Option Based Risk Management

Information and Knowledge Management

Exercise 29.01.2021

Team 22

Eva
Schleicher

Elisa
Rodepeter

Diana
Pop

Michael
Ruth

Tim
Zickenrott

Content

- Real Options Theory
- Option-Based Risk Management (OBRiM)
- Risk Management Process
- Benefit of OBRiM for the Business Value of IT

Real Options Theory

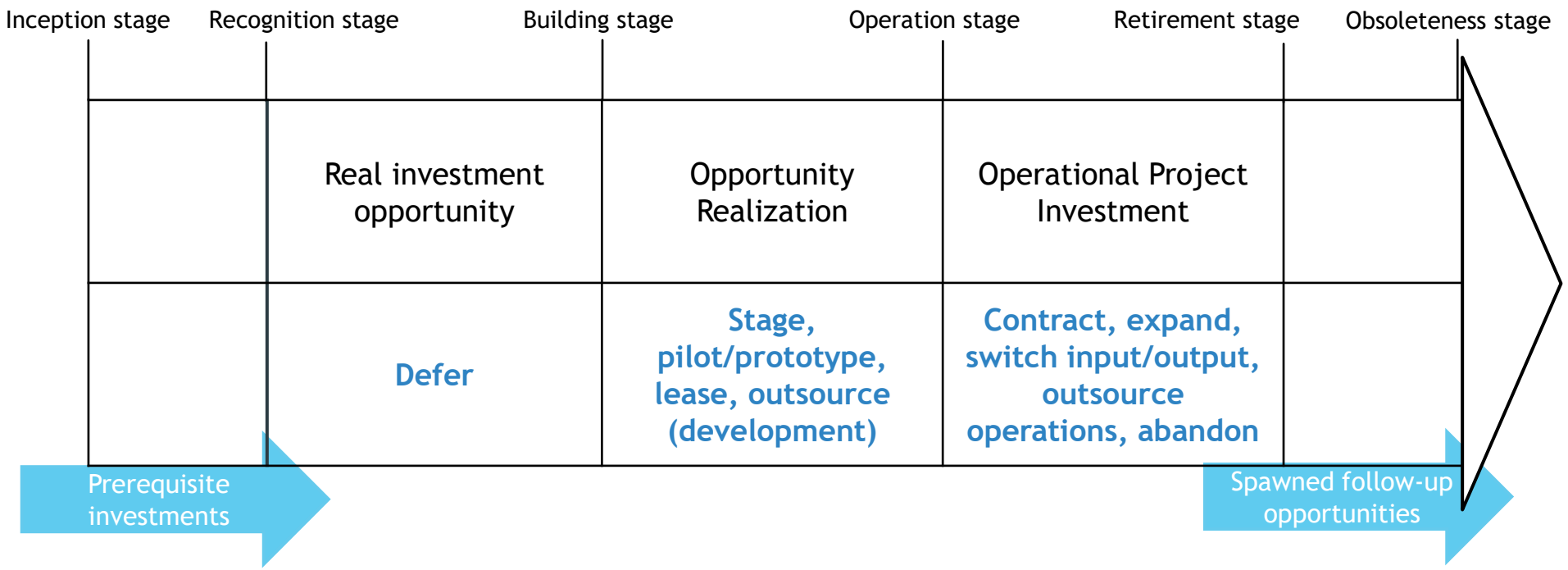
- Managers want to maximize value while taking underlying risks into account in information technology investments decisions
- Managerial flexibility allows for rational, value-adding actions to affect traits of the investment, e.g., timing or scope
  - Which risk countermeasures are optimal for a specific IT investment or even adding value from an economic perspective?
  - Need guidance on how to plan, design and create options to structure an investment in a way that maximizes its value

Real Options Theory

- **Real Option**: right, but not obligation, to make a business decision, typically a capital investment
  → capture value of managerial flexibility
- Conceptualizing and valuing different forms of flexibility as real options when deciding on IT investments
- Based on ideas of **financial risk management**
  → design positions that protect against losses/generate profits from exploiting, well-defined risks specific to each investment
  - Put and Call options on financial markets
    Put: Right to buy an asset for an agreed upon price at a fixed date;
    Call: Right to sell asset for an agreed upon price at a fixed date
- **Risk**: downward or upward variation in outcomes
- **Risk management**: proactive process to skew variation in expected outcomes in a favorable manner

→ Options are not inherent to investment but must be **planned** and defined for each investment to **add value and control risks**

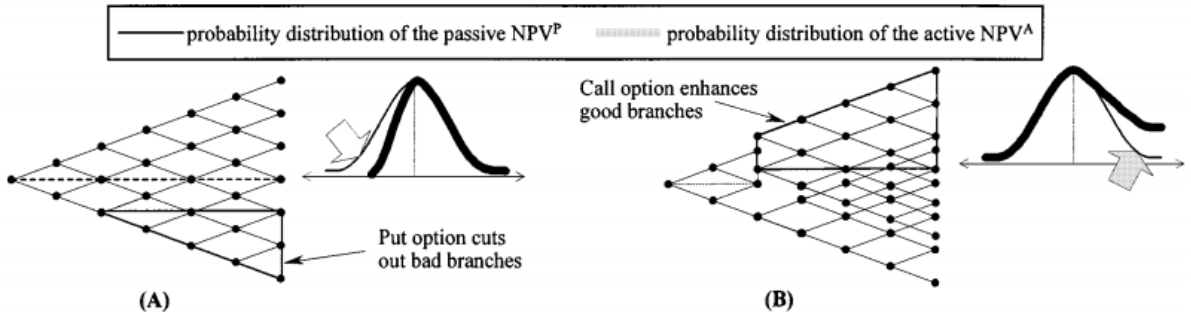
- Depending on investment stage: different real options can be embedded



Option Based Risk Management (OBRiM)

- **Real options as high-level risk mitigation strategies** to determine what forms of, and how much, flexibility to build into an investment to deploy corrective actions
- Goal: find **most cost-effective combination of real options** to embed in an IT investment to optimally control risk and maximize investment value
- OBRiM provides a set of risk-option mappings to facilitate the choice of which options to embed
- Use real option models to find economically superior choice in case of multiple available options

$NPV^A = NPV^P$ + value of managerial flexibility due to embedded options



- Most options: Put
- Only expansion is Call

Benaroch, M. (2001)

Step 1: Define Investment and Risk Profile

- Define investment's goals, requirements and assumptions
- Identify risks the project is exposed to

Step 2: Recognize Shadow Embedded Options and Find Alternative Ways to Structure Investment

- Map risks to shadow options that can control them
- Find different combinations of recognized options

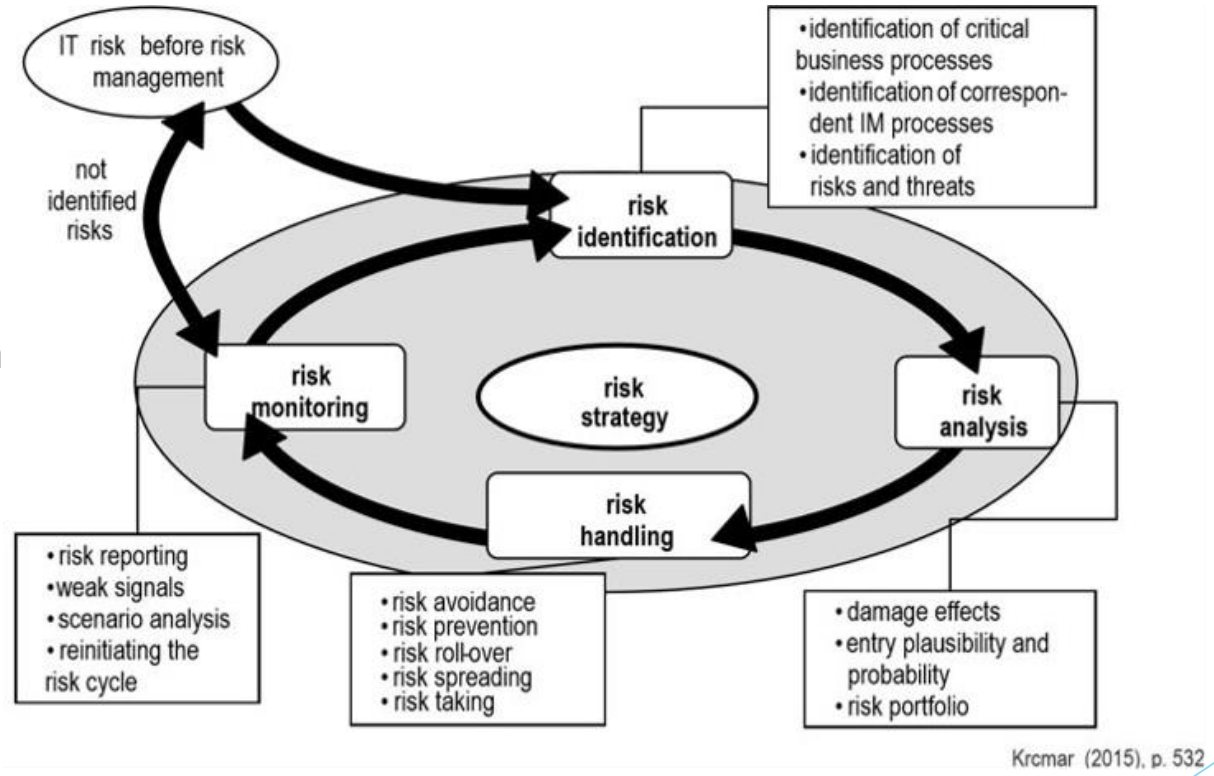
Step 3: Evaluate Combination of Options to Find Most Valuable Investment Structuring Alternative

- Assess tradeoffs and interactions between options, as well as costs
- Log-transformed binomial method for simple and intuitive evaluation of alternatives

Active NPV^A of the investment maximized

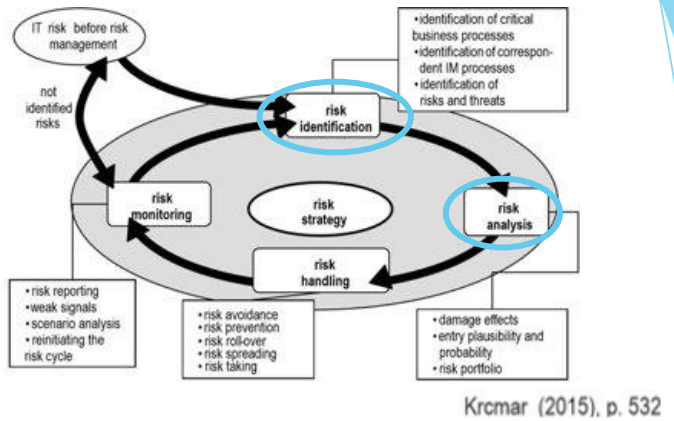
Risk Management Process of an Irish financial service organization (IFSO)

- Basic process:
  - New IT projects need to be submitted to the project investment department (PID) in form of a business case
  - PID decides whether projects are implemented



Krcmar (2015), p. 532

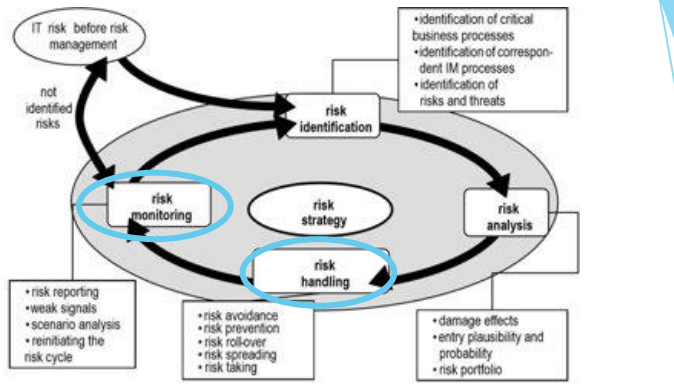
Risk Identification and Risk Analysis



Krcmar (2015), p. 532

- **Risk identification**
  - 47 question instrument was designed by an external consultant
  - Risks listed here are similar to risks found in related literature, e.g. architecture aligned = stability of technical architecture (Schmidt et al., 2001)
  - Questions indicate no magnitude of loss
- **Risk analysis**
  - Business case submitted to the PID needs to include the 47 question instrument
  - Evaluate the likelihood of occurrence for each risk on a scale from 1 to 10

Risk Handling and Risk Monitoring

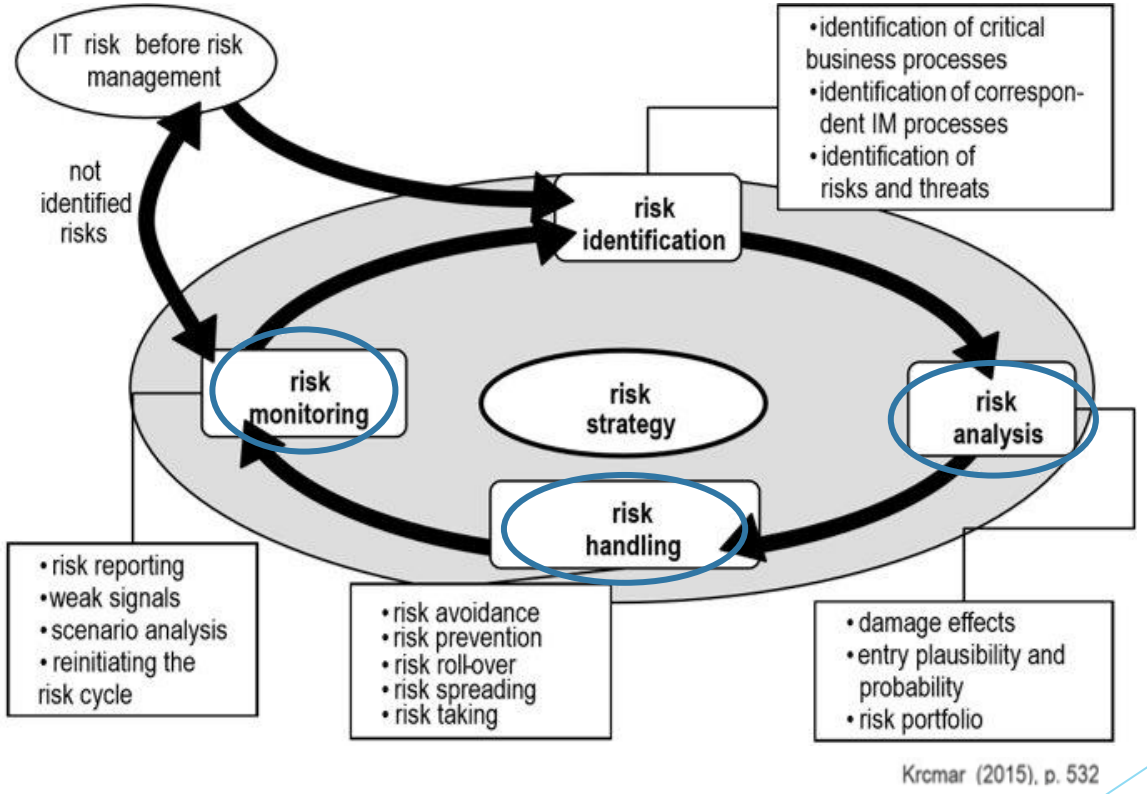


Krcmar (2015), p. 532

- **Risk handling**
  - Business case already needs to include proper mitigation (also integrated in question 35 & 39)
    - Risk prevention, e.g. trough extra training of employees, or trough extra testing/ piloting, risk roll-over e.g. trough strong contract penalties with supplier
  - Includes planned mitigation (according to the risk management plan) but also reactive risk handling
- **Risk monitoring**
  - Projects' progress and status was reported periodically to PID management (milestone reviews).

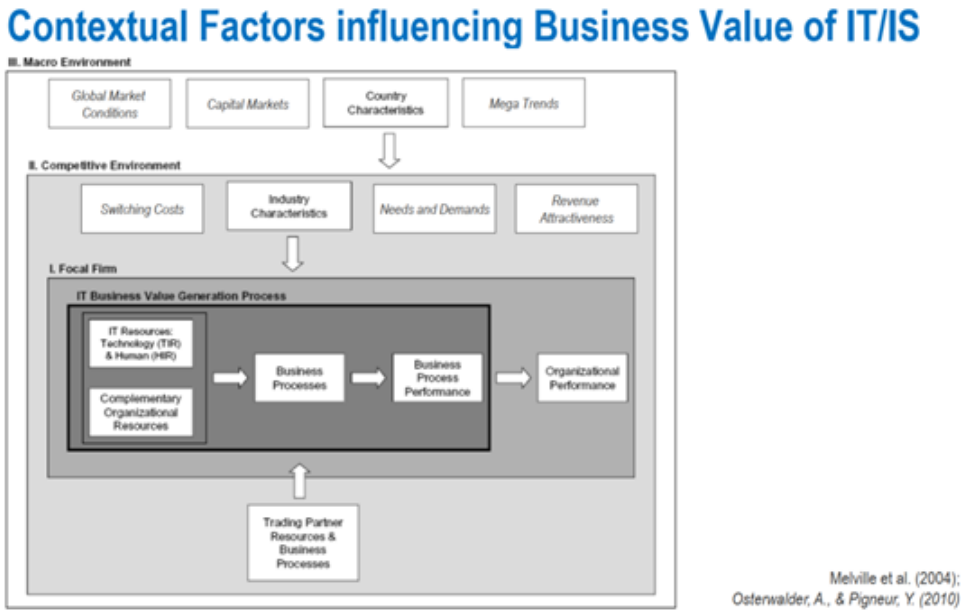
Including OBRiM in the Risk Management Process

- Risk Mitigation measures can be mapped to real options
- OBRiM can then be included in all steps of the risk management process but in the step of risk identification
- Project related risks need to be identified before identifying real options to mitigate them



Benefit of OBRiM for the business value of IT

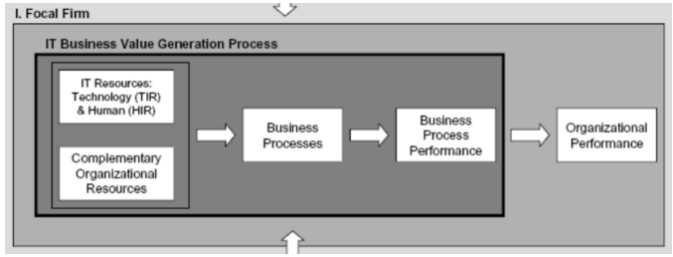
- What influences the business value of IT?



Melville et al. (2004);
Osterwalder, A., & Pigneur, Y. (2010)

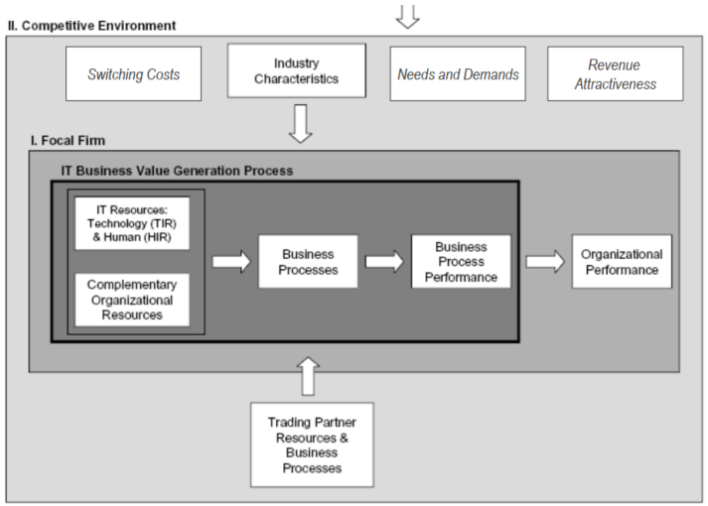
- **Risk factors** are also contextual factors
- OBRiM suggests particular **options** for different risk factors

Benefit of OBRiM for the business value of IT



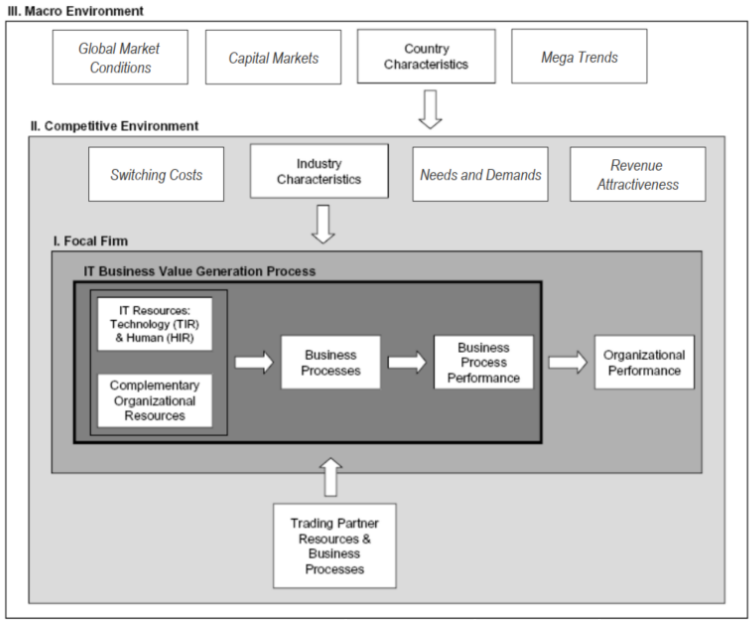
Option / Risk factor	Defer	Pilot	Prototype	Incremental development	Abandon	Contract	Outsource development	Lease	Expand
Application may be infeasible with the technology considered, or the technology is immature	+		+	+	+		+	+	
The introduction of a new, superior implementation technology may render the application obsolete	+				+			+	
Staff lacks needed skills and experience	+		+	+			+		
Parties slow to adopt the application		+		+	+	+		+	
Uncooperative internal parties	+	+		+	+			+	

Benefit of OBRiM for the business value of IT



Option / Risk factor	Defer	Pilot	Prototype	Incremental development	Abandon	Contract	Outsource development	Lease	Expand
Competition's response eliminates the firm's advantage	+	+			+	+		+	
Demand exceeds expectations	+	+							+
Low customer/supplier/partner demand/adoption/usage	+	+		+	+	+		+	

Benefit of OBRiM for the business value of IT



Melville et al. (2004);
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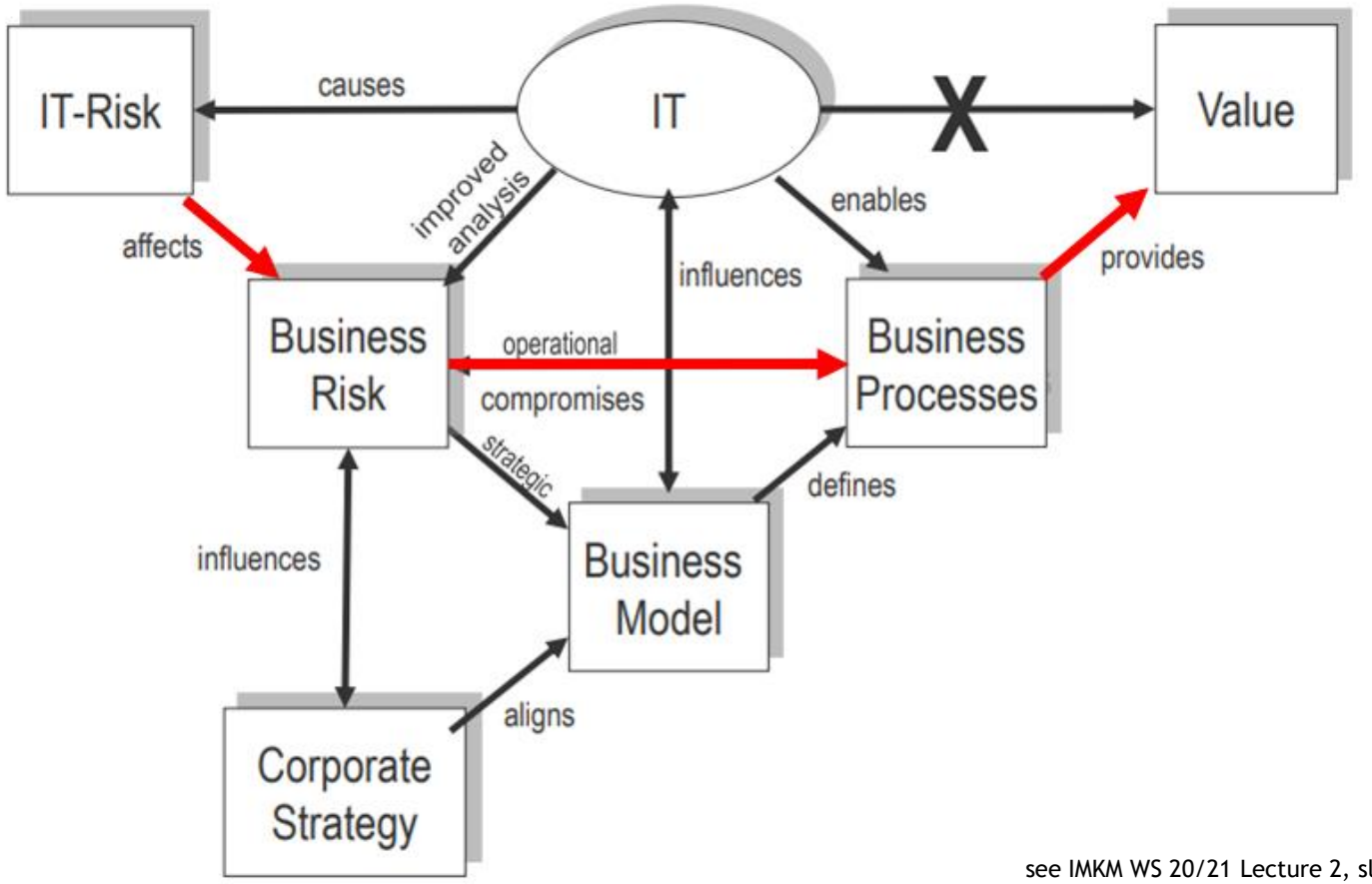
Option / Risk factor	Defer	Pilot	Prototype	Incremental development	Abandon	Contract	Outsource development	Lease	Expand
Unanticipated action of regulatory bodies	+				+			+	

Benefit of OBRiM for the business value of IT



see IMKM WS 20/21 Lecture 2, slide 13

How to apply OBRiM – An Example

- IT Project
  - Risk of low adoption by customers

	Profit				
	Year 1	Year 2	Year 3	Year 4	Year 5
50%	20	20	20	20	20
50%	40	40	40	40	40

  - Initial capital requirements: MU 150, financed with loan with interest rate of 2%

$$NPV = -8{,}60 = -150 + \frac{0{,}5 * 40 + 0{,}5 * 20}{1{,}02} + \frac{0{,}5 * 40 + 0{,}5 * 20}{1{,}02^2} + \frac{0{,}5 * 40 + 0{,}5 * 20}{1{,}02^3} + \frac{0{,}5 * 40 + 0{,}5 * 20}{1{,}02^4} + \frac{0{,}5 * 40 + 0{,}5 * 20}{1{,}02^5}$$

How to apply OBRiM – An Example

- Option 1 – Pilot:
  - Additional cost of MU 10

	Profit				
	Year 1	Year 2	Year 3	Year 4	Year 5
20%	20	20	20	20	20
80%	40	40	40	40	40

$$NPV = 9{,}68 = -160 + \frac{0{,}8 * 40 + 0{,}2 * 20}{1{,}02} + \frac{0{,}8 * 40 + 0{,}2 * 20}{1{,}02^2} + \frac{0{,}8 * 40 + 0{,}2 * 20}{1{,}02^3} + \frac{0{,}8 * 40 + 0{,}2 * 20}{1{,}02^4} + \frac{0{,}8 * 40 + 0{,}2 * 20}{1{,}02^5}$$

- Option 2 – Contract:
  - Additional cost of MU 25

	Profit				
	Year 1	Year 2	Year 3	Year 4	Year 5
10%	20	20	20	20	20
90%	40	40	40	40	40

$$NPV = 4{,}11 = -175 + \frac{0{,}9 * 40 + 0{,}1 * 20}{1{,}02} + \frac{0{,}9 * 40 + 0{,}1 * 20}{1{,}02^2} + \frac{0{,}9 * 40 + 0{,}1 * 20}{1{,}02^3} + \frac{0{,}9 * 40 + 0{,}1 * 20}{1{,}02^4} + \frac{0{,}9 * 40 + 0{,}1 * 20}{1{,}02^5}$$

Discussion questions

- *Which limitations of the OBRiM (Option-Based Risk Management) fra*mework *do you see?*
- *What is a possible advantage of OBRiM over ROT (real options theory)?*
- *If you were a manager dealing with IT investment risks, would you consider OBRiM a useful tool? Why (not)?*

Discussion questions

- *Which limitations of the OBRiM framework do you see?*
- Observations by Benaroch et al. (2006):
  - **Cannot account for all types of risk mitigations**
    - Some mitigations don't correspond to any type of option
    - Thus, cannot be modeled within OBRiM framework
  - **Practitioners show difficulties in applying real option concepts**
    - OBRiM cannot work efficiently in this context
  - **Recommendations**
    - Better training of IT personnel in financial concepts
    - Developing a simplified version of the model + methodological aids (e.g. implementing the mechanics of OBRiM in decision support tools)

Discussion questions

- *What is a possible advantage of OBRiM over ROT?*
  - OBRiM offers a **formalization of the ROT-framework** in the context of IT risk management
    - concrete suggestions based on specific risks
  - Benaroch et al. (2006) found that experienced managers who make decisions based on intuition end up untertaking the options that would have been suggested by OBRiM too
    - OBRiM offers explicit knowledge that is in line with managers' tacit knowledge

Discussion questions

- *If you were a manager dealing with IT investment risks, would you consider OBRiM a useful tool? Why (not)?*
  - It depends.
    - If I would not have much experience in a certain situation, OBRiM could be a **good first indication of the viable options**. So yes, it would be a useful tool in this case.
    - If I would have a lot of experience regarding a given project, intuition might reveal the best option. In this case, OBRiM could also be useful as a **check-up to critically assess the option** I chose based on intuition.
    - But if OBRiM suggests an option which makes no sense in a certain context and which goes against years of experience, then it would not be a useful tool.
  - As always, frameworks are just helping tools, not oracles of absolute truth.

References

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- IMKM WS 20/21 - Lecture 2, slide 13.