

CT MBSE

Chairs: Marco Ferrogalini, David Lesens

Results of MBSE Survey 2014

October 2014



Presentation of the MBSE TC

The AFIS MBSE Technical committee has around 60 members coming from 32 different academia organizations or companies representing almost all the majors industrial sectors.

It's co-chaired by Marco Ferrogali from Alstom Transport and David Lesens from Airbus Defence and Space.

The main purposes of the technical committee are to:

- ❑ Promote, improve knowledge and skills of the players around the use of models in systems engineering
- ❑ Share feedback among the various stakeholders
- ❑ Develop specific topics around MBSE

The key principles are the following:

- ❑ Establish a very strong collaboration / integration with the MBSE working groups of INCOSE and the SE DSIG of the OMG
- ❑ Develop projects consistently with the members participation
- ❑ The choice of topics to be developed is made according to the needs of the members and in coordination with others technical committee

CT MBSE composition

❑ **Members (mailing list) → 60**

❑ **Active members (members which contribute to WGs) → 30%**

❑ **Sectors:**

✓ **Services/Consulting → 9**

✓ **Aerospace → 6**

✓ **Tools vendors → 4**

✓ **Automotive → 3**

✓ **Defence → 1**

✓ **Transport → 1**

✓ **Academia → 1**

✓ **Others → 5**

Companies / Academia members → 32

ADN

Aeroconseil

Airbus

Airbus Defence and Space

AKKA

Alstom-Transport

Alten

Altran Sud Ouest

Atego

Coerensis

ColIESys

CS SI

Dassault Systèmes

ENAC

Esterel Technologies

IBM Rational

MAP Système

MBDA

Pragmadev

PSA Peugeot Citroën

Renault

RTaW

Samares Engineering

Safran

Schneider Electric

Sherpa Engineering

Siemens Mobility

Thales (Alenia Space, Global Services)

Université Lorraine

Valeo

MBSE Survey scope and content:

The objective of this survey is to know the actual insights of Model Based Systems Engineering in France.

It's composed of 31 open or multiple choice questions on:

- General modelling (Part I)
- MBSE practices (Part II)
- Model driven analysis: simulations (Part III)
- Model driven analysis: static (Part IV)

On line questionnaire (GoogleDrive):

The screenshot shows a web browser window displaying a Google Forms questionnaire. The title of the form is "MBSE Survey 2014 - AFIS CT MBSE". The introductory text states: "It is the objective of this survey to know the actual insights of Model Based Systems Engineering. This survey has four parts, General Modelling, MBSE practices and Model driven analysis (static and simulations) questions. Please be so kind to answer all questions with the best information available." Below this, there is a section titled "MBSE Survey Part I - General Modelling". The first question is "1. What industry do you work in?" with a note "(Please tick all that apply)". The options are: Aerospace, Automotive, Consulting, Defence, Maritime, Oil and Gas, Software (Embedded / Product), Software (IT), and Other (with a text input field). The second question is "What is your job title?" with a text input field. The third question is "How large is Systems Engineering (or equivalent) function within your organisation?" with a radio button and the number "5" as an option. The browser's address bar shows the URL: "https://docs.google.com/forms/d/17qpdt6KgVwCZYiC4_OBsWdjW1itgc-Aqn-J7LJRkglg/viewform".

https://docs.google.com/forms/d/17qpdt6KgVwCZYiC4_OBsWdjW1itgc-Aqn-J7LJRkglg/viewform

MBSE Survey roadmap and participation:

The initiative has been launched on beginning of March 2014 with the idea of replicating the same initiative that has been realized in UK one year before. The results of UK survey are available following the link here below (thanks to James Tower, UK Chapter MBSE Leader)

http://www.incosewiki.org.uk/Model_Based_Systems_Engineering/index.php?title=MBSE_Survey

In order to gather as much as possible participants, the survey has been promoted with:

- a banner on the AFIS site in the “news” section (see picture below)
- an e-mail to all AFIS adherents
- an announcement via the SysML France forum (special thanks to Pascal Roques for his support on promoting the initiative)
- an announcement through LinkedIn

The survey has been closed by the end of July with around 30 participants



MBSE Survey Part I

General Modelling

1.1 What industry do you work in?

1.2 What is your job title?

1.3 How large is Systems Engineering (or equivalent) function within your organisation

1.4 Sharing of models: within your company

1.5 In which Systems Engineering activities does your organization or your customer organization use modelling?

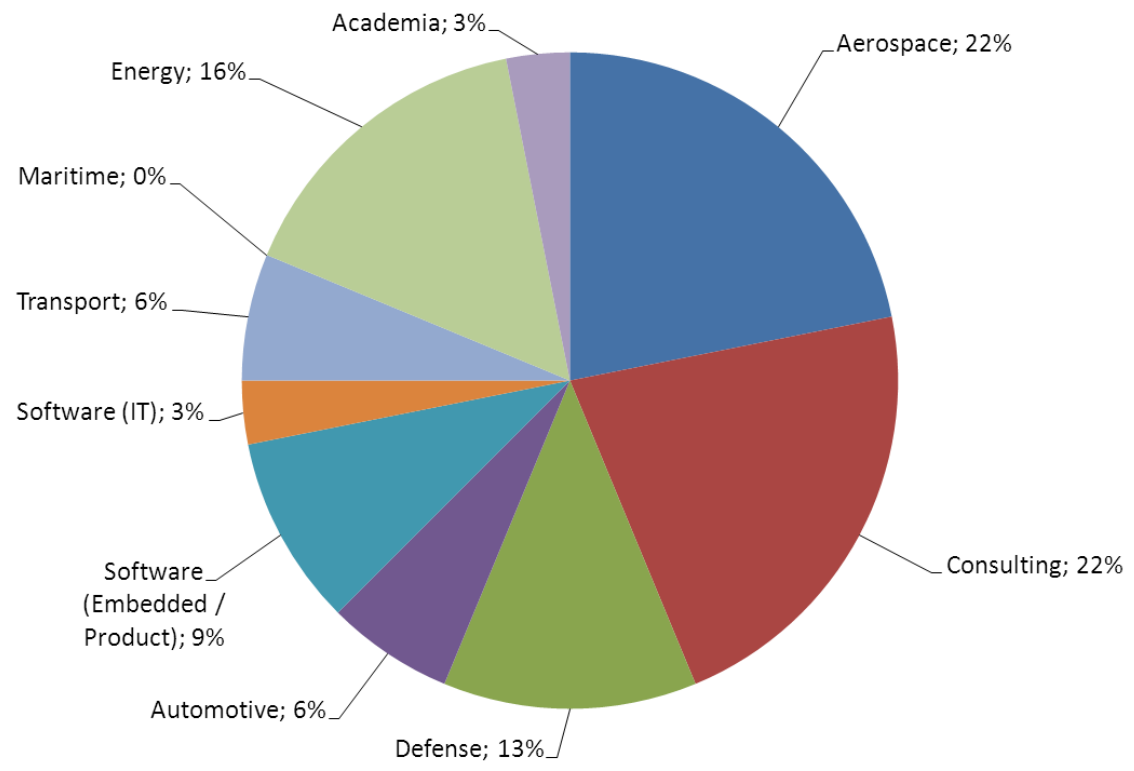
1.6 Which modelling languages does your organisation use for Systems Engineering?

1.7 What software tools does your organisation use for Systems Engineering modelling?

1.1 - What industry do you work in?

All the majors industrial sectors producing complex systems have participated to the survey

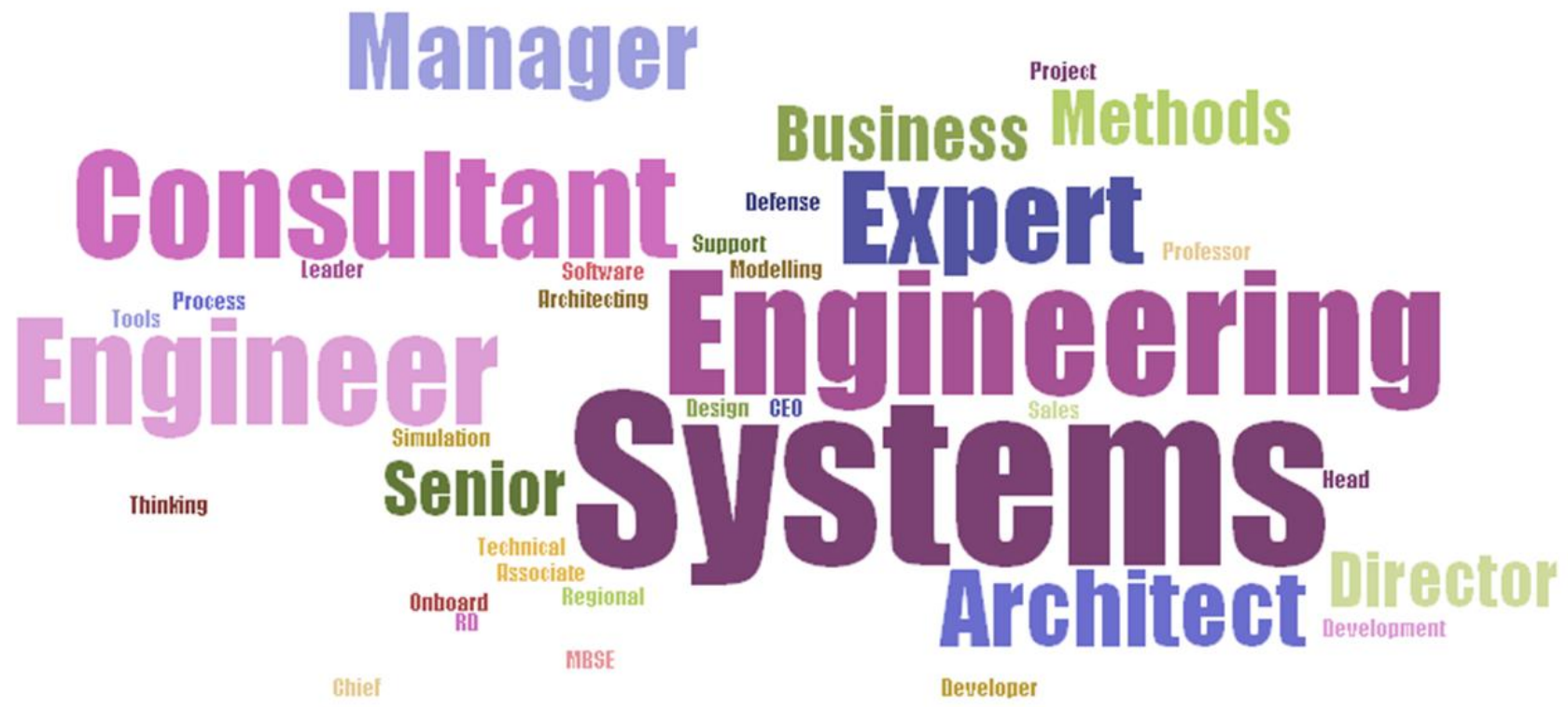
Aerospace	22%
Consulting	22%
Defence	13%
Automotive	6%
Software (Embedded / Product)	9%
Software (IT)	3%
Transport	6%
Maritime	0%
Energy	16%
Academia	3%



MBSE Survey Part I - General Modelling

1.2 What is your job title?

System Engineering: Engineer, Experts, Architect, Consultant, Business, Methods

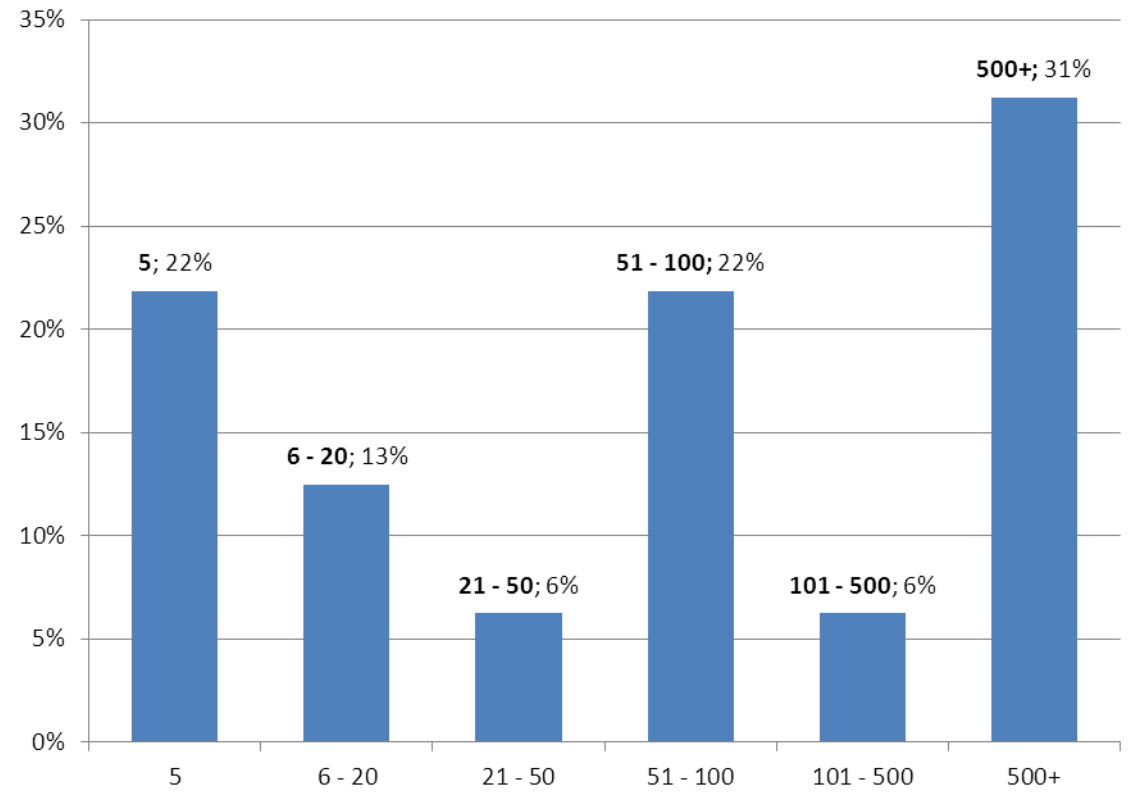


MBSE Survey Part I - General Modelling

1.3 How large is Systems Engineering (or equivalent) function within your organisation

More than 1/3rd of the survey participants work in a very large SE organization (>500)

5	22%
6 - 20	13%
21 - 50	6%
51 - 100	22%
101 - 500	6%
500+	31%

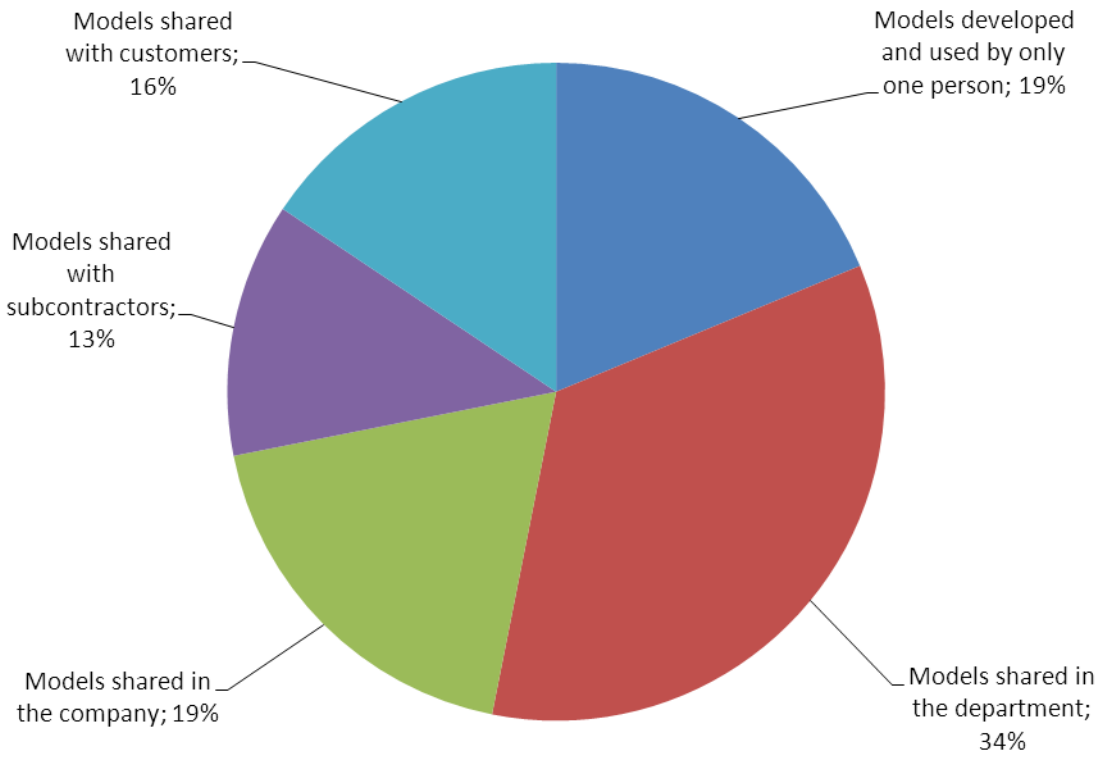


MBSE Survey Part I - General Modelling

1.4 Sharing of models: within your company

Models are quite shared inside a given department, less frequently shared within the company and even less with customers or subcontractors. The notion of extended enterprise is already in place but it has still to be deployed in more massive manner...

Models developed and used by only one person	19%
Models shared in the department	34%
Models shared in the company	19%
Models shared with subcontractors	13%
Models shared with customers	16%

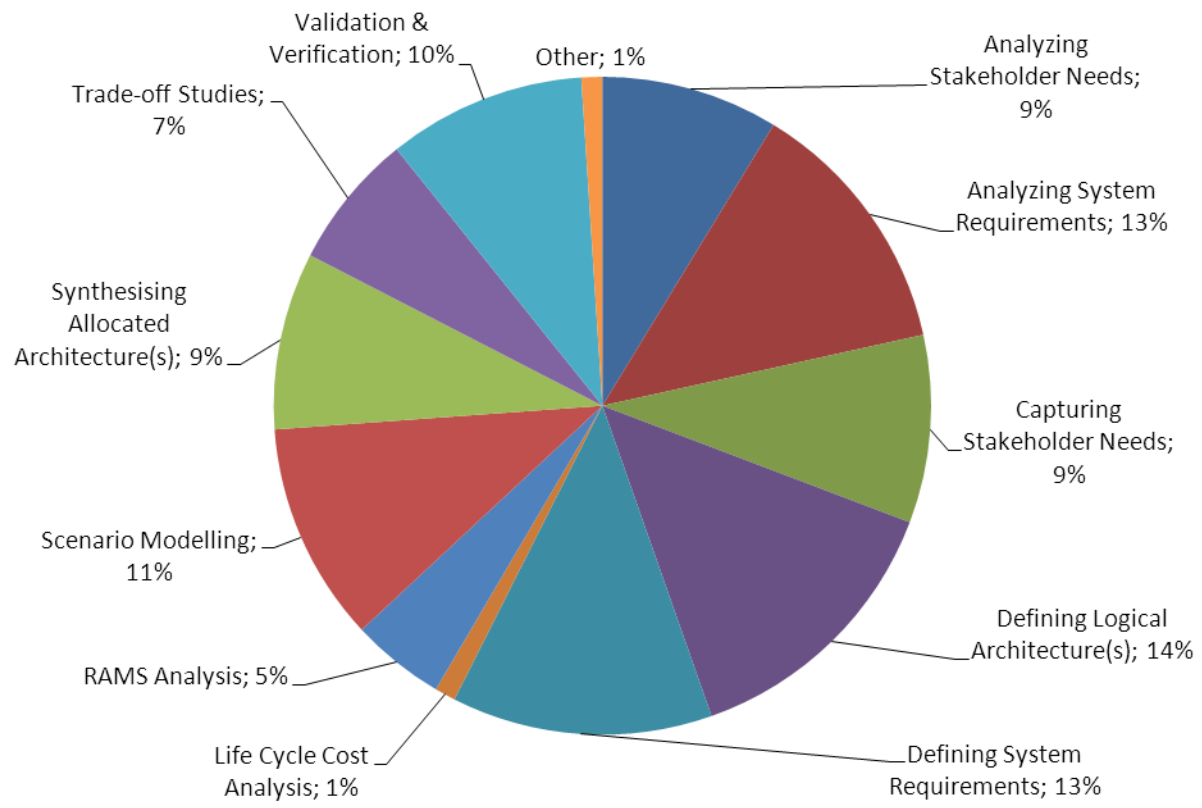


MBSE Survey Part I - General Modelling

1.5 In which Systems Engineering activities does your organization or your customer organization use modelling?

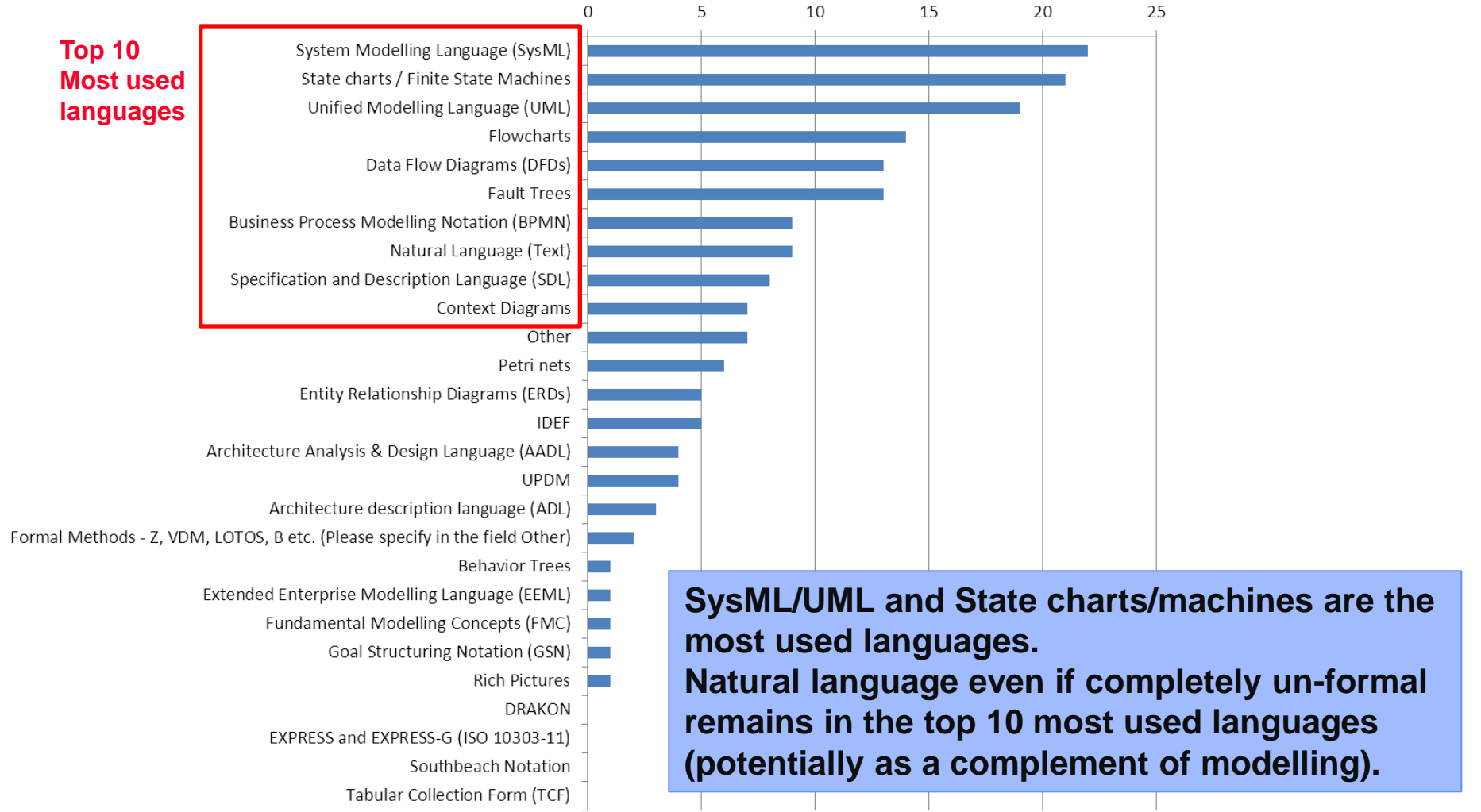
More than 40% of the modelling activities usage are focused on requirement management activities, with around 25 % on the Architecture Definition and finally not so much for trade-off studies, V&V or RAMS analysis

Analysing Stakeholder Needs	9%
Analysing System Requirements	13%
Capturing Stakeholder Needs	9%
Defining System Requirements	13%
Defining Logical Architecture(s)	14%
Life Cycle Cost Analysis	1%
RAMS Analysis	5%
Scenario Modelling	11%
Synthesising Allocated Architecture(s)	9%
Trade-off Studies	7%
Validation & Verification	10%
Other	1%



MBSE Survey Part I - General Modelling

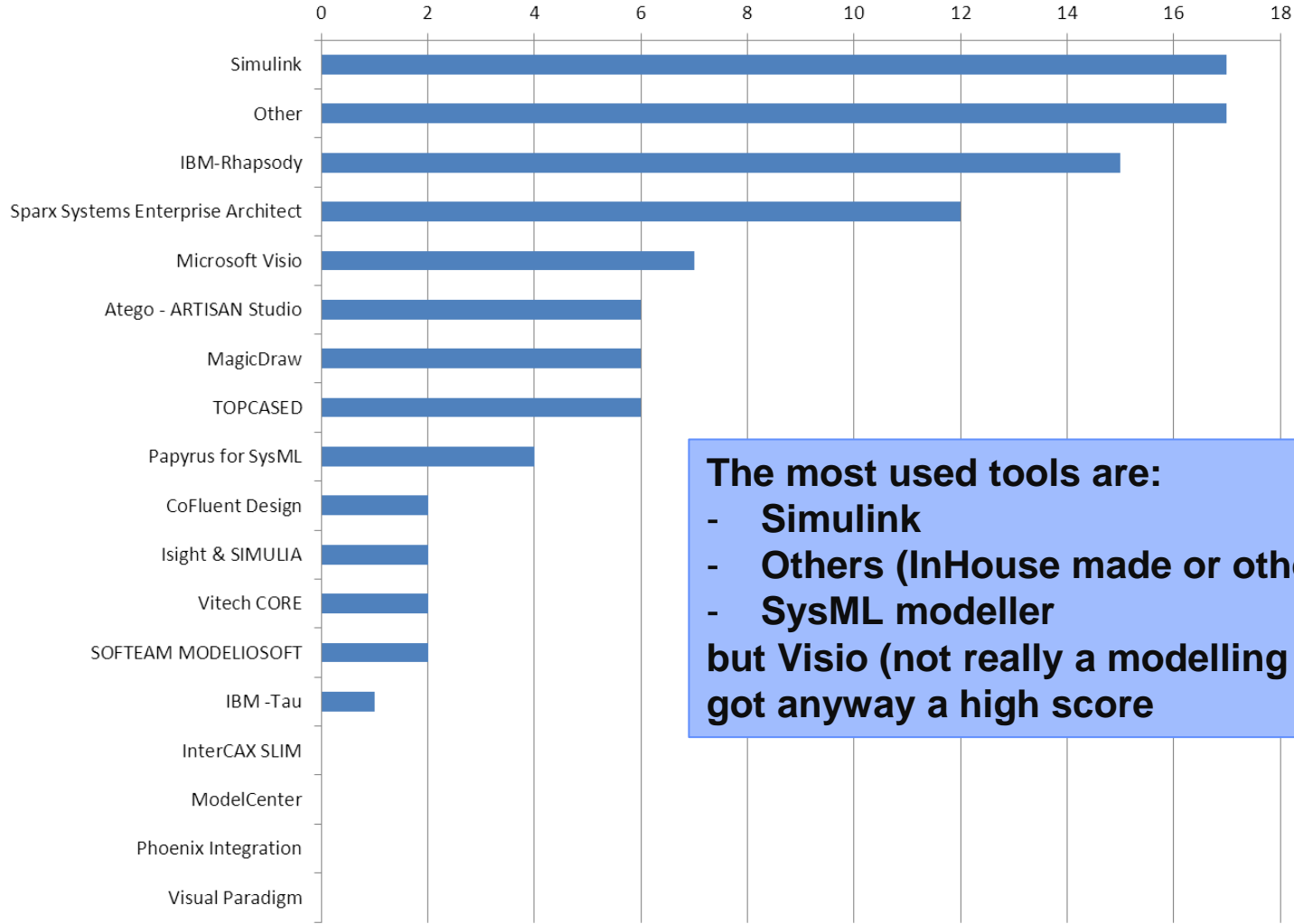
1.6 Which modelling languages does your organisation use for Systems Engineering?



SysML/UML and State charts/machines are the most used languages. Natural language even if completely un-formal remains in the top 10 most used languages (potentially as a complement of modelling).

MBSE Survey Part I - General Modelling

1.7 What software tools does your organisation use for Systems Engineering modelling?



The most used tools are:

- **Simulink**
- **Others (InHouse made or others COTS)**
- **SysML modeller**

but Visio (not really a modelling tool) has got anyway a high score

MBSE Survey Part II

MBSE practices

- 2.1 Is MBSE just the use of modelling by the Systems Engineering function of an organisation?
- 2.2 Do you believe your organisation implements MBSE?
- 2.3 If yes, then how mature is MBSE within your organisation ?
- 2.4 What MBSE Processes / Standards do you use within your organisation or in your customer organization ?
- 2.5 In your opinion what are the 3 main advantages of MBSE?
- 2.6 In your opinion what are 3 main challenges for MBSE?
- 2.7 What are the 3 main objectives you would like the MBSE Working Group to achieve?

MBSE Survey Part II - MBSE practices

2.1 Is MBSE just the use of modelling by the Systems Engineering function of an organisation?

Yes	39%
No	61%

→ MBSE is more than MBE

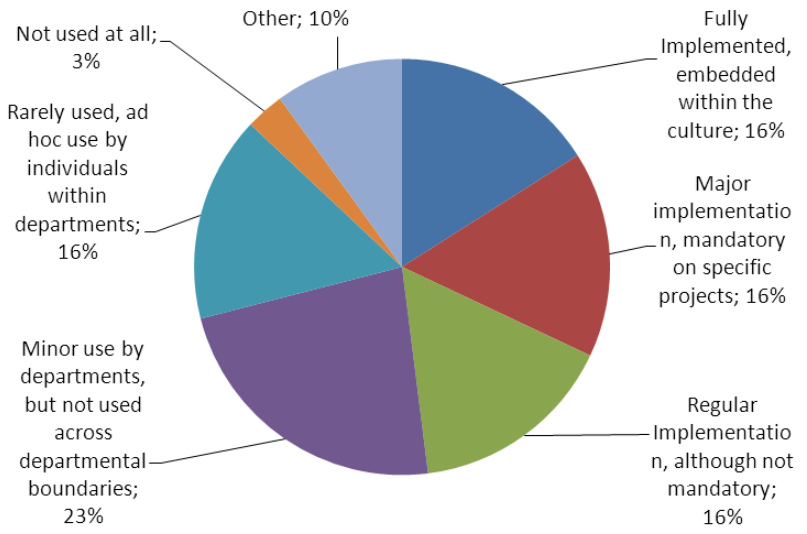
2.2 Do you believe your organisation implements MBSE?

Yes	68%
No	32%

→ MBSE it's almost implemented (or at least the companies wish to give this image!).

2.3 If yes, then how mature is MBSE within your organisation ?

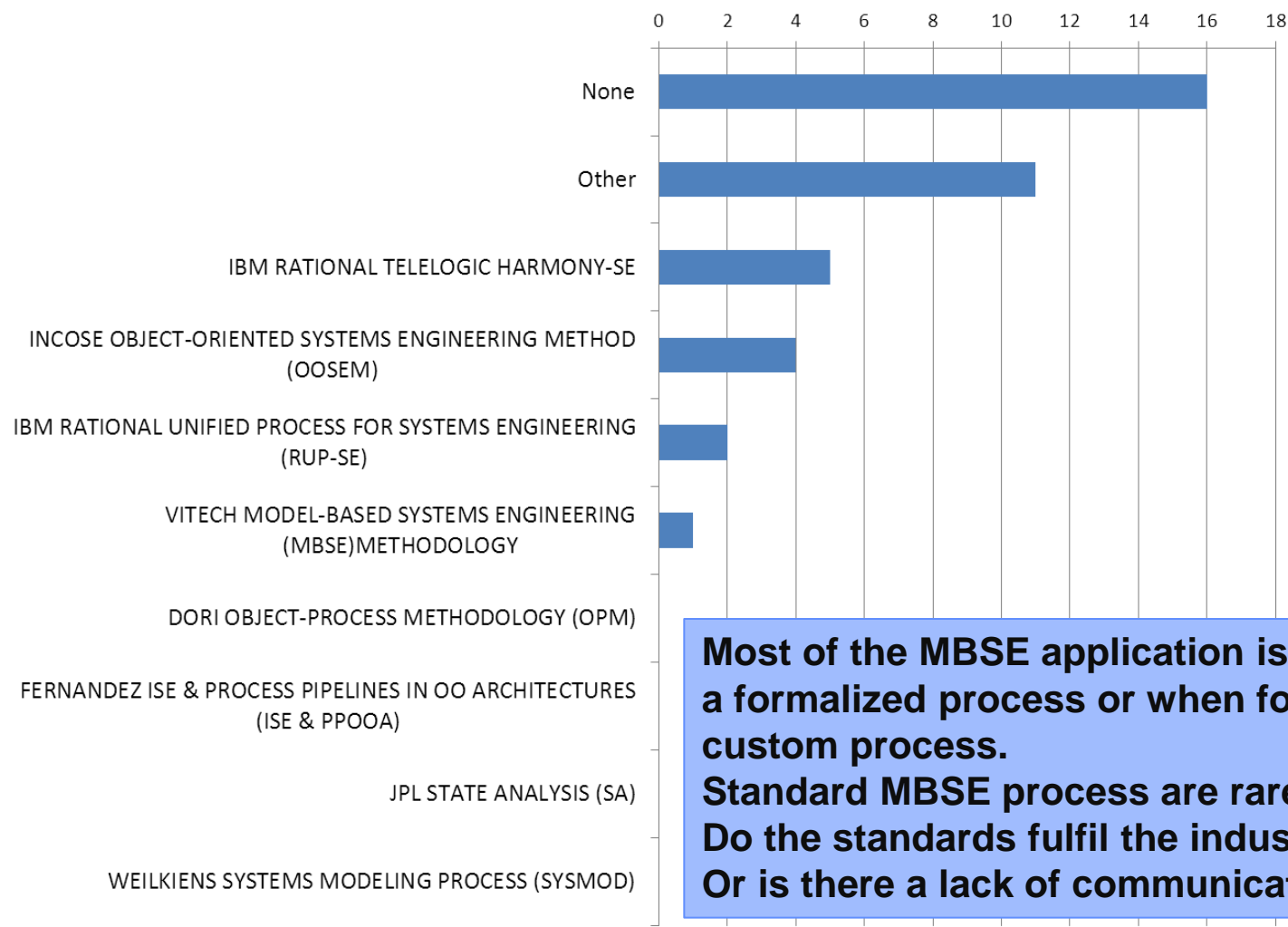
Fully Implemented, embedded within the culture	16%
Major implementation, mandatory on specific projects	16%
Regular Implementation, although not mandatory	16%
Minor use by departments, but not used across departmental boundaries	23%
Rarely used, ad hoc use by individuals within departments	16%
Not used at all	3%
Other	10%



→ The implementation level of maturity is quite heterogeneous

MBSE Survey Part II - MBSE practices

2.4 What MBSE Processes / Standards do you use within your organisation or in your customer organization ?



**Most of the MBSE application is done without a formalized process or when formalized with a custom process.
Standard MBSE process are rarely used
Do the standards fulfil the industrial needs?
Or is there a lack of communication?**

MBSE Survey Part II - MBSE practices

2.5 In your opinion what are the 3 main advantages of MBSE?

Early improved communication



MBSE Survey Part III

Simulation

MBSE Survey Part III - Simulation

3.1 How would you define simulation?

3.2 Which departments use simulation in their work?

3.3 In which Lifecycle Stages do you use simulation?

3.4 What simulation techniques do you use in your work?

3.5 What software tool(s) do you use for your simulation?

3.6 Are you able to combine Descriptive Modelling and Simulation (Analytical Modelling) techniques successfully in your work?

3.7 In your opinion what are the 3 main advantages of Integrating Descriptive Modelling and Simulation?

3.8 In your opinion what are the 3 main challenges of Integrating Descriptive Modelling and Simulation?

MBSE Survey Part III - Simulation

3.1 How would you define simulation?

Behaviour, Execution



MBSE Survey Part III - Simulation

3.2 Which departments use simulation in their work?

Mechanical, Software (but no system?)



MBSE Survey Part III - Simulation

3.3 In which Lifecycle Stages do you use simulation?

More design than V&V

design

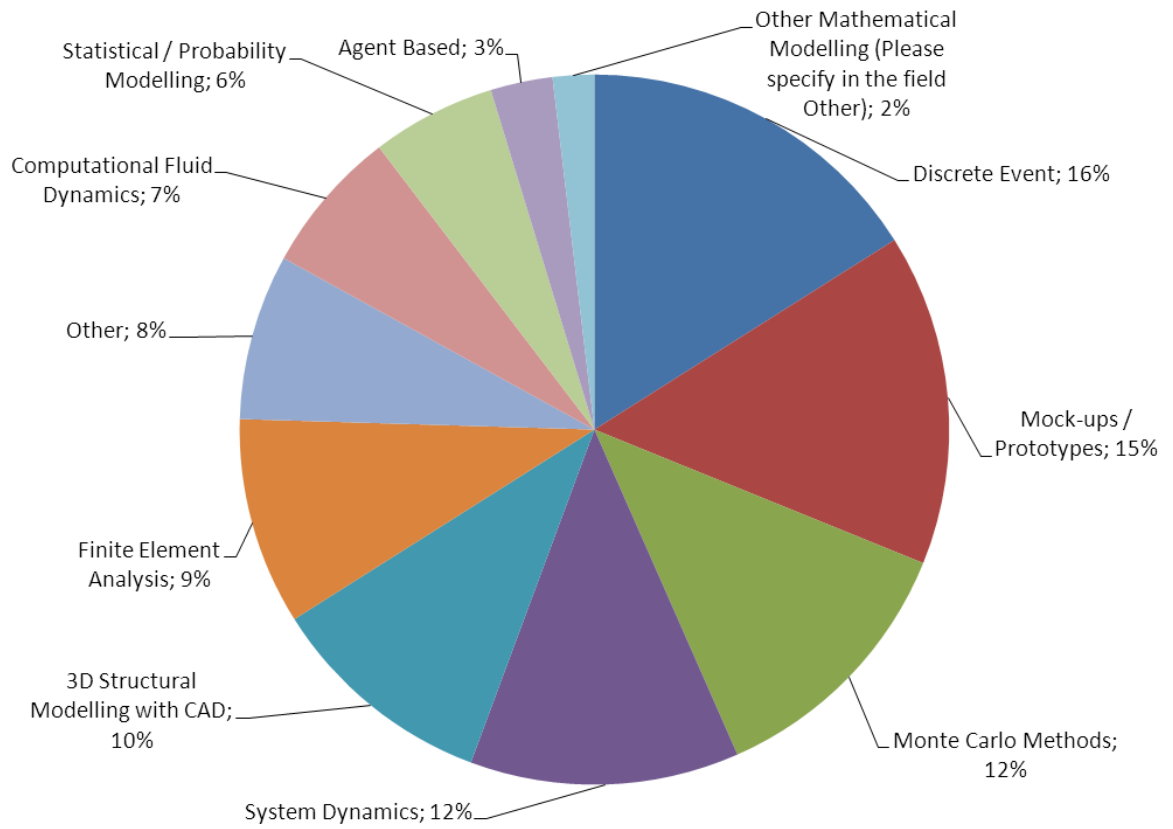
verification



3.4 What simulation techniques do you use in your work?

No really emerging techniques

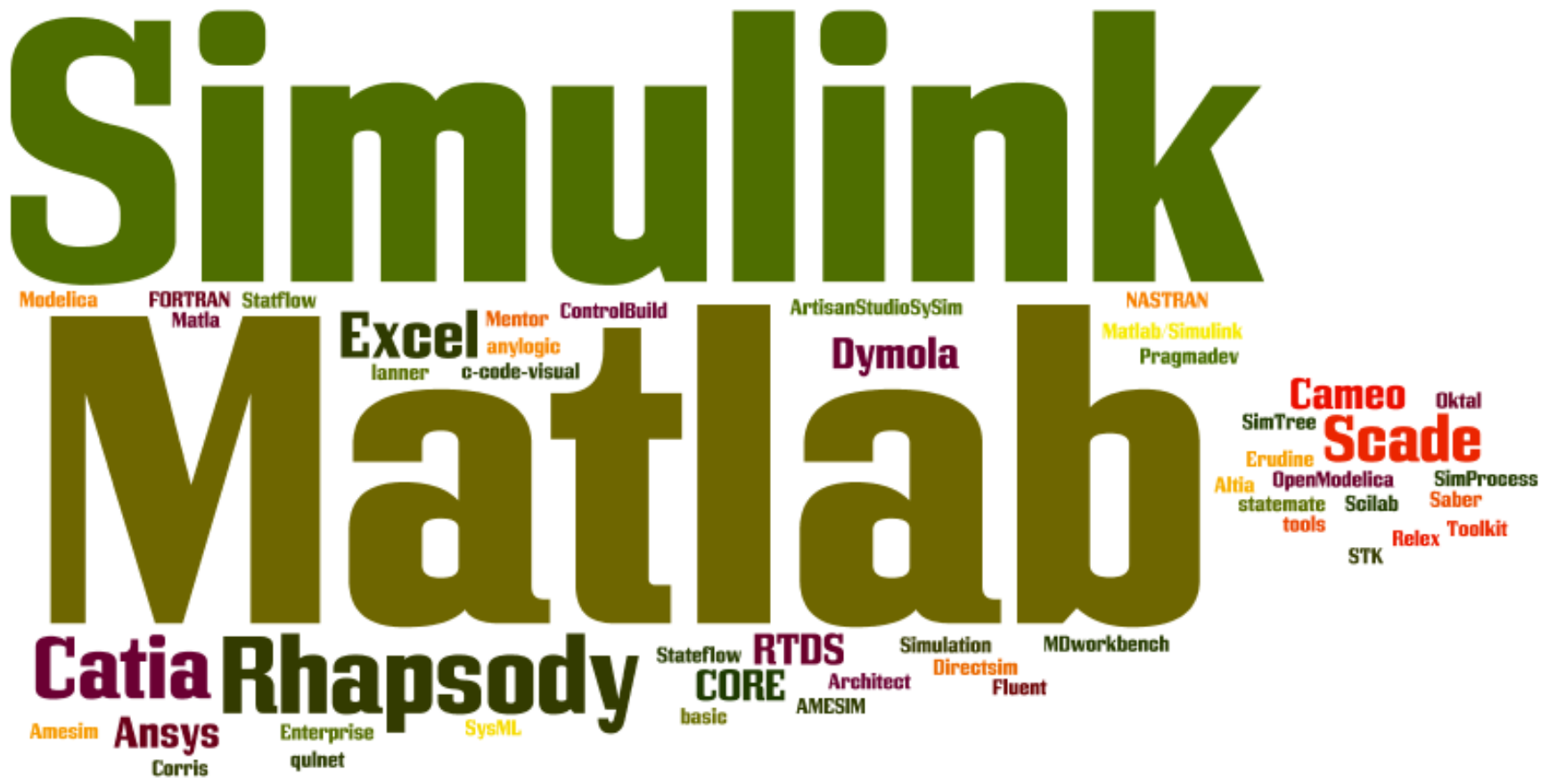
Discrete Event	16%
Mock-ups / Prototypes	15%
Monte Carlo Methods	12%
System Dynamics	12%
3D Structural Modelling with CAD	10%
Finite Element Analysis	9%
Other	8%
Computational Fluid Dynamics	7%
Statistical / Probability Modelling	6%
Agent Based	3%
Other Mathematical Modelling (Please specify in the field Other)	2%



MBSE Survey Part III - Simulation

3.5 What software tool(s) do you use for your simulation?

The Mathworks!
SysML/UML and discrete events modelling are the most used but not for simulation

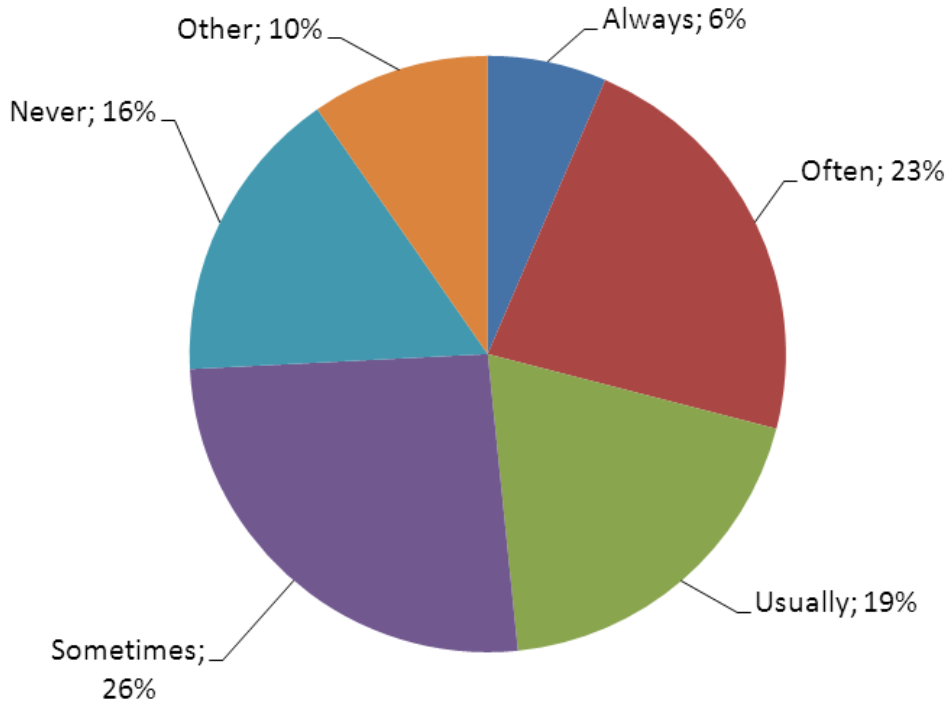


MBSE Survey Part III - Simulation

3.6 Are you able to combine Descriptive Modelling and Simulation (Analytical Modelling) techniques successfully in your work?

Simulation is already well integrated with the design

Allways	6%
Often	23%
Usually	19%
Sometimes	26%
Never	16%
Other	10%



MBSE Survey Part III - Simulation

3.7 In your opinion what are the 3 main advantages of Integrating Descriptive Modelling and Simulation?

Mainly consistency



MBSE Survey Part III - Simulation

3.8 In your opinion what are the 3 main challenges of Integrating Descriptive Modelling and Simulation?

First easiness and then a lot of issues



MBSE Survey Part VI

Model Static analysis

MBSE Survey Part IV

Model Static Analysis

- 4.1 How would you define model static analysis?
- 4.2 Which departments model static analysis in their work?
- 4.3 In which Lifecycle Stages do you use model static analysis?
- 4.4 What model static analysis techniques do you use in your work?
- 4.5 What software tool(s) do you use for model static analysis?
- 4.6 Are you able to combine Descriptive Modelling and Model Static analysis techniques successfully in your work?
- 4.7 In your opinion what are the 3 main advantages of Integrating Descriptive Modelling and Model Static analysis?
- 4.8 In your opinion what are the 3 main challenges of Integrating Descriptive Modelling and Model Static analysis?

MBSE Survey Part VI Model Static analysis

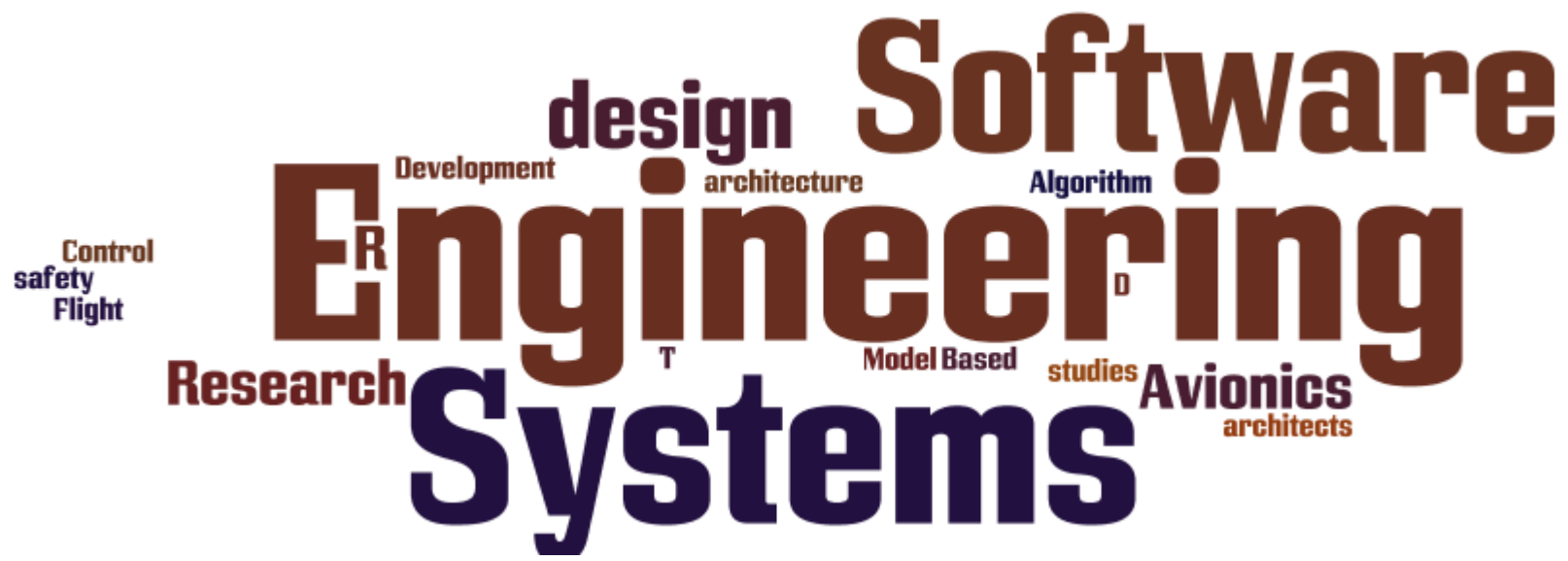
4.1 How would you define model static analysis?

Completeness, Rules



4.2 Which departments model static analysis in their work?

System as frequent as software



MBSE Survey Part VI

Model Static analysis

4.3 In which Lifecycle Stages do you use model static analysis?

Mainly design, as for simulation but also for concept and validation (in opposite to simulation)



MBSE Survey Part VI Model Static analysis

4.4 What model static analysis techniques do you use in your work?

Mainly rules and syntax (i.e. quite simple analysis)



MBSE Survey Part VI Model Static analysis

4.5 What software tool(s) do you use for model static analysis?

The MathWorks is first for simulation, In-house is first for analysis
Does it mean than COTS are more mature for simulation than for analysis?



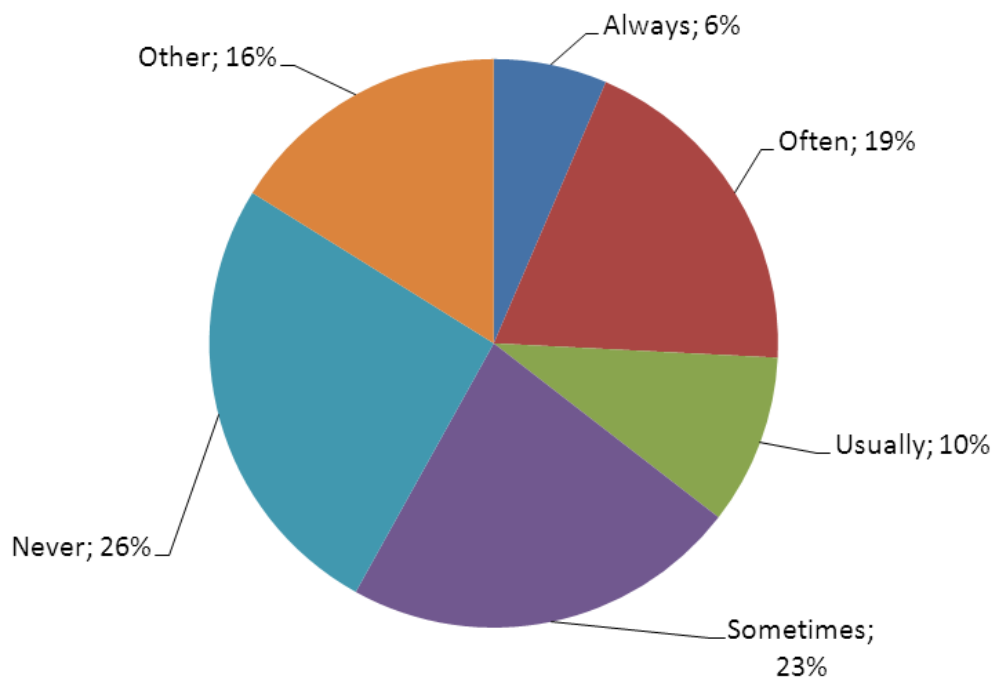
MBSE Survey Part VI

Model Static analysis

4.6 Are you able to combine Descriptive Modelling and Model Static analysis techniques successfully in your work?

Model static analysis is less frequent than simulation

Always	6%
Often	19%
Usually	10%
Sometimes	23%
Never	26%
Other	16%



MBSE Survey Part VI

Model Static analysis

4.7 In your opinion what are the 3 main advantages of Integrating Descriptive Modelling and Model Static analysis?

Consistency as for simulation but also, “formal”, “quality”, V&V



