



# Multi-attribute Model for Assessment of SMEs adoption of High Performance Computing Cloud Services

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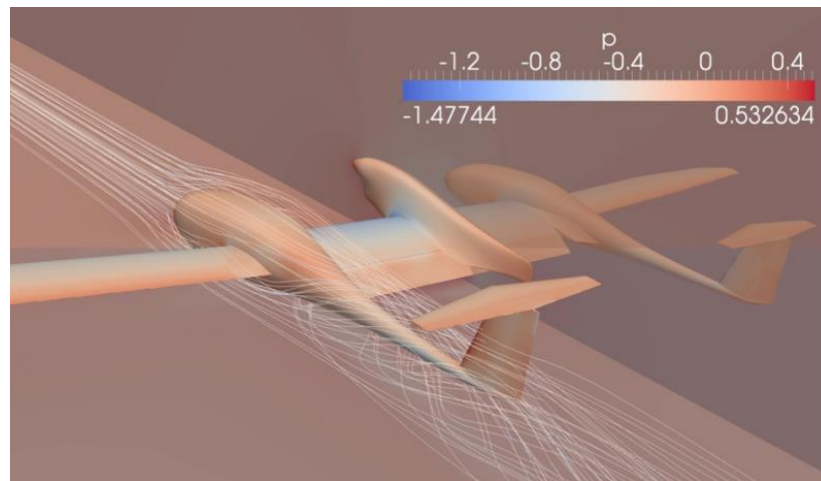
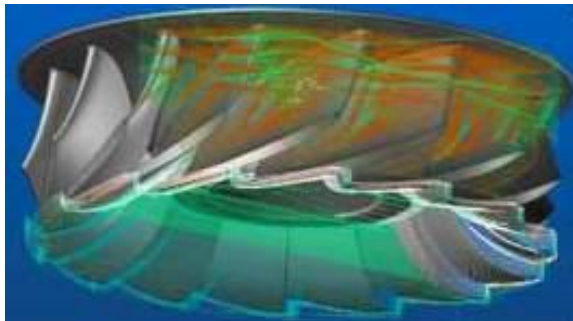
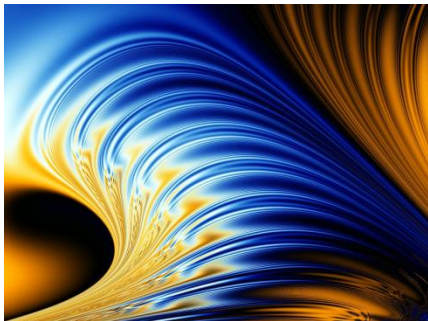
# Introduction

- HPC offered as a cloud service - one of the key competitiveness boosters for SMEs, particularly manufacturing.
- Huge amount of € and \$ are currently being spent on simulation experiments through various initiatives.



# Introduction

- Technology adoptance is in its early stages.
- Business models are not yet fully explored.
- No methodology for HPC Cloud readiness assessment.
- Selection criteria for funding rely on individual expert evaluation.



# Problem

- Governments, SMEs, HPC/Cloud providers and Academia need an appropriate methodology and tools to identify the potential to use HPC in Cloud.

# Goals

- Develop a qualitative multi-attribute model for evaluating SMEs HPC in Cloud adoption readiness.
- Model aims to support stakeholders to evaluate SMEs HPC in Cloud adoption potential.
- Model will serve as a tool to support communication between stakeholders, offering a transparent explanation of evaluation.

# Methodology

- Qualitative Multi-Attribute Decision-Making Methodology DEX

- Problem definition

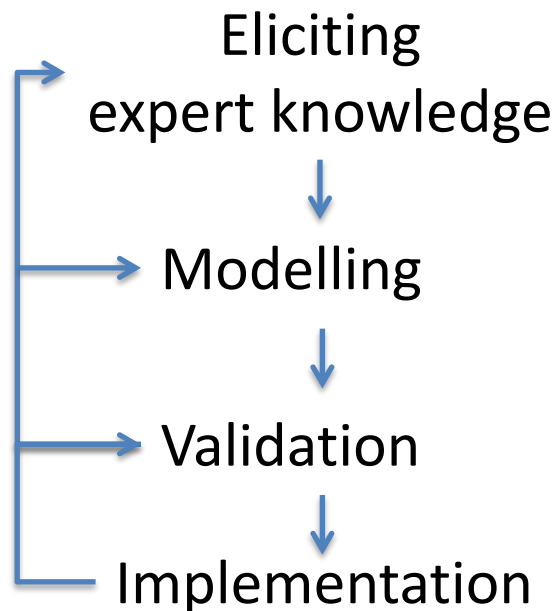
- Attribute identification & selection

- Attribute scale definition

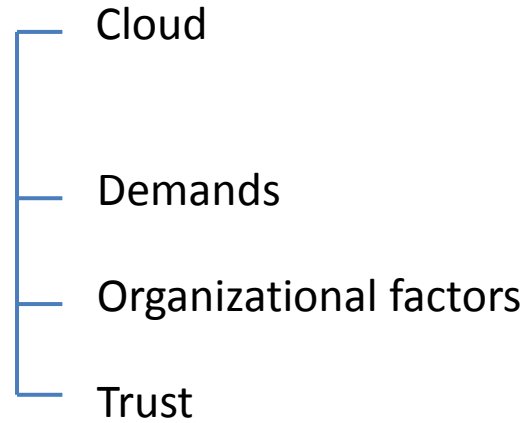
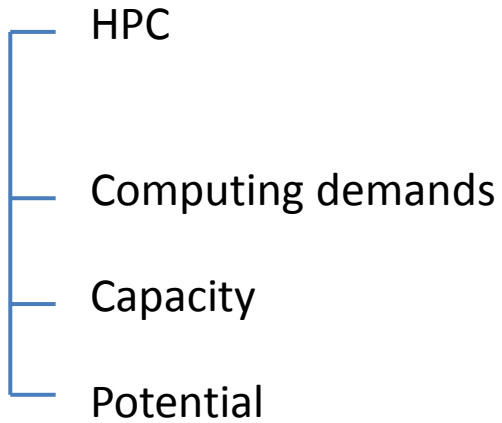
- Aggregation rules

- Options evaluation

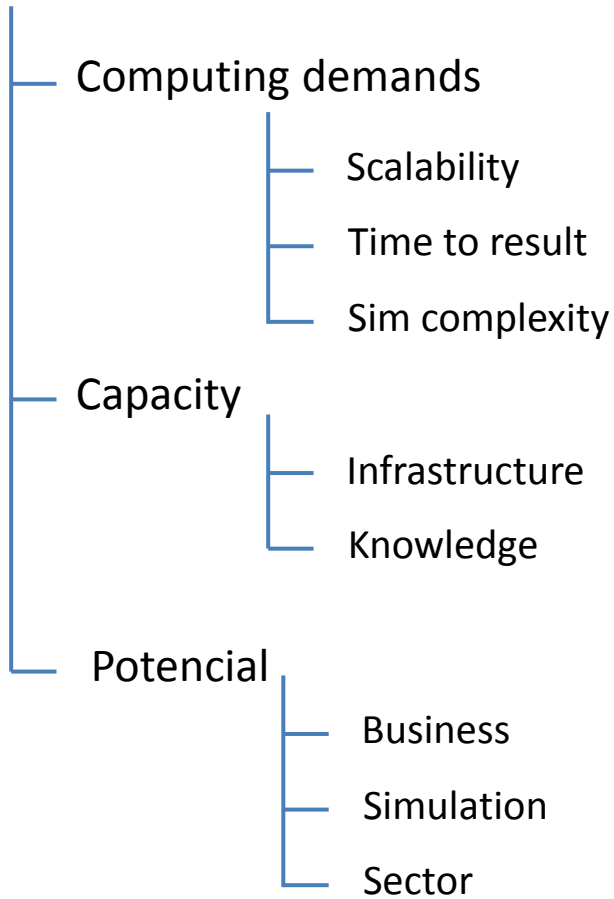
- Analysis



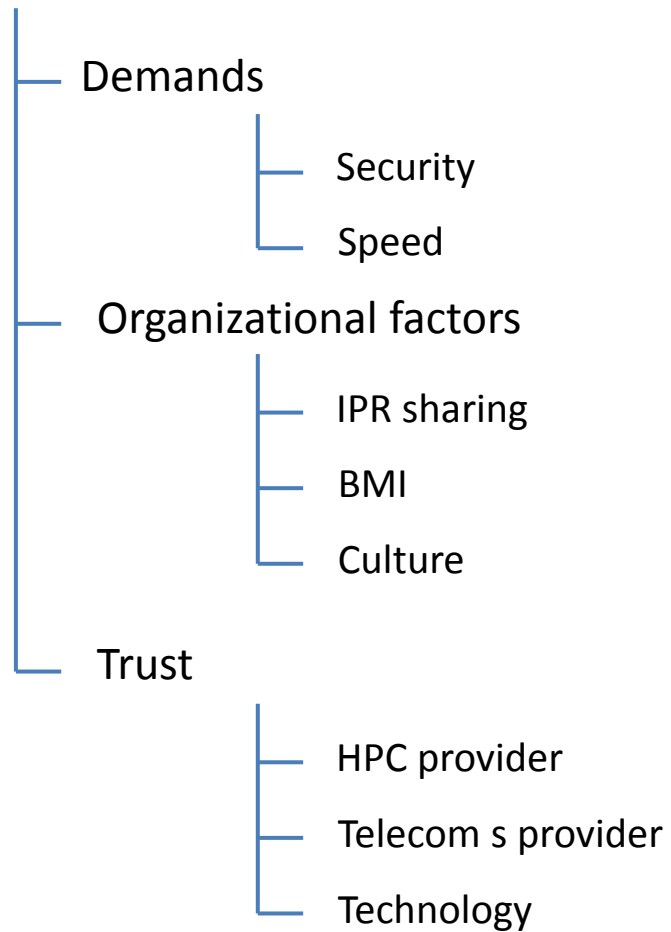
# Cloud HPC Readiness



## HPC

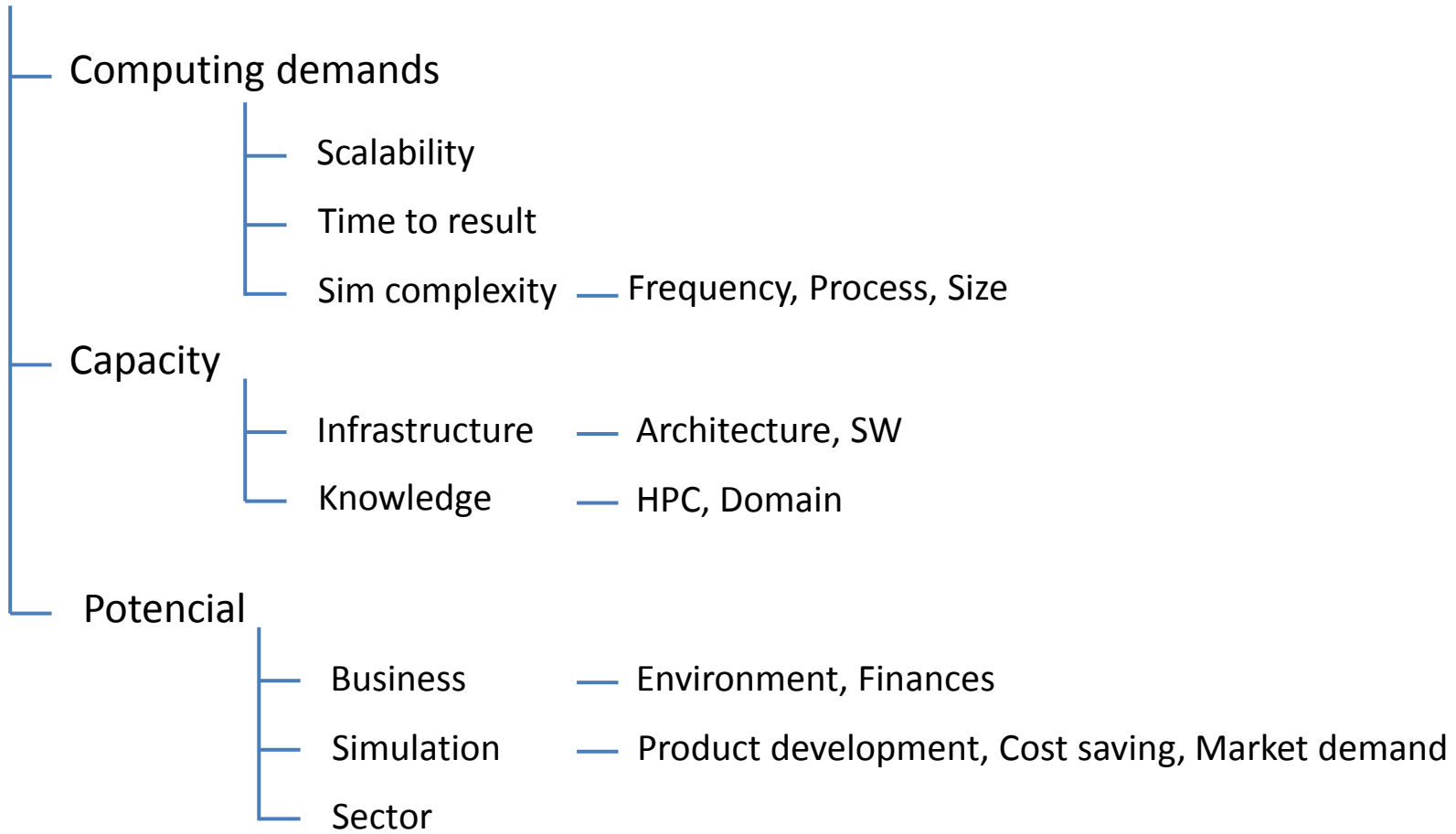


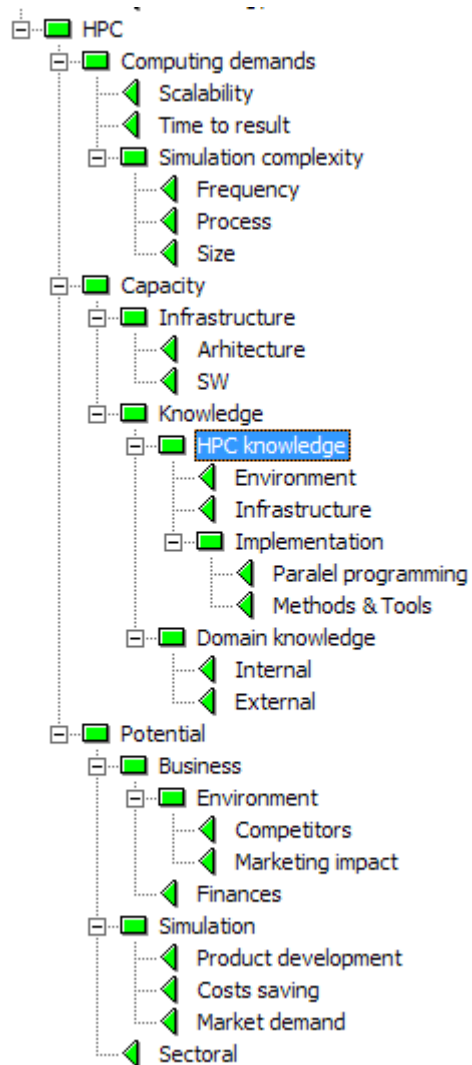
## Cloud



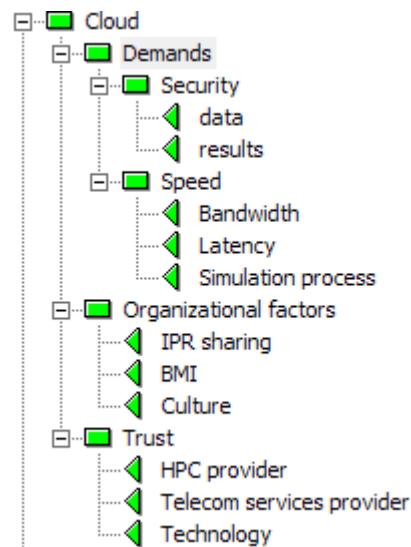


# HPC





**Cloud HPC Readiness**



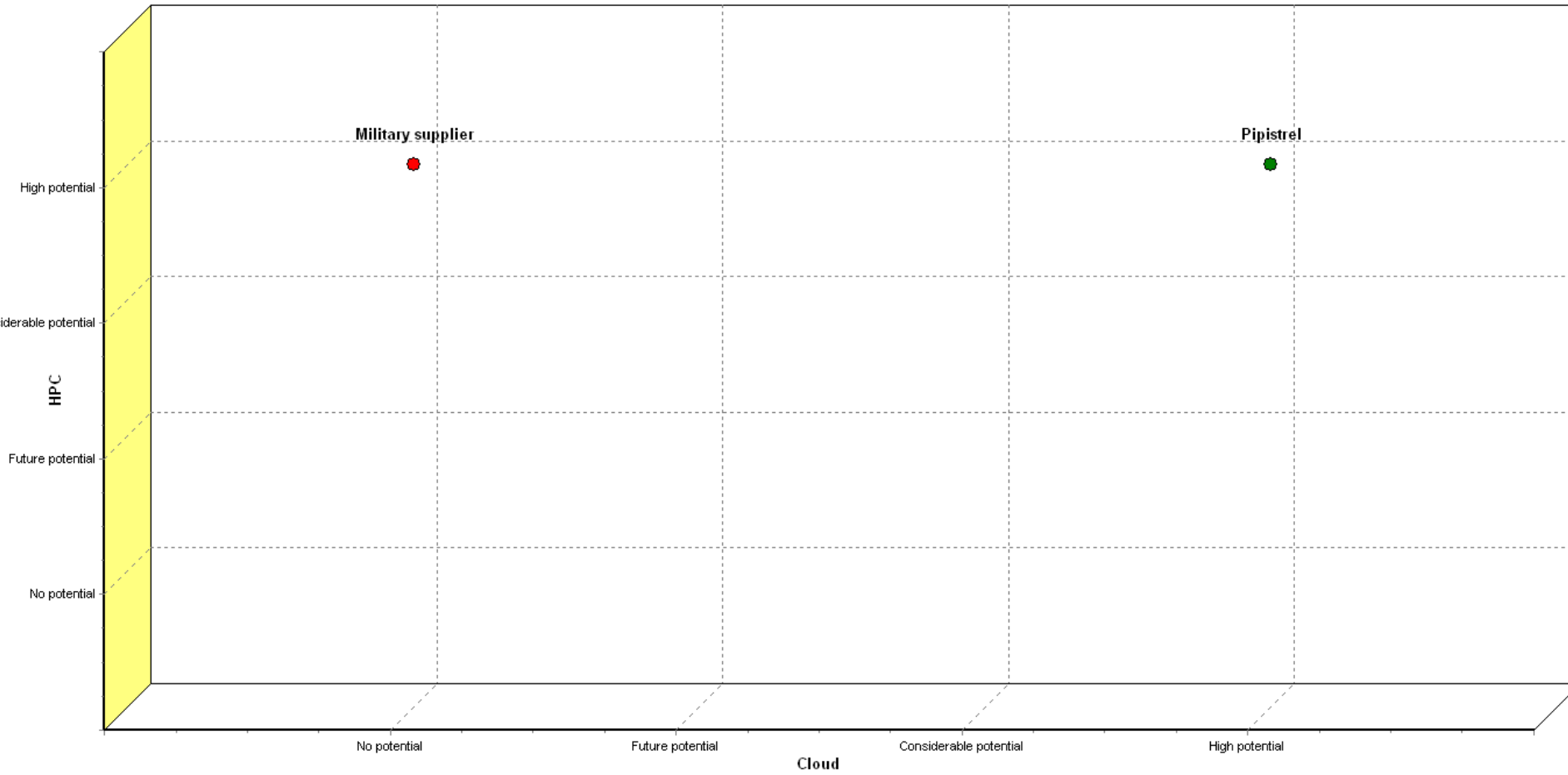
# Options

<b>Option</b>	<b>Military supplier</b>	<b>Pipistrel</b>
<b>data</b>	Level 3	Level 1
<b>results</b>	Level 3	Level 1
<b>Bandwidth</b>	medium	low
<b>Latency</b>	acceptable for distributed computing	not important
<b>Simulation process</b>	normal	normal
<b>IPR sharing</b>	Not at all	Yes
<b>BMI</b>	Low	High
<b>Culture</b>	fairly favorable	highly favorable
<b>HPC provider</b>	no	trust
<b>Telecom services provider</b>	no	trust
<b>Technology</b>	sceptic	trust
<b>Scalability</b>	> 1024	16 - 1024
<b>Time to result</b>	medium	short
<b>Frequency</b>	monthly	weekly
<b>Process</b>	10 - 100	10 - 100
<b>Size</b>	< 10.000 CPUH	< 10.000 CPUH
<b>Arhitecture</b>	own	SaaS
<b>SW</b>	Own development	Opensource
<b>Environment</b>	High	Medium
<b>Infrastructure</b>	High	High
<b>Paralel programming</b>	High	Not needed
<b>Methods &amp; Tools</b>	High	High
<b>Internal</b>	High	High
<b>External</b>	Medium	High
<b>Competitors</b>	they say they do	they do successfully
<b>Marketing impact</b>	Medium	High
<b>Finances</b>	> 200%	> 200%
<b>Product development</b>	Necessary	Necessary
<b>Costs saving</b>	Considerable	High
<b>Market demand</b>	High	High
<b>Sectoral</b>	excellent	excellent

# Evaluation

Option	Military supplier	Pipistrel
. Cloud HPC Readiness	<b>Low</b>	<b>High</b>
.. Cloud	<b>No potential</b>	<b>High potential</b>
... Demands	<b>Very high</b>	<b>Feasible</b>
.... Security	<b>Very high</b>	<b>Acceptable</b>
..... data	Level 3	Level 1
..... results	Level 3	Level 1
.... Speed	<b>Demanding</b>	<b>Acceptable</b>
..... Bandwidth	medium	low
..... Latency	acceptable for distributed computing	not important
..... Simulation process	normal	normal
... Organizational factors	<b>Not favorable</b>	<b>Favorable</b>
.... IPR sharing	Not at all	Yes
.... BMI	Low	High
.... Culture	fairly favorable	highly favorable
... Trust	<b>no</b>	<b>high</b>
.... HPC provider	no	trust
.... Telecom services provider	no	trust
.... Technology	sceptic	trust
.. HPC	<b>High potential</b>	<b>High potential</b>
... Computing demands	<b>High</b>	<b>High</b>
.... Scalability	> 1024	16 - 1024
.... Time to result	medium	short
.... Simulation complexity	<b>Medium</b>	<b>Medium</b>
..... Frequency	monthly	weekly
..... Process	10 - 100	10 - 100
..... Size	< 10.000 CPUH	< 10.000 CPUH
... Capacity	<b>Excellent</b>	<b>Excellent</b>
.... Infrastructure	<b>Medium</b>	<b>Good</b>
..... Arhitecture	own	SaaS
..... SW	Own development	Opensource
.... Knowledge	<b>Excellent</b>	<b>Excellent</b>
..... HPC knowledge	<b>High</b>	<b>High</b>
..... Environment	High	Medium
..... Infrastructure	High	High
..... Implementation	<b>High</b>	<b>High</b>
..... Paralel programming	High	Not needed

# Graphical evaluation



# Conclusions

- Problem of evaluating SMEs readiness to adopt HPC Cloud services.
- Qualitative MADM.
- Further validation of the model on the experiment data.
- Implementation.



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