

Innovation and Competitive Advantage - Examples of innovation in timber frame housing construction

Supplementary material for in-class discussion

Thomas Rimmler

Researcher - Finnish Forest Research Institute

Socrates/Erasmus IP Inno-Forest, 13 Sept. 2006, Zvolen, Slovakia

METLA

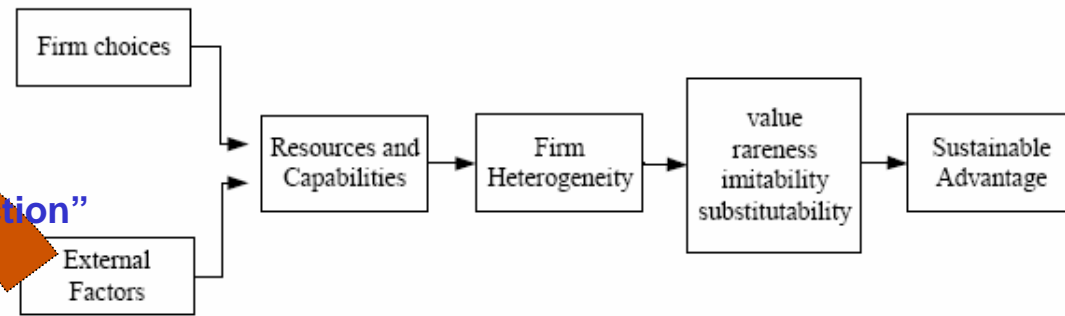
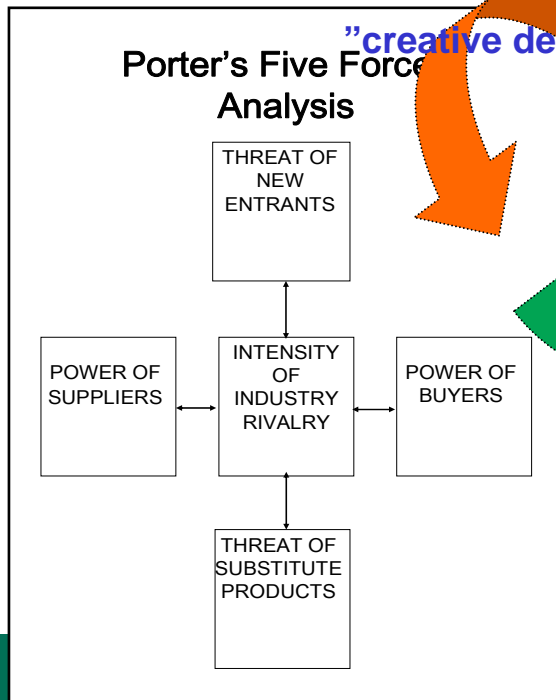
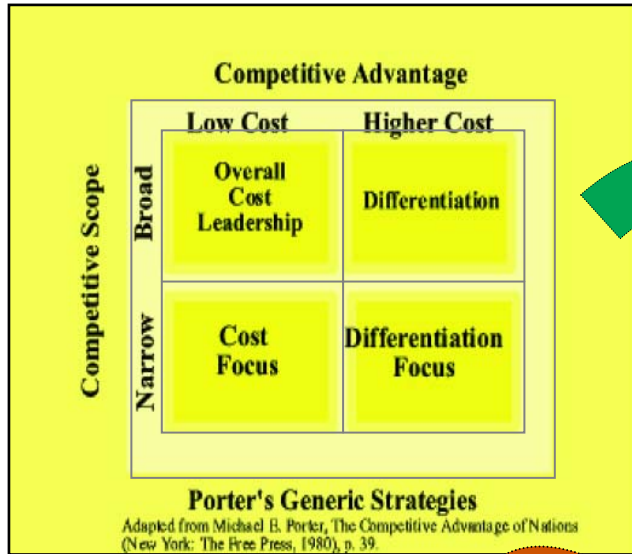
The timber frame construction value chain

Structural wood products

<p>Construction services (architectural design, structural engineering & contracting services to housing developers, construction companies or self-procuring builder-owners)</p>	
<p>Integrated timber construction system solutions Precut stick-frame systems, panelised systems, volumetric systems for timber-frame homes, high- / low-rise single- / multi-storey residential buildings</p>	
<p>Timber structures – System components: deliveries of subsystems, load-bearing frame structures: truss, subfloor & wall structures & elements, roofing, partition wall structures, eaves, exterior & interior wall coating, floor coating, windows, doors incl. casing, staircases, handrails, terraces</p>	
<p>Timber structure components glulam beams & pilars, I-joints, siding boards, rafters, mouldings, wood panels, tiles etc.</p>	
<p>Structural timber products</p>	
<p>Sawn timber products specially sawed (heartwood split), cut-to-customer lengths, stress graded, kiln heat treated, planed, surfaced, finger-jointed, moulded, preformed, preservation</p> <p>Standard sawn timber rough-cut, green dry, standard size</p>	<p>Engineered wood products plywood, particle board, fibreboard, LVL, glulam, OBS, PSL, OSL, etc.</p>
<p>Timber raw material residues from sawmilling and planing solid timber sourcing: standing timber selection, logging, scaling & bucking veneer and lumber production: normal-sized, small logs from final cuts or thinnings EWP, pulp, bioenergy production: lower-end quality fractions</p>	

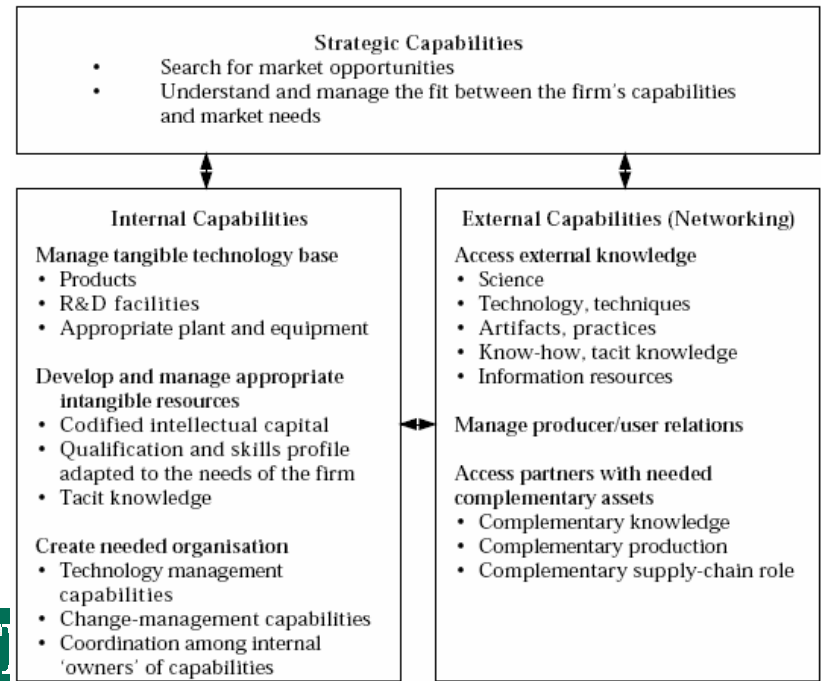
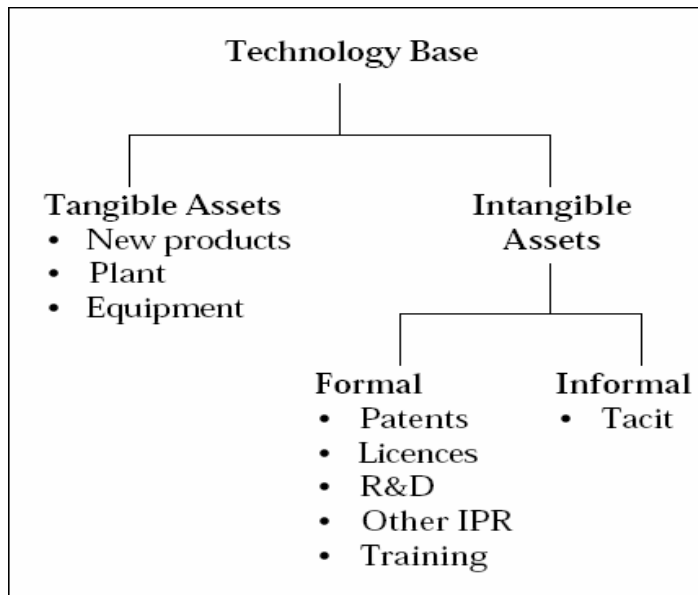
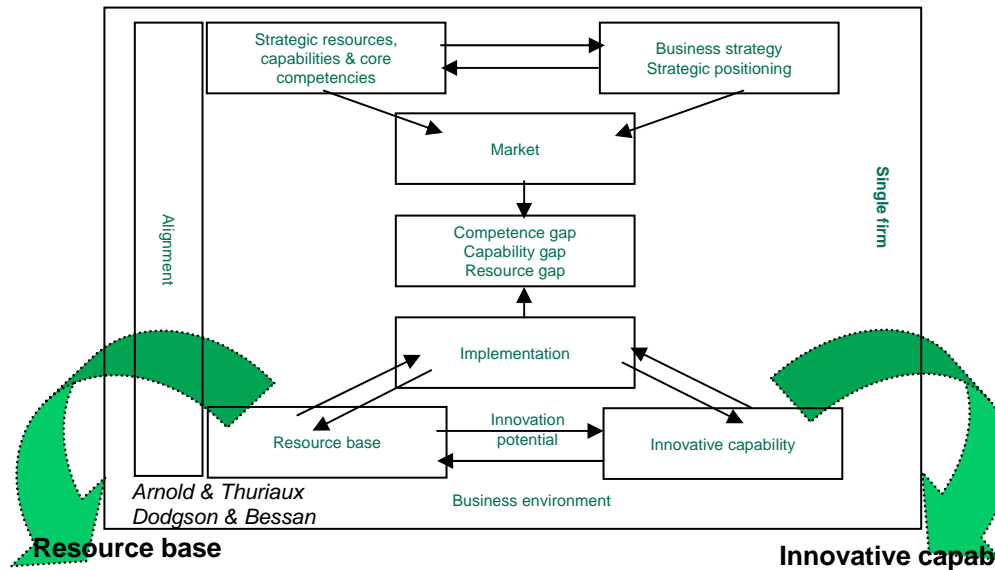
Sources of competitive advantage

The market-oriented view



Sources of competitive advantage

The resource-based view



Theoretical models of the innovation process

- **The linear model**

- *basic research and R&D most important for technological innovation*
- *no attention to transforming scientific knowledge into marketable products*
- *unidirectional causal chain*
- *technological opportunities (high tech industries)*
- *radical innovations*

- **The combinatory model**

- *moderate role of scientific research*
- *exploitation of existing technologies (incremental innovation)*
- *reactivation and synthesis of on-the-shelf technologies*
- *incremental innovations*

- **The circular model**

- *complexity and uncertainty*
- *unsuccessful commercialisation restarts search for a technical solution*
- *innovation triggered by internal learning processes instead of new scientific knowledge*
- *new applications for new customers*

Schienstock & Hämäläinen 2001. Transformation of the Finnish innovation system: A network approach. Sitra Reports series 7

Innovation categories

- **Product innovation**
May be a technologically novel or significantly improved product.
- **Technological process innovation**
Implementation of technologically novel or significantly improved production or delivery methods adopted by the firm.
- **Organisational innovation**
 - *Reconfiguration of an organisational structure, managerial system; may concern routines, practices and procedures in completing recurring tasks; may be internal or external to the firm (interfirm relationships)*
 - *Technical progress and organisational innovation co-evolve*
- *Do not occur in isolation but concurrently and interrelatedly*
How organisational and managerial solutions support technological innovation?
- *Represent output-oriented definition of innovation*
- *Must be implemented on the operative level of the firm*

Schienstock & Hämäläinen 2001. Transformation of the Finnish innovation system: A network approach. Sitra Reports series 7

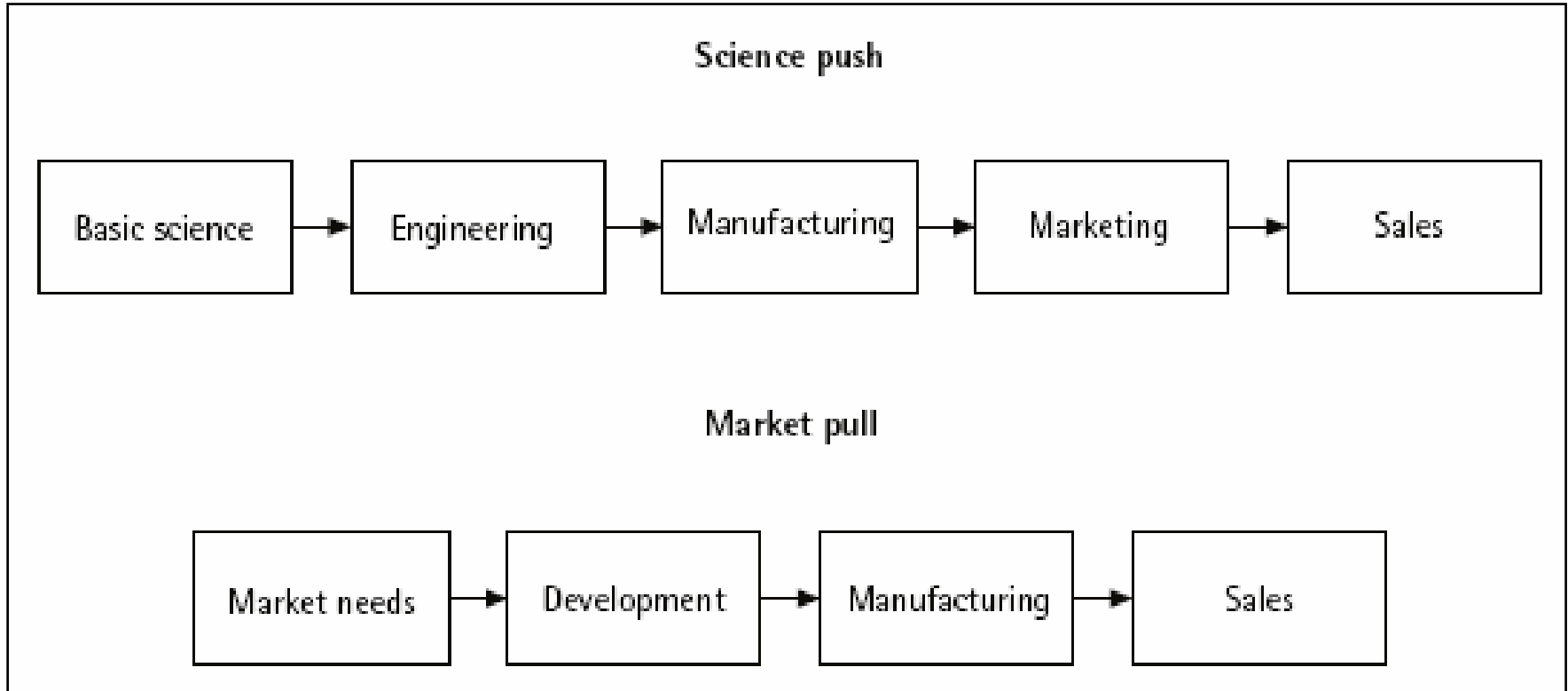
Innovation process

- A **more or less** formal and structured process in business practice
 - **non-formalized, weakly structured or conscious and recurring process; may be**
 - **prioritized quite differently across industries and firms**
 - **of strategic importance to the firm**
 - **ascribed to the ideas of individuals**
 - **a routinized operative process of the firm**
 - **based on a feed-back system for information to managers**
- **Is different** for radical and incremental innovation
- **Is a critical** success factor for the innovation performance of the firm;
therefore identifying and evaluation innovation processes in the firm is an important task of innovation research.

Schienstock & Hämäläinen 2001. Transformation of the Finnish innovation system: A network approach. Sitra Reports series 7

Theoretical models of the innovation process

The traditional models of innovation



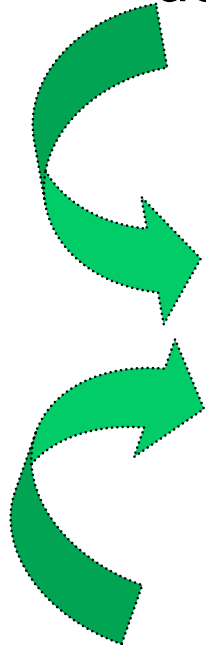
Schienstock & Hämäläinen 2001. Transformation of the Finnish innovation system: A network approach. Sitra Reports series 7

Theoretical models of the innovation process

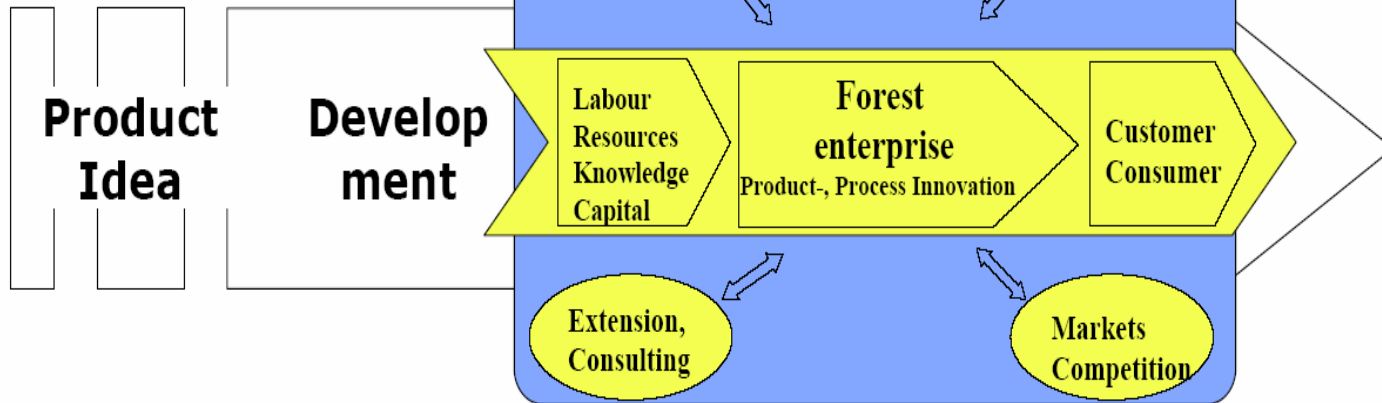
Policy approach: the innovation system

market opportunity
"demand pull"

new application for new customers



INNOVATION PROCESS



technological opportunity
"science/technology push"

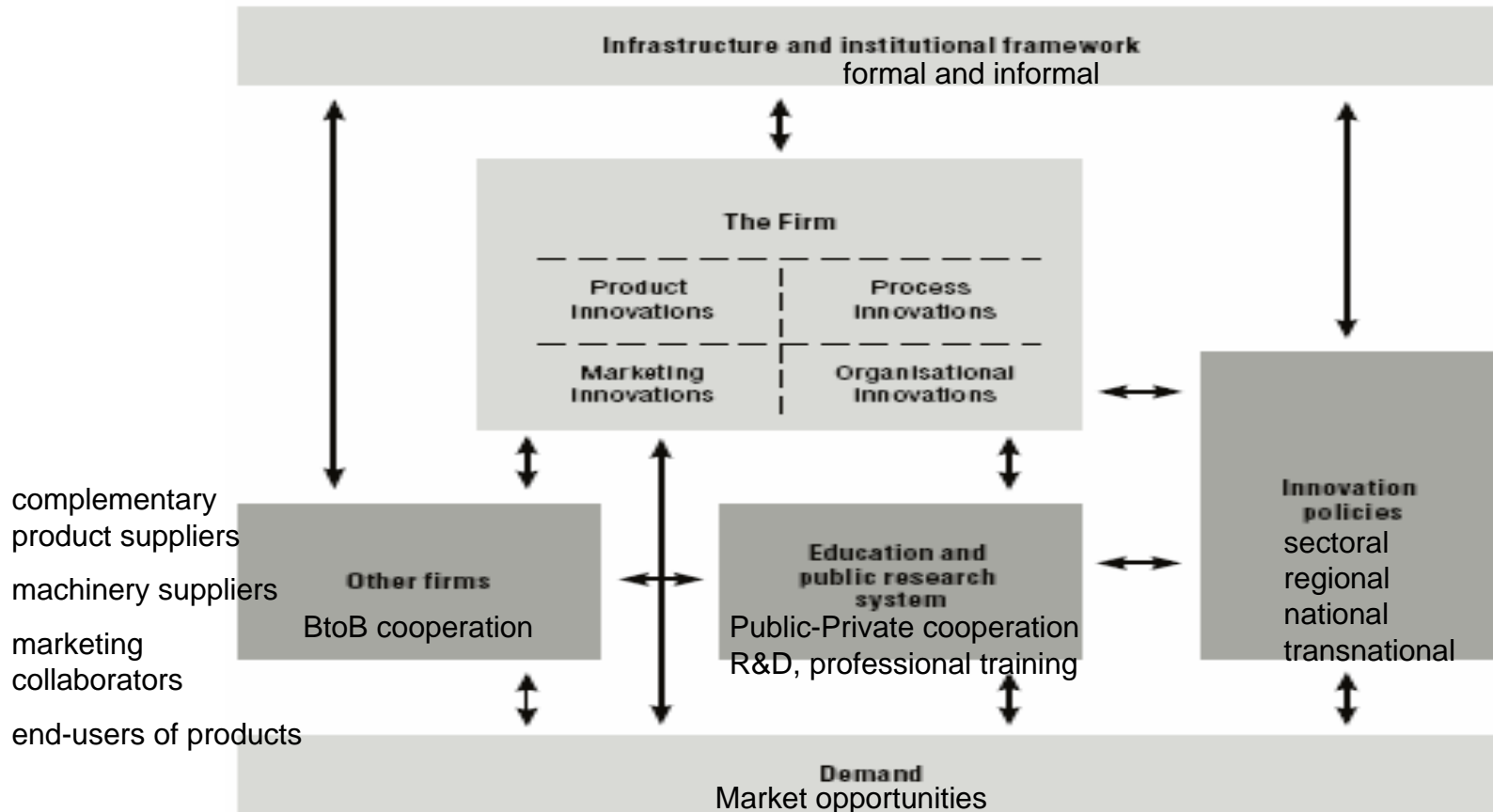
substitute product

Rametsteiner, E. Seminar on Enterprises, innovation and public policy related to forestry-wood value added chain. 11-12 Febr.2005, Joensuu, Finland.

Kairi 2005

METLA

Model of the innovation process from a firm's perspective



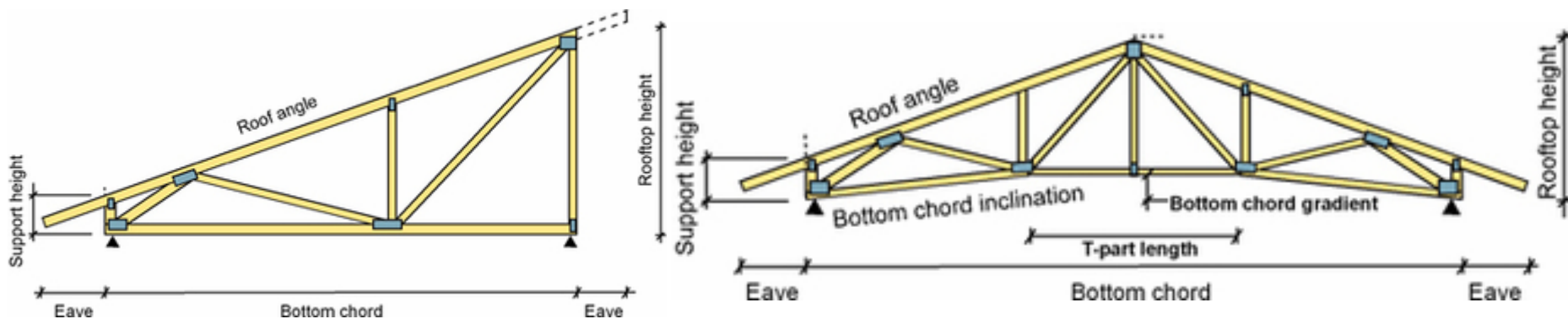
Oslo Manual, third edition. OECD 2995.

- **Framework of analysis for the driving forces of innovation**
the role of internal factors of innovation: resource base and capabilities
the role of external linkages
the role of Infrastructure and institutional environment
the role of demand

Innovative technologies in timber frame housing construction

Modern methods of construction MMC

- **Volumetric construction.** Three dimensional units are produced in a factory with all necessary internal fittings and services, and are brought to site complete.
- **Panelized systems.** Flat panel wall units are manufactured in a factory and erected on site to produce a three-dimensional structure. Open panels consist of a skeletal structure only, whereas more advanced panels may include lining materials, insulation, services, windows, doors, internal wall finishes and external claddings.
- **Subassemblies or components.** Some parts of the house may be delivered to site as components. Examples are roof trusses, floor and roof cassettes.



Innovative technologies in timber frame housing construction

Technological innovation: Modern wooden towns in Finland

- ▶ the development of innovative structural timber components and integrated product systems
- ▶ the development of integrated planning and production systems
- ▶ further development of timber-based OSM systems to address cost and quality issues
- ▶ the development of design, production and logistical networks of independent developers as lead companies and sme's of the forest-wood processing chain as partners of their supplier networks
- ▶ organisational innovations addressing the complexity of urban housing construction projects
- ▶ strategic partnering, lowest cost vs. value for money, life cycle approach



Innovative technologies in timber frame housing construction

Modern wooden towns in Finland

Sundsberg, Kirkkonummi (1)

demand-driven innovation process
(housing developers, architects)
initiates process-reengineering
(manufacturers, builders, contractors)

phase I

- ▶ 224 dwellings
- ▶ 600 residents
- ▶ panelized system
- ▶ supplier Finndomo

phase II

- ▶ 2005–2006
- ▶ 119 dwellings in small houses
- ▶ volumetric system
- ▶ supplier Finnforest
- ▶ dwelling size 85-147 sq.m.
- ▶ timber prescribed as frame and cladding material



Kuva 11. Kirkkonummen Sundsbergin alue muodostuu kolmessa eri vaiheessa rakennettavista alueista. Tutkimuksessa tarkasteltu Sundet 1 on rajattu kuvaan. (Insinööritoimisto Bertel Ekengren Oy 2004)

Innovative technologies in timber frame housing construction

Modern wooden towns in Finland

Technological innovation: volumetric building modules



Innovative technologies in timber frame housing construction

Modern wooden towns in Finland

Technological innovation: Panel systems



- detached and semi-detached houses
- gross floor area 10,917 sq.m.
- 88 residences
- block density 0.5
- last of three blocks ready summer 2005
- gross floor area 87.5 - 141 sq.m.
- load-bearing walls of the bottom floor of reinforced concrete
- the intermediate floors of hollow core slabs
- the other wall structures and the roof trusses are made of wood



Innovative technologies in timber frame housing construction

Modern wooden towns in Finland

Technological innovation: Stick frame platform system



Multistorey timber frame appartement houses:
Puu-Paavola, Lahti

Innovative technologies in timber frame housing construction

Modern methods of construction MMC

Competitive advantage of MMC over conventional construction methods:

New technology provides efficiency gains:

- **labour savings, particularly on-site skilled labor**
- **time savings by faster completion of buildings**
- **cost savings and financial benefits**
- **quality improvements**

Exploiting efficiency potential requires organisational innovations

- **supply chain management**
- **process re-engineering**

Thank you for your attention!