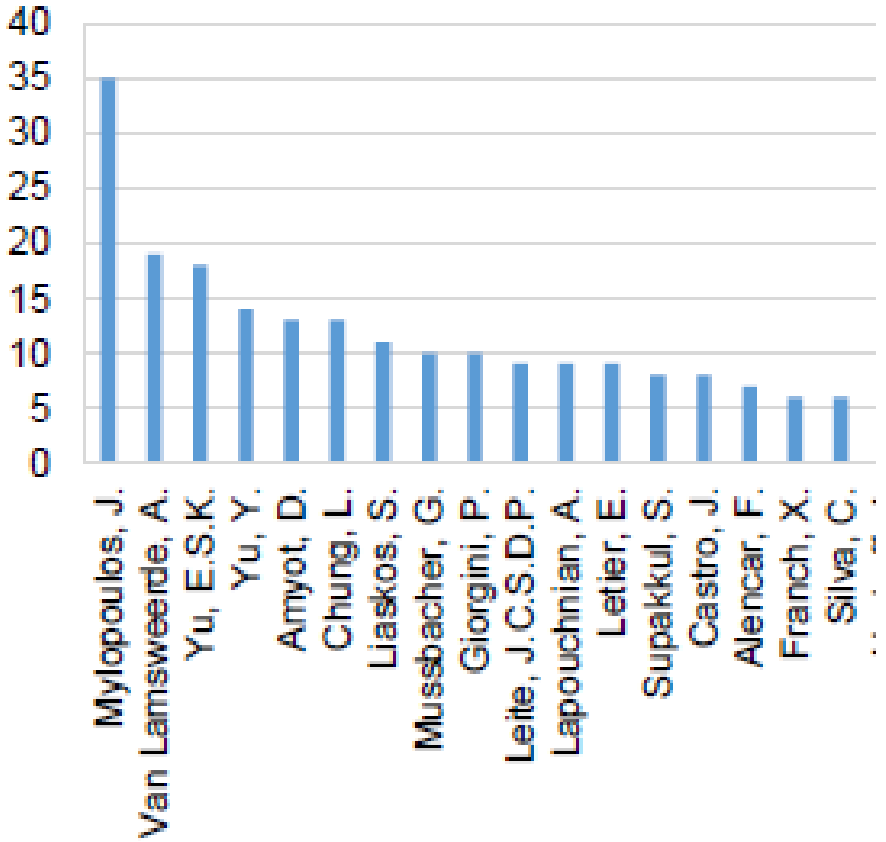


RQ6 Citations

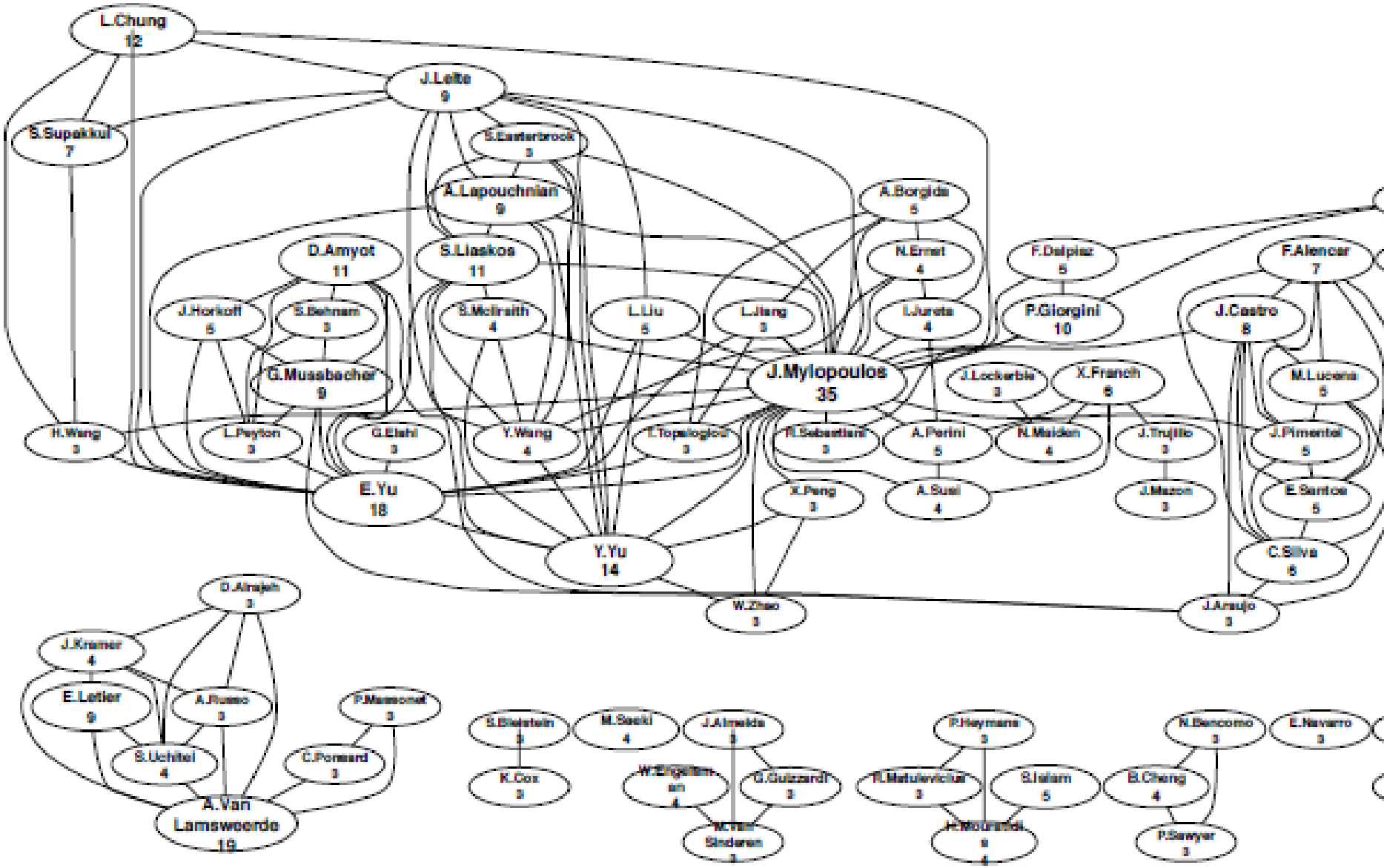


- Van Lamsweerde, A.Goal oriented requirements engineering: A guided tour. RE 2001
- Van Lamsweerde, A., Letier, E..Goal. Handling obstacles in goal oriented requirements engineering. TSE 2000
- Rolland, C.,Souveyet, C., Achour, C. B. Guiding goal modeling using scenarios. TSE 1998
- Mylopoulos, J., Chung, L., Yu, E.S.K. From object oriented to goal oriented requirements analysis. CACM 1999

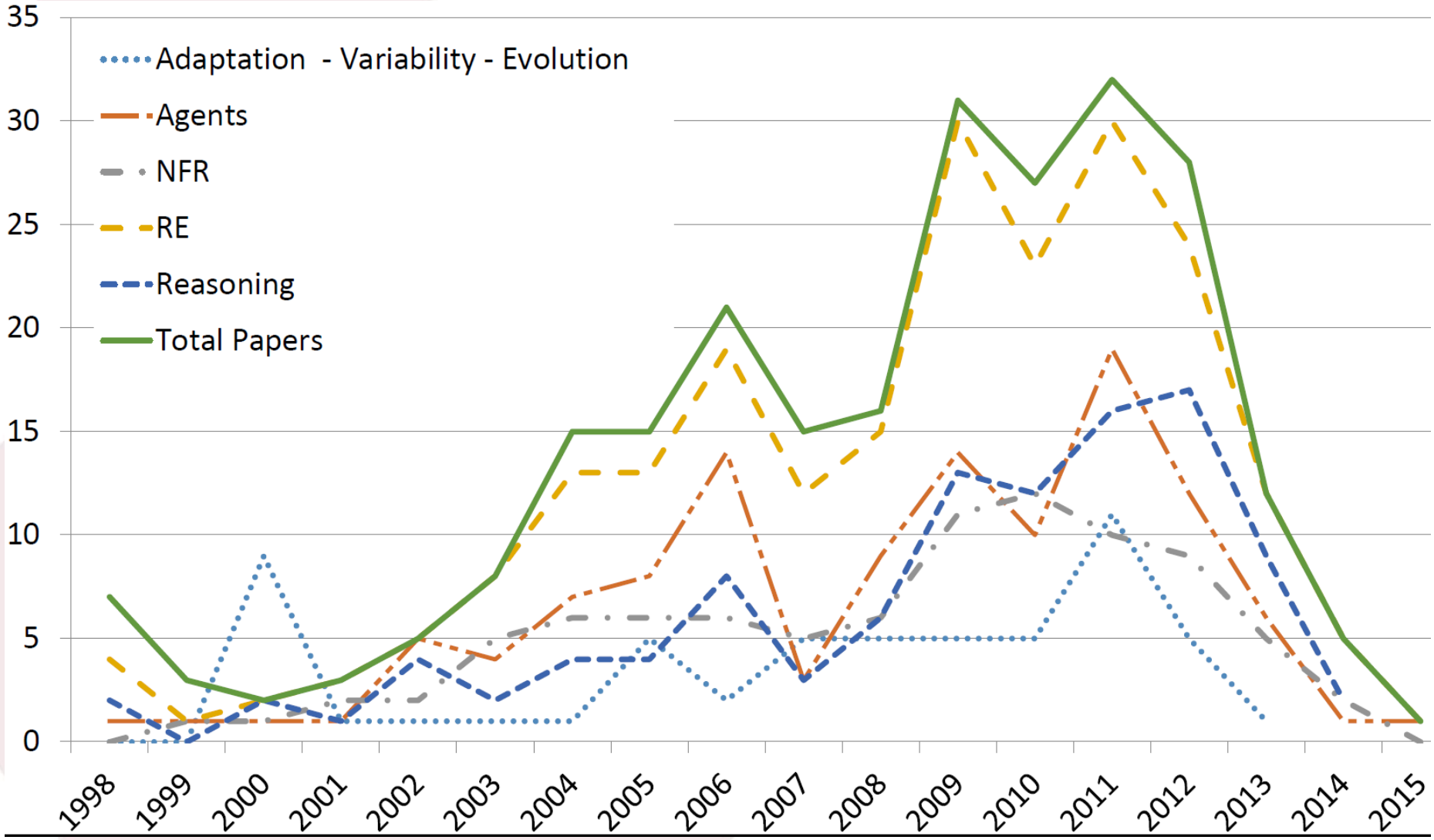
RQ6 Top authors by total # publications cutoff > 5 publications



RQ6 Co-author network 3 or > papers



RQ7 Is interest in GORE increasing or decreasing



Findings: Goal Oriented Requirements Engineering

- Kaos and i* Framework appear nearly equally
  - Majority of papers non-committal regards to framework
- Venue: RE and REJ dominate, but wide variety of venues
- GORE has seen increased interest in recent years, possibly with a dip in interest recently
- About half of the publications have a case study
  - Scalability tests are still in use, while other forms of evaluation are rare
- Some trends in research topics, eg. rise in adaptation/variability/evolution
  - Most popular topics seem to rise and fall with the number of papers

Findings: Goal Oriented Requirements Engineering

- Lots of new proposals
  - Slight rise in use of past approaches (implementations, integrations, extensions)
- Many papers with low citations
- Small number of top authors dominate in terms of citation,
  - But the degree of involvement in terms of number of included papers is spread more widely
- Authors do not necessarily collaborate with the authors they cite
  - Divergence and isolation of various camps or schools
  - Need for more future convergence in the GORE community

GORE Downstream

Goal Model Challenges

- Goal models are helpful in understanding potential problems and solutions, but…
  - it is not always clear what to do with models after they are built
- How to use goal-oriented models to move towards detailed requirements, specification, architecture, or design?
- How can goal models be used not only as part of other RE efforts (e.g. specifications, validation, planning), but as part of the entire SE or system life cycle?

J. Horkoff, et. all: Using Goal Models Downstream: A Systematic Roadmap and Literature Review. International Journal of Information System Modeling and Design - 6(2): 1-42 (2015)

Using Goal Models Downstream

- How can goal models be used to improve system effectiveness at run-time, or as the environment and needs of stakeholders evolve?
- What is the connection between GM and other artifacts?
- What approaches exist that map/integrate/transform goal models to later stage software artifacts?

J. Horkoff, et. all: Using Goal Models Downstream: A Systematic Roadmap and Literature Review. International Journal of Information System Modeling and Design (IJISMD) - 6(2): 1-42 (2015)

Research Questions

- RQ1 What types of transformations are used ([mapping/transformation] [horizontal/vertical], [endogenous/exogenous])?
- RQ2 What goal modeling frameworks are used most frequently?
- RQ3 What sources or targets are goal models mapping/transformed /integration to/from/with? Are there trends in these choices?
- RQ4 What are the motivations for the approaches? Are there trends in these motivations?

Research Questions

- RQ5 What type of research papers focus on these approaches(validation/evaluation/solution/philosophical/ opinion/experience)?
- RQ6 In what journals or conferences do approaches typically appear?
- RQ7 What techniques are most widely cited? Are citations equally distributed?
- RQ8 Who are the main contributors? What does the network of authors look like?
- RQ9 Is interest in goal model transformation increasing or decreasing?

- 243 papers found both through snowballing and systematic search
- Several research databases (IEEE, Springer, ACM) published in 11 years (2003 - June 2014)
- (“requirements engineering” OR “software engineering”) AND (“goal model”) AND (transformation OR mapping OR derivation OR alignment OR integration OR link)

- “goal model” replaced with a variety of common forms (e.g., “goal modeling”, “goal oriented requirements”).

Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Transforms (maps/integrates) to/from/with a GOL to/from/ with an RE or SE artifact or model, and	Describes only model extensions, or
Describes exogenous vertical or horizontal, or endogenous vertical transformations, and	Describes only endogenous horizontal transformations, or
If GOL is formalized, uses formalisms as part of downstream development, and	Formalizes a GOL without using formalisms as part of downstream development, or
In conference, journal, or in/is a book, and	Is a theses, or
Workshop or regional conference with more than three citations per year, and	Workshop or regional conference with less than three citations per year, or
Is published in English.	Is published in another language.

RQ1 Transformation Types

Mapping: A set of rules that describes how one or more **constructs** in the source modeling language can be connected to one or more **constructs** in the target modeling language

Transformation: A process that takes one or more source **models** as input and produces one or more target **models** as output by following a set of transformation rules

Vertical: A transformation where the source and target models reside at **different** abstraction levels
Horizontal: A transformation where the source and target models reside at the **same** abstraction levels

Exogenous transformation: A transformation between models expressed in **different** languages
Endogenous transformation: A transformation between models expressed in the **same** languages

	Mapping	Transformation
Vertical	74	67
Horizontal	39	27

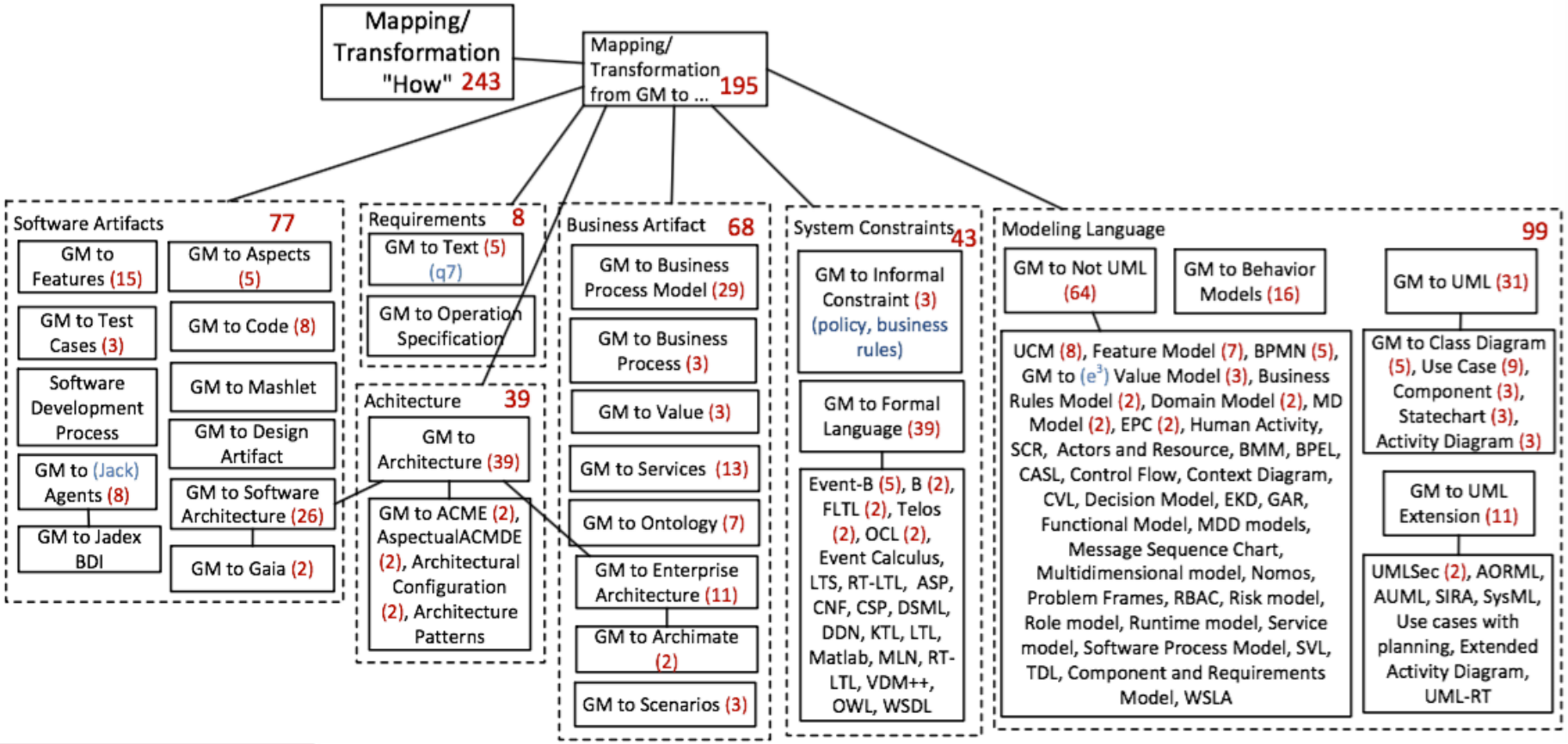
	Endogenous	Exogenous
Vertical	7	154
Horizontal	18	60

RQ2 Goal model Source/Targets

The top 8 goal model source languages

Unidentified Goal Model	i*	KAOS	Tropos	GRL	NFR	SIG	Map
55	49	28	19	12	10	4	4

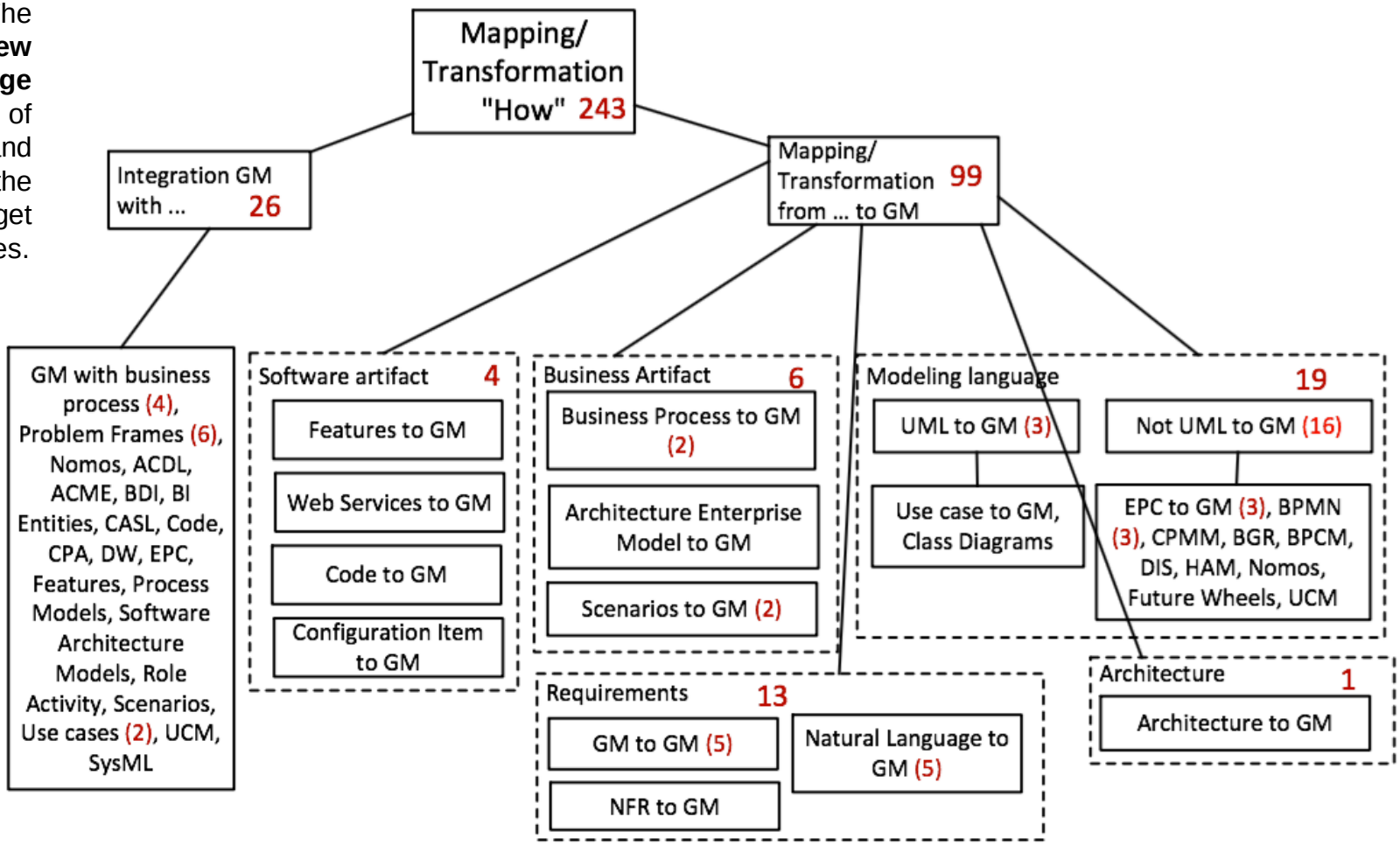
RQ3 What sources or targets?



Transforming **from** Goal Models (default count of (1))

RQ3 What sources or targets?

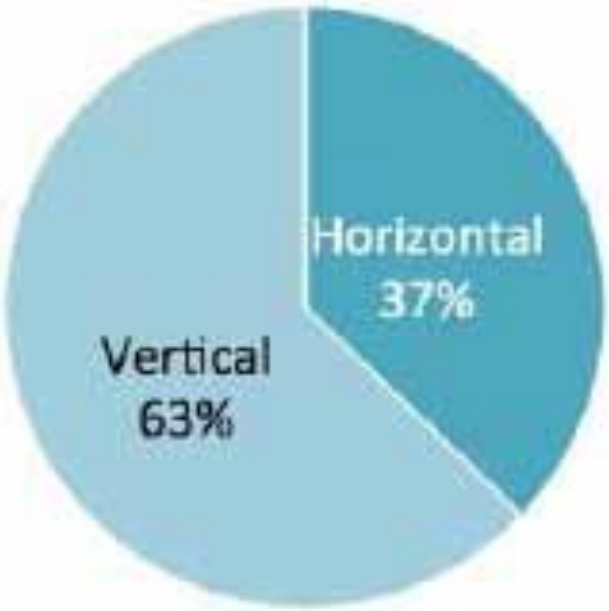
Integration: The creation of a **new modeling language** which is **made up** of constructs and relations from the source and target modeling languages.



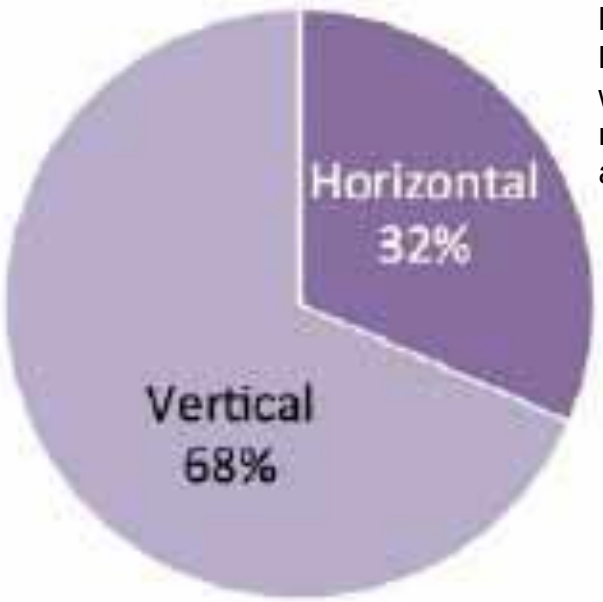
Transforming **to** Goal Models (default count of (1))

Horizontal or Vertical Transformations?

- Techniques are using GM for purposes beyond early reaquirements



to Goal Modes



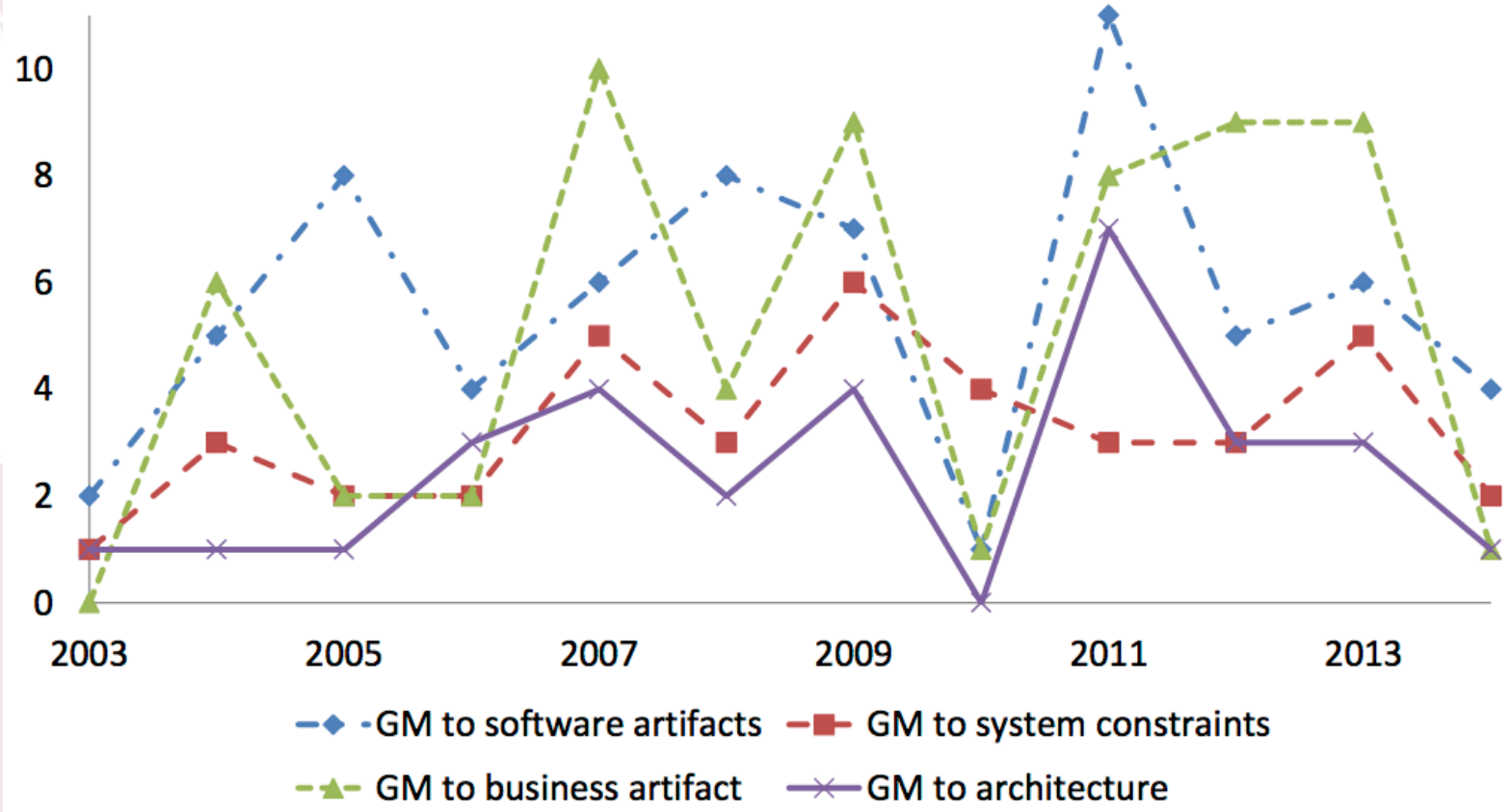
from Goal Modes

Vertical: A transformation where the source and target models reside at **different** abstraction levels

Horizontal: A transformation where the source and target models reside at the **same** abstraction levels

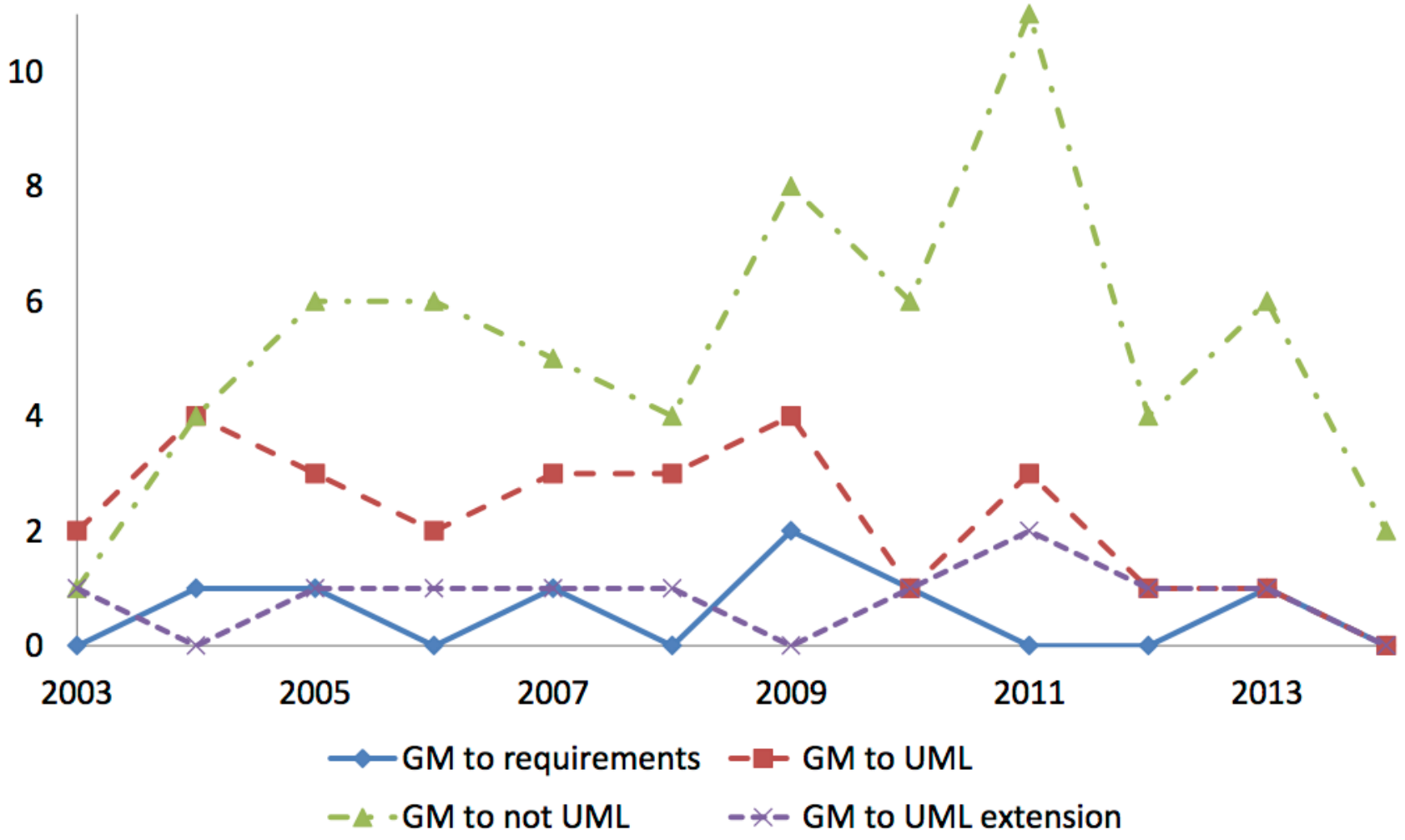
RQ3 What sources or targets? Trends

Transforming **from** Goal Models

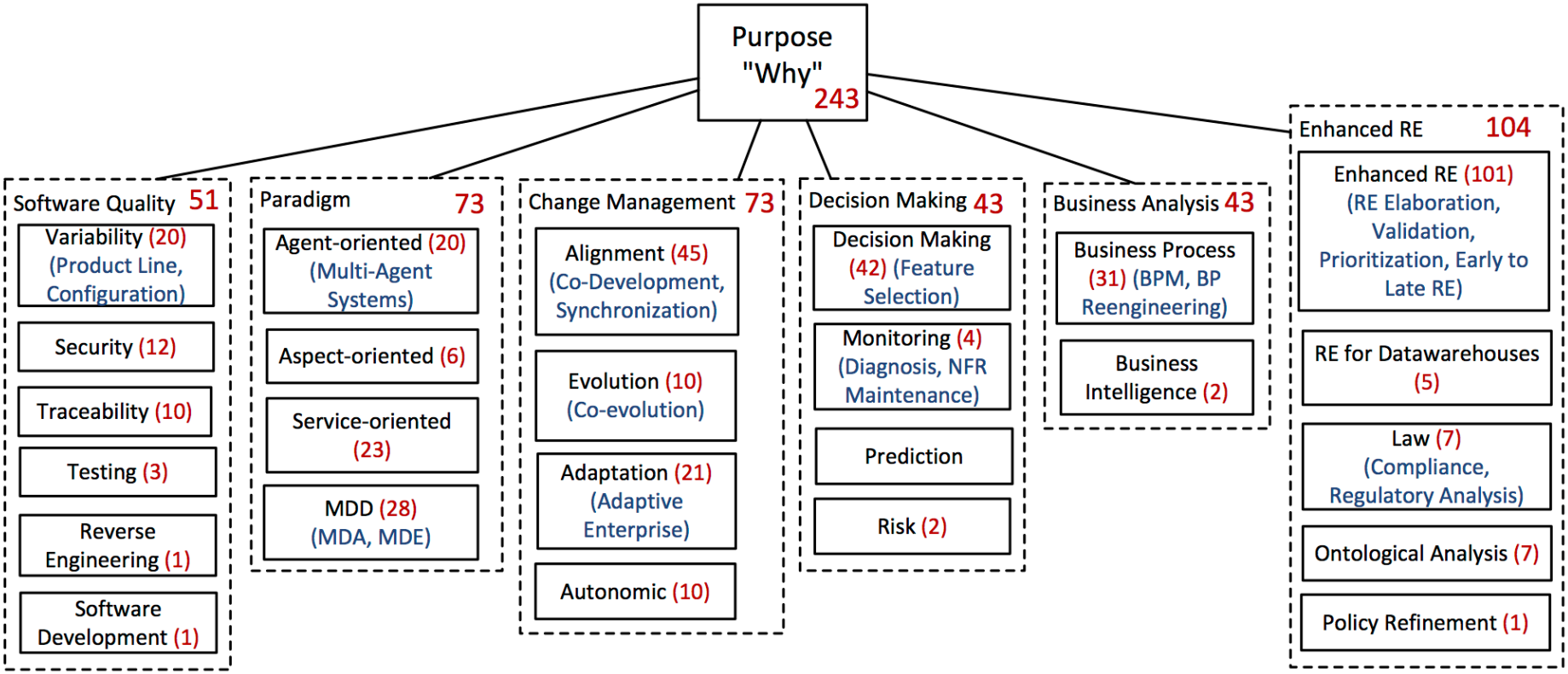


RQ3 What sources or targets? Trends

Transforming **from** Goal Models



RQ4 What are the motivations for the approaches? Trends?



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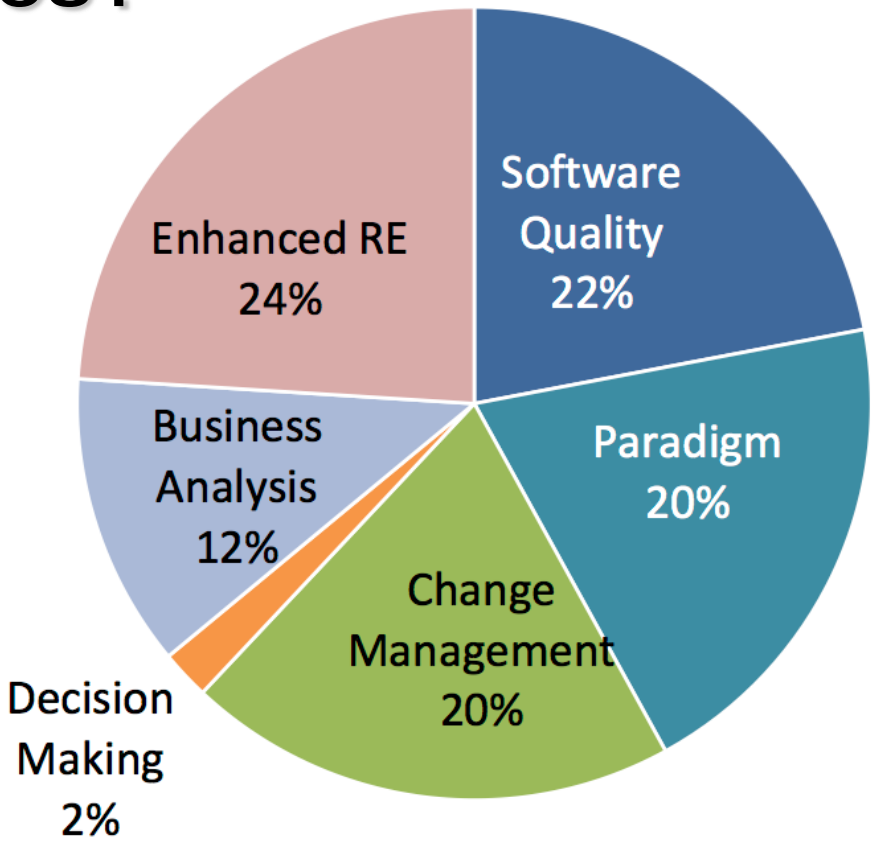
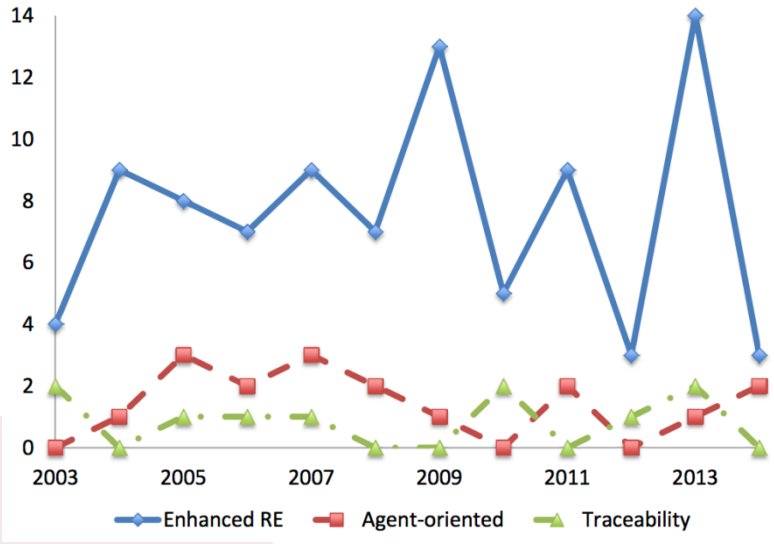
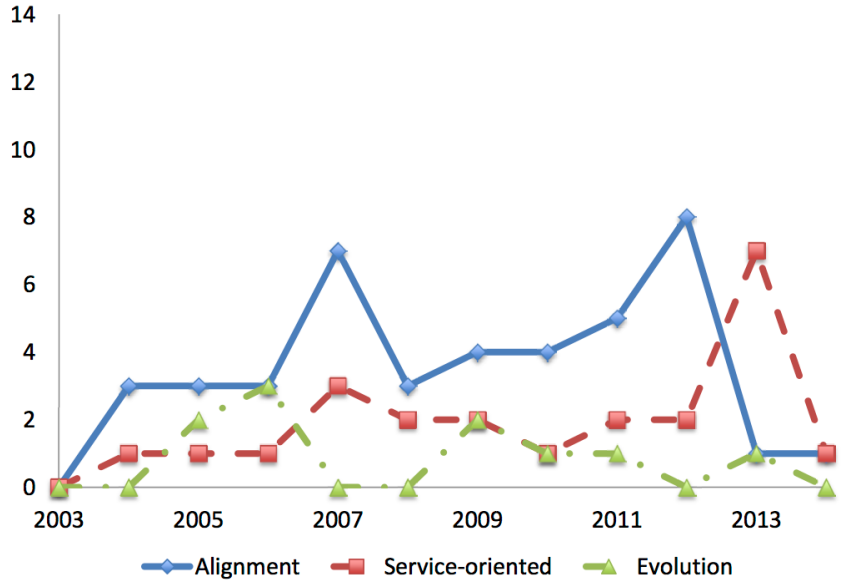


The distribution of the 50 papers with the most citations/year into high-level “why” categories

RQ4 What are the motivations for the approaches? Trends?





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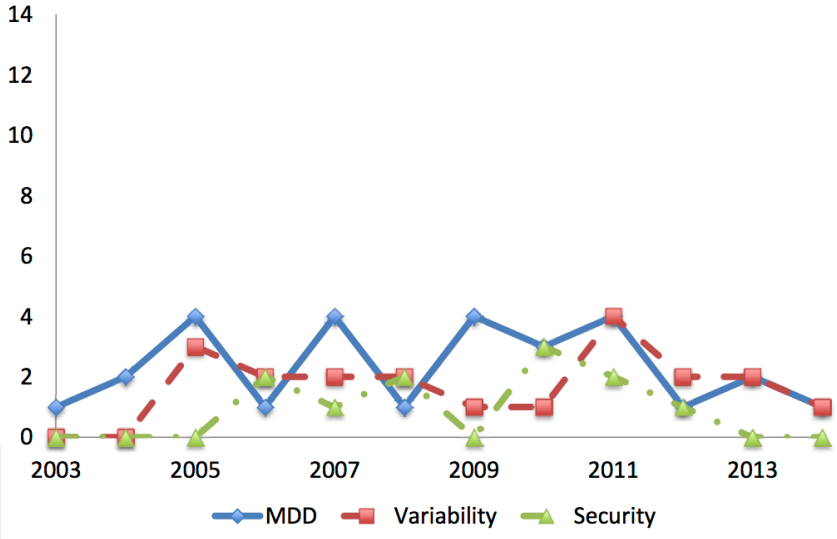
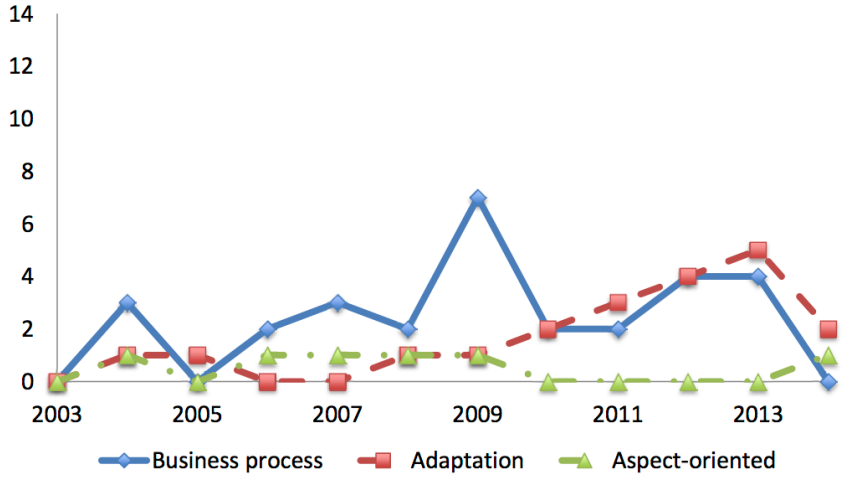
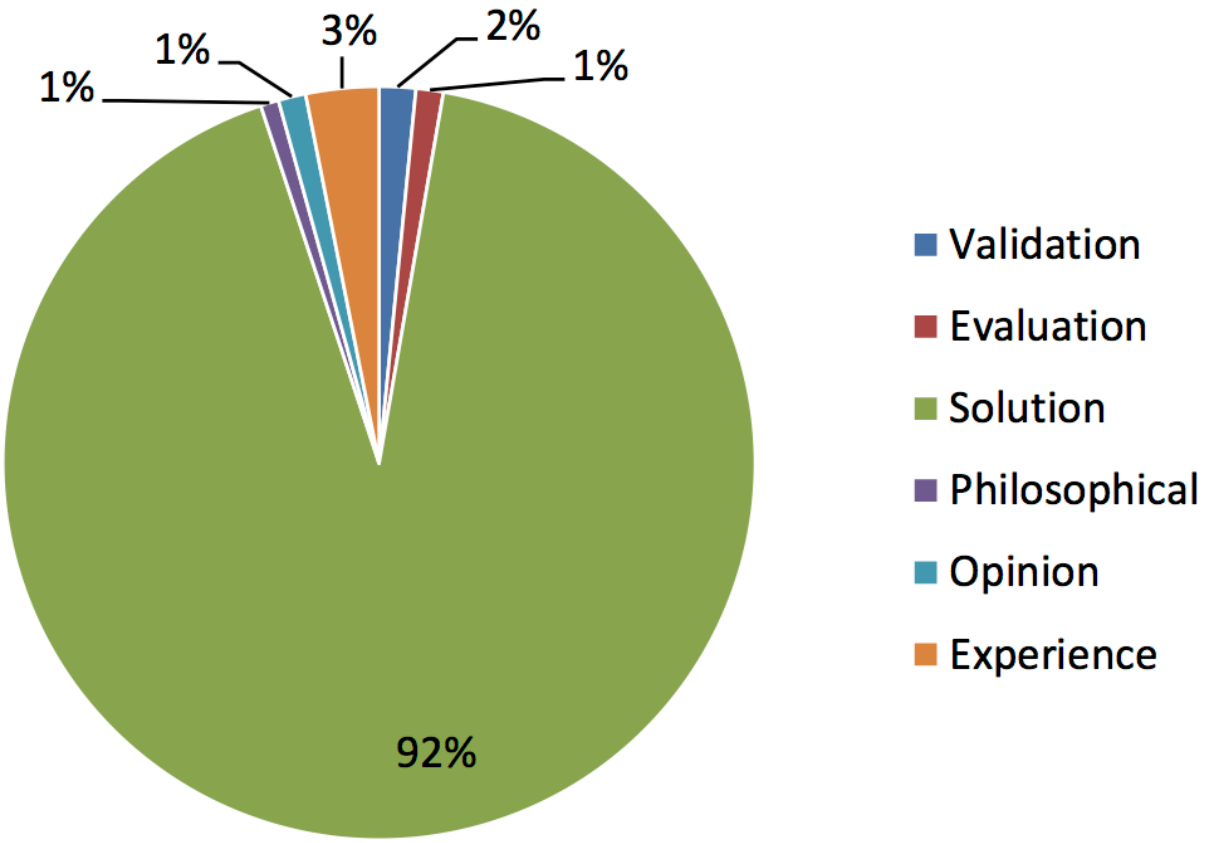


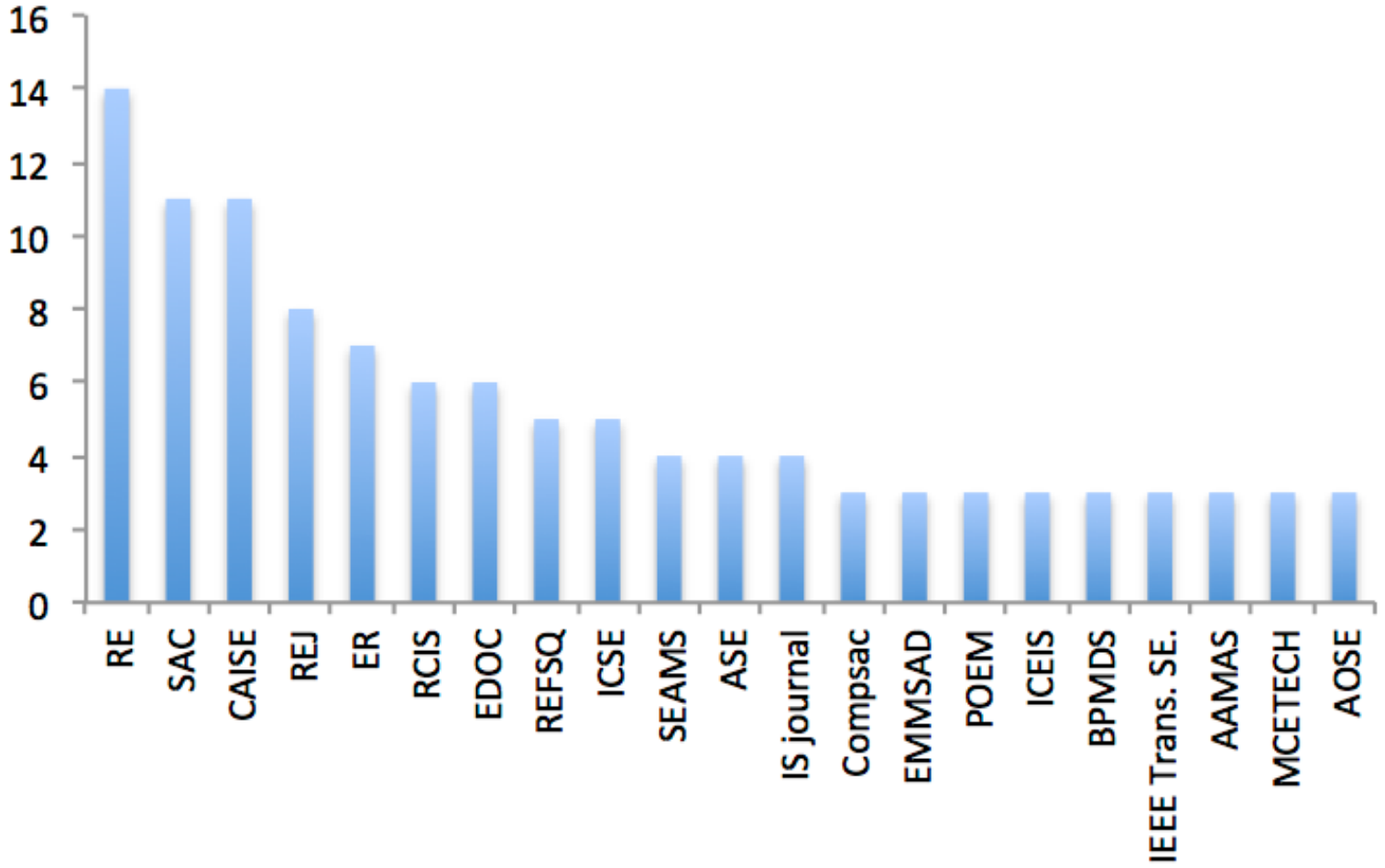


RQ5 What types of research papers?



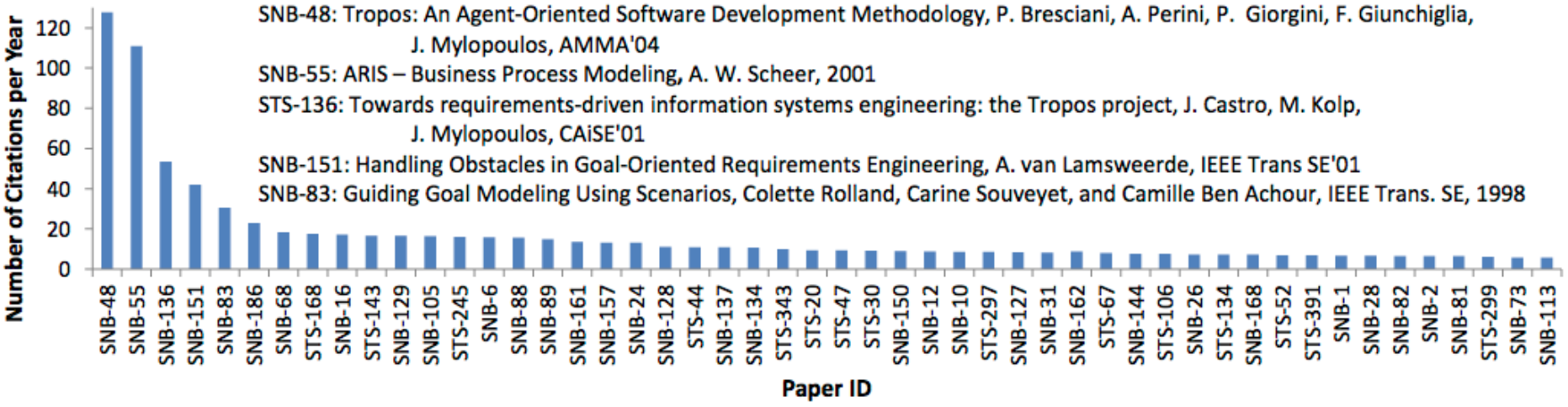
R. Wieringa, N. Maiden, N. Mead, and C. Rolland, "Requirements engineering paper classification and evaluation criteria: a proposal and a discussion," Requirements Engineering, vol. 11, no. 1, pp. 102–107, 2006.

RQ6 In what journals or conferences?



RQ7 What techniques are most cited?

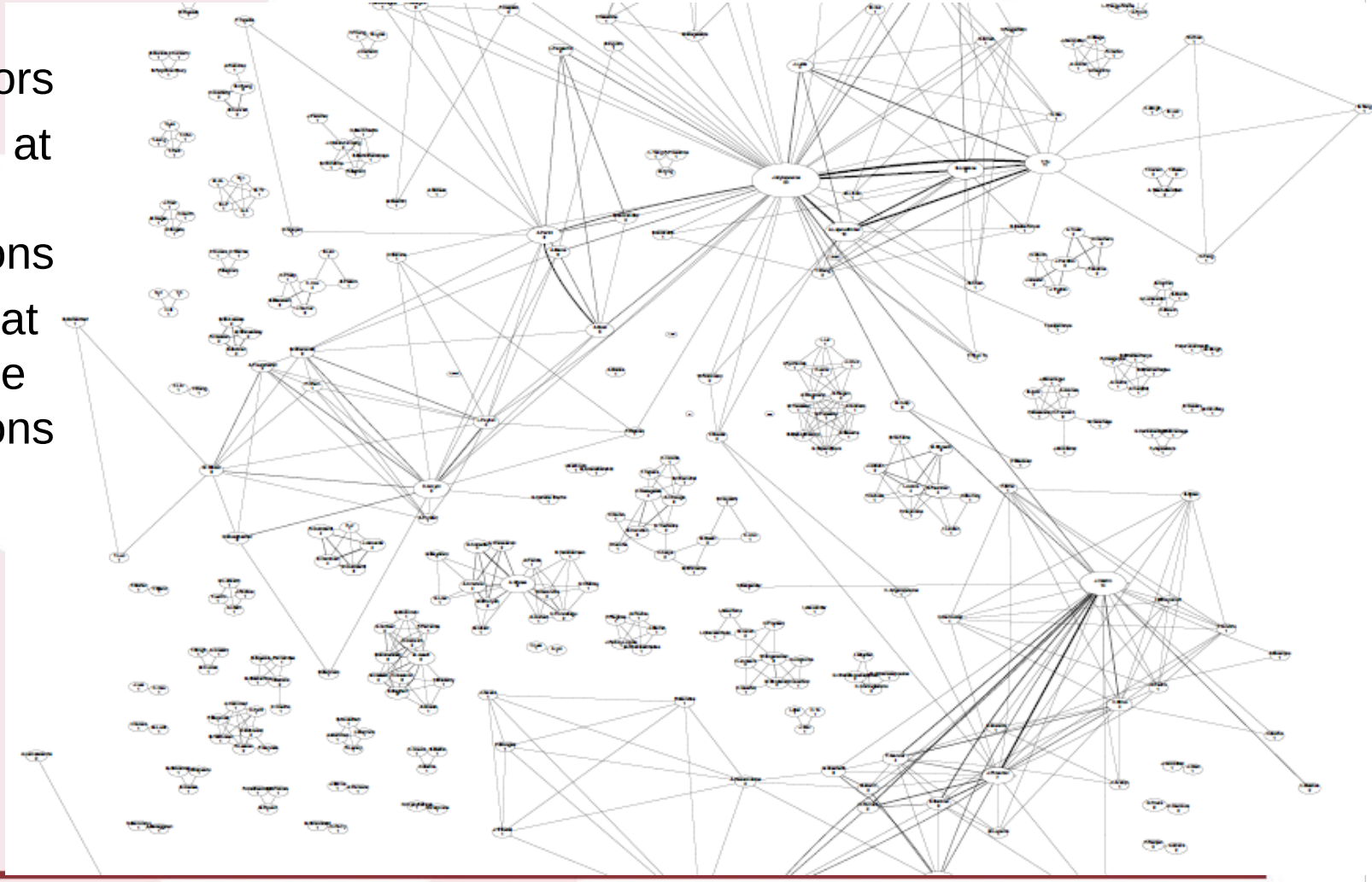
Citation Counts for the Top 50 Publications



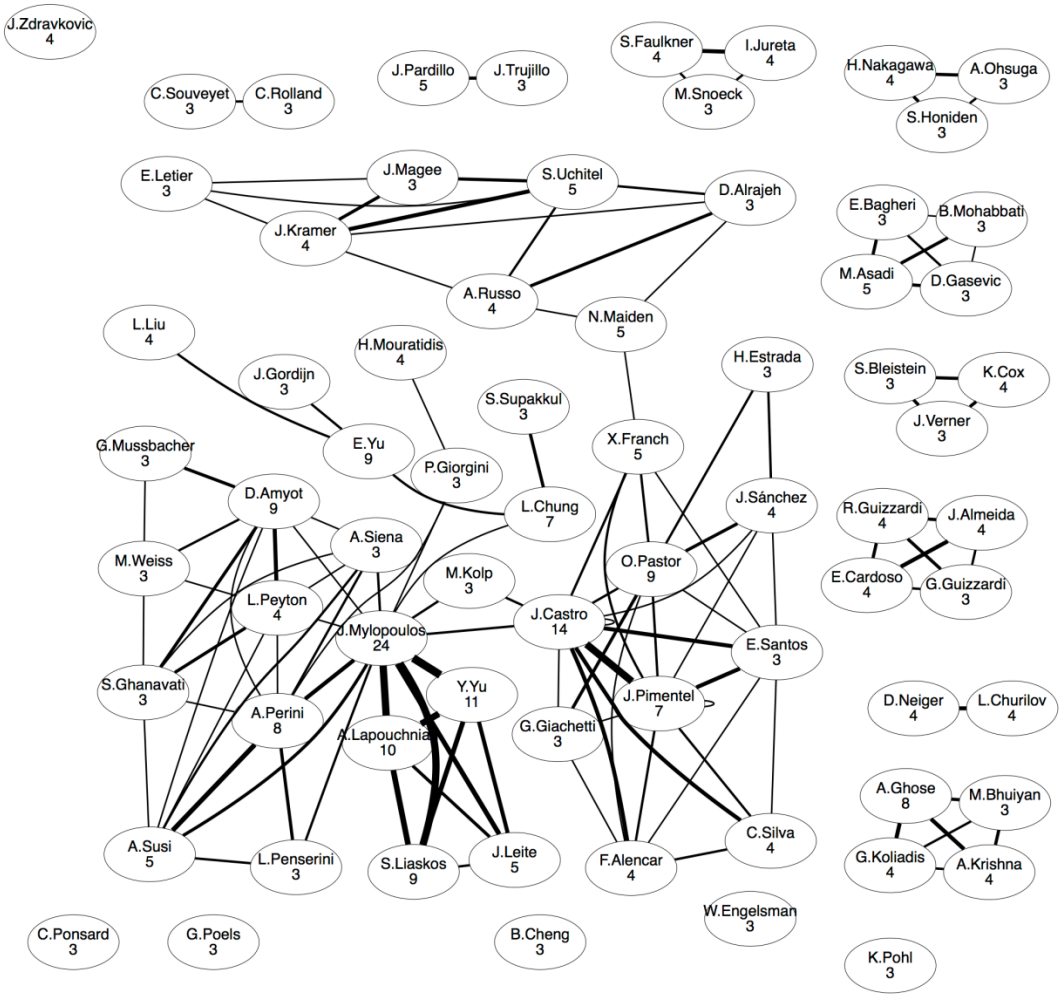
- Average number of citations is 42, but most papers have few citations
- The top 10 cited papers have 53.4% of the total citations

RQ 8 Who are the contributors ?

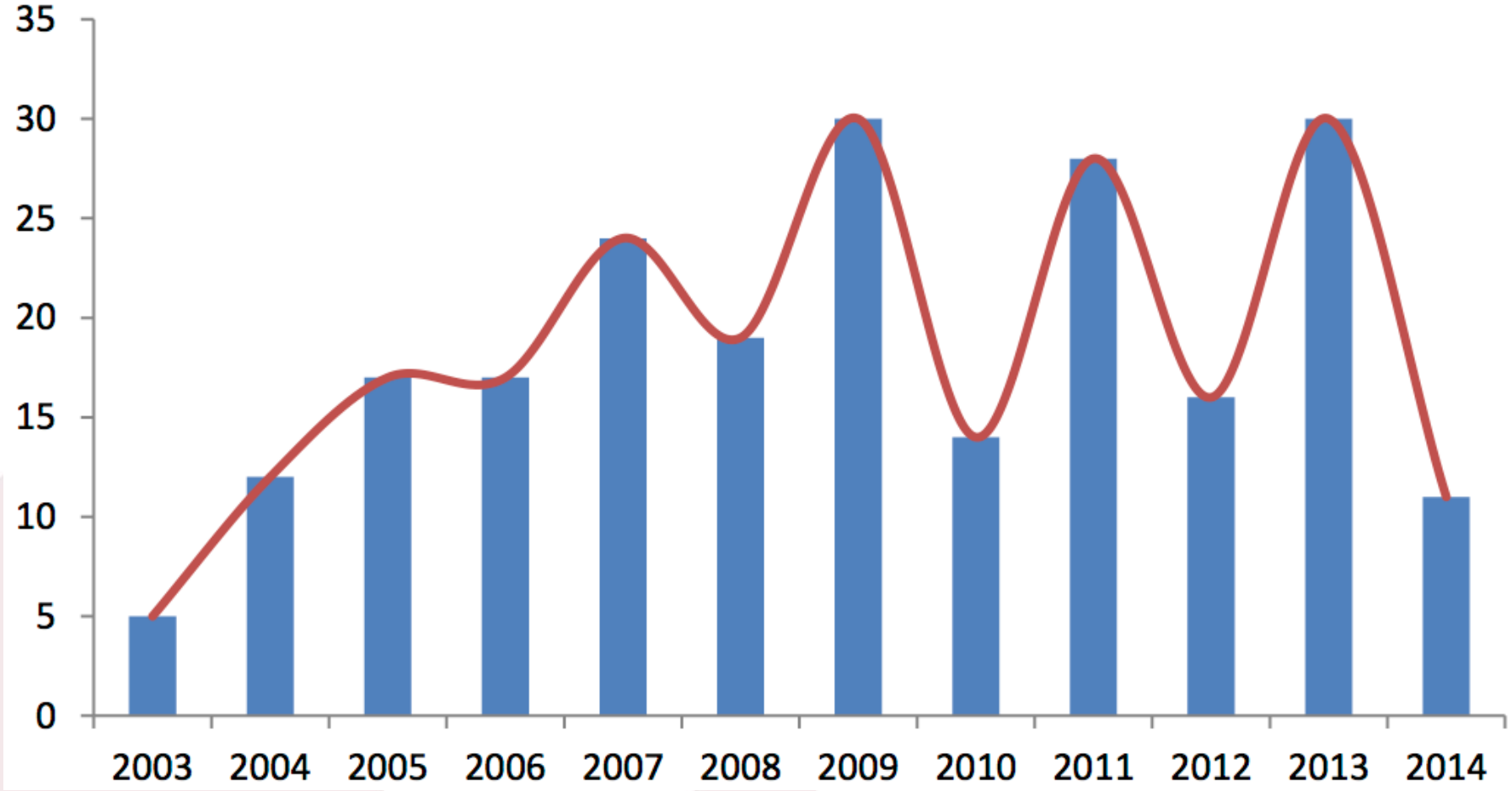
- 484 authors
- 149 have at least two publications
- 72 have at least three publications



RQ 8 Who are the main contributors > 3 papers?



RQ9 Is interest increasing or decreasing?



Findings: Using Goal Models Downstream

- High number of vertical, exogenous approaches
- A wide variety of sources, targets, motivations, paradigms
- Only a small percentage of approaches widely cited
- Focus on new solutions
  - Area is relatively immature, with divergent set of approaches
- Authorship is relatively fragmented,
  - with many isolated groups
- Number of publications is this area was descreasing, but interest seems to be steady

Survey Methodology: Process

- 243 papers found both through snowballing and systematic search