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Systematic Analysis of IT Complexity Challenges Hindering the Implementation of Industrie 4.0 Roadmaps

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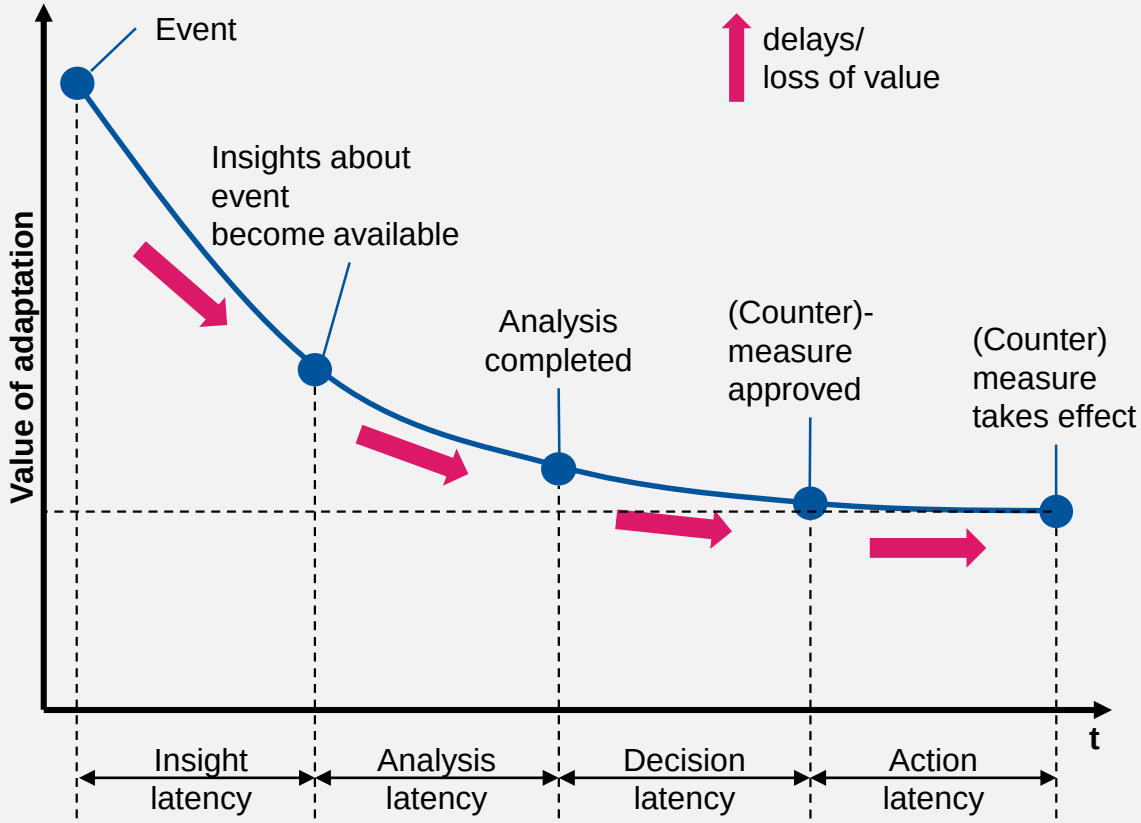
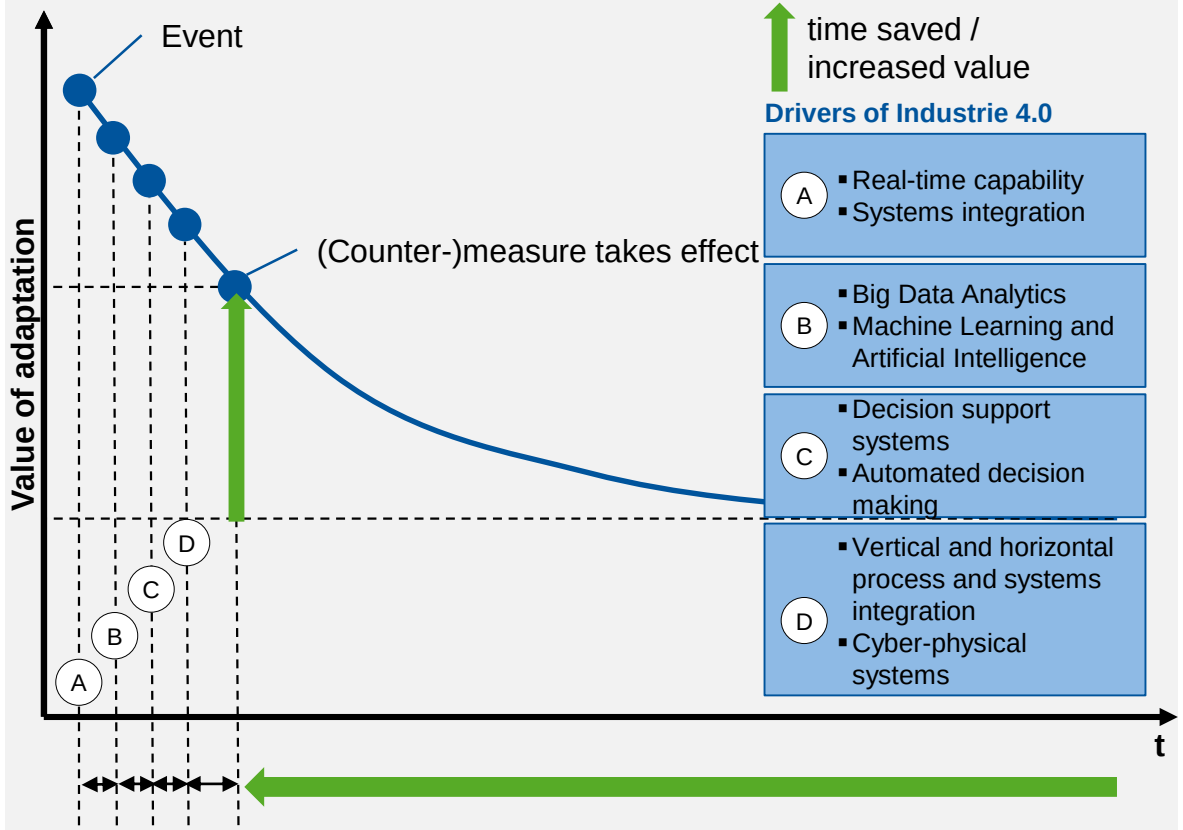
Motivation: Digital, agile businesses outperform traditional businesses because of lower latencies in the entire reaction chain

Typical reaction of traditional companies to unplanned event



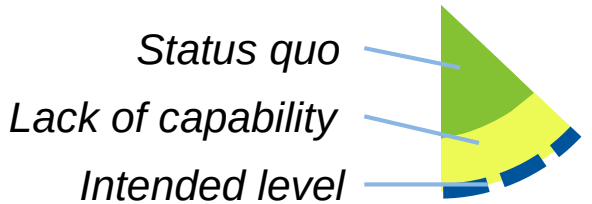
Typical reaction of agile companies to unplanned event



Companies become faster and more agile with Industrie 4.0

Source: SCHUH ET AL. 2017, P.11

Motivation: acatech Industrie 4.0 Maturity Index enables a systematic development of manufacturing companies



Resources

- Automated data acquisition
- Decentralised (pre-)processing data
- Task-based interface design
- Efficient communication
- Digital competencies

Information systems

- Horizontal and vertical integration
- Application-specific user interfaces
- Contextualised data delivery
- Resilient IT infrastructure
- Data analysis

Organizational structure

- Agile management
- Flexible communities
- Motivational goal systems
- Focus on customer benefits
- Decision rights management

Culture

- Open communication
- Openness to innovation
- Continuous professional development
- Data-based learning and decision-making
- Confidence in processes and IT-systems

Source: Schuh et al. 2017, p. 19

Hypothesis: IT complexity challenges are hindering the implementation of Industrie 4.0 roadmaps significantly

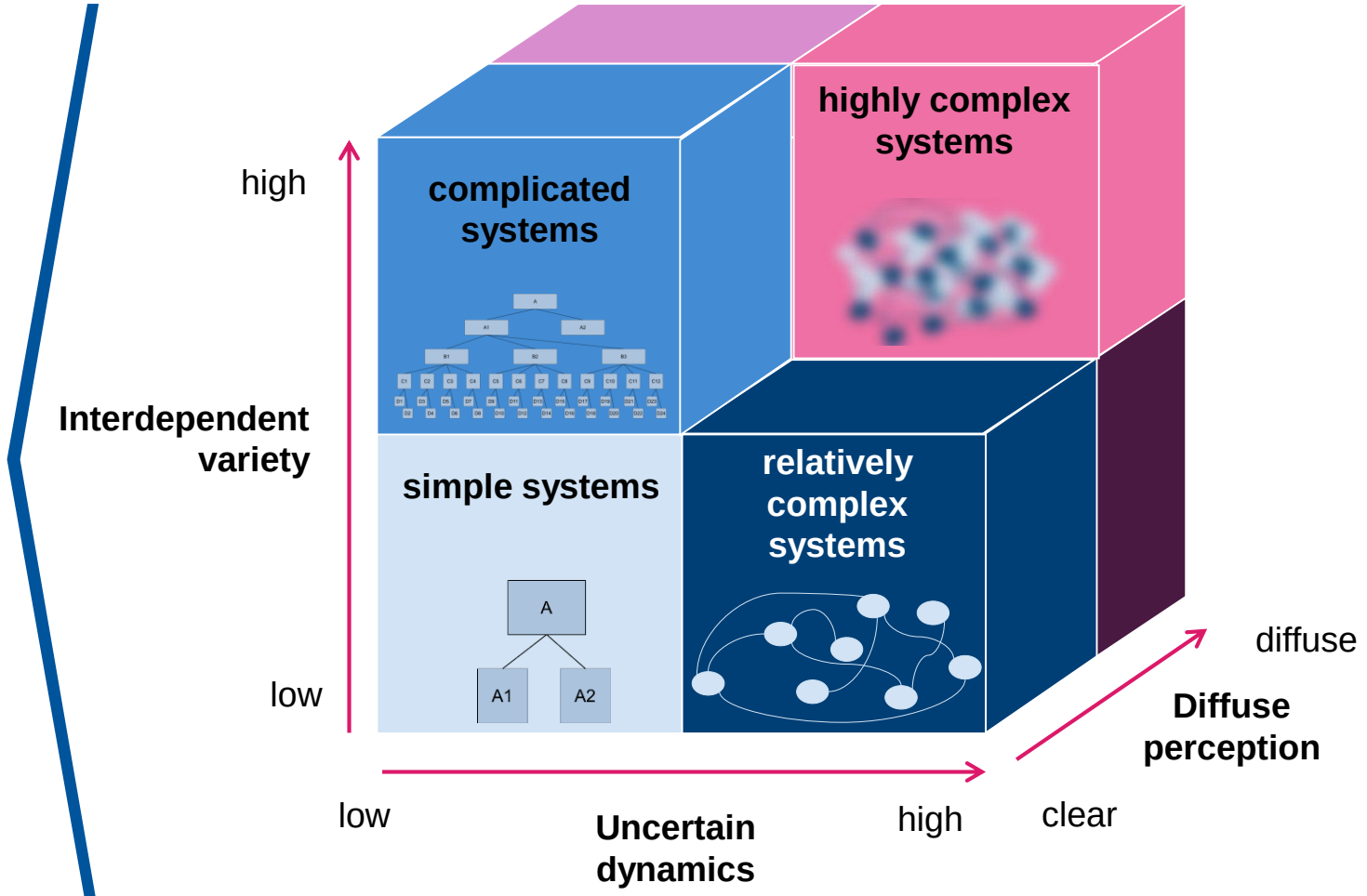
IT complexity in practice

> IT complexity will soon make it impossible to effectively control digital performance.[1)]

> 66% of IT employees fear to be overwhelmed due to increasing IT complexity.[2)]

> 44% of companies do not keep their internal digital processes under surveillance. 15% say it's due to the high complexity of their IT landscape.[2)]

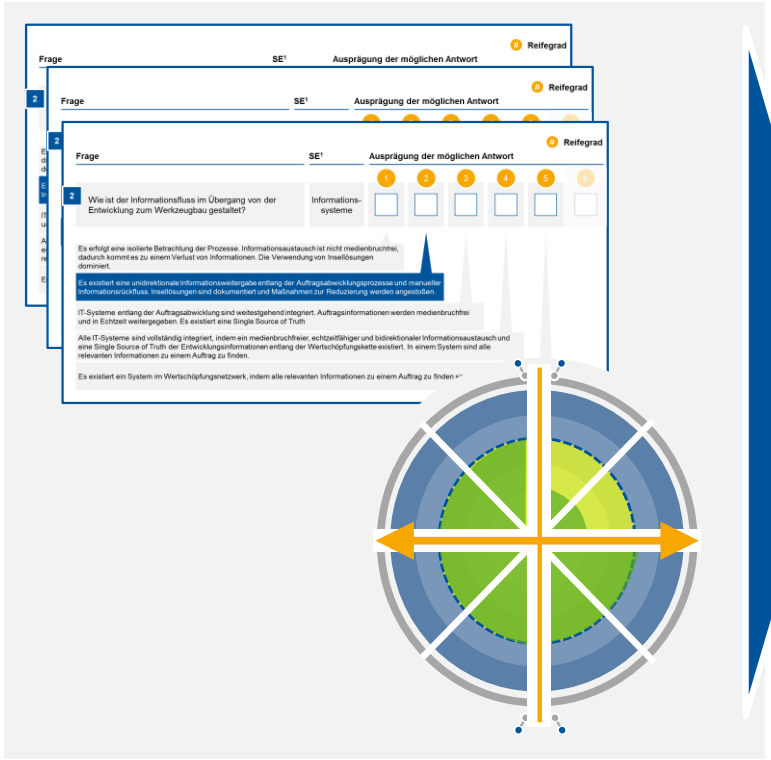
Dimensions of IT complexity[3)]



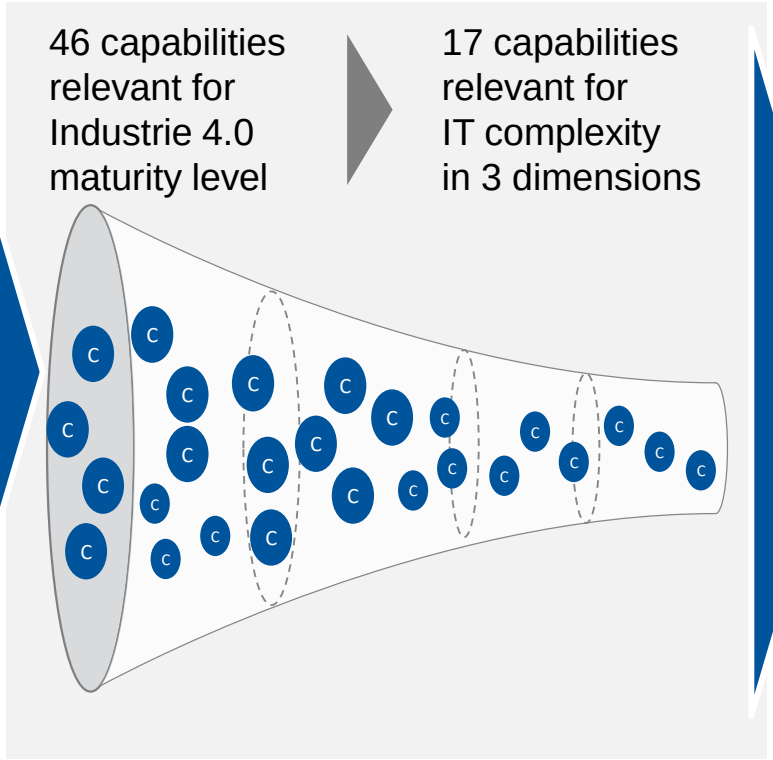
1) DYNATRACE 2018
2) IPSWITCH 2016
3) SCHUH ET AL. 2013

Approach: Real-life data from 12 companies gathered in Industrie 4.0 Roadmap projects were systematically analyzed

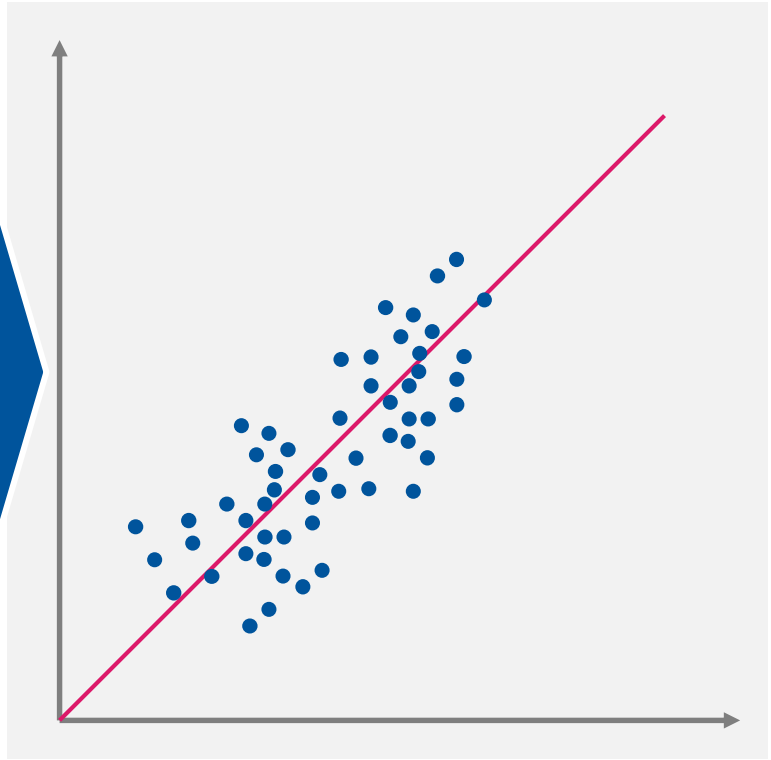
Gathered data of 12 companies assessing 55 core processes



Determination of IT complexity relevant Industrie 4.0 capabilities



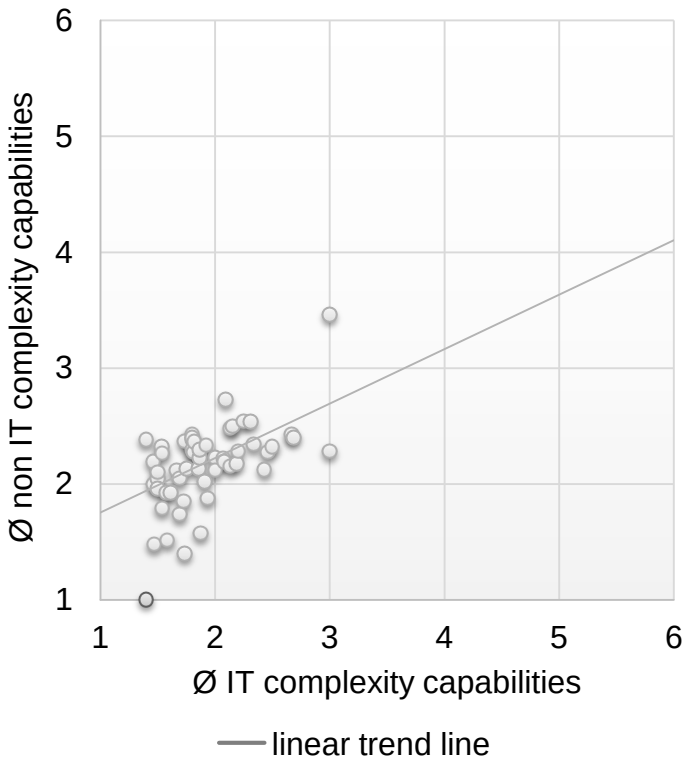
Data analysis regarding relationship between IT complexity and Industrie 4.0



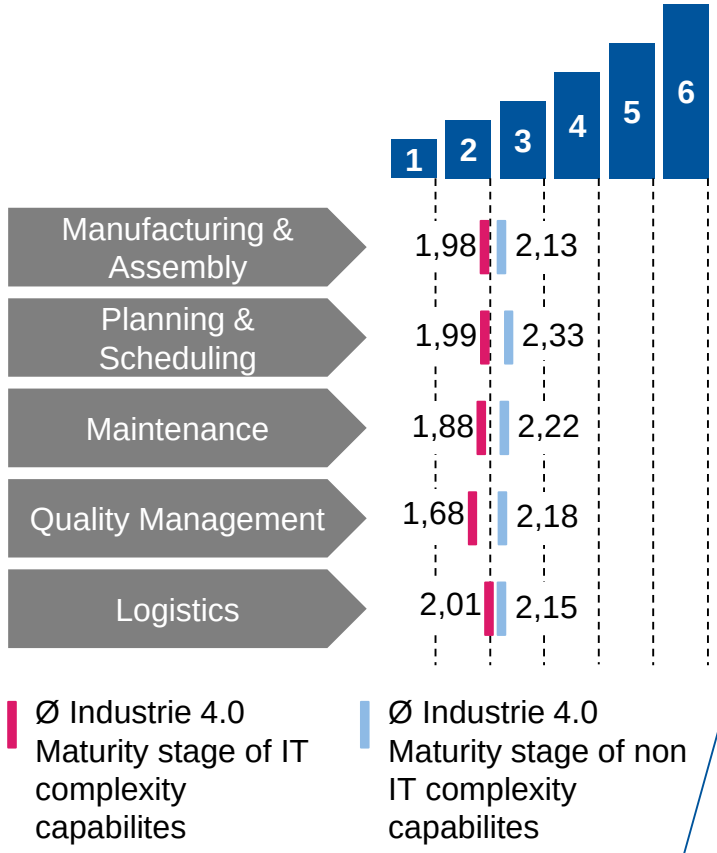
The approach ensures a systematic analysis of real-life data from manufacturing companies to determine if IT complexity is a significant obstacle in reaching a higher Industrie 4.0 maturity level.

Results: In 4 out of 5 analyzed core processes IT complexity is a statistically significant obstacle for a higher Industrie 4.0 maturity level

Scatter Plot of all processes



Maturity stage's average per main process



Results

- 55 processes analyzed: planning & scheduling (7), manufacturing & assembly (21), maintenance (5), logistics (9), quality management (8), sales (1), service (2), tool-shop (2)
- A linear correlation between IT complexity capabilities and the overall maturity level of a company could be shown by a Pearson Product Moment correlation of r=.85 (model fit 72%, r^2=72)
- Within main processes Student's T-Test shows statistically significantly lower mean of the Industrie 4.0 maturity for those capabilities relevant for IT complexity, exception is logistics

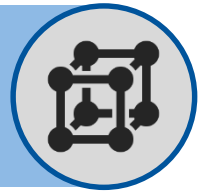
Interpretation: Manufacturing companies have to invest in their management of IT complexity to successfully implement Industrie 4.0

IT complexity relevant capabilities with the lowest overall mean value

Capability	Mean value
Resilience (stability of IT system operations)	1.44
Data model (model of all data relevant to the company)	1.51
Data storage (centrality and redundancy of data storage)	1.58
User interface (ease of use and changeability of user interfaces)	1.67
Vertical integration (integration between IT systems of different levels)	1.73

Resilience – Companies need to increase redundancy and therefore operational stability of IT systems. This also includes a comprehensible documentation of the system's configuration as well as a risk analysis of potential failures.

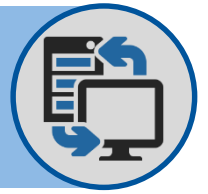
Data model – Companies need to develop one core data model containing all relevant data points assigned to the IT systems used and the business processes supported.



Data storage – As foundation for data driven process optimization as well as data driven services, a central and redundant data storage is necessary. Companies can realize this e.g. by implementing a data warehouse.

User interface – As employees of a company are used to easy-to-use smartphones, simple, structured and tailored user interfaces are important to support the employees in using the company's IT systems.

Vertical integration – A single source of truth for all information relevant to the core business processes needs to be created. Information is stored redundancy-free and easy to access for all employees involved in the business process.



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Thank you very much for your attention!

References

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