Dynamic Risk Assessment on Innovation Risks in the German Machinery and Plant Engineering Industry

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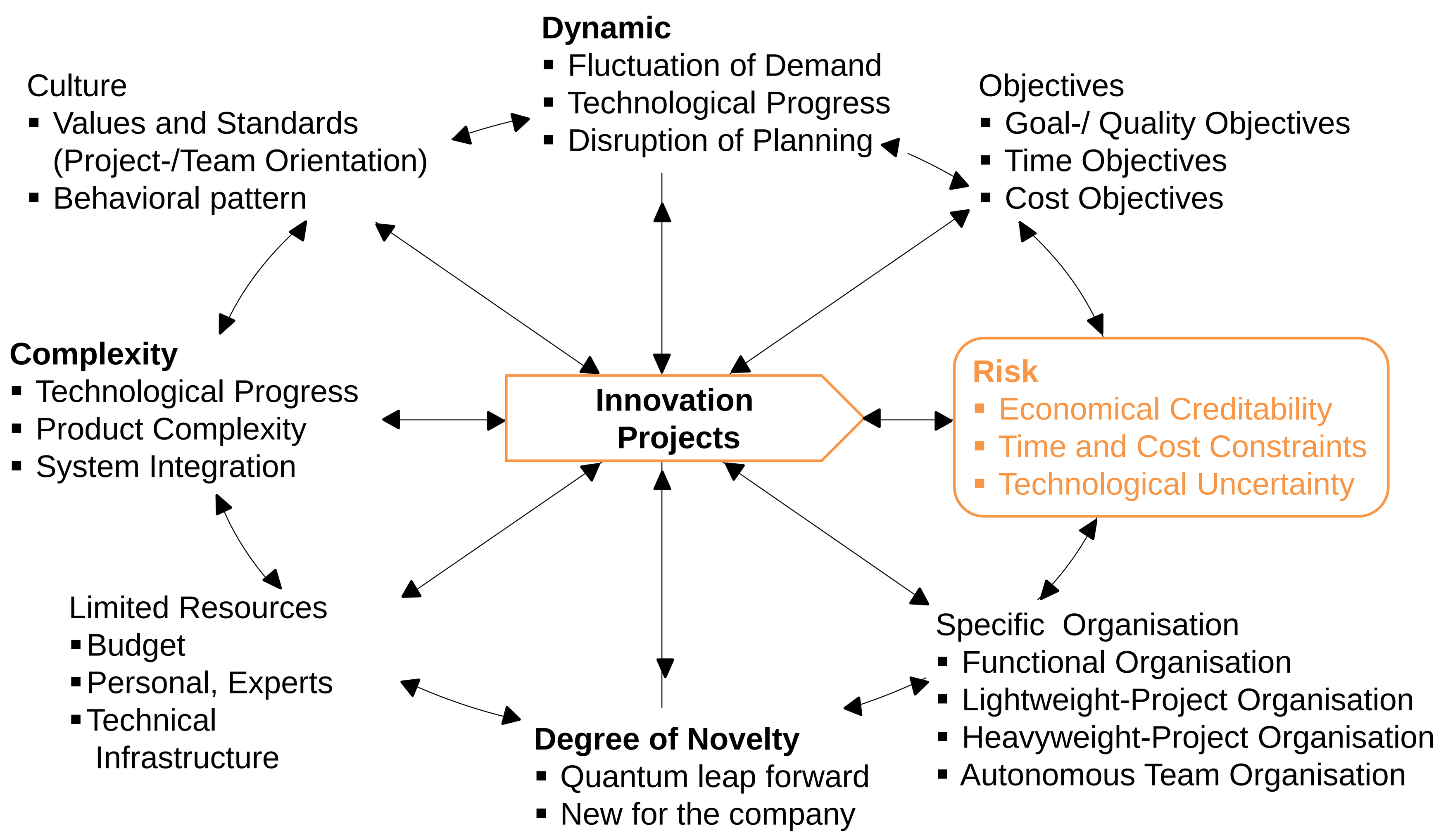
Abstract

For Today's companies innovation becomes the source of strategic differentiation or cost leadership. Within this challenging competition they are facing frequent changes in their environments, which significantly increase complexity in the management of innovation. Therefore, deviations from companies' innovation objectives, commonly known as innovation risks, are also increasing.
Risks arise from complex structures and are modelled in risk nets. Most managers are aware of the fact that risks could interact with each other; nevertheless, the "portfolio of innovation risks" are managed separately. This separation limits the understanding of the behavior of dynamics and interaction in risk nets.

Simulation methods based on statistics are already approved as an approach for risk analysis, where risks are identified, valued and aggregated. The limitations of these simulations methods can be overcome using System Dynamics to gain new insights into the behavior of risk nets and their future development.
In the current research project cause-and-effect relations and the dynamics of innovation risks are investigated in the German machinery and plant engineering industry. With the support of the German Engineering Association and leading companies in the industry, this research will demonstrate the potential of System Dynamics for a holist holistic risk assessment of Innovation risk.

1. Isolated Perspective on Interconnected Innovation Risks



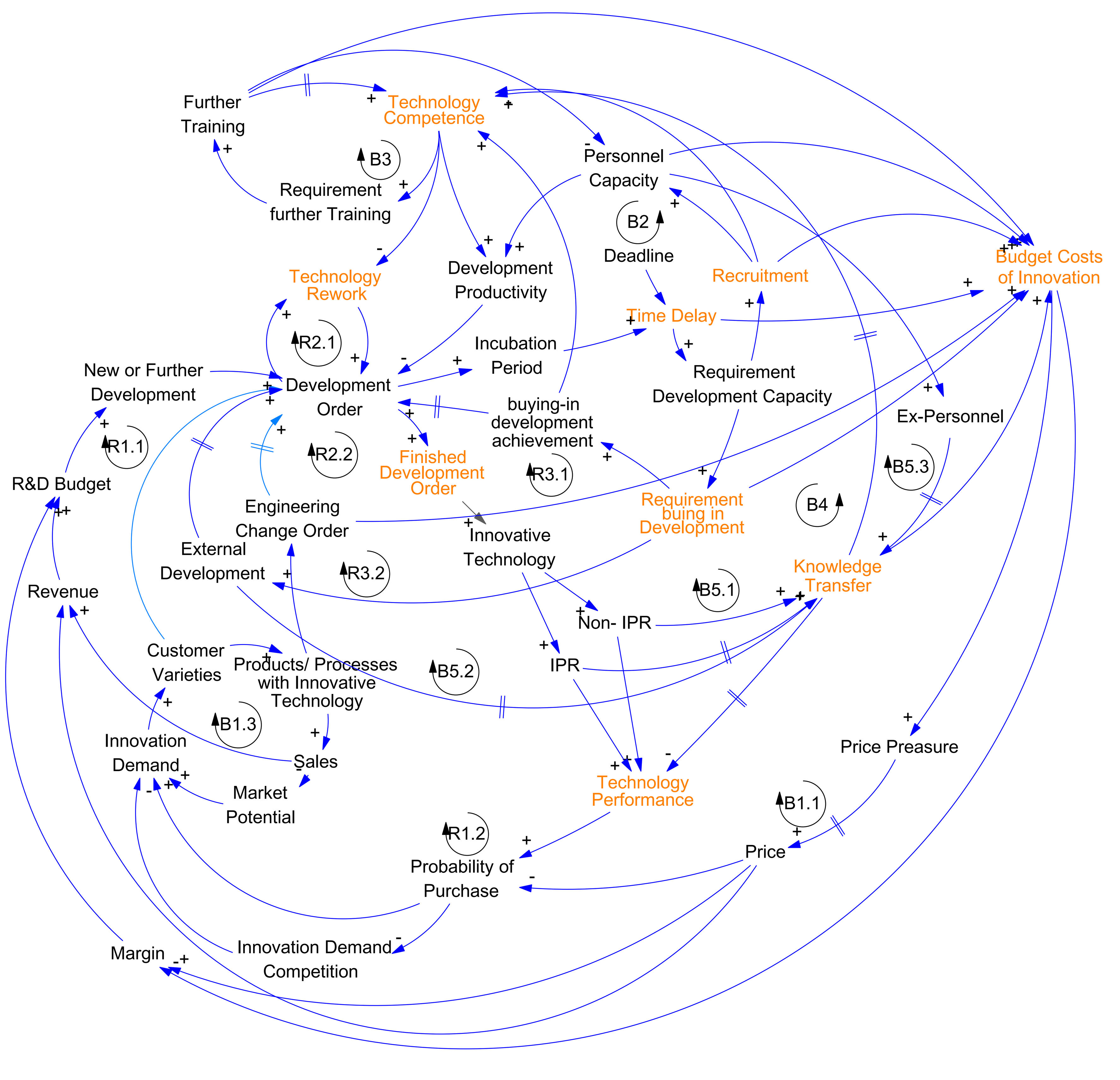
2. Limitations on Risk Handling of Common Methodical Approaches

Approach	Dynamic	+ Complicacy	= Complexity
Ishikawa Diagramm	Statically	Comprehensive amount of risks and relations	Average
Risk- Check Lists	Statically	Comprehensive amount of risks	Average
Scenario Analyses (Worst-Case/ Best-Case)	At this stage	Limited amount of scenarios	Low
Scenario Analyses (Sensitivity Analyses)	No cause effect connections	Comprehensive amount of scenarios	Average
Gaussian bell curve	Gaussian distribution	Comprehensive amount of risks	Average
Portfolio Analysis	Limited Dynamic and " at this stage view"	cause effect connections / Feedback	Low
Stochastic	Limited data analysis	Comprehensive amount of risks	Average
Monte-Carlo-Simulation	Random walk	Comprehensive amount of manifestations	Average
…			
System Dynamics	✓	✓	✓

3. Modelling Innovation Risks with Standard Structures

Potential Standard Structures & Selected Structures (bold)	Feedback Loops Industry	Risk Factors
1. Technology Leadership **Maier (1998);** Milling (1996) auf Basis von Bass (1969); Dillerup (1999); Milling (2002); Morecroft (2008); Warren (2008).	R1.1 R&D Policies R1.2 Competition B1.3 Market	Technology Performance
2. Price Competitiveness **Maier (1998); Bossel (2004);** Milling (2002).	B2 Pricing	Budget Costs of Innovation
3. Quality **Lyneis & Ford (2007); Rahmandada & Weiss (2009); Rahmandad & Hu (2010);** Ford & Sterman (1998); Lyneis et al. (2001); Love et al. (2002).	R3.1 Internal Rework Cycle R3.2 External Rework Cycle	Technology Rework Finished Development Order
4. Time for Development **Rodrigues & Williams (1998);** Lyneis et al. (2001); Love et al. (2002); Lyneis & Ford (2007); Richardson (2014).		Time Delay
5.1 Internal Capacity Expansion **Lyneis & Ford (2007);** Rodrigues & Bowers (1996); Ford & Sterman (1998); Rodrigues & Williams (1998); McGray & Clark (1999); Lyneis et al. (2001); Morecroft (2008).	R5.1 Internal Capacity Expansion	Recruitment
5.2 External Capacity Expansion **Ford & Sterman (1998)**	R5.2 External Acquisition R5.3 External R&D Placing	Requirement buying in Development
6. Technical Qualification **McGray & Clark (1999); Lyneis & Ford (2007); Warren (2008);** Lyneis et al. (2001); Rodrigues & Williams (1998).	B6.1 Internal Acquisition of Knowledge B6.2 External Acquisition of Knowledge	Technology Competence
7. Knowledge Transfer **Georgantzas & Katsamakas (2008); Warren (2008);** McGray & Clark (1999); Luna-Reyes et al. (2008); Rahmandada & Weiss (2009).	B7.1 Knowledge Drain Reverse Engineering B7.2 Knowledge Drain External B7.3 Knowledge Drain Internal	Knowledge Transfer

Innovation-Risk-Net for the Machinery and Plant Engineering



Cooperation Partners

Cooperation Science	Cooperation Experts	Cooperation Real Case	Consulting Cooperation
Steinbeis-Hochschule Berlin SHB; ZfBU GmbH Zentrum für Betriebswirtschaft und Unternehmensführung; Deutsche Gesellschaft für System Dynamics e.V.; Universität Stuttgart; HHN Hochschule Heilbronn	EY Building a better working world; FutureValue Group	SALMEN … for your success!; SCHUNK; GEMÜ; DIEFFENBACHER	VDMA Risk Management Council & Internal Revision German Engineering Association

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