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"Mechanisms and Success Factors in Technology Acquisitions Processes"

A Pragmatic View to Acquisition of Innovative Technology

Rainer Hasenauer
Marketing Management Institute
Research Group High Tech Marketing
Wirtschaftsuniversität Wien
http://www.wu.ac.at/mm/team/hasenauer
www.hitechcentrum.eu
www.hitec.at

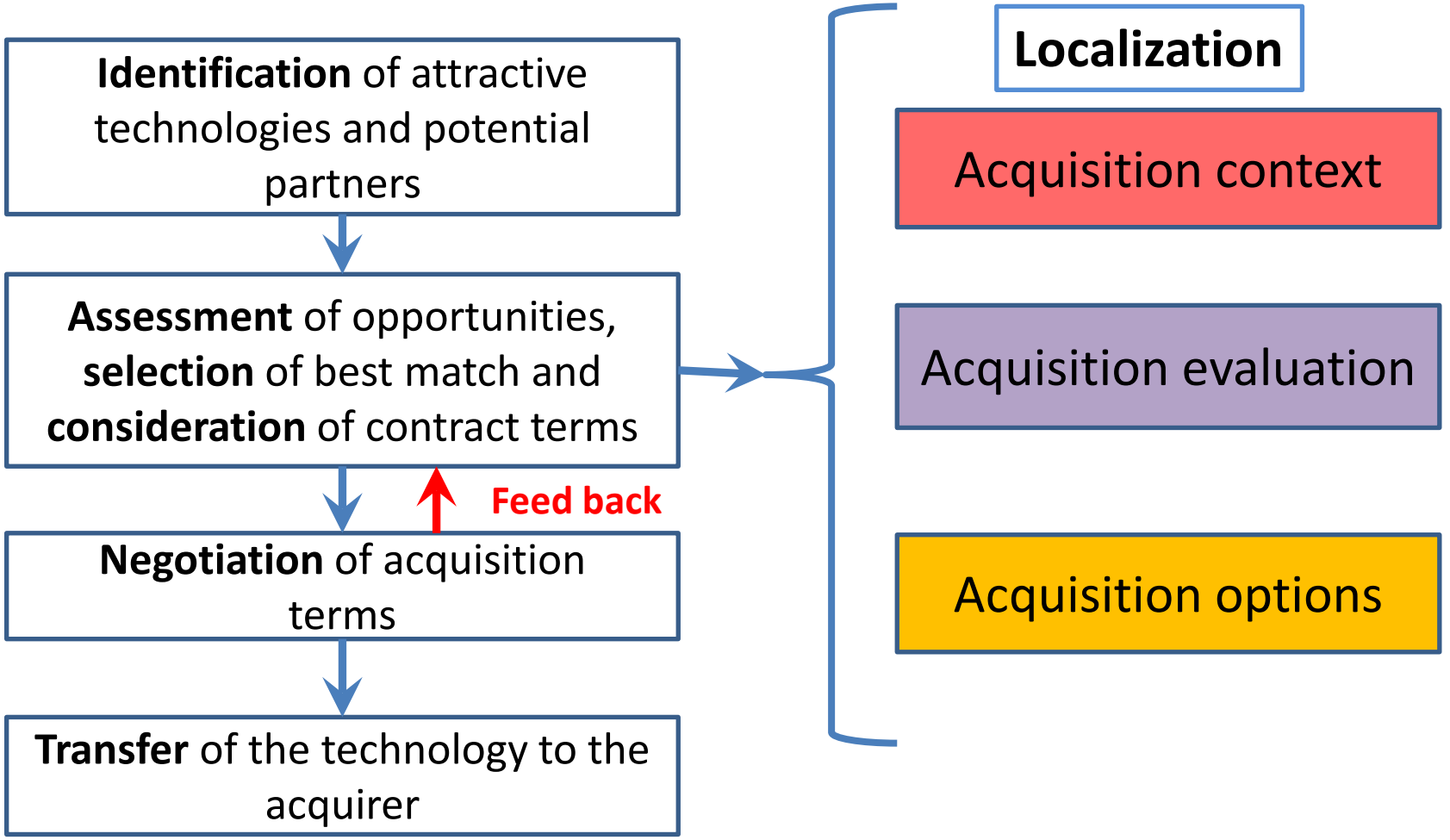
A Pragmatic View to Acquisition of Innovative Technology

1. Initial environment and preconditions
2. The Search for Opportunities
3. Candidate Set and Compliance to the Acquirer
4. Selection Criteria
5. Absorptive Capacity
6. Success Factors / Rejection Factors
7. Lessons Learnt

1. Starting Point and preconditions

- This key note focuses on acquisition of innovative technology and success factors of related decisions for SME.
- Absorptive capacity is key!
- We rely on the coherence of Technology Readiness Level (TRL) and Market Readiness Level (MRL) as an approach of early risk detection and successful market entry.
- We will show empirical results of 26 different technology products for 2012 to 2015.

Technology Acquisition Process [1])



[1] Letizia Mortara, Simon Ford: "Technology Acquisition: A guided approach to technology acquisition and protection decisions", Institute of Manufacturing ,Univ. of Cambridge 2012 , p5

2. The Search Strategy for Opportunities

- **Search motivation**:
  To overcome the limits of the actual technology in use. To proactively improve competitive position.
- **Search Task / Search Question**
  Search goal, search constraints (time, resources),

  Example: 3D printer with 40µ accuracy
- **Information sources** for search navigation
  www, Fairs, Conferences, Experts, formal mutual Information exchange, Customers, Suppliers
- **Search quality:** related to information source quality
- **Search economy:** search benefit vs. search risk

3. Candidate Set and Compliance to the Acquirer's objectives

Successful search is transformation of **nescience (non-knowledge)** into **proved knowledge.**

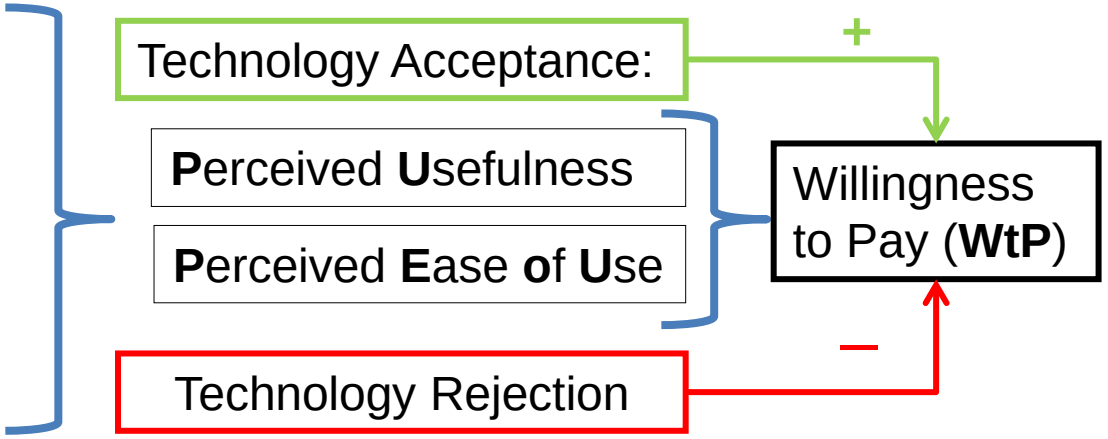
Acquirer's activities:

- Set up and involve **B**uying **C**enter (**BC**) in acquisition process
- Identify long list of technology candidates **T**(X,Y,Z)
- Check compliance to **M**arketability **C**riteria [**MC**;**T**]
- Evaluate technology acceptance (PU / PEoU)[1]) [6]
- Check coherence between TRL and MRL [2]) [3]
- Evaluate risk of assimilation gap
- Evaluate willingness to pay by capital budgeting

1) PU: Perceived Usefulness, PEoU : Perceived Ease of Use
2) TRL: Technology Readiness Level; MRL Market Readiness Level

Criteria of High-Tech Innovation Marketability and Technology Acceptance / Rejection

(MC 1.) Innovativeness
(MC 2.) Testability
(MC 3.) Controllability
(MC 4.) Compatibility
(MC 5.) Implementability
(MC 6.) Assimilability[1])



- Cross-functionality is a proven economic success factor in high-tech innovation and implies communication between multiple knowledge disciplines
- The buying and selling center are represented by a **multidisciplinary** buying (acquirer) respectively selling team (supplier)

[1]) Assimilation Gap is significant => Rejection of Innovation

4. Empirical findings

26 Examples of innovative Technologies before Market Entry[3])

Example of classifying 26 innovative technology projects by coherence between Technology Readiness & Market Readiness and risk evaluation

[3] Rainer Hasenauer, et.alt.: “Managing Technology Push through Marketing Testbeds: The Case of the Hi-Tech Center in Vienna, Austria” in: “MANAGEMENT OF THE TECHNOLOGY AGE” Proceedings of PICMET 2015, IEEE Catalog Number: CFP15766-USB, PICMET ISBN USB: 978-1-890843-32-8, edited by Dundar F. Kocaoglu, pp. 99 - 127

Technology Push/Market Entry Projects

(2013-2014)

ID	Innovation	Entry	Industry
A	Gesture controlled mmi	2014	scanner
B	Technical simulation	2014	software
C	Atmospheric nitrogen deposition collector	2014	sensor
D	Aerosol jet-printing	2014	3d printing
E	Selective Laser Melting	2014	3d printing
F	Sensors for mobile robots	2014	sensor
G	Health CCPM	2013	robotics
H	Safety Robot	2013	robotics
I	Atmospheric plasma for wood surface energy	2013	material science
J	Phase change material	2013	building construction
K	Flame retardant rubber	2013	material science
L	Magic lens augmented reality	2013	software
M	Bone diagnostics	2013	medical diagnosis

Technology Push/Market Entry Projects
(2011-2012)

ID	***Innovation***	***Entry***	***Industry***
N	Continuous Non-Invasive Blood-Pressure Measurement	2012	medical diagnosis
O	'Watch dog' for semiconductor	2012	software
P	Containment	2012	building construction
R	Lab on chip diagnostics	2012	software
S	Vibrational acoustic analysis	2012	medical diagnosis
T	Smart bottling plant	2011	machine construction
U	Bright red systems	2011	scanner
V	mmi pressure and temperature sensors	2011	sensor
W	Bionic surface	2011	material science
X	Cellular materials	2011	material science
Y	V-REDOX	2011	energy storage
Z	Diamond-like carbon	2011	material science

Readiness of 26 Technology Push Projects

Market Readiness	Demand Level	1 Fundamental research	2 Applied Research	3 Research to prove feasibility	4 Laboratory Demon-stration	5 Technology Development	6 whole system Field demon-stration	7 Industrial Prototype	Product Industrial-isation	Market / Sales Certification
Building the adapted answer to the expressed need in the market	9						L;		H;	
Identification of the Experts possessing the competencies	8					Q;U;	B;		J;K;	Y;
Definition of the necessary and sufficient competencies and resources	7									
Translation of the expected functionalities into needed capabilities to build the response	6					O;	M;T;	P;		
Identification of system capabilities	5				Z;	A;				
Quantification of expected functionalities	4		W;		F;V;	R;	N;	E;		
Identification of the expected functionalities for new product/service	3			S;	X;	C;	G;	D;		
Identification of specific need	2		I;							
Occurence of feeling "something is missing"	1									
	Technology Level									

Technology Risk

Market Risk

Industry	
Software	B;L;O;R
Sensor:	C;F;W
Material	I;K;W;X;Z
med. diagnosis	M;N;S
Scanner	A;U
Robotics	G;H
3D print	D;E
building constr.	J;P
wearables, location services	Q;Y
machine	T

Red-not ready for market

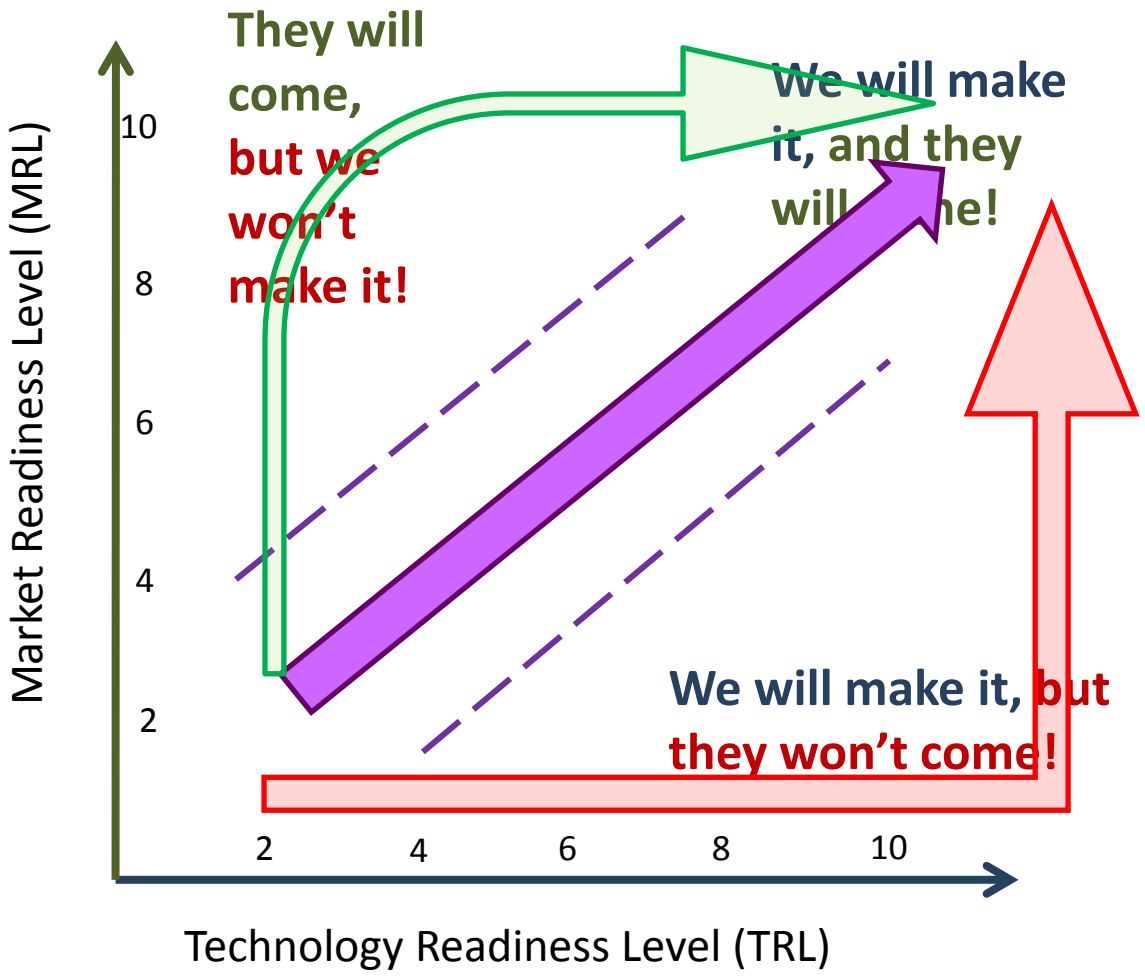
Yellow – Transition:

Green—Ready for market

Off diagonal = risk

Technology management = stay on diagonal!

Stay on the Diagonal!
This is valid also for the acquirer!

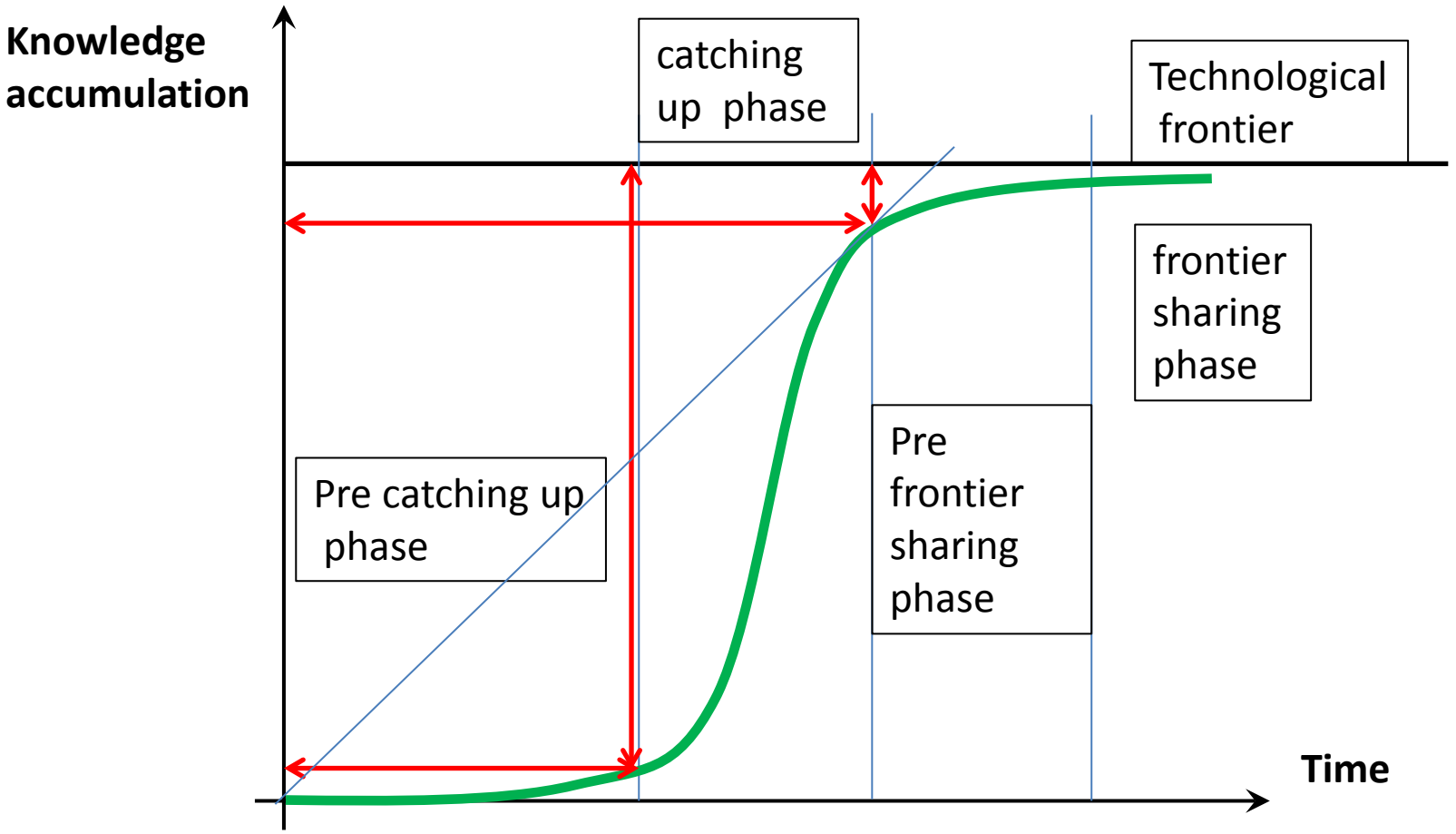


- Concurrent, step-by-step market and technology development places the right product into the right market window at the right time.

5. Absorptive capacity

- **Absorptive capacity**, the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. It's a function of the firms prior knowledge. (Cohen / Levinthal [7])
- The closer a country to the technological frontier the more growth depends on having **highly educated** workforce. (Nelson/Phelps 1966)
- The further back from the frontier the more count good **primary** and **secondary education.** ([4] Aghion/Howitt 2006).
- Main channels of advanced technology diffusion are **Trade Openness** and **FDI**. ([5] Yergali Dosmagambet, 2008, p17).
- **Education speeds the technology diffusion** and accelerates the catch up speed to the technological frontier, **hence narrowing the gap.**

Absorptive capacity[2])



[2] Rajneesh Narula, 2002, p.31

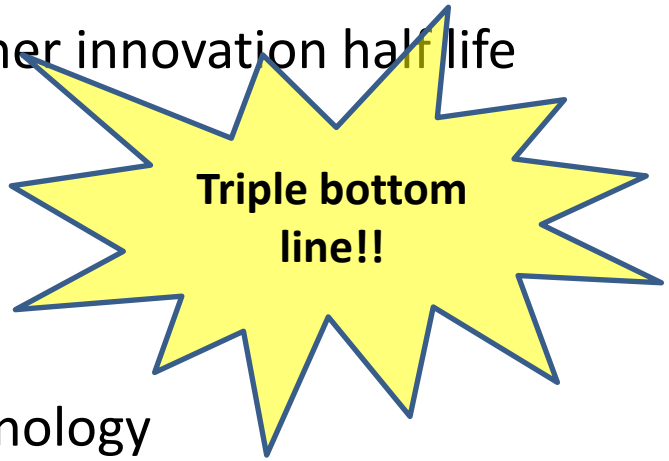
Behavioral patterns of catching up the technological frontier

Income status	Domestic source	Foreign source
Rich income highly educated	Domestic Technology base	Import capital goods
Medium income Good educated	Benefit from foreign imports of embedded technology	Used foreign patents and embodied technology in imported capital goods
Poor income	Benefit from foreign patents	Use foreign patents

FDI and collaborative ventures are highly efficient measures to speed catching up the technological frontier.

6. Success Factors: direct success (1)

- **Economic ratios**:
  - lower costs, higher productivity (Output/Input), higher profitability (RoS, RoI)
- **Technical ratios:**
  - higher availability, less breakdown time, increased stability of quality (MTBF higher, MTTR lower, % availability higher; σ(Qual) lower
- **Competitive ratios:**
  - increased **relative market share**, higher innovation half life
- **Social ratios:**
  - Improved labor conditions,
  - increased job variety
- **Environmental ratios:**
  - decreased footprint due to new technology



6. Success Factors: indirect success (2)

- Increased **technological competence** of workers by knowledge transfer
- **Complementary effects** of new technology to joint business processes and activities (lower set up time, shorter cycle time)
- **Motivational impulse** to apply newly gained knowledge to similar applications by internal R&D
- Increased **technological autonomy** by acquiring maintenance and repair knowledge
- **Develop business** by offering supportive technology service for the local market.

6. Success Factors: Negotiation (3)

- Put emphasis on contract design with supplier:
  - training of own staff + exams at suppliers site,
  - Factory acceptance test with own staff
  - Site acceptance test with own staff
  - Detailed documentation
  - Service level agreements and training
  - Joint application centered R&D agreement
  - Agreement on Reference Installation for local market

7. Lessons Learnt

- Acquirer's decision supported by Buying Center has to take into account the requirements of user, quality manager, purchasing manager, legal, risk and financial aspects.
- Technology supplier must bridge the gap between existing and required knowledge / skills to implement the acquired technology.
- Acquirer's absorptive capacity is key!
- Service / maintenance focused partnership is key.
- FDI, foreign trade liberalization and localized know how transfer services for sustainable partnership.

THANK YOU!

Q & A?

MAIL1: rainer.hasenauer@wu.ac.at
MAIL2: rh@hitec.at
SKYPE: rainer.hasenauer

References

[1] Letizia Mortara, Simon Ford: “Technology Acquisition: A guided approach to technology acquisition and protection decisions”, Institute of Manufacturing ,Univ. of Cambridge 2012 , p5

[2] Rajneesh Narula: Understanding Absorptive Capacities in an “Innovation Systems” Context: Consequences for Economic and Employment Growth, DRUID DANISH RESEARCH UNIT FOR INDUSTRIAL DYNAMICS Working Paper No 04-02 p.31

[3] Rainer Hasenauer, et.alt.: “Managing Technology Push through Marketing Testbeds: The Case of the Hi-Tech Center in Vienna, Austria” in: “MANAGEMENT OF THE TECHNOLOGY AGE” Proceedings of PICMET 2015, IEEE Catalog Number: CFP15766-USB, PICMET ISBN USB: 978-1-890843-32-8, edited by Dundar F. Kocaoglu, pp. 99 – 127

[4] Aghion, Philippe, and Peter Howitt. 2006. Appropriate growth policy: A unifying framework. Journal of the European Economic Association 4(2-3): 269-314.

[5] Yergali Dosmagambet. Technological Absorptive Capacity and Productivity Dynamics with a Special Reference to Kazakhstan. Humanities and Social Sciences. Universite d'Auvergne - Clermont-Ferrand I, 2008.

[6] “Community Based Innovation and Cross Industry Technology Acceptance” in Proceedings of the Conference 3. /4. Nov. 2009, Smolenice/SK “New trends in Marketing”, Trnava 2010, pp133-146

[7] Cohen, Wesley, M. & Levinthal, Daniel A. Absorptive Capacity: A New Perspective on Learning and Innovation, ASQ, 35 (1990), 128-152.