Teknologiasta liiketoimintaa

Tutkimuslähtöinen tuotekehitys teräsrakentamisessa –

Research-intensive product development in the steel construction

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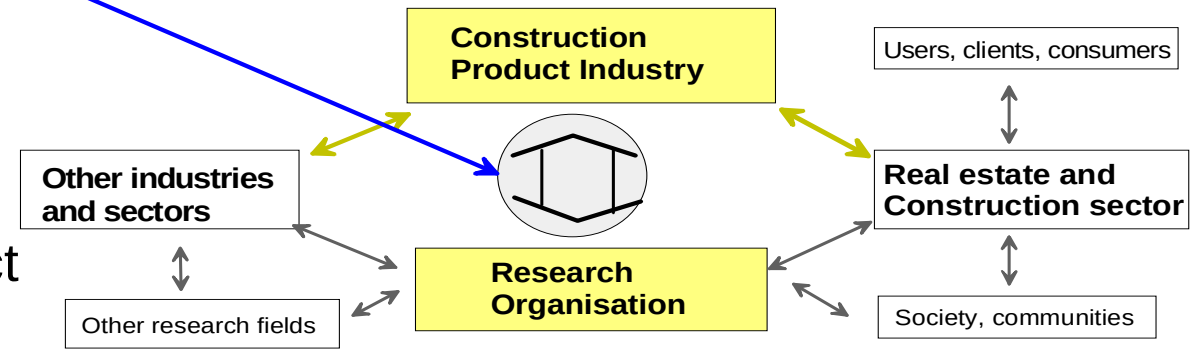
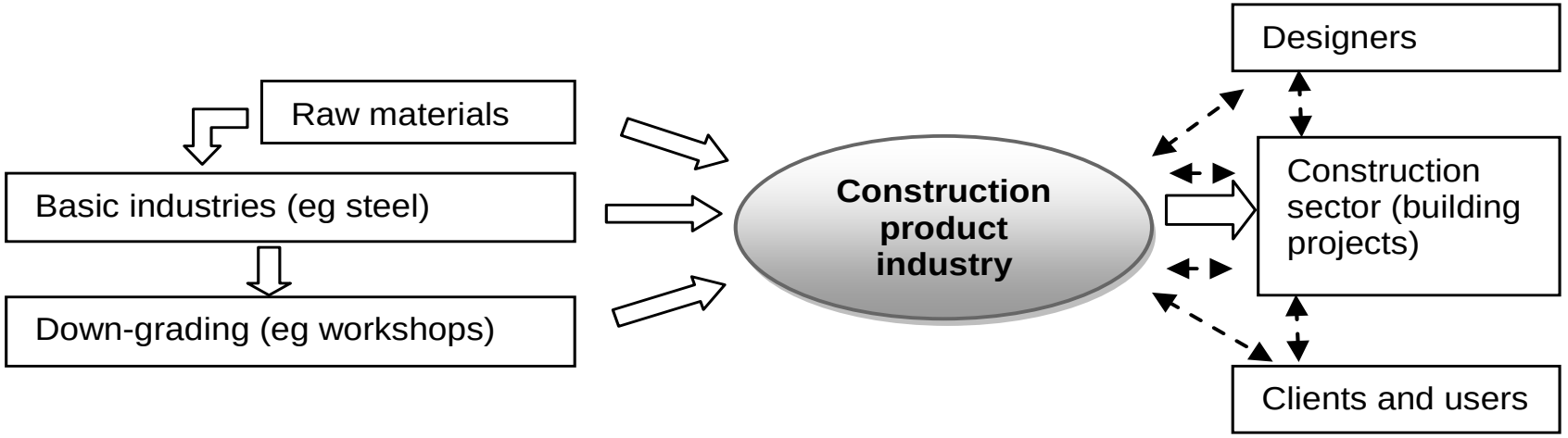
Content

- Scope and definition
- Research methods
- Findings about thin-gauge steel solutions
- Findings about sandwich panels
- Forms of co-operation
- Concluding remarks

- Scope: Forms of co-operation and content of knowledge interaction between the construction product industry and research organisations in product development and product innovation processes



- The construction product industry means here manufacturers who are in charge of CE marking and supply chains of manufacturers



Research methods

Cases - longitudinal

- Thin-gauge steel solutions
- Sandwich panels
- Composite floor structures
- Modular steel building
- Energy-efficient steel-framed building

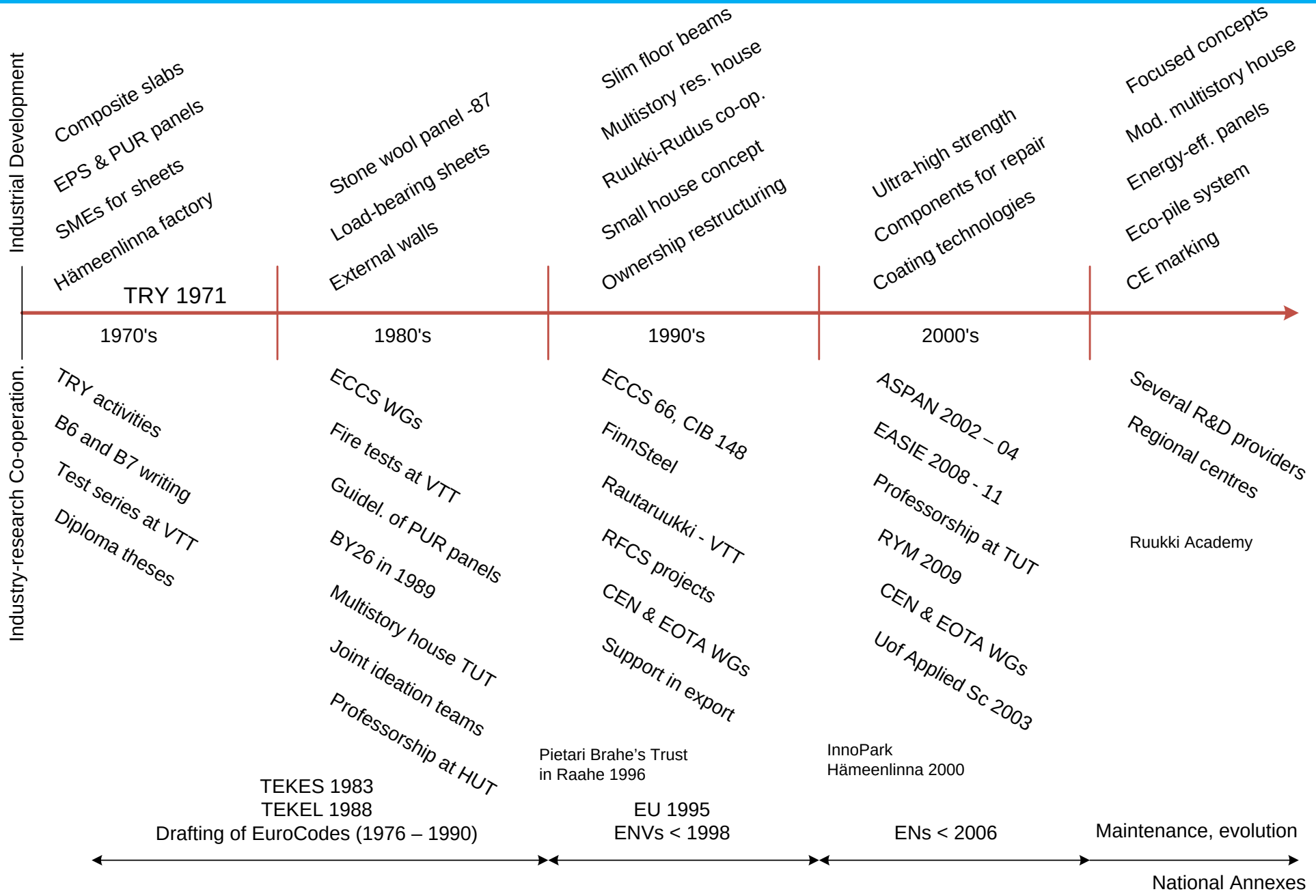
Interviews

- 16 interviews
- 10 in industry
- Non-directive and semi-structured types

Extensive literature survey

Time	*Phase of thin-gauge steel structures*	*Industry-research co-operation, examples*
< 1970	Steel used mainly in bridges **Non-load-bearing sheets**, eg in roofings	
1970s	Hämeenlinna factory in 1972 Several SME's for cold-forming High profiles **Sheets as load-bearing structures** – mostly in upper floors of industrial halls The Part B6 of the national Building Code 1976	Master theses in HUT (one in 1970, 1975, 1976 and 1978) Steel sheets, basic calculation formulae, resistances, continuous structures Preparation of national codes in 1973 – 1976, VTT's role in quality assurance Experimental test series at VTT; SMEs very active VTT Research Notes no 198 Nordic co-operation, harmonisation of test methods
1980s	**New types of load-bearing structures**: purlings, studs, use in external walls Components for external walls (export to Soviet Union boosted off-site technology)	Master theses at technical universities Contracted projects (TRY co-ordinating often); a larger project about research and product development; TRY's course about building with thin-gauge steel structures Fire tests at VTT, some in Sweden ECCS technical committees and working groups Professorship at HUT
1990s	Restructuring on the industry **Small building concepts** based on thin-gauge steel structures Thermal stud and components AWS to participating walls Honeycomp panels	1990 Rautaruukki Oy- VTT-programme agreement Tekes Technology Programme FinnSteel 1995-2000: joint R&D projects and product develpoment Structural and fire safety, acoustics, thermal performance, connections, gluing, service life design RFCS Programme open in 1995, joint projects Hämeenlinna
2000s	Production technology more automatic Refocus of Rautaruukki, space for SMEs Eurocode 3, national annexes	

Timing	*Phase of sandwich panels*	*Industry-research co-operation – examples*
1970s	**Panels with a polystyrene or polyurethane core** Several manufacturers, mostly SMEs Different phase materials were tried, especially with polystyrene. Export to Soviet Union	Master theses at HUT 1974, 1975, 1976, 1977 and three in 1979; some theses at TUT; industrial initiatives Contract work at TUT VTT Research Notes about sandwich panels with a polystyrene core Prof. Jumppanen to VTT
1980s	The Finnish Polyurethane Industry published design guidelines (folders) **Panel with a mineral wool core**; rapid growth of international markets - Structural wool for the core - Vacuum test method – also for quality - Gluing and manufacturing technology - Ageing properties and test method - Design methods	Co-operation in preparation of guidelines Voluntary quality assurance agreements – design values verified and controlled through continuous material and panel tests ECCS's Technical Working Group 7.4 (established in 1983) Close R-I communication in development of the new concept; VTT's expert moves to the company Fire tests at VTT HUT and TUT concerning ageing test National and Nordic type approvals
1990s	**ECCS No 66**, 1990 **CIB Publication 148**, 1992 More manufacturers of panels with mineral wool core in Finland and other countries Expansion of applications in use	Joint Committee of CIB and ECCS,: panels with a mineral wool core added; continuous joint efforts Several projects at HUT about continuous structures, connections and service life design design of fastenings of sandwich panels (ECCS 2009
2000s	ECCS Publication no 115 (a basis for the harmonised product standard) **Harmonised product standard** EN14509 for CE marking (in 2006, in force in 2010)	CIB and ECCS published updated versions of Recommendations in 2000 and 2001; about fastenings in 2009 Joint EU project ASPAN 2002-2004 (CEN contract) CEN TC128 for the harmonized product standard Large-scale EU co-operation project EASIE
2010s	CE Marking Thermal performance of panels and walls	Thermal simulation and modelling of buildings (HUT)


Industrial Development
Composite slabs
EPS & PUR panels
SMEs for sheets
Hämeenlinna factory
Stone wool panel -87
Load-bearing sheets
External walls
Slim floor beams
Multistory res. house
Ruukki-Rudus co-op.
Small house concept
Ownership restructuring
Ultra-high strength
Components for repair
Coating technologies
Focused concepts
Mod. multistory house
Energy-eff. panels
Eco-pile system
CE marking
TRY 1971
1970's
1980's
1990's
2000's
Industry-research Co-operation.
TRY activities
B6 and B7 writing
Test series at VTT
Diploma theses
ECCS WGs
Fire tests at VTT
Guidel. of PUR panels
BY26 in 1989
Multistory house TUT
Joint ideation teams
Professorship at HUT
ECCS 66, CIB 148
FinnSteel
Rautaruukki - VTT
RFCS projects
CEN & EOTA WGs
Support in export
ASPAN 2002 – 04
EASIE 2008 - 11
Professorship at TUT
RYM 2009
CEN & EOTA WGs
Uof Applied Sc 2003
Several R&D providers
Regional centres
Ruukki Academy
Pietari Brahe's Trust
in Raahe 1996
InnoPark
Hämeenlinna 2000
TEKES 1983
TEKEL 1988
Drafting of EuroCodes (1976 – 1990)
EU 1995
ENVs < 1998
ENs < 2006
Maintenance, evolution
National Annexes

Concluding remarks about co-operation

- In the emerging phase of steel construction, co-operation was vital for national design methods and creation of national knowledge assets
- Role of associations important in co-ordination
- Common networks in Nordic and European arenas

- Vital support of export based on product-specific information
- Vital in development of universal design methods and product verification procedures

- VTT's influential position has disappeared in last 15 years
- Nowadays, companies have individual knowledge assets
- Several R&D providers regionally, nationally and internationally
- A tight network of regional R&D co-ordination centres

Thanks

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- All the interviewees

- *For your kind attention*