28th Annual INCOSE international symposium

Washington, DC, USA

July 7 - 12, 2018

MBSE Applicability Analysis in Chinese Industry

Jinzhi Lu[1,*], Yuejie Wen[2], Didem Gürdür[1], Qi Liu[3], Martin Törngren[1]

1. KTH Royal Institute of Technology
2. China Academy of Space Technology
3. Suzhou Tongyuan Software and Control Technology Co. Ltd.

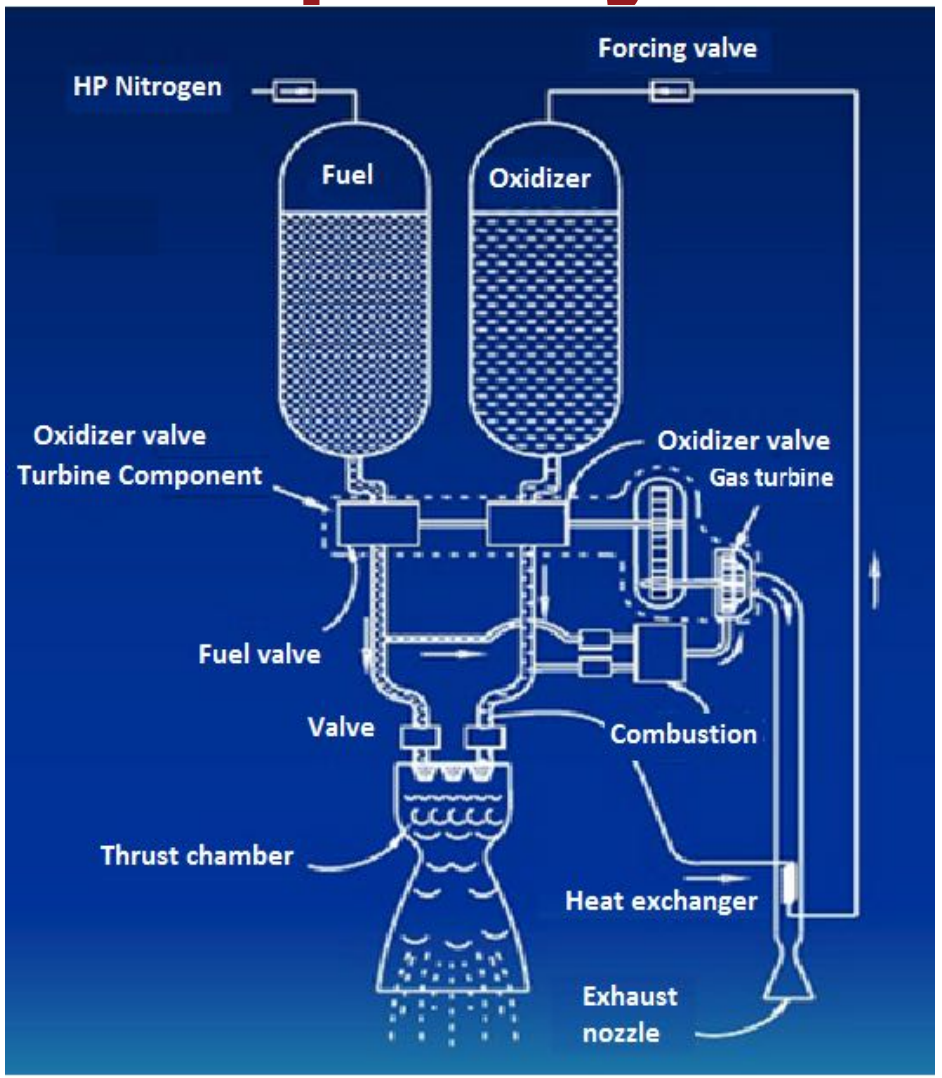
CONTENTS

WHY

Motivations and Goals

Complexity of tool-chain

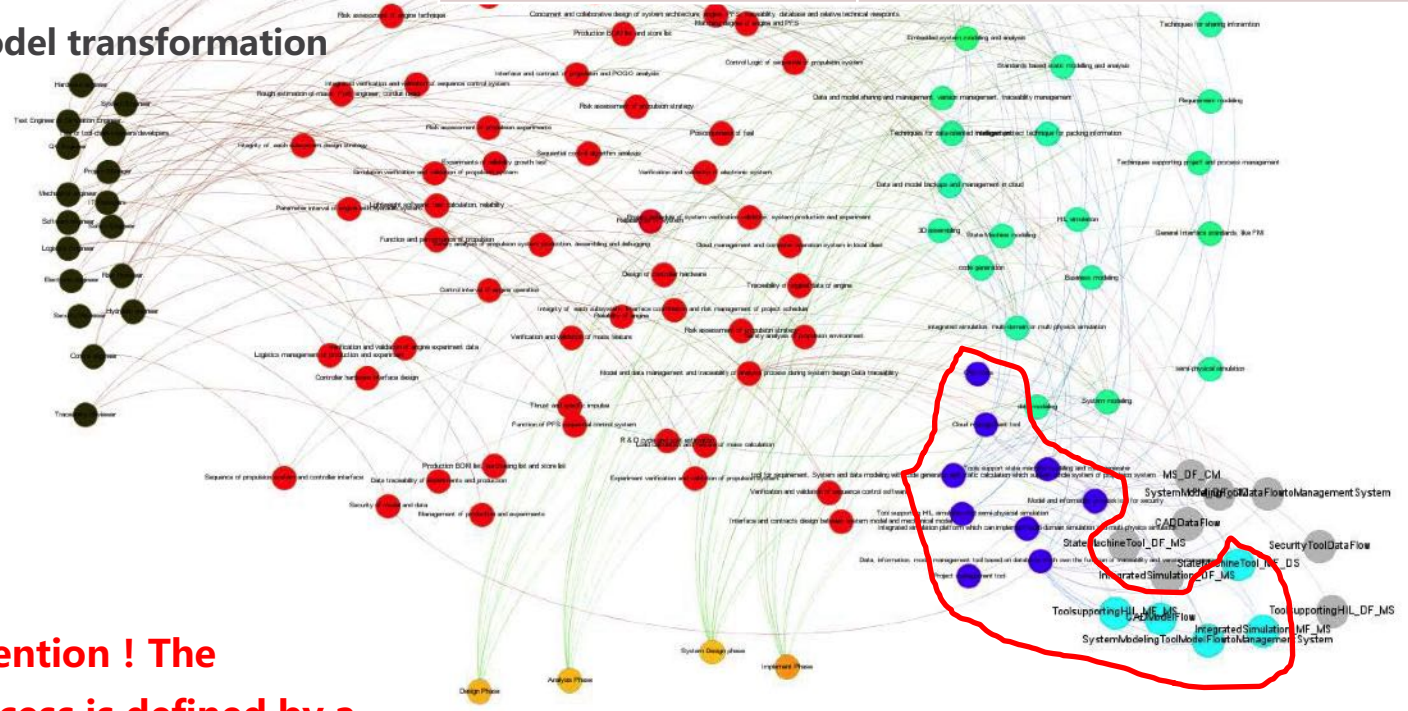
Example:



Source:<<Introduction of Aerospace Technology>>, Yang Bingyuan, Jia Yaoxing, 2009. Page:77

- Stakeholder
- Tool
- Model-based approach
- Tool channel
- Process
- Viewpoint
- Model
- Model transformation

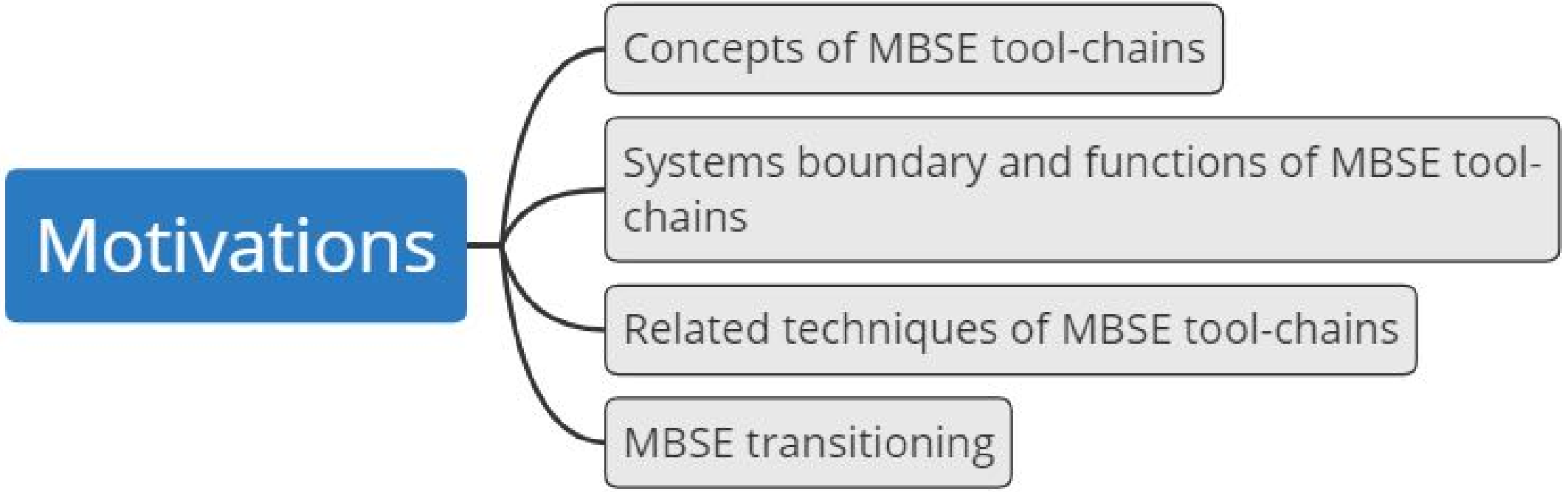
Model-based approach	Requirements Definition and Analysis Process
System Engineer（propulsion）	Thrust and specific impulse. Techniques: static modelling and calculation, requirement modelling.



Attention ! The process is defined by a very high level ! ! !

Tool-chain and model flow 2

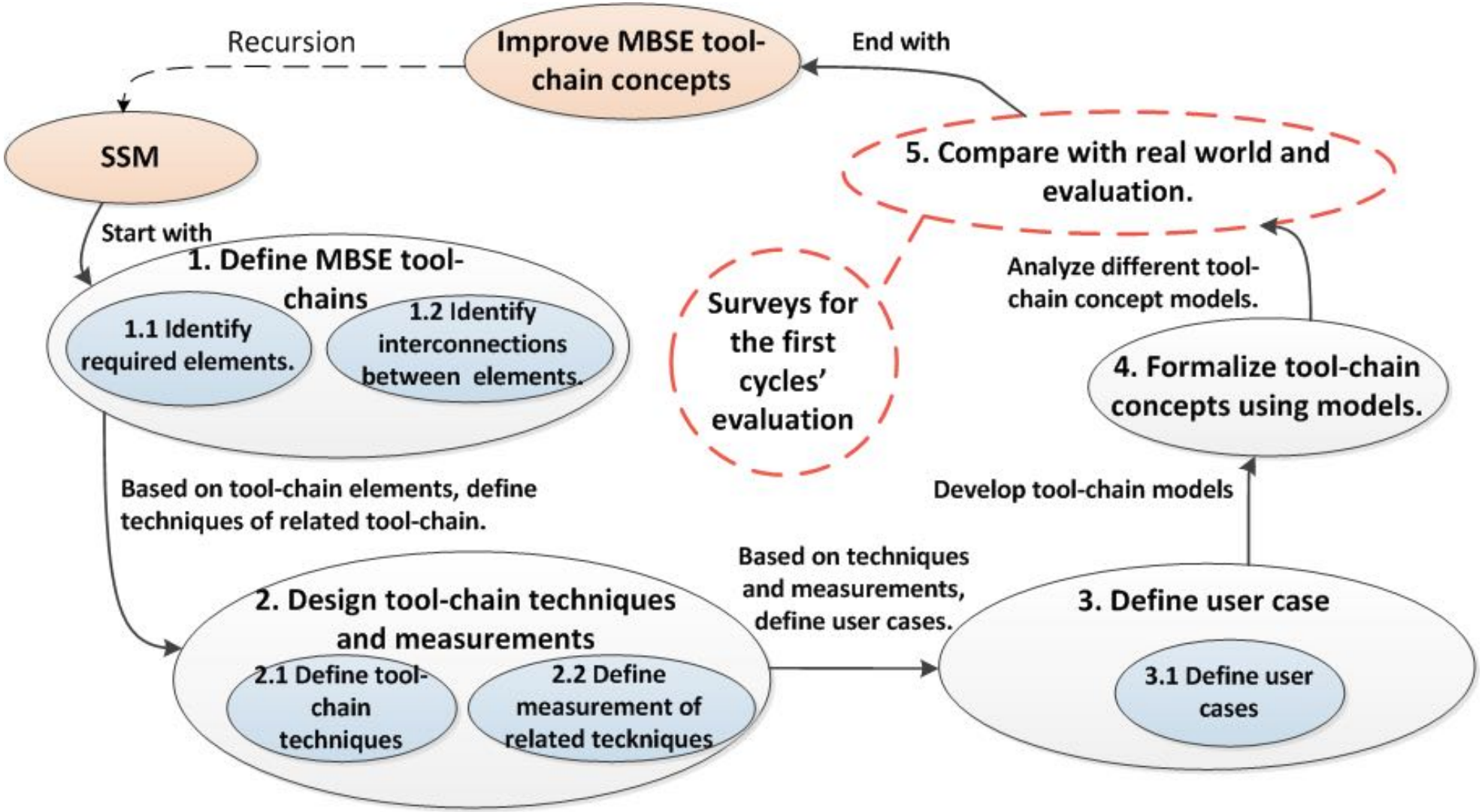
Motivations



WHAT

Research Methodology

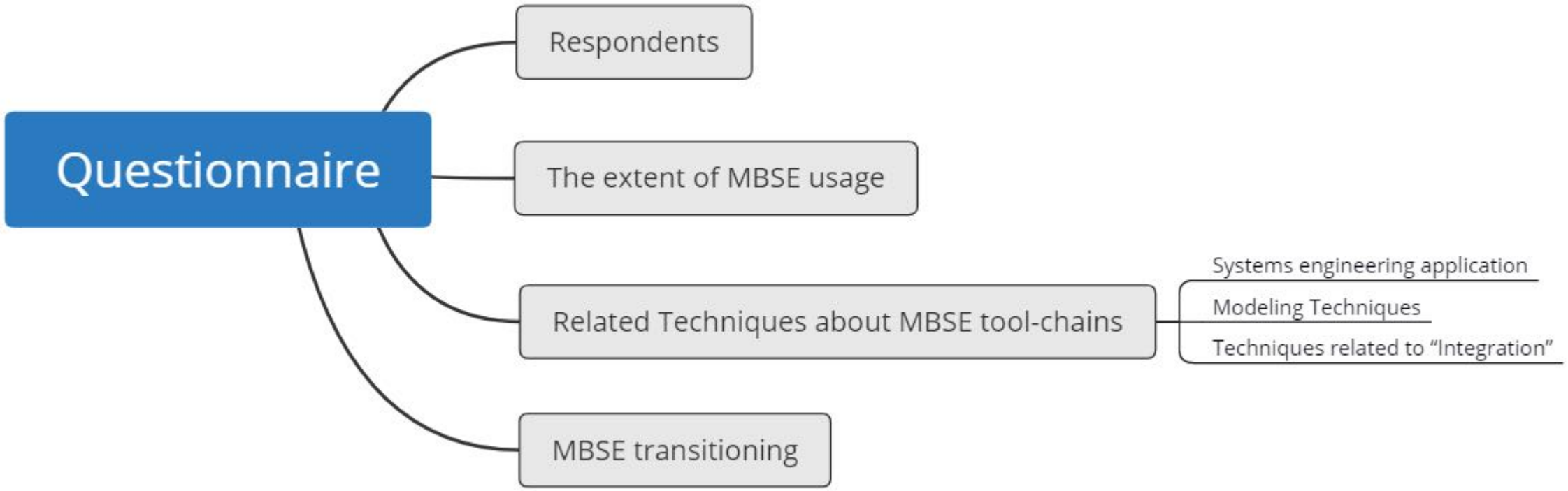
SSM and Systems Thinking



Previous work

Step	Papers
Define initial concepts of MBSE tool-chains	An Investigation of Functionalities of Future Tool-chain for Aerospace Industry
Define model concepts used in MBSE tool-chains	An Empirical Evolution of Frameworks to Develop a Co-simulation Environment for Cyber-physical System
Define a DSM approach to formalize MBSE tool-chains	A Domain-specific Modeling Approach Supporting Tool-chain Analysis (under reviews)
Evaluate MBSE tool-chain using measurements	A Service-oriented Tool-chain for Model-based System Engineering of Aero-engines(under review) …

Questionnaire Design



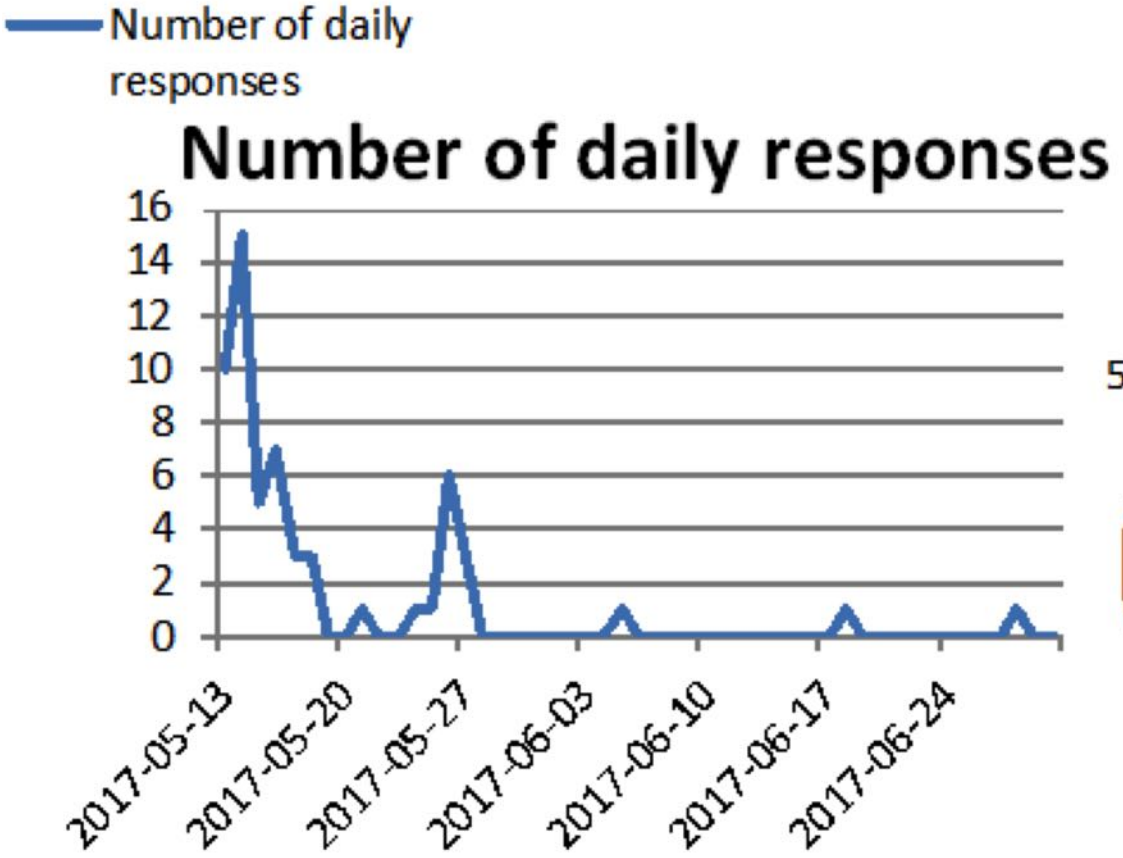
Survey Method

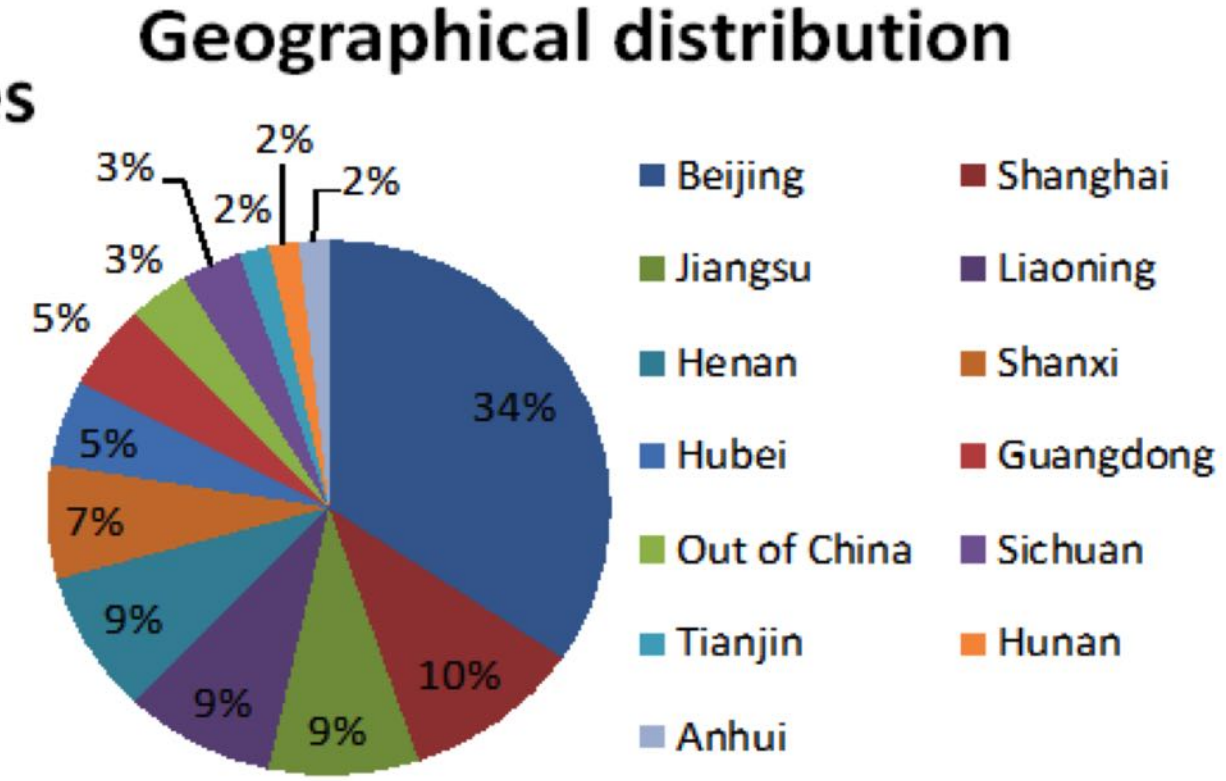
Interest group	Domain	Potential response for survey	Social network
CCOSE(http://www.ccose.org/), a systems engineering interest group	systems engineering	422	Weichat
Four forums about model-based design	CAD, CAE and Mechanical engineering	Open	Internet
Modelica interest group	Multi-domain modeling	116	Weichat
PDM/PLM interest group	PLM/PDM	558	QQ
Multi-domain modeling group and co-simulation interest group	CAE, Modelica and co-simulation	998	QQ
Interest groups of AMESim, Matlab/Simulink and Flowmaster	CAE and modeling	330	QQ
Forums of systems engineering, systems engineering methodology,	Systems engineering	1060	Weichat
Forums of Forward design	Design method	86	Weichat
Forums of Suzhou Tongyuan	Modelica	109	Weichat

HOW

Questionnaire Result

Response

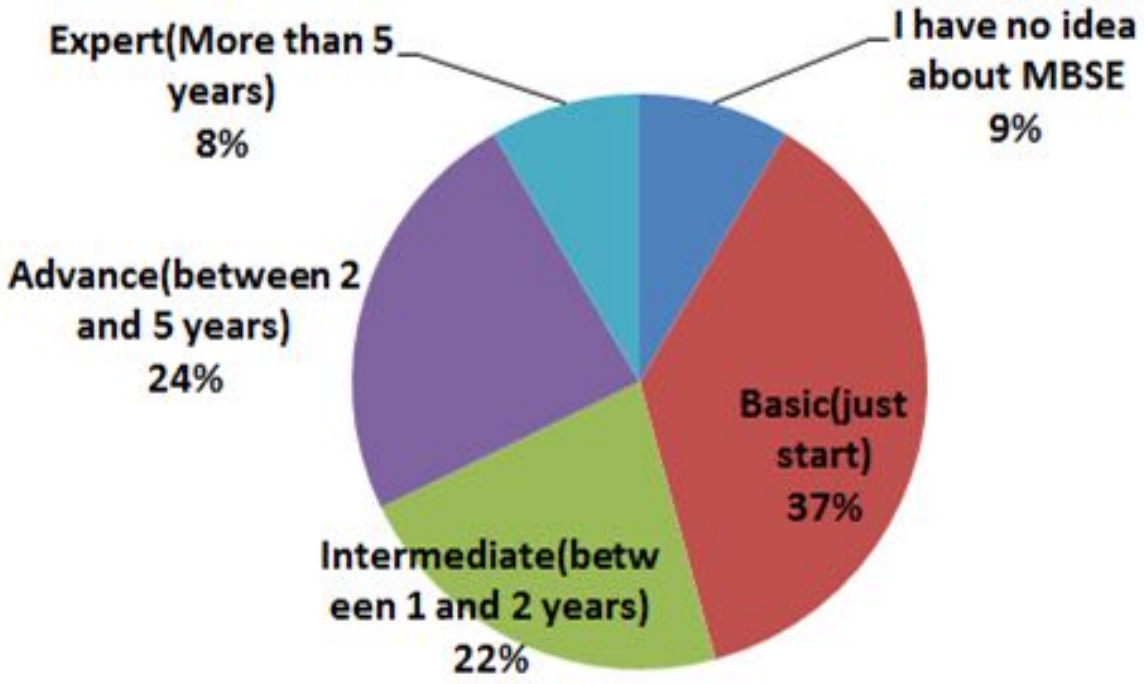




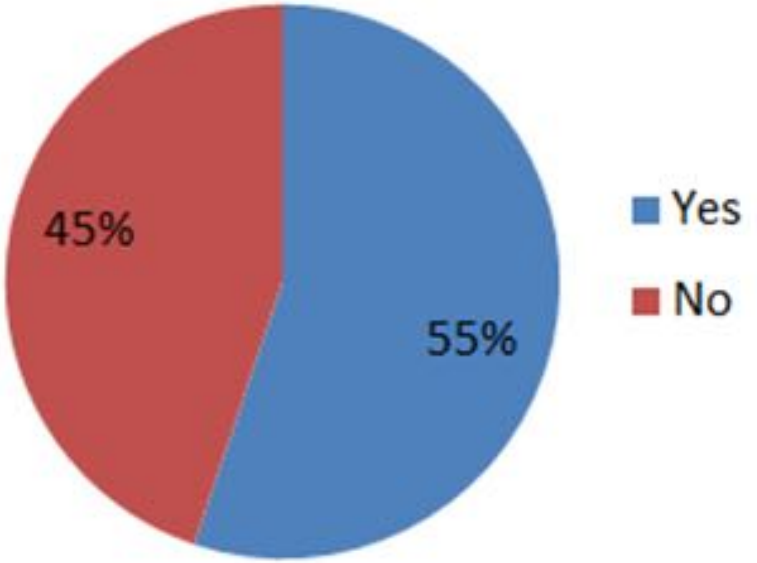
Total:58 responses

Respondents

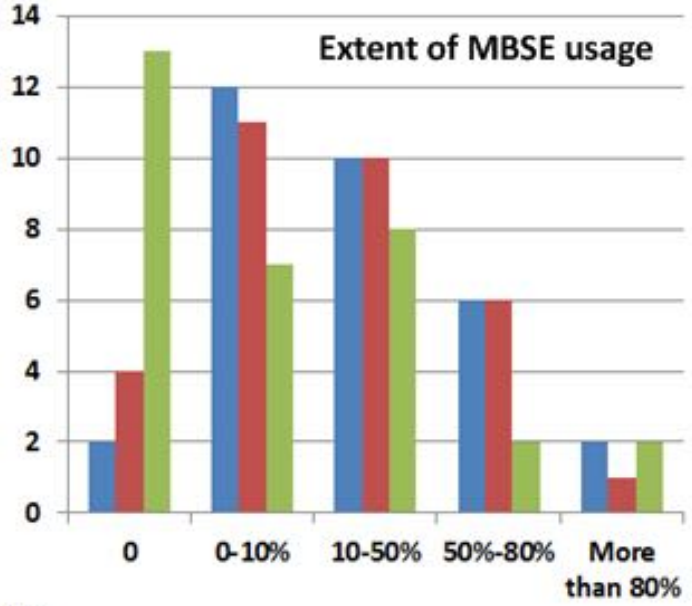
a- Know-how Level

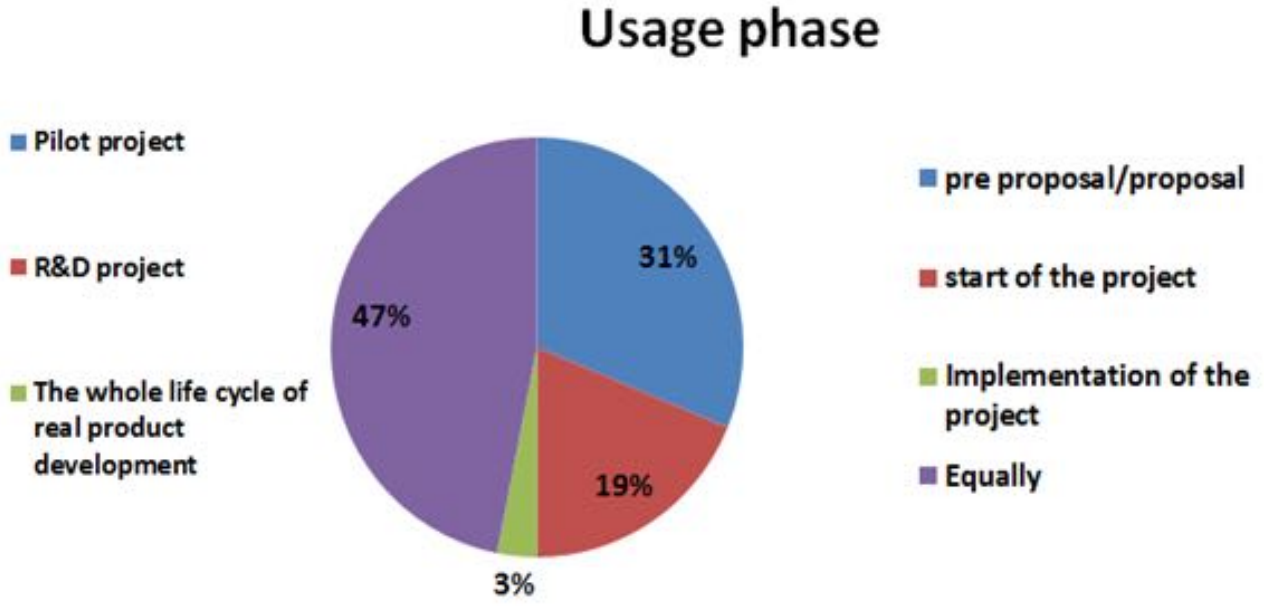


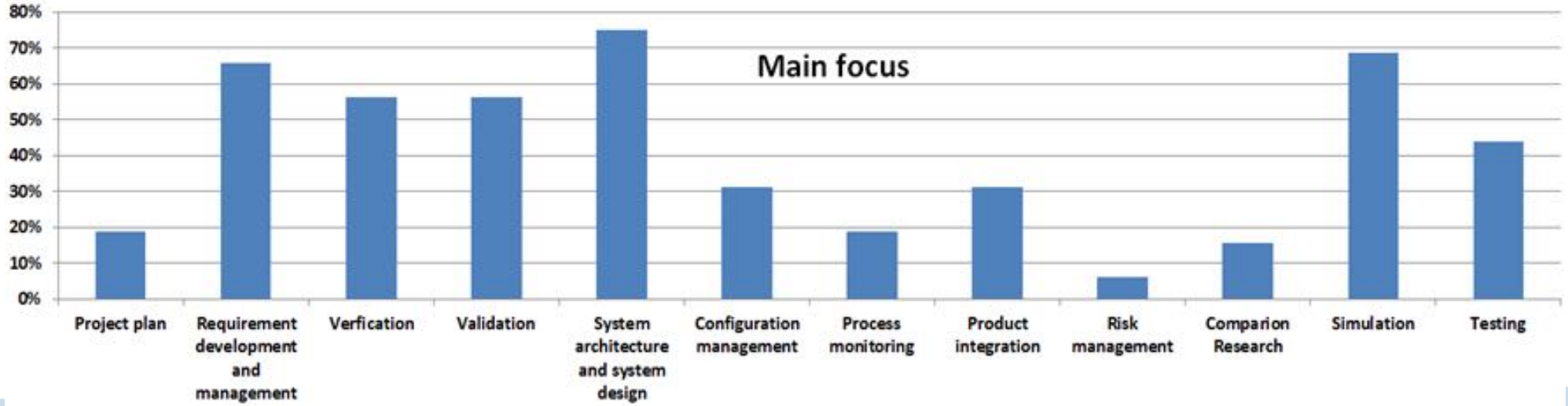
b-Do you use MBSE in your team?



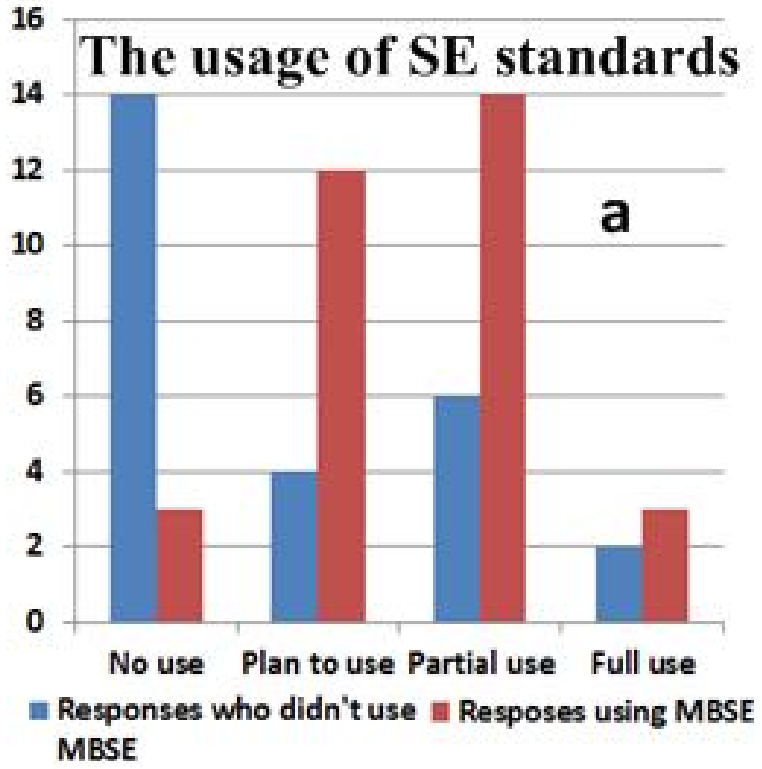
Extent of MBSE usage

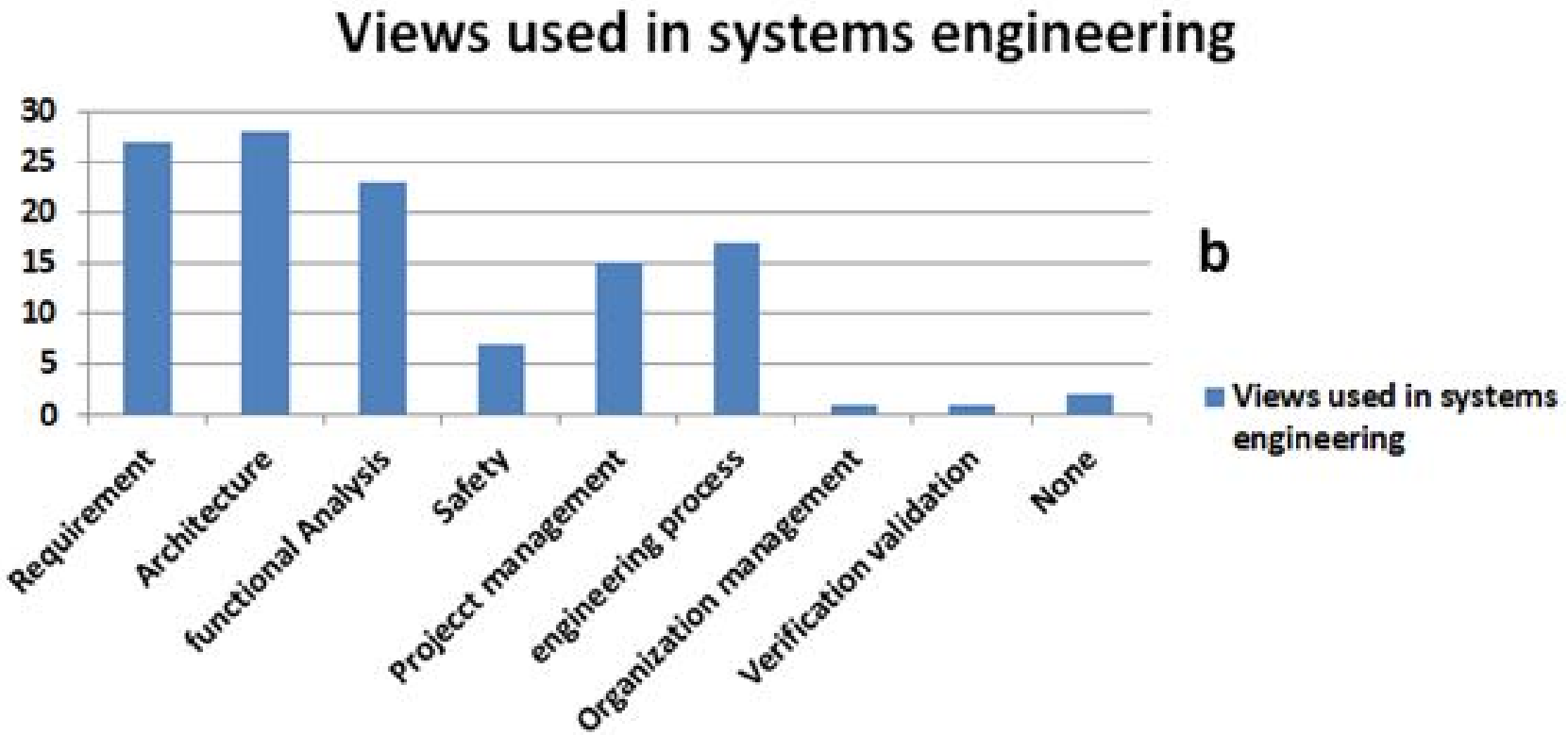




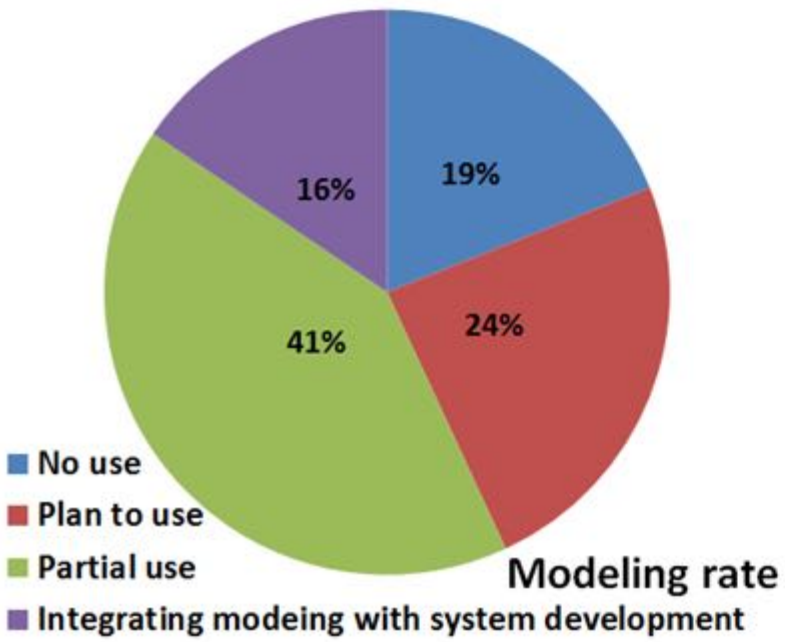


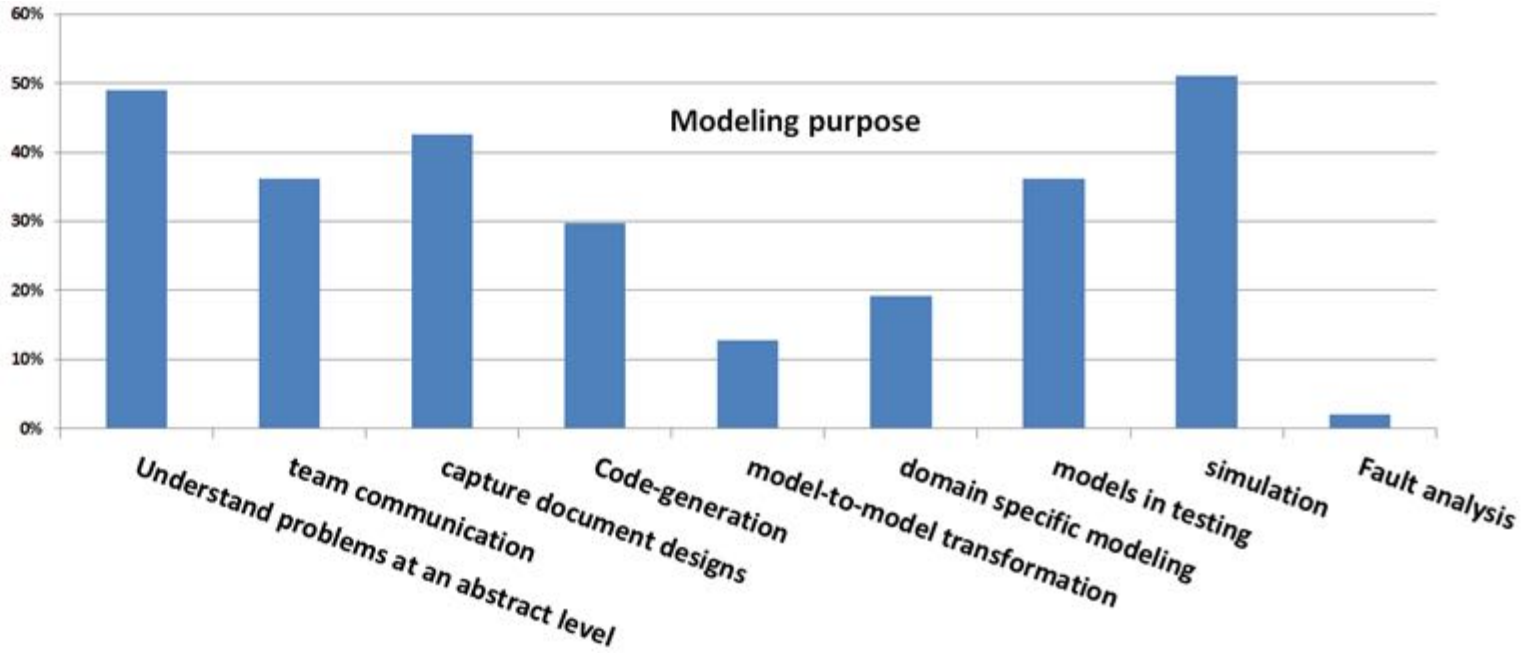
Related Techniques-SE





Related Techniques-Modeling





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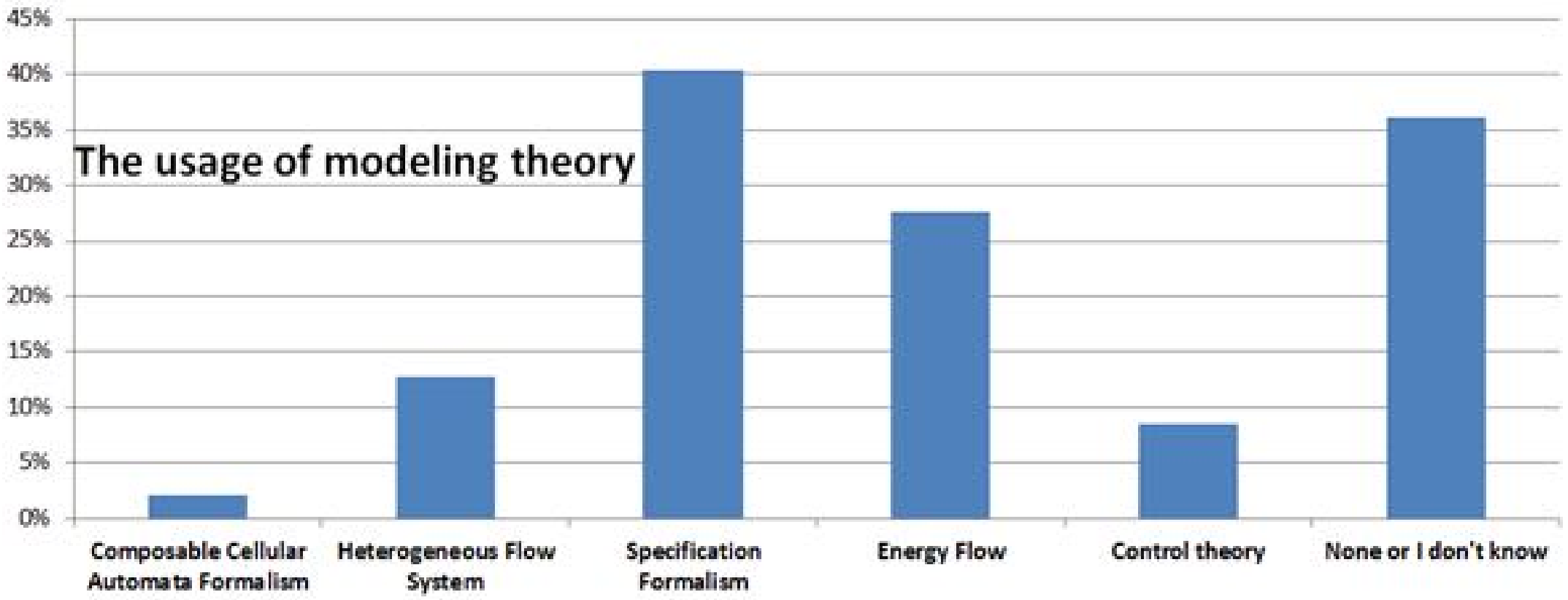

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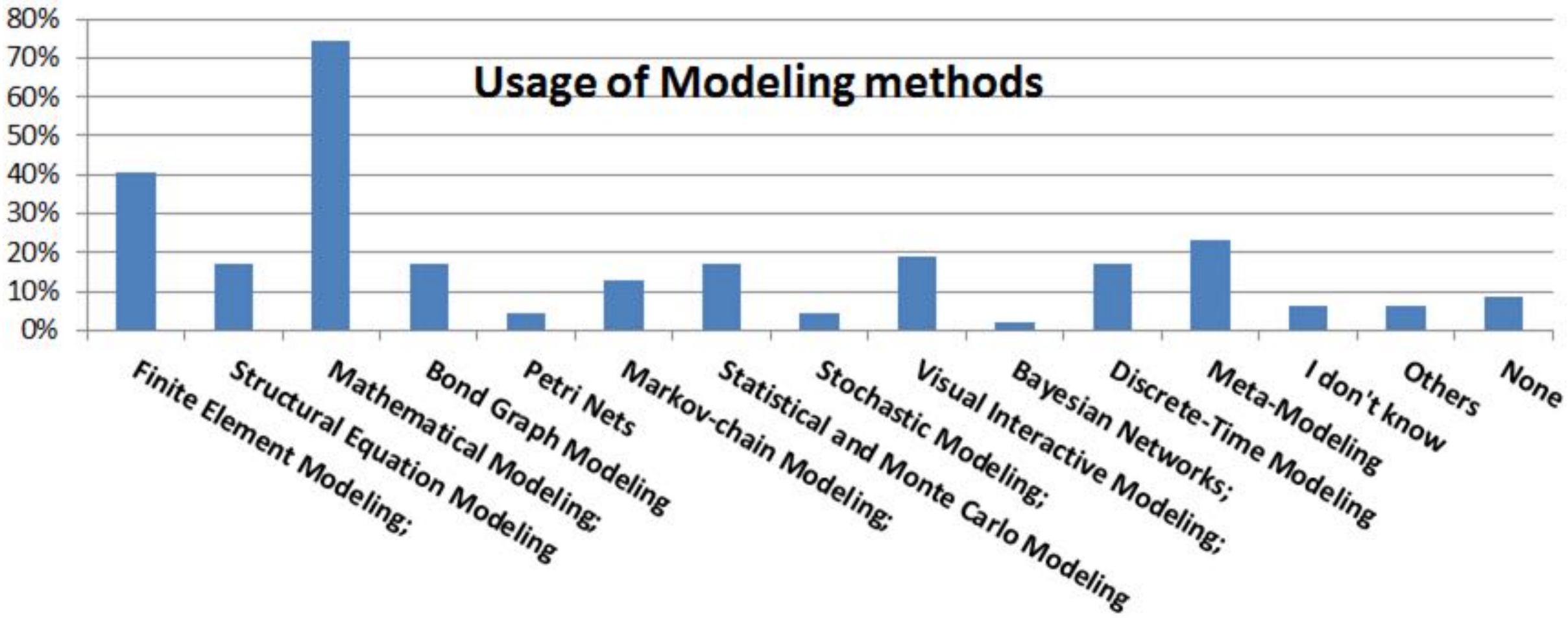

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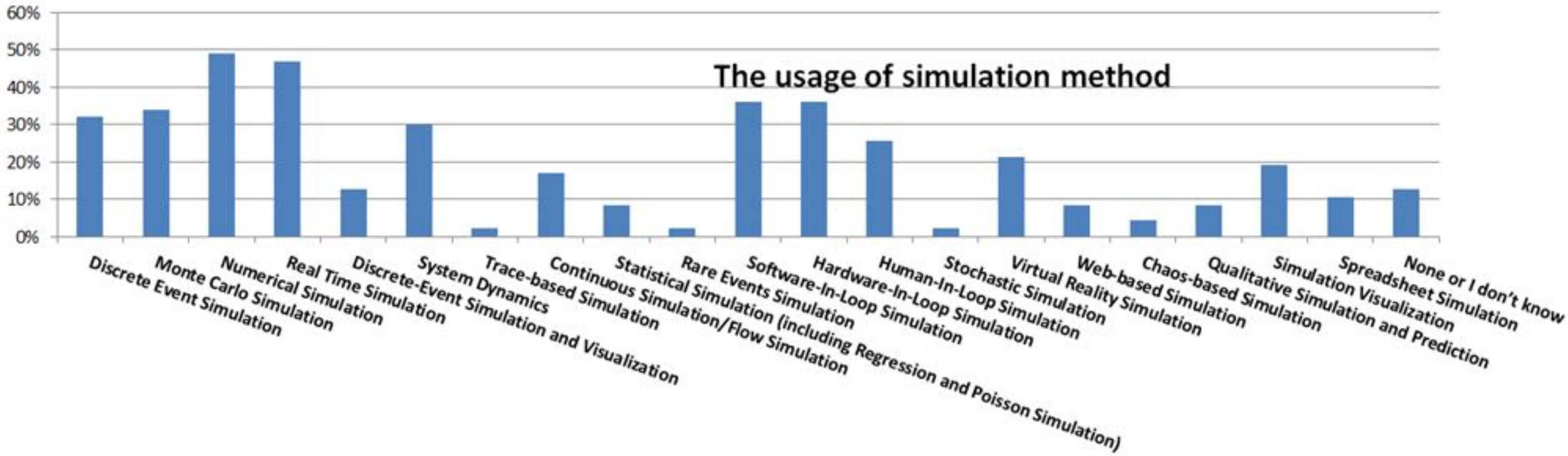

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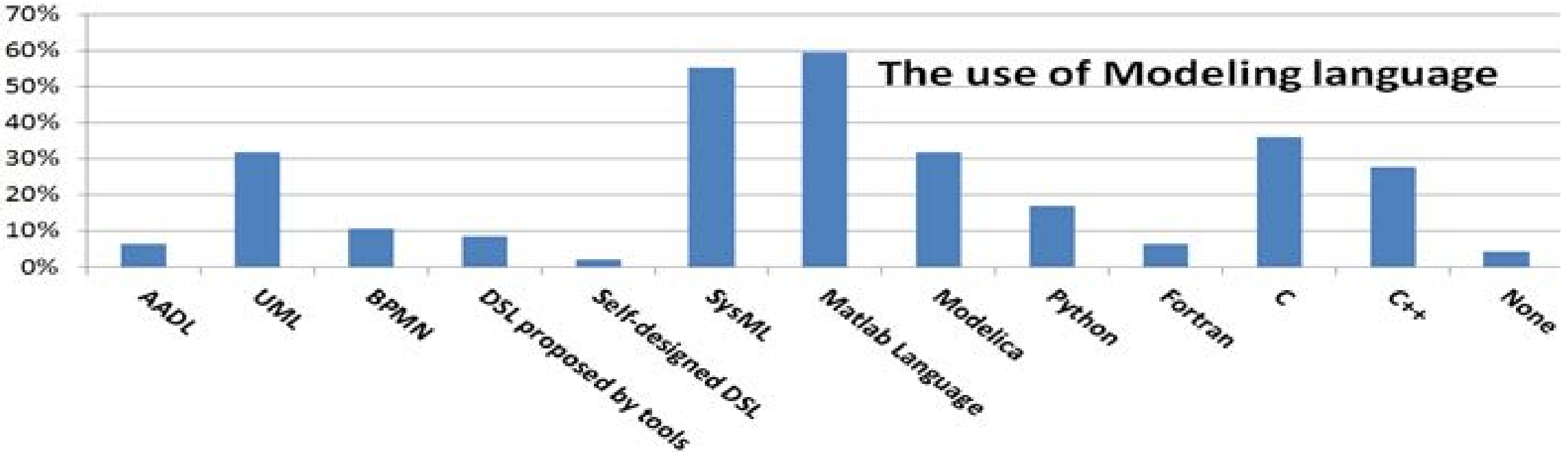
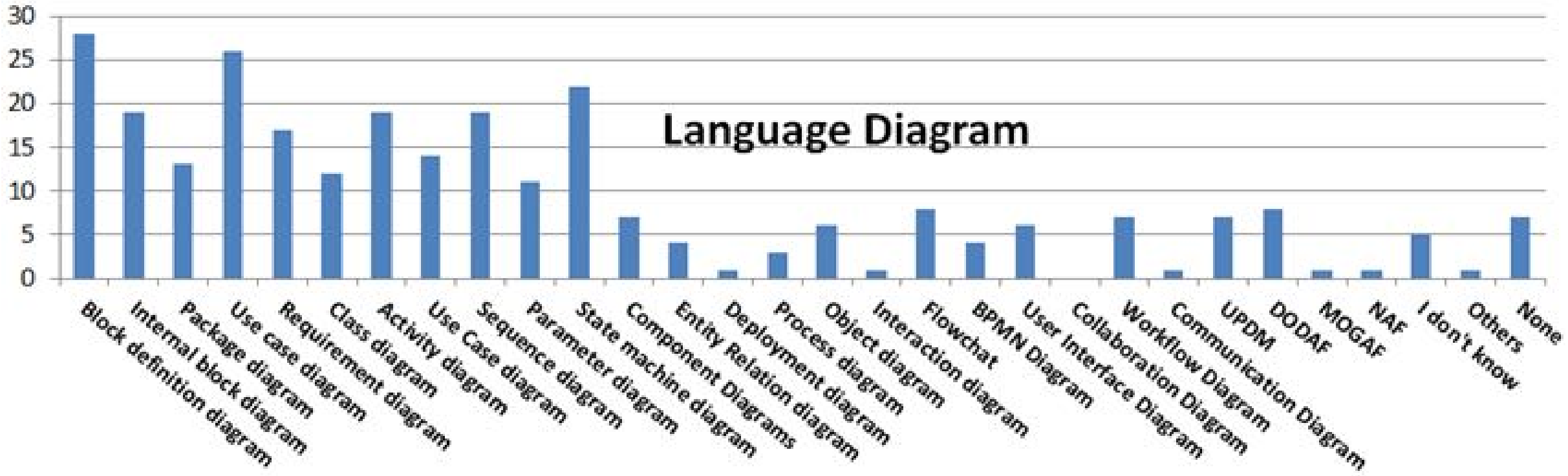
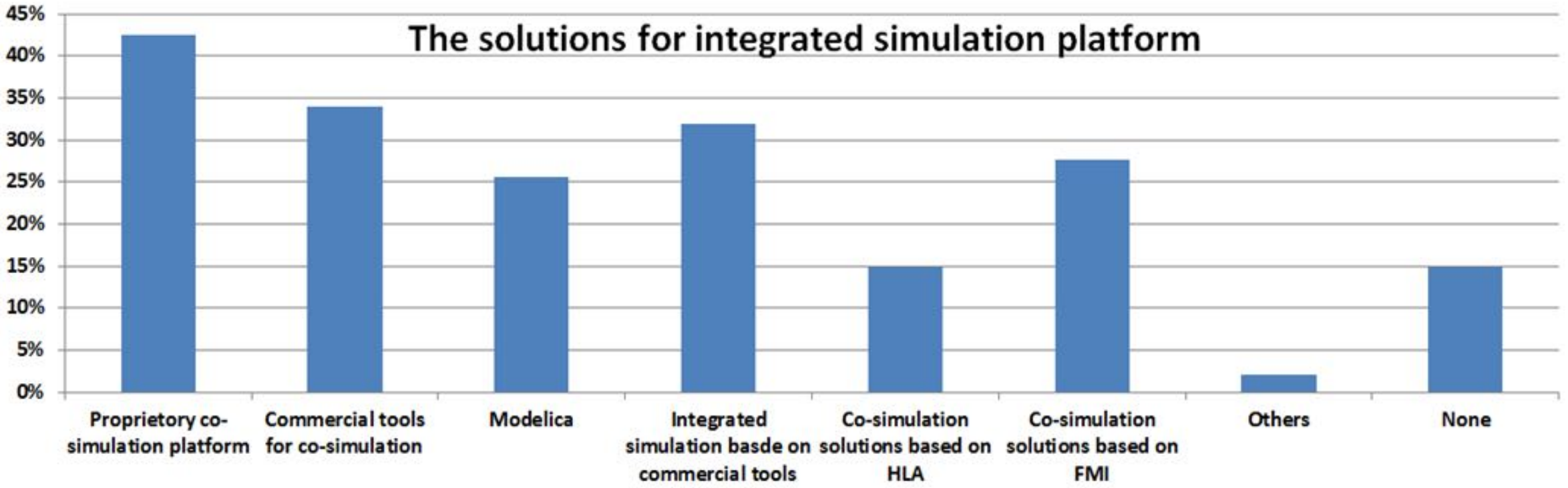


Related Techniques-Modeling

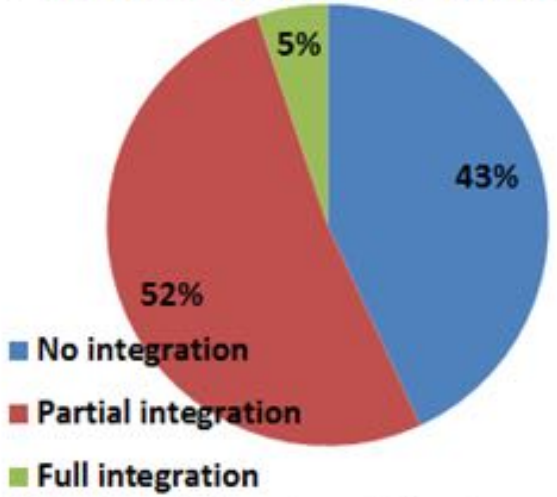


Related Techniques-Integration

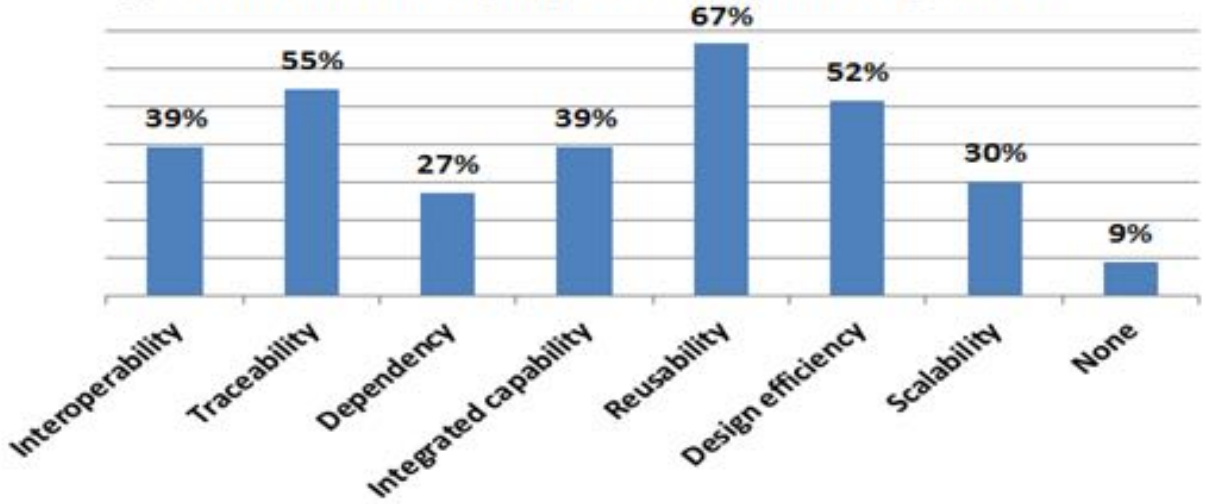


Related Techniques-Integration

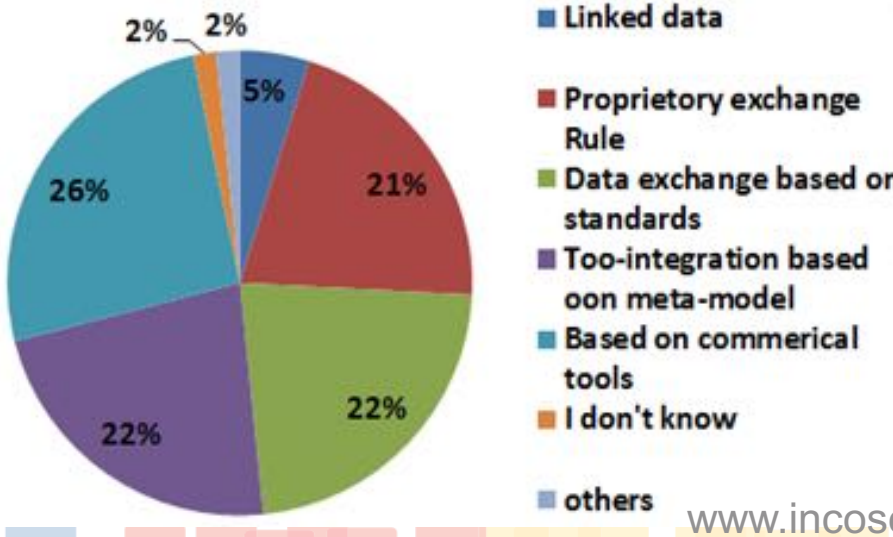
a The rate of tool-integration



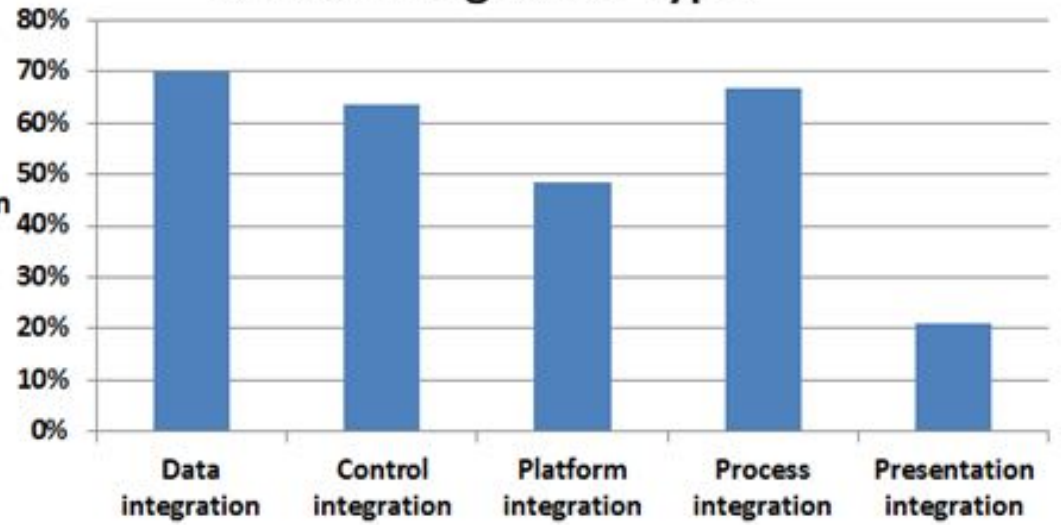
b non functional properties for tool-ingration



c Method for tool-integration



d Tool integration Type



Related Techniques-Integration

- **Interoperability**

The capability of two or more components in tool-chains, e.g. tools, models can be exchanged and the capability to use the exchanged information in a heterogeneous network;

- **Traceability**

The capability can establish a relationship between technical recourses, system information, system development processes and social networks.

- **Dependency**

The capability can process the dependent relationships of technical recourses, system information, system development processes and social networks.

- **Integrated capability**

The capability can integrate existing tools, model and data.

- **Reusability**

The capability can reuse technical resources (e.g., models, data, tools) by other module or works.

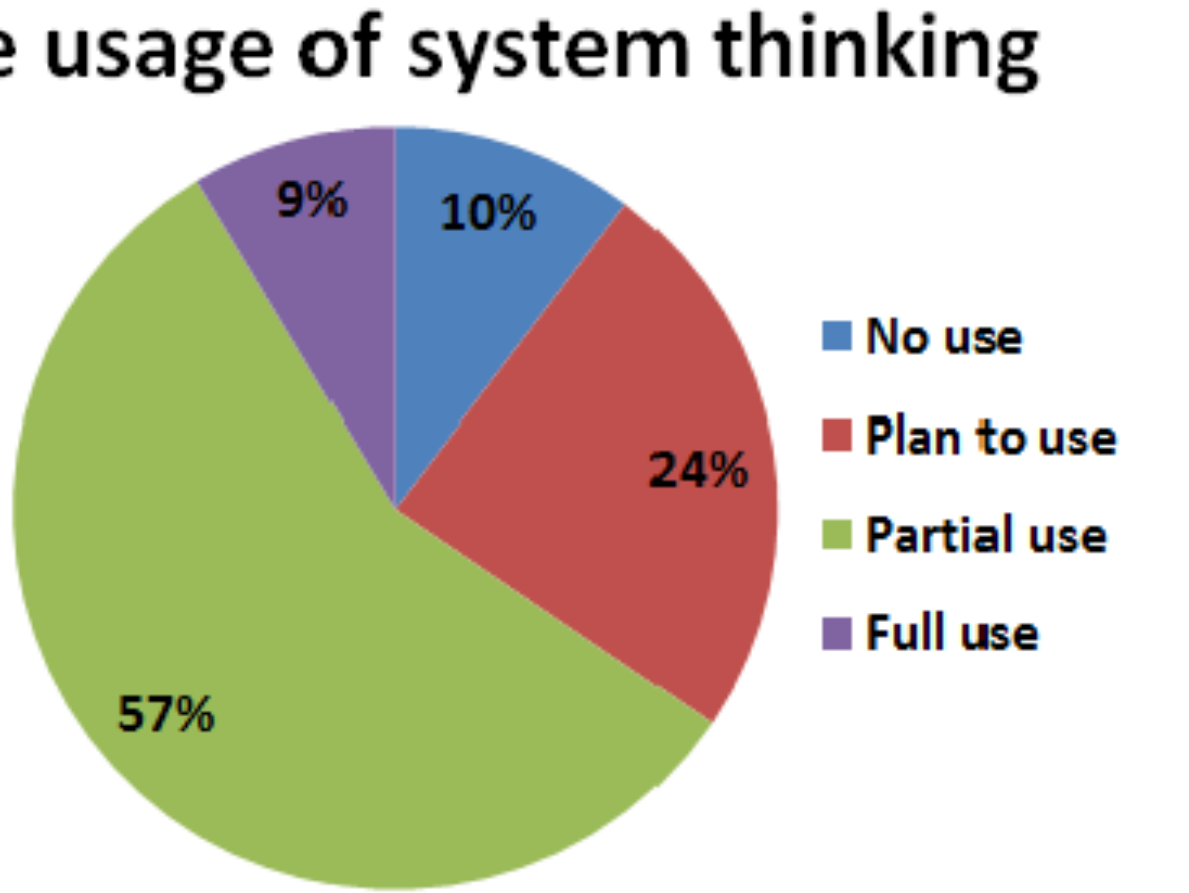
- **Design efficiency**

The degree to which the system developers implement their design jobs by developed tool-chains.

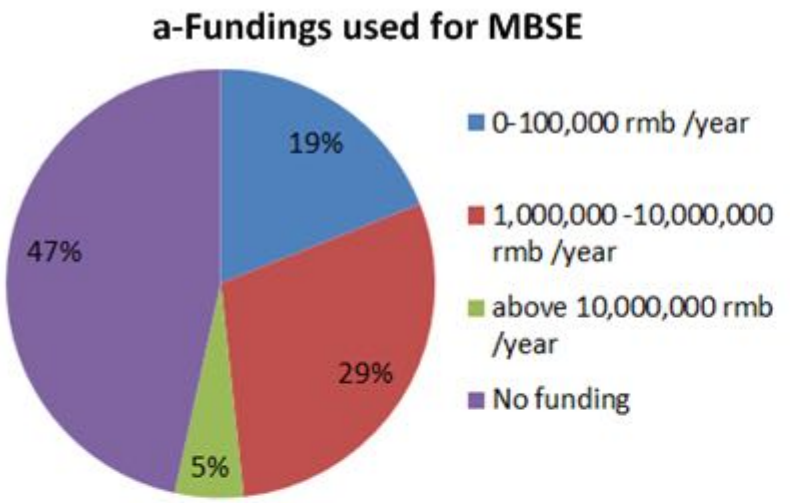
- **Scalability**

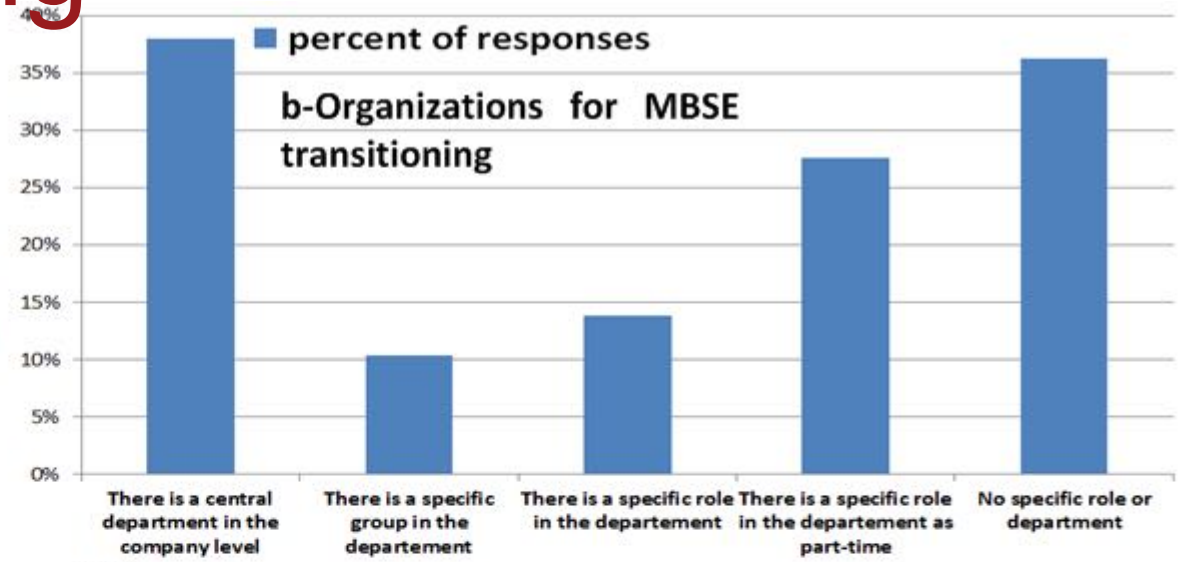
The capability that tool-chain can handle a growing amount of engineering work or its potentials to be enlarged to accommodate that grow.

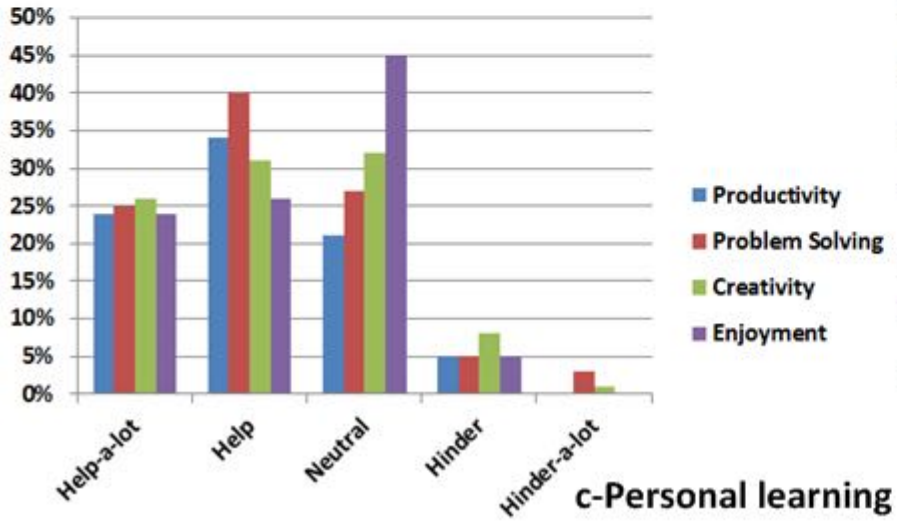
MBSE transitioning

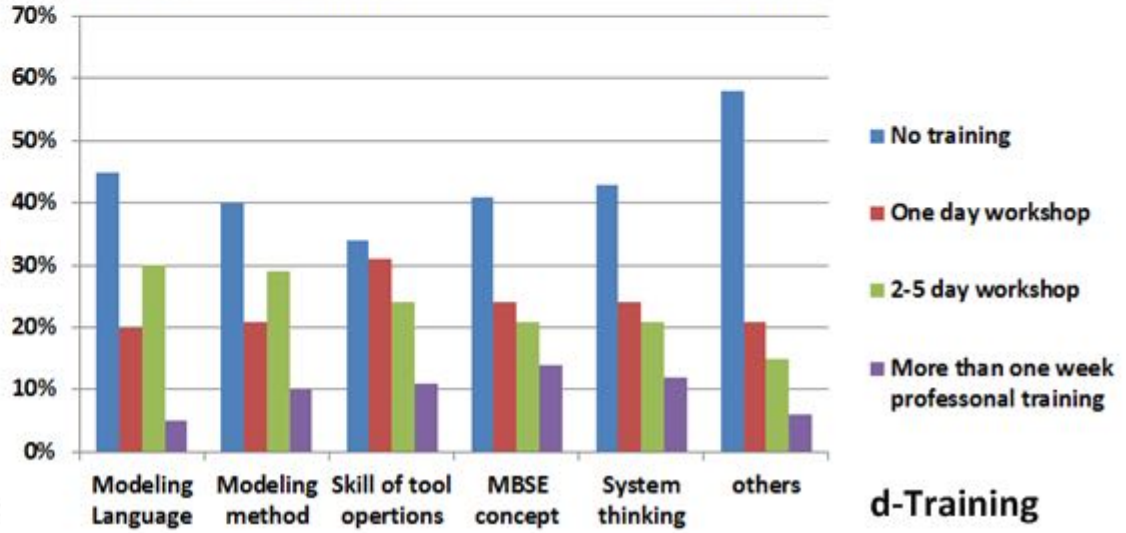


MBSE transitioning

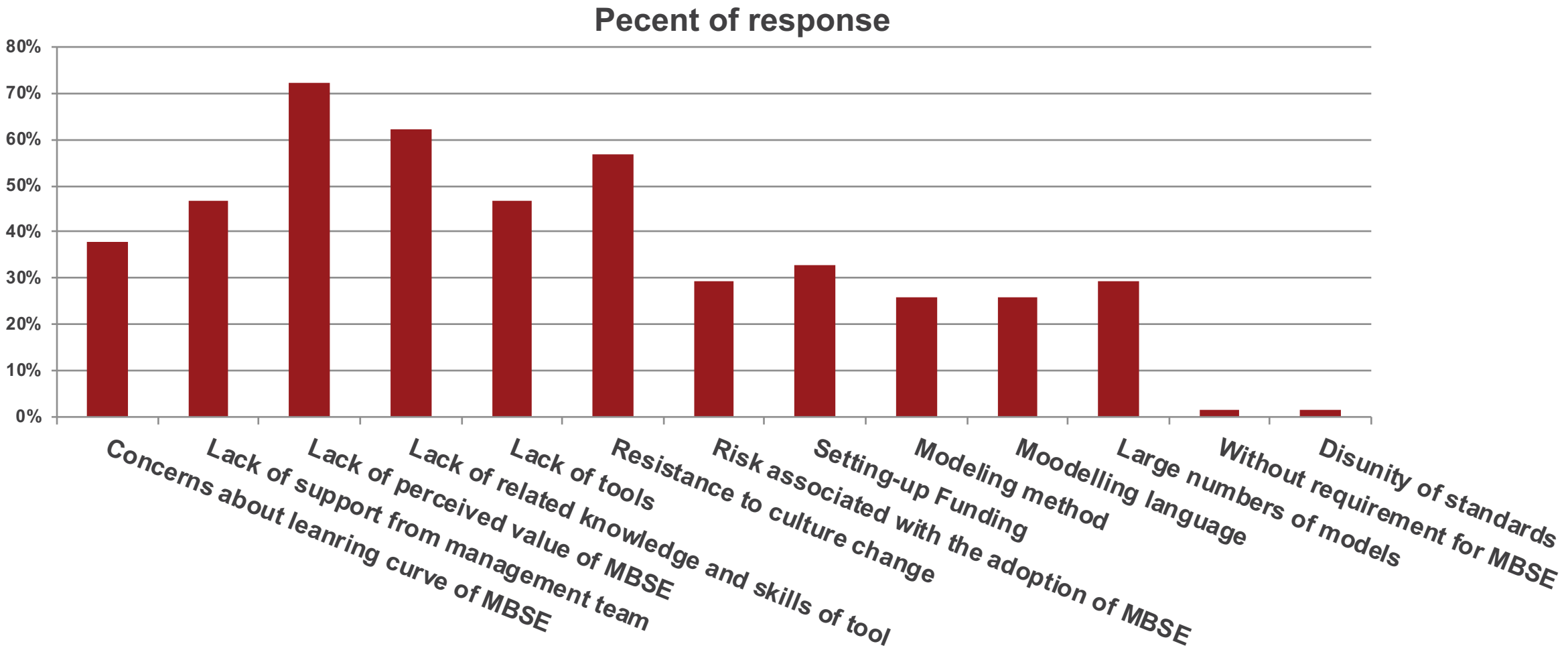








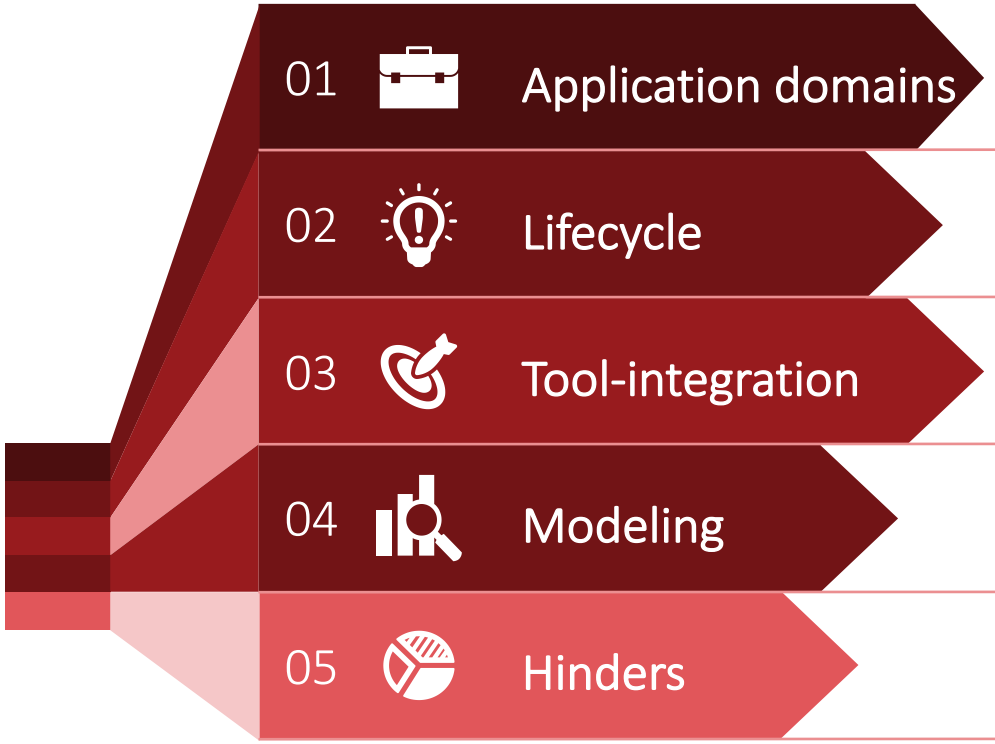
MBSE transitioning



HOW WELL

Learns and Future Works

Learns



Current MBSE industrial applications in China are implemented on some specific application areas, particularly aircraft, aerospace, vehicle, defense industries and tool suppliers.

We can infer that MBSE can be implemented through the whole life cycle based on most of the respondents' understandings.

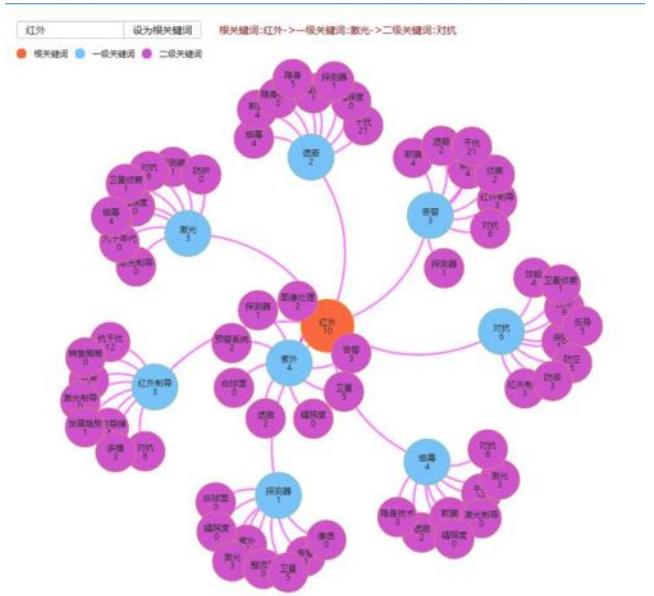
Current Chinese industries adopt integrated simulation and tool integration to construct MBSE tool-chains.

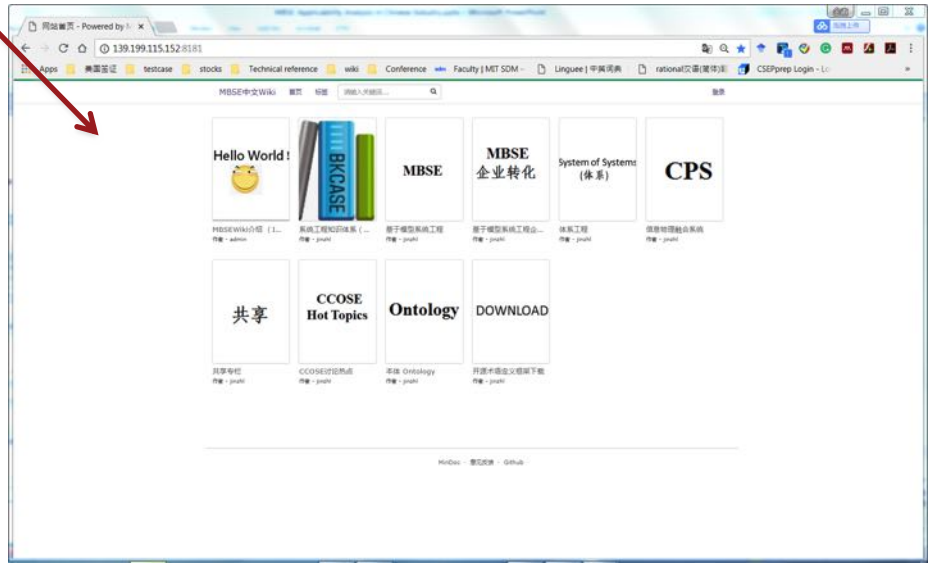
MBSE techniques are not only "SysML" and "UML".

Most of the respondents think lack of understanding the value of MBSE and lack of related skills and ability are two main challenges to block MBSE transitioning processes.

Future work

- Future work
  - 2000 papers analysis using a developed knowledgement tool
  - An open source MBSE wiki to support terminology definitions
  - Capability model of MBSE
  - A domain specific modeling approach to formalize MBSE transitioning based on evolution theory





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