

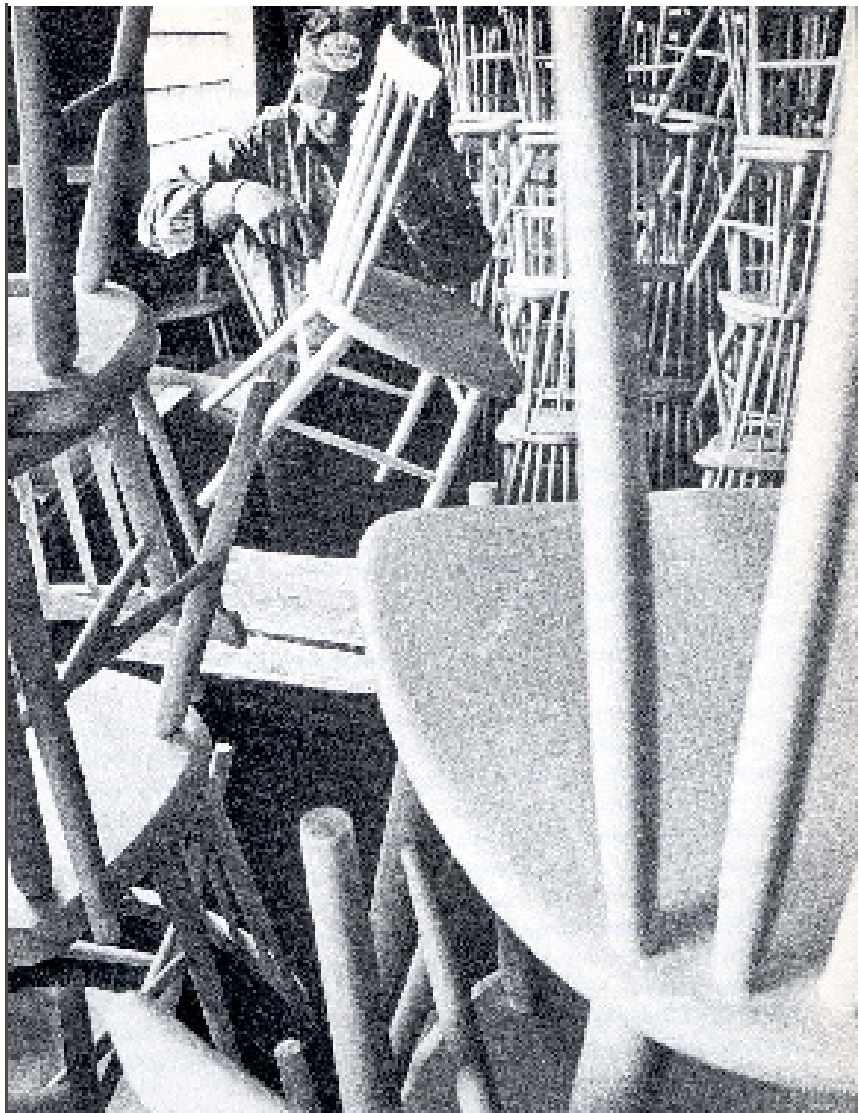


VINNOVA ANALYSIS  
VA 2005:01

# WOOD MANUFACTURE

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The Innovation System  
that beats the System



STAFFAN BREGE, HANS-ERIC JOHANSSON & BÖRJE PIHLQVIST

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## About VINNOVA

VINNOVA, the Swedish Agency for Innovation Systems, integrates research and development in technology, transport, communication and working life.

VINNOVA's mission is to promote sustainable growth by developing effective innovation systems and funding problem-oriented research. Through its activities in this field, VINNOVA aims to make a significant contribution to Sweden's development into a leading centre of economic growth.

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# Wood manufacture

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## Foreword

The task of VINNOVA is to encourage sustainable growth through the development of effective innovation systems and the financing of research dictated by real needs. Through its work, VINNOVA shall make a clear contribution to the development of Sweden as a country with a leading position in terms of growth.

Careful analyses of our growth sectors in an innovation system perspective provide knowledge of, and insight into, the strength and weakness relationships and thus a better basis for the type and direction of our commitment in each area.

In its Business Plan, VP, for 2003-2007, VINNOVA has described a number of priority measures and amongst these 18 growth sectors. One of these is "**Wood Manufactures\***", defined as the later stages of the value-adding process towards building and interior fitting-out. This growth sector is one of the first in which VINNOVA has carried out an innovation system analysis (IS analysis). This provides a basis for the planning of VINNOVA's future work in this sector.

The completed innovation study is a continuation of the material, competence and experience generated by NUTEK's work in the forestry and wood industry at the end of the nineties ("strategiska satsningar på svensk tränäring"). The results include, for example, VINNOVA's project "Idépromemoria för hållbar tillväxt" (Sketch memorandum for sustainable growth), studies within the industry, and the development which has taken place, and continues to take place, in the field of Wood Manufactures.

On behalf of VINNOVA, the analysis has been carried out by Staffan Brege, Professor in Industrial Economics at Linköping University, Hans-Eric Johansson at HE Bostadsutveckling and Börje Pihlqvist at IUC Sydpoolen AB.

We should like to thank all those who have taken part in the process round our IS analysis and who have contributed to the analysis as it is today. Comments on the analysis are welcome and can be sent to Eva Esping, VINNOVA. The report VA 2004:02 is reproduced here in English.

VINNOVA April 2004

Per Eriksson  
Director-General

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\* The sector covers the later value-adding stages in the manufacture of products and components within wood-based building, joinery, interior fittings and the furniture industry. This includes various industrial applications which can be assembled as parts of systems. New uses for materials and developments such as wood composites and EWP (Engineered Wood Products) for mainly wood-based systems are included.



## **Summary (short version)**

In its Business Plan VP 2003-2007, VINNOVA has defined a growth sector Wood Manufactures, which covers the later value-adding stages in the manufacture of products and components within wood-based building and interiors. The sector is perceived as having a major potential but also represents a challenge because of its strategic role as a new innovation system between two traditional and stagnating systems, forestry/wood production and building.

Wood Manufactures has been closely studied in a comprehensive innovation system analysis (IS analysis), carried out in accordance with the recommendations for IS studies prepared by VINNOVA's Department of Innovation Systems. The study has been presented in VINNOVA's Report 2004:2, and is summarized here in Annex 1, which forms the background material to the programme text.

An effective innovation system is characterized by three criteria:

1. A common vision shared by the majority of the players in the system;
2. A common commitment to the direction and co-ordination of resources;
3. The addition of new and innovative resources.

Development within the innovation system Wood Manufactures is seen as the key to increased co-ordination within the whole value-adding wood chain, something which is obviously missing between IS Wood Manufactures and Building (figure on page 1 in annex 1). This lack of co-ordination has been clearly noted in earlier programmes ("the missing link") but it was then assumed that this lack would be filled by having one co-ordinating component supplier level. Only with the help of VINNOVA's IS analysis was it possible to identify the majority of the contributing sub-contractors' value-adding chains where co-operation between players is lacking. Instead of co-operation, all that happens in these cases is that a (standardized) product is handed over.

## Summary (long version)

Wood Manufactures (Building with wood) is one of the eighteen sectors which VINNOVA has identified as future growth sectors. Wood manufacture is defined as the value-adding process which is carried out after the primary cutting of the wood (which is mostly destined for building and for the furniture industry) in the sawmill. Building and civil engineering - and in particular the erection of buildings - is responsible for the largest share of the wood, both in value and in volume.

Building with wood brings together two established innovation systems - building and sawmilling, which only co-operates in development work to a very limited extent. The handing-over point is usually wood in standard sizes.

At present wood manufacture has a turnover of about €2.2 billion<sup>1</sup>, of which €2.2 billion goes to furniture and the rest to other wood manufacture houses, doors, windows, floors, kitchens, staircases, joinery etc). It employs about 35,000 people. There is a sawmilling and sheet material industry with a turnover of €3.5 billion. Downstream in the direction of dwelling, the building industry (houses, flats and offices) has a turnover of around €1 billion. The retail furniture trade has a turnover of about €2.2 billion and the building materials trade about €3.3 billion.

The analysis of the growth sector Wood Manufactures is based on a market perspective and in this case on dwelling. The focus is on added value in wood manufacture, rather than of the volume of wood used. Wood manufacture is divided into three sub-systems:

1. New Build housing
2. Repair-rebuilding-extensions/ (refurb/DIY<sup>2</sup>)
3. Furniture and interiors

For each sub-system in the innovation system Wood Manufactures there is a current picture in the form of a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) and a vision of the future state of the innovation system. Finally, the report gives recommendations on how the route towards the vision should be planned.

The investigation shows that the innovation sector Wood Manufactures has the potential to act as a catalyst for the wood-based value-adding chain in

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<sup>1</sup> € = SEK 9,2

<sup>2</sup> DIY = Do It Yourself



the field of building, but that at the present time it cannot be said to possess the structure and the qualities needed in a strong innovation system.

In the field of new-build housing (to the year 2015) the vision is that the production process has made the changeover to industrialized building, in which prefabricated wood components are widespread. This includes blocks of flats higher than two storeys, where until 1995 the use of wood as a structural material was prohibited.

A general analysis of industrialised building shows that the greatest savings in cost lie in a higher degree of prefabrication, integration of technical systems and optimised logistics compared with traditional in situ building. Wood as the core material in the system has - in comparison with other building materials - extremely good characteristics which make possible a substantial effectivisation of the building process. The cost of the wood is negligible in this connection, amounting to about 3% of the cost of production of the building.

The cost reduction brought about by industrialized building means lower dwelling costs and thus an increased demand for new housing. The stock of housing in Sweden needs an annual addition of about 40,000 dwellings in order to be sustainable. At present production is only about half this number, about 20,000 dwellings (somewhat more than half as flats) which means that a considerable increase is needed to retain our standard of accommodation.

The vision is, with the help of increased industrialised building with wood components, to reach the required 40,000 dwellings, half of them in the form of houses. This would mean that wood manufacture excluding furniture would increase its turnover from €3.0 to €5.0 billion. The greatest change would be in the wood house industry, which would increase from €0.7 to €1.6 billion. On top of that, an entirely new sector, the Housing Industry, would open, consisting of component systems for flats with a potential of €0.5 billion. When this paradigmatic shift occurs, uniting Wood Manufactures with Building, the growth sector should be given a new title - "Building with Wood". Within this sector we foresee that wood-based systems will capture market shares from concrete and steel.

Within the DIY sector a continued strong increase is expected and the whole refurb and extensions sector will follow the increase in new-build. Components such as doors, windows, flooring, kitchens, staircases, trim and wood cladding are expected to increase as a result both of increased new-build and increased refurb. A cautious estimate based on current employment levels in the sector (excluding furniture) shows that an increase of 10,000 jobs is a reasonable consequence of the vision, jobs which for the most part would be created outside the major urban regions.

We judge export opportunities to be considerable both for industrialised building and for consumer-friendly DIY products. Within industrialised building it is the wood house industry that has the greatest opportunities in the short and medium perspective. Today, as many as 2,000 houses are exported annually. In time there may be exports from the new Housing Industry, but the take-off run is longer here. Finally, the DIY sector presents interesting opportunities, not least for the larger sawmilling concerns who with increased added value can take the step into the realm of Wood Manufactures.

The vision for the furniture industry is continued growth from €2.2 billion up to €2.7-€3.3, based on the high degree of internationalisation today which can continue to increase. There are several "locomotive" companies which can continue to boost the furniture industry, IKEA of course but also firms in the office segment such as Kinnarps and EFG, together with Hilding Anders, Hästens and Dux in the beds segment. Alliances (clusters) of small and medium-sized furniture manufacturers are needed in order to establish a stable export business. If the vision is to become reality, IKEA must continue to make purchases in Sweden from the home flat-pack furniture industry (if possible on an increased scale), the major office suppliers must keep their production in Sweden and the home sheet materials industry must continue to supply the furniture makers with competitive materials.

SWOT analyses for the various parts of the innovation system reveal similarities and differences. A strength factor in all three parts is the existence of "locomotive" companies which can lead development forward. In New Build this is primarily the leading prefabricated house firms, in DIY the more traditional sawmilling companies and in furniture IKEA and the office furniture manufacturers.

As a sub-system, industrialised production of new-build flats is the least developed. However, development has passed the first pilot building phase and certain niche markets already exist, particularly student housing. Other common strength factors are strong political backing at national and regional levels, together with the favourable characteristics of wood functionally, aesthetically and environmentally. A strength factor - or rather a future opportunity - is the formation of TMF, the Employers' Association of the Swedish Wood Products Industry, which can take a concerted grip on the Wood Manufactures sector.

On the weakness side, all the sub-systems suffer from weak and fragmented innovation systems and sluggishness in discarding traditional values and structures, specially in major building contractors and sawmilling companies. The level of competence is generally too low and higher priority is needed for research within Wood Manufactures, which has been pushed into

the background by forestry research and building research. Conflicts of interest and poor co-ordination between various departments constitute a politically-generated weakness.

The greatest threats to Wood Manufactures are that housing construction fails in getting up speed at home, while cheap imports take a large share of the market. Other threats are that the necessary rethinking in major companies and in the research and educational systems are all too long drawn-out. Wood manufacture needs to be strengthened in its lobbying, in attracting risk capital, in marketing and in rousing public opinion.

The above weaknesses and threats constitute obstacles in the attempt to achieve the visions, obstacles which must be removed or circumvented. If we can succeed in this, and at the same time build upon the strength factors, great opportunities will arise. Industrialised building with prefabricated system components of wood has great potential, as has a consumer-friendly development of products within DIY.

Industrialised building in wood can be the lever which gives radically reduced costs (of the order of magnitude of 30%) and industrialised building can be the "salvation" in a future shortage of building workers. In both new-build, DIY and furniture/interiors it is important to build on the basis of the work done in the "locomotive" firms existing today. The export potential is great, especially in new-build which starts from a lower export share and a low proportion of timber building out in Europe.

The favourable characteristics of wood functionally, aesthetically and environmentally must be utilised further. Wood is well placed to attract future consumers who are gaining increasing power over their way of living, and environmental factors will become more and more important as time goes on. Strong growth in Wood Manufactures would have very positive effects on employment in depopulation areas, on the balance of payments and on the environment.

Our recommendation is that the players in Wood Manufactures focus on the development of various types of innovation: products and systems, commercial and marketing concepts, organization-wise in co-operation between firms, production-wise and in the form of better materials. In industrialised building in particular, growth of the market is essential, and here steered public procurement could provide a useful impetus. This is primarily a matter of developing, integrating and applying known technology and practice - only later will applied research make a meaningful contribution to the innovation system.

Round this kernel of innovations and market growth it is important to focus research on a number of vigorous technical platforms, to start and provide training in Wood Manufactures and industrialised building, to disseminate

knowledge to various categories, particularly specifiers in building, to create an infrastructure of standards, rules and handbooks, to retain and better coordinate government steering which is needed in sectors dominated by small and medium-sized suppliers and to clarify a new commercial profile directed towards moulders of public opinion, investors, politicians etc.

This process will take time, especially in wood building and the industrialised production of flats - it is a question of creating a new infrastructure where there are many pieces of the puzzle to be fitted together.

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# 1 Wood Manufactures - the innovation system that beats the system

## 1.1 Wood Manufactures seen as an innovation system

Wood manufacture is defined as the further processing of wood that takes place after the primary production of wood goods in the sawmill. Most processed wood is destined for the building sector (about three-quarters of the volume), either via the wood manufactures industry in the form of windows, floors, kitchens etc or more directly to the building site in the form of structure and studs. The furniture industry is the other important part of the wood manufactures industry, and is responsible for most of the remainder of the processing of wood material.

The limits of wood manufacture can be defined as follows:

*“The sector covers the later value-adding stages in the manufacture of products and components within the wood-based building, joinery, interior decoration and the furniture industries. This includes various industrial applications which are assembled as parts of systems. New materials and developments such as wood composites and EWP (Engineered Wood Products) for - primarily - wood-based systems are included in the concept.”*  
(Eva Esping, Basic Analysis growth sector Wood manufactures, Vinnova 2003)

An innovation system is the mutual interplay which takes place between firms within, for example, an industrial sector. It also covers firms in adjoining trades, research within firms and within public bodies, and society in its various roles as regulator, specifier, financier etc. When this interplay works well, the conditions for innovation are favourable.

Innovations are those activities which lead to technical and commercial development in a sequence from the preparation of new products, services, concepts etc up to the point where this development has been successfully launched on the market. Innovation thus includes not only various types of technical inventions but spans across a much wider field which also includes commercial realisation.

A working innovation system at national sectorial level will in our continued discussion be characterized by the three following features or criteria:

1. A common vision shared by the majority of the players, either collectively or in the form of the majority of large and influential players acting in the same way.
2. A common commitment to the direction and co-ordination of resources, either collectively or where the major firms are so dominant that they can be said to represent all.
3. Addition of new and innovative resources, collectively or by dominant players.

## **1.2 Two traditional innovation systems - Building and Wood processing**

The industrial sectors Sawmilling (which primarily covers the sawmills' primary production of sawn wood goods) and Building originated in their present form in the second half of the nineteenth century and have to a large extent retained their organizational structure ever since. In both sectors, however, peripheral activities have come to dominate the major forestry- and building companies more and more and what used to be the core activity has become a sideline.

This can be seen most clearly in the field of sawmilling, where in all the major forestry companies pulp and paper manufacturing are now the core activities while sawing and further processing have more importance in keeping up the value of the raw material than for the firms' industrial activities. Since the end of the nineties, however, there has been a break in the trend in the sense that the sawmills have, in terms of ownership and organization, detached themselves from pulp and paper and that value-adding processing has more and more come to the fore.

In the building sector the major firms' building activity has come to be dominated more and more by financial, property and development activities at the expense of the firms' own production of buildings. Building has more and more been pushed into the category of a "shipment", which could equally well have been procured from a sub-contractor as forming the core activity of the company.

The effects of this changed perception of operations is reflected in development work and in the inclination to invest in the various sectors. The result has been that the sawmill sector has become a highly competitive industry with very small margins and many long-standing sins of omission as regards the further processing of wood into the realm of wood manufactures. In the building sector, the change initially meant a sharp reduction of capacity, without the emphasis placed in other industries on effectivisation. Prices



have increased and production has been concentrated on products for customers with ample means.

This latter development is neither politically acceptable nor sustainable in the long term for the building sector. In the current recession this has been made obvious by government investigations and the introduction of new control systems. The building industry has now understood the need either to develop or to scrap the old core activity, which has increased the level of activity both as regards R&D and the consolidation of activities. There are now players with building as their core activity and new players within the component industry who are interested in integrating forward.

The development which we have described above regarding two mature industrial sectors which have diversified away from their original core activity, has caused the innovative ability in sawmilling and in building to function increasingly badly. If we apply the criteria for a working innovation system as described above, we can establish that in both sectors (perhaps most in building) there is an obvious lack of common visions, common investment and access to innovative resources.

### **1.3 Furniture - a decaying innovation system**

During the twentieth century, furniture-making passed from handicraft to more and more industrial forms. This development can be seen most clearly in the flat pack furniture industry which supplies IKEA, and in the office furniture segment. Parallel with increased industrialisation, other materials besides wood have been employed, in many areas to the exclusion of wood as the dominating material. Another trend which has grown stronger towards the end of the twentieth century is the retail trade's dominance in the furniture chain, something which naturally applies to IKEA but also to other more national furniture chains.

Is it possible to speak of a working innovation system within the furniture industry today? If we look at the sector as a whole we must assert that the handicraft innovation system which existed in the wood-based furniture industry in the middle of the twentieth century has been demolished, and that there is now no innovation system for the whole trade which satisfies the criteria sketched above. A feature of the earlier innovation system was control of the process from raw material to finished product.

There is however an innovation system centred round IKEA, which covers the value-adding chain right back to the raw material in the forest. IKEA's commercial concept can as such be regarded as a major innovation - a firm which developed a range, placed the production with sub-contractors and where the customer himself was responsible for the final assembly (an early

DIY concept). During the nineties IKEA has tightened its grip on the value-adding chain and plays an important part for the development of the trade's range, not least in the form of complete interiors where furniture and other items are combined. Other areas where IKEA plays an important part are effectivity in furniture factories, development of new materials in the wood sheet industry, access to international buying channels etc. It should be added that IKEA's innovation system is only in part located in Sweden.

Seen from the perspective of innovation systems the furniture industry as a whole has been poorly represented. There has hardly been any form of collective research, even within the IKEA segment. Neither have there been any strategically formulated efforts from society, with the exception of small-scale attempts at structural changes in the forest industry programme at the end of the nineties and the ongoing Träklusterprogrammet led by NUTEK, VINNOVA and ISA. The trade programme Trä in the former NUTEK was in its time directed towards the wood processing industry as a whole but should rather be regarded as a supportive programme from state-of-the-market, rather than structural, motives.

In our opinion the furniture industry today is much too many-faceted and small scale to merit description as a single innovation system (which is made clear in connection with the structural description in chapter 3). Seen from the point of view of dwelling, the various players or segments in the furniture industry have shown no interest in integrating building and dwelling (apart from co-operation between IKEA and Skanska in the Bo Klok project). It is thus up to the whole furniture industry, or the furniture trade, to find its way back to a coherent, working innovation system based on commercial thinking with closely connected links between material development (wood and other materials in combination), production and distribution channels (the furniture trade and/or direct channels to the consumer).

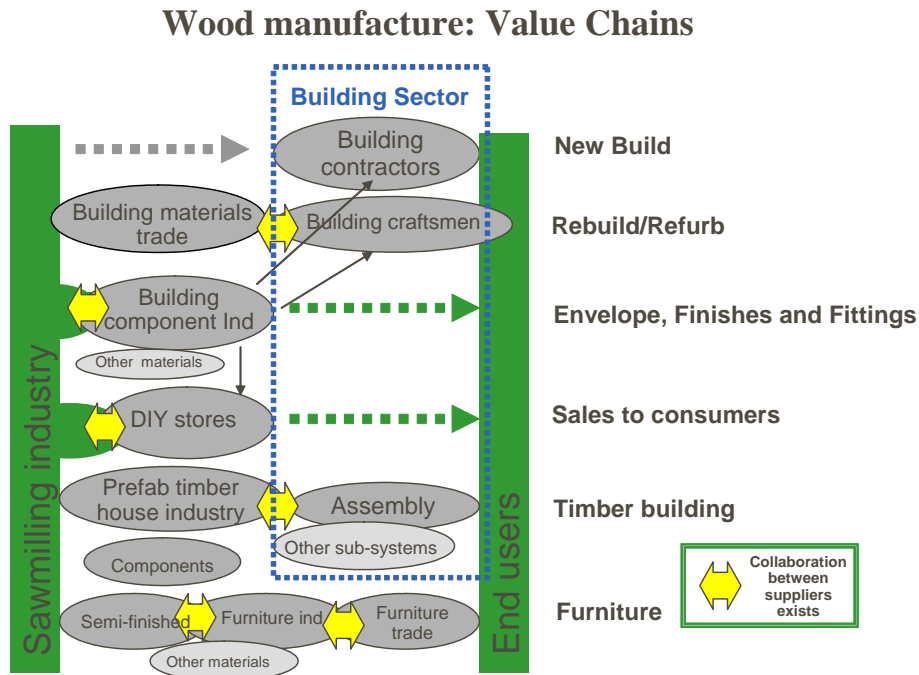
#### **1.4 Two traditional innovation systems at odds with each other**

The historical link between building and wood through the carpenters' guild ceased to exist in the first half of the nineteenth century. Until then harvesting, woodworking and the making of products were well gathered together under the guild. During the second half of the nineteenth century the two present industrial sectors building and sawmilling arose. Since then no common development has occurred (though the sheet materials industry has come into being). Boards, joists, rafters and planks remain the dominating commercial products of the sawmills.

The figure below shows the various value-adding chains which can be identified from the sawmill to finished products with a large wood content. The

word sawmill is used here to cover both early conversion and drying, together with grading, planing and sawing to dimensions. The part enclosed by a broken line is that which is defined as being part of the innovation sector Wood Manufactures.

Figure 1.1 The gap between the innovation systems Wood Manufactures and Building



In several of the value adding chains there is no co-operation between the players - the point of contact is reduced to the status of handing-over a standardized product. New-build is a clear example of this. The products at the handing-over point between sawmill and building are mostly studs/joists and cladding. When co-operation between the parties breaks down it is often price which is the decisive parameter for this type of relationship - geographic and cultural distances also provide a breeding ground for middle-men and agents.

In other value-adding chains the building market is often the intermediary - in refurb/extensions there exists co-operation between the building materials trade and craftsmen. In the DIY segment, the sawmills often refine their range to provide more consumer-friendly products and they co-operate with the major (often foreign-owned) building market chains. In other value-adding chains there can be an extra stage between the sawmill and building; either the building component industry where the sawmills themselves have (up to a point) integrated forward, or the timber house industry which in various degrees either carries out erection itself, or utilises independent builders. Co-operation between suppliers exists in these value-adding

chains. Finally, the value-adding chain for furniture exhibits co-operation between the semi-finished, end product and sales stages.

The above analysis shows the gap between the two innovation systems Sawmills and Building. Nowhere are there direct contacts of co-operative character. Where co-operation does exist it is in the middle commercial and industrial stage that we define as Wood Manufactures. The furniture side also shows a need for increased co-operation, in particular that the sawmills take the step into Wood Manufactures and that the link with the Swedish sheet materials industry is upheld and strengthened.

## **1.5 Building with wood - the integrating innovation system**

By strengthening the innovation system in the growth sector Wood Manufactures, the growth and innovation rate in the two adjacent sectors Building (downstream) and Wood Manufactures (upstream) in the value-adding chain are stimulated. We do not, however, suggest at the present time that the Wood Manufactures sector satisfies the demands which can be made on a working innovation system. The shortcomings of the furniture segment have been analysed in section 1.3 above. In the remainder of Wood Manufactures such as wood houses, doors, windows and floors there is no concerted innovation picture in terms of visions, commitment or innovative resources. Our analysis shows, however, the strategic position of Wood Manufactures in the value-adding chain. The key to vitalising the chain from forest and wood to dwelling lies within the boundaries of Wood Manufactures.

## **1.6 Why mix building and furniture?**

An important starting point at the edges of an innovation system are the customer and market perspectives. In analogy with this our analysis starts with dwelling, where both building and furniture are important parts. The intersection between building and furniture is in itself particularly interesting. It concerns the development of interior solutions, various types of interior combined to a whole for the benefit of the dwellers. This is clearest in such areas as "compact living", where different types of interior can fulfil different purposes - that is be multi-functional. Since future building will to a large extent be focused on categories such as old people's and student dwellings, it is obviously of the greatest importance to hold together building and furniture as important parts of the function of dwelling.

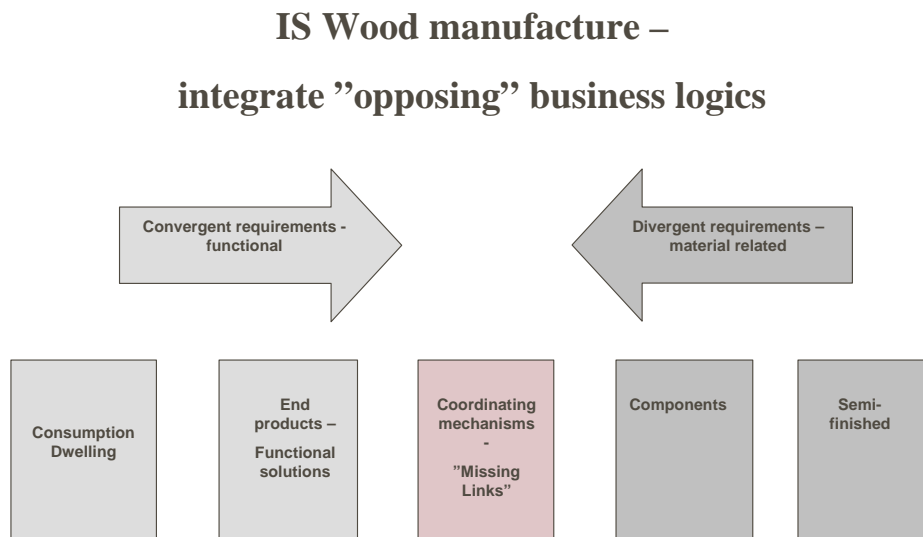
An interesting detail question is where the boundary goes between what belongs to the building and what is movable property owned by the dweller. The boundary itself seems to be movable and rules in different countries vary regarding what is regarded as real estate and what is the private

property of the dweller. In Sweden the tendency seems to be towards regarding interior details as movable.

## 1.7 More co-ordination in the value-adding chain leads to increased growth potential

We regard the development of innovations in Wood Manufactures as the key to increased co-ordination across the whole value-adding chain. Building sends far too weak and unclear signals backwards in the value-adding chain regarding technical and commercial requirements on systems and components. In an industrial perspective there is a lack of "channel captains" at the end product stage who oversee the chain in the rear mirror.

Figure 1.2 The wood/building chain - an uncoordinated value chain



This is particularly true of new-build and the professional part of refurb and extensions, while the building market chains have begun to act as channel captains for the DIY sector in the same way that IKEA and other furniture chains long done in the furniture trade.

The dilemma of Wood Manufactures, on the other hand, emanates from the "divergent product logic", i.e. the principle that the whole of the log which comes in from the nearby forest must be put to use. This leads to a splitting into numerous product qualities and as a result numerous customer categories - the problems of focusing in the stage of further processing are obvious. A "missing link" which co-ordinates the chain into various types of customer- and market-orientated functional and system solutions is a subject of discussion in the trade. In comparison with other value-adding chains, e.g. in the vehicle, aircraft and telecom industries, the wood-based value-adding chains exhibit inferior co-ordination between processing stages.

This study will show that there exists a growth potential in the Wood Manufactures sector which motivates its inclusion as one of the 18 growth sectors in VINNOVA's strategic planning. Increased housing production, brought up to date through "lean thinking" philosophy, can be seen as a jigsaw where Wood Manufactures can be a vital piece. Wood Manufactures excluding furniture can increase strongly from €3.0 to €5.0 billion, and the labour force increase of the order of 10,000 people. The development of the furniture sector depends on other factors than the Swedish production of buildings - above all on various ways of increasing competitiveness both on the home market and for export. The growth sector Furniture in Wood Manufactures also has growth potential, though this is smaller (see further section 4.1).

## **1.8 Economic, ecological and social sustainability**

The role of wood and the importance of Wood Manufactures seen in an innovation system perspective is further strengthened when ecological and social aspects are considered. The realisation that world resources are finite, and of the effect of the increasing carbon dioxide content on the climate form a dramatic global background for the growing insight that wood as a building material has a special place. Trees form a renewable material and have the property that they take up carbon dioxide. In many European countries today there are national wood building programmes and the interest in using wood as the material in a more rational housing construction is greater than ever - even in countries which lack the raw material base. Increased wood use is an important strategy in the fulfilment of the aim of the Kyoto Treaty to reduce the emission of carbon dioxide.

Besides the contribution of Wood Manufactures to economic growth and ecological sustainability there are a number of factors pointing to its importance for social sustainability. A strong Wood Manufactures means major regional political advantages in the form of increased employment in depopulation areas. In addition better living conditions - at home and at work - are an important part of social well-being and a means of attacking the current sick-list problem.

## **1.9 Paradigmatic shift in wood and building research**

There are, however, a number of efforts since the end of the nineties which point in the right direction - forward in the value-adding chain rather than the more traditional efforts based on the primary production of sawmills and purely forest-orientated research. Important contributions made by NUTEK/VINNOVA have been the completion of the programme for fostering the Swedish food and furniture industry. In addition, new research

environments have been created in WDAT (Wood Design and Technology) in Växjö, Skewood in Skellefteå and Luleå and in the SSF (Swedish Foundation for Strategic Research) Researcher School for Sawmilling which is administered from Luleå Technical University.

Similarly, the establishment of industrial development centres (IUC) for wood and NUTEK's current drive to form clusters within further processing and the furniture industry are important steps. Within building research there is the researcher school Competitive Building, a joint effort between KTH (The Royal Institute of Technology in Stockholm), its counterpart Chalmers in Gothenburg, and Luleå Technical University, which assists the development of industrialised building, though not primarily with wood as the bearer of the prefabricated component system.

In a broader comparison, the research support which falls within the growth sector Wood Manufactures and which strengthens a paradigmatic shift is limited. This is particularly clear if we take a longer perspective and compare the research investments in Building and in Forestry/Sawmilling which have been made during e.g. the last twenty years. We see this as a problem in view of the integrative role of Wood Manufactures between the two established innovation systems. There is therefore a need for a continued and strengthened investment in the innovation system Wood Manufactures, an investment characterised by clearer common visions and more co-ordinated efforts.

## **1.10 International overview**

### **1.10.1 Labour shortage in the European building industry**

The building sector seems to be the only more important industrial sector which under the latter half of the twentieth century has not been the subject of thorough effectivisation. Since the mid-sixties the production process has not been developed in any decisive way. The number of hours required to produce a unit has instead increased due to new demands on the product and on working conditions. The predominant method of production still takes the building's site as its starting point - In situ building with inserted goods.

This is understandable in the dominating refurb/extensions sector but difficult to understand in new-build. The absence of a continuous development of the process has successively increased the price level for newly produced units and dwelling has become more and more expensive in relation to other forms of consumption. Additionally, the earlier housing subsidies have been reduced or withdrawn.

In the Nordic countries building is a well-paid profession, while in the rest of Europe the picture is more varied. There are still large differences between skilled and unskilled workers. The building market in many countries has for decades been dependent on imported labour. Britain has utilised the large reserve of labour in the Commonwealth, Spaniards and Portuguese have worked in France, and in Germany Turks have carried out a large part of the volume work in a very segregated building hierarchy (master-apprentice-trainee).

The building sector has everywhere become less attractive to youth. In Sweden LO, the trades union congress, admits that there will be a shortage of about 100,000 building workers in ten years' time. In Britain unskilled labour has taken over the bulk of production, which has both reduced quality and increased prices. Above all it has led to the fact that production has had to adjust to the level of competence available, which explains the dominance of brick and block construction there.

In France a large number of the qualified immigrant workers have disappeared, since Spain and Portugal now have amongst the highest levels of building activity in Europe. They have partly been replaced by immigrants but there is also a considerable import of workers from Central Europe - from future EU countries. In Germany there is now a deep recession in the building trade (production halved in three years) and therefore no shortage of workers there.

Summing up, we can note that in all markets with normal building activity there is a shortage of qualified workers. In those countries where activity is low, the problems are not visible but are nevertheless latent if the volume is to increase. This is particularly true in Sweden.

The shortage of labour will arise or become permanent in the whole of Europe and it forms a strong driving force for industrialisation where this is possible (in New Build). Increased industrialisation means with necessity changed material preferences, as for example bricklaying can hardly form part of an industrial process. Wood has obvious advantages in this new scenario but will meet competition, inter alia in the form of steel. Concrete appears to be too heavy a material for the dominant low-rise construction.

### **1.10.2 Internationalisation of housing construction**

Since time immemorial building has been tied to the locality, and this still applies even though building firms have become large and international. To understand the organization of building firms it is necessary to differentiate between their activities in civil engineering and in building.



Civil engineering today is highly internationalised - it is here that the economies of scale exist for large firms with specialised competence. The functional requirements are in all important respects identical everywhere, enabling design expertise to be coupled to the major building firms. A small number of players have captured an increasingly large share of the market and they operate with highly qualified personnel who work internationally. The market consists of bridges, power stations, motorways etc.

Building (as opposed to civil engineering) is still organized on a national basis and uses general techniques known generally. Expertise concerning the product is concentrated not in with the building contractors but in independent and (outside the Nordic countries) often very strong groups of consultants. Information on, and resources in, the local market are therefore very strong points for builders. The major building firms understand this and as regards building (rather than civil engineering) have strong local ties. In this sector they tend to act as a federation of many small local entities.

Housing construction has until now followed the normal pattern in building - local production. Dwellings are, however, on the way to becoming fairly international products both as regards content and function. The external differences are manageable and tend to get smaller, the input of knowledge from the point of view of building technology is low. New players with industrially-made products have therefore been able to establish themselves in this market with lower prices as their main argument.

The cost advantages of industrially-produced dwellings are large, particularly in markets with a shortage of labour. In the Nordic countries, high wages in the building sector lead to the same incentive to the customer to accept the new technique even though it means a certain limitation in design due to standardization.

There are now clear signs that industrialised building in the future will develop into an international market. The harmonization of building regulations (the Eurocode will be introduced in 2008) and widespread CE marking mean that frontier problems will be reduced and thus open for international trade in components. Traditional local and handicraft production will in future be hard-pressed by players from low-wage countries - increased use of finished building products will be their (only) hope of survival on the local market.

### **1.10.3 Internationalisation of the furniture industry**

The Swedish furniture industry has an export share of 50-60% - a high figure compared with building and other wood manufactures such as houses, doors, windows etc. The foremost exception in wood manufactures is

Floors, which have a high degree of standardization across frontiers and an export share of up to 80%.

IKEA realized early on, after the demise of the "Million programme" (a building programme which built a million new dwellings in the years 1965-74:translator's note) the need of internationalisation - first with the aim of keeping ahead of competitors with attractive prices, later by strengthening the brand with modern design. With the step into modern logistics and its results for an investment in international markets followed the establishment of production companies, the development of the range and, not least, IKEA-owned buying companies.

Other segments within the furniture trade which have achieved strong internationalisation are beds and office furniture, with examples such as bed producers Hilding Anders and Hästens and office furniture producers Kinnarps and EFG. A common feature of these producers is that they are biggish firms with resources for an internationalisation. In other segments dominated by smaller firms the opportunities of internationalisation are less favourable. A number of attempts at export co-operation have been made over the years, unfortunately with meagre results.

The consequences of internationalisation for the Swedish furniture industry can thus be seen as a divergent development. On the one hand the major players strengthen their brands on the international market, inter alia by integration forward (control/ownership of distribution channels) and with greater emphasis on brand profile and design than on production (excepting IKEA's producers). The segments which have concentrated on the home market and particularly on the Swedish furniture trade are today under severe pressure from international import competition. This depends partly on the fact that furniture chains which compete with IKEA have not taken up a clear stance which distinguishes their ranges, but instead choose to too great an extent to compete on price. This leads in turn to Swedish furniture chains either themselves or through importers increasingly buying their ranges from producers in low-wage countries. The firms which exist in the segment design for the home and for public environments are still very dependent on the home market and on those consumers or buyers who demand high quality design and function rather than low price.

Summing up we can see a trend in the wake of internationalisation where more and more production is placed in low-cost countries, while the Swedish furniture industry has very little idea of consumers'/buying groups' priorities regarding design, function or other qualities of the product.

## **2 Disposition of the VINNOVA study**

### **2.1 The commission**

A study of the growth sector Wood Manufactures is a part of VINNOVA's strategic work on future projects, inter alia within the framework of 18 growth sectors, one of which is Wood Manufactures. The project is a further development of a basic analysis carried out by Eva Esping and will contain a so-called enhanced future view. The study shall contain the following parts:

- A visionary picture of Wood Manufactures up to the year 2015.
- A recommendation on how the Innovation System shall be developed in order to bring the vision to reality.
- An analysis of Strengths-Weaknesses-Opportunities-Threats (a SWOT analysis).
- A description of the present situation.

The aim of the vision is sustainable economic growth combined with socially and ecologically sustainable development.

The commission is broader than merely determining how VINNOVA should allocate its resources. Instead, the commission calls for a description and an analysis which can form a basis for a national strategy for research and development in the Wood Manufactures sector. The next stage in the analysis work, which lies outside the present commission, is to (a) determine which specific programmes will form VINNOVA's share and (b) recommend commitments by other players to support the development of the growth sector Wood Manufactures.

### **2.2 Reference framework for the Innovation System analysis**

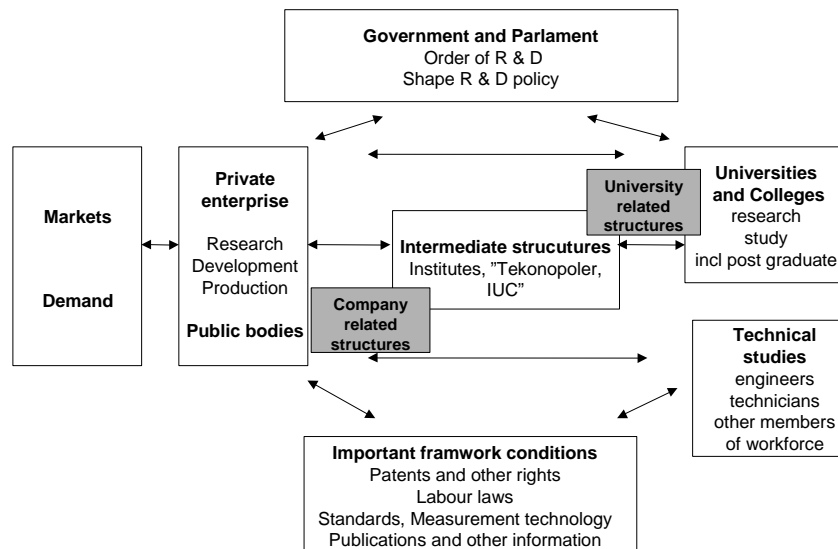
The study has taken as its starting point a simple model of an innovation system (figure 2.1, below) which identifies the various players. Society is represented by a hierarchy of players from the government and parliament and important framework conditions which can be said to constitute a kind of institutional player, down to intermediate structures such as IUC, Teknikbrotstiftelser and similar which are financed with public money. These intermediate structures can lie nearer the industry or nearer the universities.

Public activities in the form of departments and authorities can also be players with their own systems of production like those in commerce. Research and development can be carried out in the same organs that handle the operative production, or be placed in universities or other institutions of higher education. The development of the educational system is also central to the formation of an innovation system.

**Figure 2.1 Simple model (reference frame) of the innovation system**

## Wood manufacture – the Players

### A simple model of the innovation system



Torbjörn Winqvist, Vinnova

### 2.3 Market-led analysis methodology

One of VINNOVA's most central points of departure in the analysis of innovation systems is the importance of taking the market as the starting point. In the case of Wood Manufactures the starting point is dwelling, on which an absolute majority of the activity is concentrated.

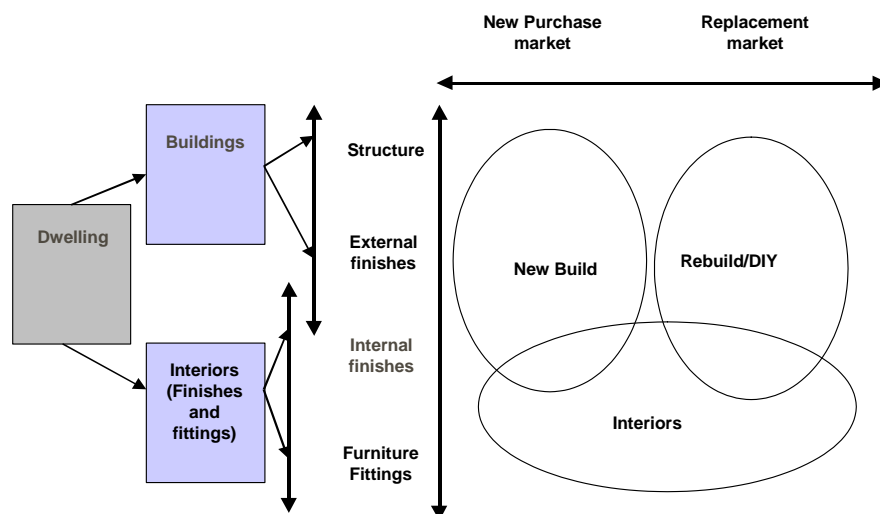
If we trace dwelling backwards towards its underlying needs we find ourselves in an analysis of building and interior fittings, which overlap one another at the movable boundary between that which is fixed (and is often chosen by the building owner) and that which is movable (and chosen by the tenant). We divide building schematically into three parts - exteriors, structure and interiors. Interiors consist of furniture and fittings.

In the analysis which follows, we distinguish between three sub-segments within Wood Manufactures (see figure 2.2 below):

- New Build, which focuses on the building of houses, flats and other buildings such as offices. It does not however include Civil Engineering, where Wood Manufactures at present has a limited relevance. This does not however mean that the building of bridges and noise baffles may not increase in time both in quantity and importance. New-build is that part of the innovation system which to the largest extent will be subject to a restructuring to increased industrialised building - that is a larger share of prefab and a fast and effective assembly on site.
- Refurb and extensions, which includes DIY and which primarily deals with interior products. Here, the building materials trade - not least the major building market chains - will play a major part and take up the role of channel captains. The requirement within Wood Manufactures will be to produce consumer-friendly solutions suitable for DIY.
- Furniture and interior fittings of wood which in themselves consist of a number of groups, from IKEA suppliers with a high degree of production efficiency to small sub-contractors, and from office and bed manufacturers to producers of design furniture for homes and public areas. A challenge in this segment is to take the step from furniture as isolated pieces to complete interiors, which include the furniture as a whole and with it interior finishes and features such as floors, walls, ceilings, cupboards, staircases etc.

**Figure 2.2 Analysis method - step-by-step derivation backwards in the value-adding chain**

## Analysis Methodology



The various sub-segments fit together in several ways:

- Constructionally in the sense that if new-build in the form of structure and studs etc is built in wood this will affect the choice of interior materials, which can in turn open new opportunities to form ensembles of interiors/fittings, above called "complete interiors". This connection is important for architects and structural engineers, who can explore new solutions and find new forms of expression.
- Demand-wise inasmuch as an increase in New Build will energise the refurb/ extension sector and the demand for interiors. In this sense New Build has a central role as the motor in the home-market innovation system Wood Manufactures. The development of the export market can have other driving forces behind it.

## **2.4 From cubic metres per person to value per cubic metre**

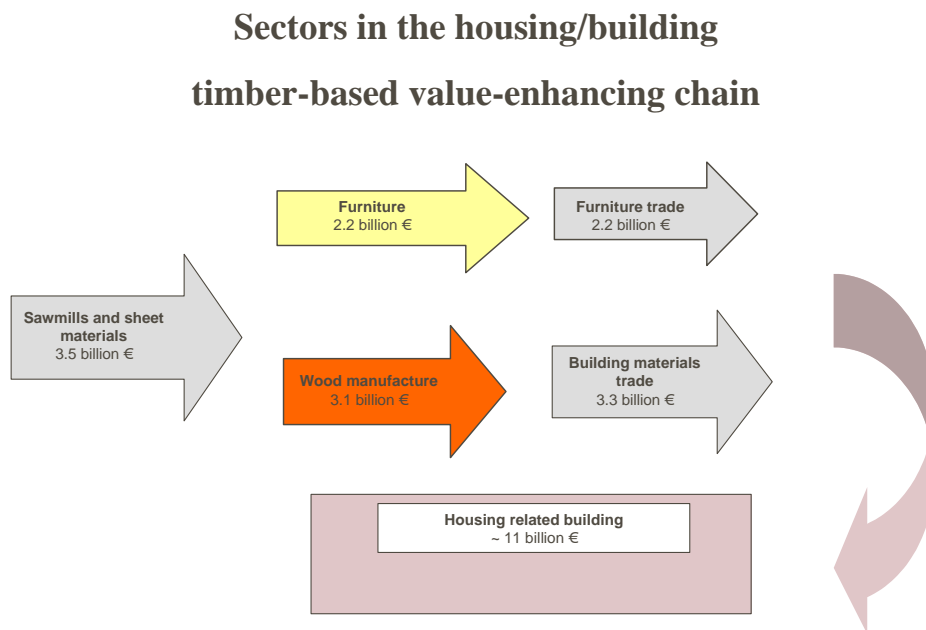
The strong focus on industrialised building in the New Build segment is motivated by the large savings in cost which can be made through a changed division of work in the value chain. As we intend to show further on in the report, the wood in New Build of a timber house represents about 2% of the total cost and 3% of the production cost. To steer the wood manufactures segment into a course which presses down the price of the wood material and which maximizes the use of wood is therefore not central to our analysis.

### 3 Structural view of the value-adding chain in wood manufacture

#### 3.1 Wood Manufactures within the overall value-adding chain

The growth sector Wood Manufactures has a turnover of €5.2 billion, of which €2.2 billion is furniture and €3.0 billion is other wood manufactures. Upstream in the direction of the raw material, sawmilling and sheet materials account for €3.6 billion and downstream there is a level of trade on the home market for €5.4 billion (before home-produced manufactures are in place in a housing construction) worth €10.9 billion. The growth sector Wood Manufactures (including furniture) has a workforce of more than 30,000 employees and a added value of the order of €2.2-2.7 billion.

Figure 3.1 Wood Manufactures in the overall value-adding chain



## 3.2 Building

### 3.2.1 Segments within the building sector

The building sector has in recent years become more and more market-orientated but there are still a large element of society orientation built into the system. This still applies to the housing sector despite fast and widespread deregulation. The market for non-residential accommodation has also undergone considerable changes in the last ten years, both in the private and public sectors.

In the whole building sector, the above development has meant that basic functions with standardized design and quality have been replaced by customer-orientated options where both function, design and quality can be chosen freely. The old legal distinction between fixed and movable property in a building is ripe for revision.

In Sweden – as in most of Western Europe – the rebuild and rebuild sector is now larger than New Build. In the official statistics from Statistics Sweden, the refurb and rebuild sector now has a steady 55% of the total turnover of the building sector (including civil engineering) of €23 billion. It should be noted that the value of DIY in houses is not included in this figure.

This relationship between rebuilding and New Build will remain or grow (depending on the amount of new construction) because in Europe – in contrast to the USA – we count on a considerably longer life cycle for our buildings. At the present rate of construction – which is far too low - the housing stock will take about 250 years to renew. A more realistic view is that our housing will on the average be used for 150 years, and will during this time be the subject of 5 major rebuilds and a further 10 renewals of the outer skin.

Rebuilding and rehab are also of great importance for non-residential accommodation. It is now usual for offices in attractive regions to be rebuilt for every change of tenant, i.e. at cycles of 3-5 years. This is more a matter of adaptation and division of space than of real technical rebuilding but it affects both joinery, furniture and finishes.

Published statistics on the turnover of the building sector have always contained uncertainties, and these uncertainties have grown with the rise of the rebuilding/ DIY market in houses. Here, the value of the occupier's own work is never accounted for and in addition there is quite a large "black" market.



### 3.2.2 Players within Wood Manufactures excluding furniture

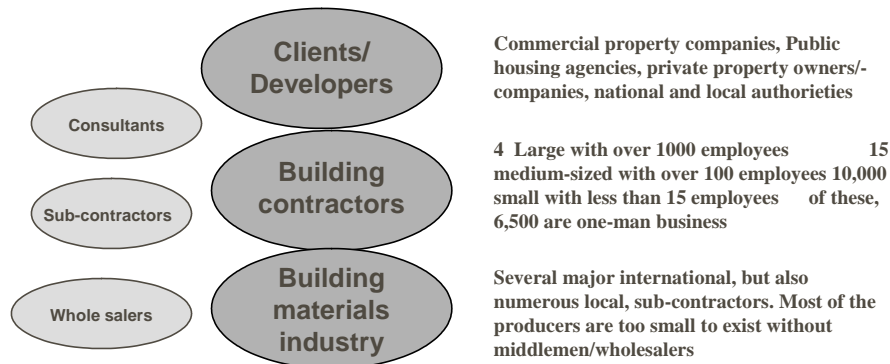
The building of cities contains by definition both collective and individual elements. There is, in addition, a very clear connection with prevailing conditions in the local economy. The relationship between parties can however hardly be seen as a triple-helix constellation which powers the development of innovations, since the contribution of society is more often normative than innovative.

Professional players (i.e. players who are recurrent initiators of building projects) dominate the market even if the final users are separate individuals. Few clients for one-off houses or non-residential accommodation possess sufficient expertise to become players on the market.

**Figure 3.2 The building sector – Players and interested parties in the value-adding chain**

### The building sector: Players/partners

The leading player's in the sector: Those who stake risk capital.....



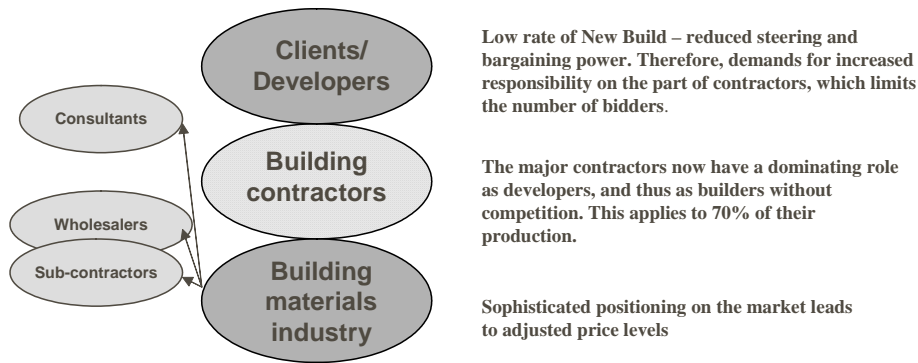
Commercial players can be (a) commercial property owners who rent out non-residential space and housing, (b) publicly-owned housing companies (c) local or county councils who erect buildings for their own use (schools, hospitals etc.).

Professional property owners – at least the larger ones – can be expected to possess competence to administer New Build projects. Their experience derives from their building management – the knowledge of what is "right" as regards design and material. Clients who possess this knowledge are the "specifiers" of their projects.

**Figure 3.3 The building sector – Market positions of players and interested parties**

### The building sector: Players/partners

Position:



There is however a large group of commercial players whose activities for the most part consist of building management and whose New Build activity is very limited. During the procurement process they will be more dependent on consultants/architects or on building contractors, who in such cases assume the role of specifiers.

The four major building contractors in Sweden – Skanska, NCC, Peab and JM – have a special position on the building market in that they are normally also clients to their own projects, i.e. they own them, at least during a transition period. They thus become specifiers for this part of their production – a share which in recent years has been over 70% of their production.

Clients who themselves lack the competence to manage their projects normally use an architect or special consultants for this purpose. This system is often dominant abroad, with architects/engineers in the lead. Builders and sub-contractors are however always parties to design and choice of components by proposing alternatives which are (investment-wise) to the advantage of the client.

Summing-up it can be said that the final choice of design and system/material/choice of components in a project is based on the prevailing conditions there – there is no general model. This is one of the reasons why no development of wood building systems has taken place since the introduction of studs in the 1930s.

Consumer influence on the dwelling has shown a marked increase since the 1990s in Sweden – a trend which is at least as clear in the rest of Europe.

Private ownership and co-operative ownership now account for 70-80% of all New Build. In addition, there is a constant transition from rented to co-operatively owned accommodation in attractive regions.

The dwelling consumer is influenced in his choice of materials and components by entirely different channels than the professionals. The new players in the building materials trade have understood how to corner the new market. In addition to the DIY market they have found another market in the small building firms primarily engaged in rebuilding for private persons.

Support systems for the management of the more customer- and project-orientated products (for which there is an increasing demand) are however lacking to a large extent. Staircases, special joinery (apart from kitchens and bathrooms), windows and doors are available only as heavily standardized products in the building markets. Amongst manufacturers there are many small firms with the competence and capacity to produce customer-orientated products – but there is no intermediate level which can co-ordinate market and industry. Since meaningful R&D does not exist within the sector this is, unfortunately, an example of a very un-coordinated innovation system.

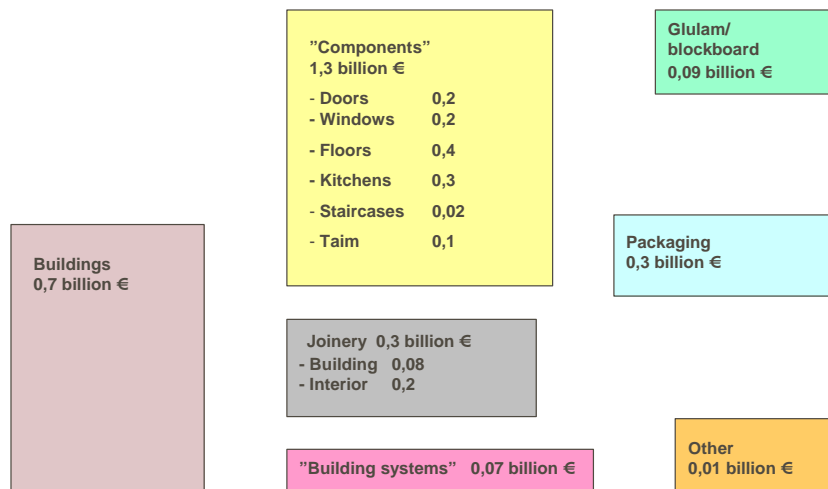
### 3.3 Wood Manufactures excluding furniture

#### 3.3.1 Sub-sectors

Figure 3.4 Sub-sectors in Wood Manufactures excluding furniture (turnover of firms with 5 or more employees)

### Wood manufacture – the makeup of the industry

Wood manufacture excluding furniture 2,8 billion €



The wood manufactures industry, excluding furniture, has a turnover of €2.8 billion and employs about 19,000 people, a figure which applies to firms with at least 5 employees. If the small firms with up to 4 employees are included, the sum rises to €3.0 and the number of employees to over 20,000. The analysis shown is based on a trade study made by Brege, Milewski and Berglund which will be published by TMF (the Employers' Association of the Swedish Wood Products Industry) in the spring of 2004.

The largest sub-sector is house manufacture with a turnover of €0.7 billion (firms with 5 or more employees). Here there are several firms with a turnover of over €22 million and the largest ones – Myresjöhus and Älvsbyhus – round €100 million. Amongst the house firms there are also those who concentrate on finished buildings such as schools, nurseries, offices etc.

A clear and widespread strategy in the house sector is to increase the degree of prefabrication in house building and shorten the times for the final assembly of the house on the site. Development is in the direction of volume building, i.e. prefabricated 3D components are delivered complete with electric wiring, kitchen equipment, storage units etc. The largest Nordic house builder, Finndomo, with its Swedish firms Hjältevadshus and Modu-

lenthus are progressing fast in this direction. Älvsbyhus in particular has impressive profitability achieved by a consistently applied strategy with a high degree of prefabrication of heavily standardized houses in large numbers. Another characteristic of Älvsbyhus is knowledge of, and influence on, previous and later value-adding stages – from the sawmill to the finished house.

The development of strategies in the house segment covers both market-strategy considerations regarding choice of customer segment and degree of customer adaptation together with more production- and logistics-influenced questions on type and degree of prefabrication and organization of the final assembly – questions which in the general debate fall under the heading "lean thinking" and which often lead one's thoughts to products such as cars and telecom. As far as the construction of the houses is concerned each manufacturer has its own standards, to the detriment of development opportunities for the segment as a whole.

The segments Glulam/blockboard and Other building components include important firms developing system components for increased industrialised building and in particular increased building with wood. These segments have a combined turnover of €0.17 billion. Major firms are Martinssons Trä and Norrfog. Seen in the light of increased industrialised building they form the embryo of a much larger segment. Parts of earlier NUTEK/VINNOVA projects were devoted to the development of this new segment. Manufacturers of system components have the co-ordinating role in the value-adding chain which is sought in Chapter 1.

The Door segment has a turnover of over €0,2 billion. Product-wise, the range can be divided into external doors, internal doors and institutional doors. Other parameters are material and type of design, e.g. panel doors. The largest firms on the Swedish market are Swedoor, a part of the Danish concern VestWood and the Norwegian firm Doria with its Swedish units Nordbo, Ekodoor and Kungsäter Dörr. An important strategic question is presence at building market level and building up the brand in relation to consumers. The logistic connection to building market trading is of great importance. Product development and profiling of doors depends mainly on material and design.

The Window segment, like that for doors, has a turnover of €0.2 billion. The largest firm is Elitfönster, which together with SP Fönster dominates the market in terms of size. Important competitive parameters are breadth of the range and bargaining power as against the building markets. As with doors, deliveries and the brand occupy a central position in the development of the strategy. Technical development centres on energy saving and indoor cli-

mate. The firm which invests most in this area is the market leader Elitfönster.

The segment Wood floors has a turnover of €0.4 billion and is dominated up to 75% by the European concerns Nybron, where Kährs are a subsidiary, and Tarkett-Sommer. Floors is the most international segment in the sense that national standards do not place barriers in the way. Movement across national boundaries is thus encouraged. The competitive parameters are not unlike those for doors and windows, though the floor segment has come further in brand building and also in thinking in terms of design. Product development is consumer-orientated, for example the introduction of "click" floors where the do-it-yourselfer can lay a floor simply by clicking together the floorboards, without the use of glue.

The Kitchen and Bathroom segment has a turnover of €0.3 billion and shows the best average profitability in Wood Manufactures excluding furniture (but is beaten by Beds). The major concerns with European strategies are Nobia with Marbodal and Myresjökök, and Ballingslöv. Both these concerns address the up-market segment amongst consumers. In the lower price classes, IKEA is a strong competitor. Kitchens and Bathrooms have come a long way in matters of brand and design, and unlike Doors and Windows (but like Houses) they control their own sales channels to the consumers. Product development in kitchens centres round the development of more functional kitchens regarding utilization of cupboard space, and ergonomic questions play a part here. In contacts with consumers it is important to produce different proposals for interiors with the help of computer-based programmes.

The Wood Stairs segment has a turnover of €0.03 billion. The largest firms are Skellefteå Snickeri Central and Snickarlaget. The loss of the German building market has come as a hard blow to this segment, as it was from there that some firms received the lion's share of the orders in the mid-90s. As with kitchens, CAD programmes are an important instrument in the design of staircases. A challenge for this segment is to convince consumers that (indoor) stairs are an important part of the interior.

The Wood Trim segment has a turnover of over €0.1 billion. The largest firm is Gapro and most of the range consists of skirtings. In common with other manufacturers of building components it is important to reach consumers via the building materials trade. As the DIY segment grows, a consumer-friendly product development becomes more important, where fixing comes high on the list of priorities.

### **3.3.2 Players within Wood Manufactures excluding furniture**

It can be noted that development work is in progress round the larger, market leading firms. Wood Manufactures excluding furniture has however not produced a working innovation system in accordance with the criteria regarding collective visions and commitment combined with the use of new and innovative resources. This applies to the industry as a whole, but also to the various segments. In addition, the innovative contributions are too fragmentary and all too few.

Wood Manufactures excluding furniture can be seen as low tech if we look at the share of R&D in relation to the turnover. In the recent trade study, the average percentage for development and design was 2.6% (figures not weighted for turnover). The house segment shows the highest figure, 4.5%, and other above-average segments are (primarily) windows and interior joinery.

In addition to the wood-related industrial players forming the Wood Manufactures industry, the innovation system contains other players such as machine manufacturers and industrial paint manufacturers, together with academic research and the community, primarily in the role of financier but also as client. Finally, the demands of consumers must also be included in the innovation system. The power of consumers over the production of buildings and building components is on the increase, and other shapers of opinion such as environmental organizations have an increasing say together with the consumers' more and more central position.

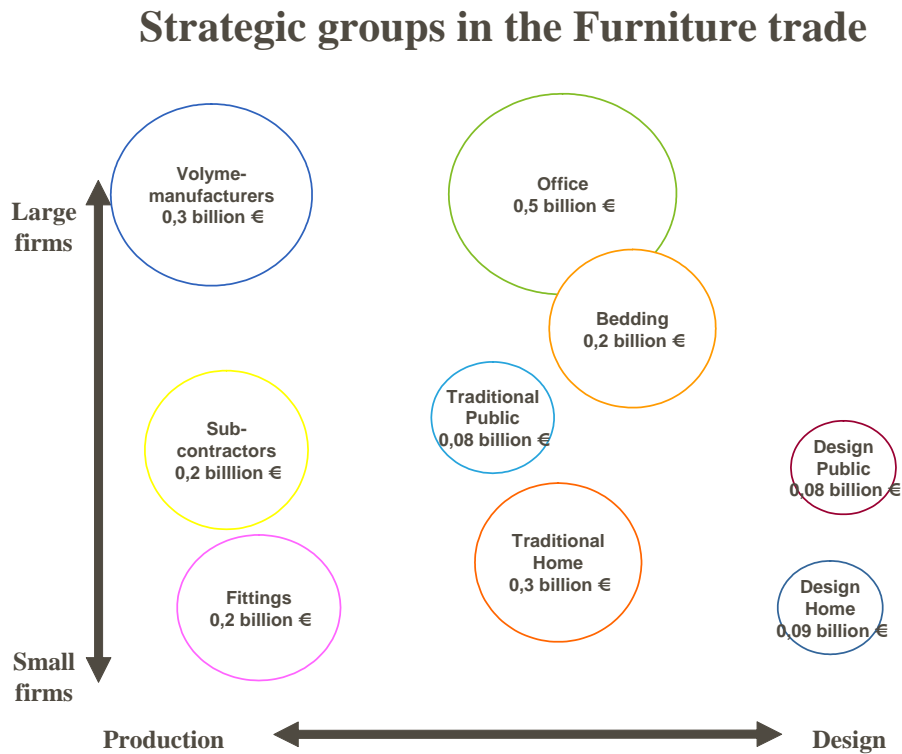
Development work powered by the industry is thus limited and the absolute majority comes from the somewhat larger firms. The industry is dominated (60% of the turnover) by firms with a turnover of €10.9 million and upwards. Within certain segments, notably kitchens, IKEA contributes as a driving force. Interesting islands of development, which should be strengthened in order to aid industrialised building, are to be found among house manufacturers and amongst the producers of prefabricated system components, such as Martinssons and Södra Building Systems.

Thus we argue that Wood Manufactures excluding furniture can at present not be regarded as a coherent and working innovation system, which it should be bearing in mind its importance as a link between the two more established innovation systems Building and Sawmilling. Technical and commercial research focusing on Wood Manufactures is limited, and so are collective research commitments from industry and from society as a whole.

## 3.4 Furniture

### 3.4.1 Strategic groups

Figure 3.5 Strategic groups in the furniture industry (turnover of firms with 5 or more employees)



The furniture industry has a turnover of about €2 billion in firms with 5 or more employees and a further €0.2 billion in smaller firms. The total turnover is thus about €2.2 billion. As in the rest of the Wood Manufactures industry it is important to analyse development broken down into segments or strategic groups. In an earlier study of the industry (Brege, Milewski, Berglund: Storskalighet och småföretagande – en studie av strategiska grupper inom svensk möbelindustri, Rapport VR 2001.41, VINNOVA), nine strategic groups were identified (see figure 3.5). These nine can be put into six groups.

Office Furniture is the largest group with a turnover of €0.4 billion. The major office furniture firms are Kinnarps, EFG and Martela, who are amongst the ten largest firms in Europe in this segment. The group also includes "niche" firms such as RH-stolen and other makers of office chairs. The larger firms in the office group control their market channels all the way to the final customer, which during the last boom made the group the most profitable in the furniture industry. Today the market scene and profitability are totally different due to the current slump and structural changes



due to the reduced need to store paper. Development in the office furniture group is largely centred on ergonomics with tables and chairs that can be raised and lowered. Flat pack parts of office furniture exhibit a high degree of manufacturing efficiency.

The volume producers could also be called IKEA producers, as IKEA accounts for a large part of their production. The group has a turnover round €0.3 billion. IKEA itself owns three firms in this group – Bräntorp Möbler, Swedwood and Tibro Kontorsmöbler. Other firms are Gyllensvan, Spaljisten and Totebo. The firms in the volume percent group are extremely effective producers of flat pack furniture, and much of the strategic development consists of effectivisation of production and finding further customers on – in the first place – export markets (this applies mostly to the non-IKEA-owned firms). The volume producers can be seen as forming a part of IKEA's innovation system, which covers the value chain from the forest to the finished product and its function with the consumer.

The Bed group is easily the most profitable group in the furniture industry and indeed in the whole of Wood Manufactures. Beds have a turnover of €0.2 billion and are dominated by Hilding Anders with a broad range of beds, together with the high-profile firms Hästens and Dux. The most successful part of the Bed group is the makers of mattresses, while bedheads of wood or other materials have been pushed into the background.

The Traditional Furniture group has a turnover of €0.3 million, with the emphasis on furniture for the home. The small and medium-sized manufacturers are to be found here, often under strong pressure from the retail furniture chains. The title "Traditional" comes from the firms' marketing of quality and tradition rather than design. One of the major strategic problems in this segment is to establish itself more decisively on various export markets.

The Design Furniture group has a turnover of €0.2 billion. With the exception of a few larger firms such as Lammhults, Materia and Balton the group is dominated by small firms. The strategic challenge in the group is to build up stable and comprehensive commercial concepts, where the design profile is complemented by professional know-how in business, production and delivery control.

The group sub-contractors and fittings has a turnover of €0.4 billion (where some other fittings are included under Wood Manufactures excluding furniture). These firms, and particularly the sub-contractors, are often each dependent on a few customer firms. The strength of this segment lies in production, material and handicraft expertise.

### **3.4.2 Players in the Furniture sector**

In the furniture industry there are a number of "locomotive" firms like IKEA and the major office and bed manufacturers. IKEA has a special place when we speak in terms of a working innovation system with integration backwards from the retail level to furniture and sheet materials for the furniture industry. Other players in the business world who form part of the innovation system for furniture are machine manufacturers, paint manufacturers, sheet material producers and the retail furniture trade. A weakness compared with, for example, Italy is the absence of machine manufacturers in Sweden. When we speak about innovation systems in furniture we should not forget the various players in the area of design and the co-operation that takes place there.

The furniture industry is also characterized by comparatively small contributions in the form of collective industrial commitments to R&D and by financing from society via authorities such as VINNOVA and through universities and colleges.

### **3.5 Sawmilling and sheet materials industry**

The sawmills and the sheet materials industry have a turnover of €3.6 billion, of which sawmilling including planing accounts for €3.4 billion and the sheet materials industry – plywood, hardboard and particle board – for €0.2 billion. Through value-adding processing, the sawmills take the step into what we define as Wood Manufactures. The sawmills own several of the firms which figure in the structural description above, and in addition carry out operations which cannot be divorced from the remainder of sawmill production. The sawmilling companies invest in commercial and technical development forward in the chain, both directed towards New Build and industrialised building, directed towards consumer-friendly product development of DIY products, and towards taking over Wood Manufactures from the manufacturers of windows, doors etc.

The sheet materials industry grapples with serious structural and profitability problems. An extremely strong contributory cause is the high cost of raw material, caused by the Swedish venture into the tax-free (carbon dioxide tax) use of bio-fuel. The price per square metre of Swedish sheets is far above that on the continent, which means that Swedish manufacturers can only just compete on their home market in terms of price, despite freight costs from the continent of the order of 20-25% of the production cost. This is a serious situation for the sheet materials industry, but also for the furniture industry, which forms a large and important customer segment. Not least the furniture manufacturers who supply IKEA feel that this is a very serious disadvantage. The Swedish furniture industry is dependent on the

possession of a home-based, competitive sheet materials industry. IKEA's emphasis on new investments points to the extremely strategic importance of this segment. The sheet material industry is attempting to meet the unfavourable price situation by developing sheet qualities in close collaboration with its customers, where parameters such as strength, weight per unit area and environmental properties are important.

### **3.6 Academic R&D work in the value-adding chain**

The investigations which have been made regarding the financing of research in the forest-based value chain leading to building, show an unbalance to the disadvantage of Wood Manufactures. The so-called PROMIS study showed that of a total of €72.4 million (in 1999) which went to forest-based research, €15.4 million (19%) went to "wood to the market" (which also includes that which we define as sawmilling). The remainder went to "forest as wood raw material" €32,6 million (41%) and "pulp to the market" €1.6 million (40%). The PROMIS study further showed that the number of persons working on R&D had increased during the 90s. Taken together, these figures show that sawmilling and Wood Manufactures are unfairly treated in comparison with forestry and paper/pulp respectively. If we then go in and examine the wood research we find that sawmill-linked research has been favoured at the expense of research which goes forward in the value-adding chain into Wood Manufactures.

At present research and development of wood-related matters are carried out at the Swedish Institute for Wood Technology Research which is now a part of SP, the Swedish National Testing and Research Institute and at the institutes STFI (wood fibres), SP itself (wood protection and wood building, plus testing) and Skogforsk (raw material matters and transport). In addition a wide range of work, primarily dealing with the more forest-based part of the value chain, at the Swedish University of Agricultural Sciences in Umeå, Uppsala and Alnarp, where the forest faculty consists of the former Royal College of Forestry.

There are research contributions of a more recent date which form the embryo of better focused research dealing with Wood Manufactures. The efforts of the state through NUTEK in the late 90s has resulted in the Skewood programme in Skellefteå and Luleå and the Wood Design Technology programme in Växjö. These programmes have a broader grasp on the value-adding chain and have, in part, a profile which suits Wood Manufactures, as does Trätek's work on building in wood and primarily within this area on the problems of fire.

Two pieces of work have been carried out by the the Swedish Foundation for Strategic Research which are also of interest. On the wood side, the

sawmilling programme (Wood Technology Programme) has been carried out as a joint project between the universities of Luleå, Lund, Chalmers and KTH (the Royal Institute of Technology in Stockholm). The thrust of the research has lain heavily on technical questions but has in a later phase shown an opening towards the market. On the building side, co-operation between the same technical universities must be taken up as an example of the attempt to introduce industrialisation and "lean thinking". However, wood is not mentioned specifically as a competitive material. For a long time resources have existed at the technical universities – Luleå, KTH, Lund and Chalmers. At KTH, research has started on wood-based composites within Biofibre Materials Centre.

At Linköping Institute of Technology a programme within wood technology directed at the problems of the manufacturing industry been linked to the training of mechanical engineers and during recent years research on market strategies has been started. Various courses on wood material, wood use and wood design at different levels exist today at several university colleges such as Dalarna University College University of Gävle, Mid-Sweden University etc.

#### **Work by public authorities (in addition to research)**

The efforts at the end of the 90s through NUTEK's wood, building and furniture programme have made a strong contribution to the paradigmatic shift with its focus further forward in the value-adding chain, which the formulation of the growth sector Wood Manufactures expresses. The efforts which are being made today go through Industrial Development Centres (IUC) directed towards wood, and through NUTEK's work on clusters involving small and medium-sized firms. In addition there are a number of regional projects for various types of network, often partly financed by EU. Taken together, the efforts being made are somewhat limited and in many cases of one-off character (see Ager, Bergqvist, Backman: Nätverk och kluster I Träsverige 2003 – En inventering och snabbtvärdering, NUTEK and Öhman and Enocson, Trä-, Bygg och Möbelprogrammet – en analys of insatser och resultat, Rapport VR 2002-24, VINNOVA).

## 4 The future innovation system

### Building with wood

#### 4.1 Vision 2015

The vision takes as its starting point that Swedish housing construction round 2015 has reached a sustainable volume of 40,000 dwellings per annum. A factor which radically contributes to this increase is a major cost reduction in New Build which is also reflected in lower rents. These cost reductions will to a large extent be made possible by an increased industrialisation of building.

In the centre of the vision is increased prefabrication within the framework of building, using wood as its structural material. Wood is more suitable than concrete and also steel as the system base. In this way wood functions as an important catalyst for development. The increased use of wood in building runs parallel with technical and commercial development in industrialised building.

The vision reflects development where half of construction consists of houses, which leads to an increase in the Houses segment from €0.7 to €1.6 billion. Production of houses for the home market is more than doubled, and in addition considerable export opportunities arise. In Sweden 90% of all houses are wood-framed, whereas the corresponding figure in the rest of Europe is round 10%.

In addition a new industrial segment, the Housing Industry, opens, directed towards prefabrication of component systems for flats – a segment with the potential to give wood-based systems a turnover of €0.5 billion. The calculations in the vision are based on the assumption that 20,000 flats are built with an average area of 50 m<sup>2</sup> and at a price of €870 per square metre. Prefabrication with wood frame is estimated to achieve a 50% market share, giving a turnover of €0.4 billion. In addition, export to the European market is expected to be built up. There, the use of wood frames in flats is very limited – less than 5%. The potential is great.

Other parts of Wood Manufactures excluding furniture will also be affected positively, in the first place the product components doors, windows, floors, kitchens, stairs, trim and panels. These products have a turnover of €1.3 billion today. In the vision an increase to €1.9 billion is envisaged, based on a doubling of New Build and R&D activity and on increased export. Within R&D, the DIY segment will show a strong increase, which means great commercial opportunities both at home and for export.

Wood Manufactures excluding furniture expects a strong increase in turnover from €3.0 to €5.0 billion, an increase of the order of €2.0 billion. In terms of jobs this means an increase of 10,000 employees to a total of 30,000 (excluding furniture). Our jobs calculation is conservative, as we assume that there is a certain amount of spare capacity to start with. The increase corresponds to a turnover per employee of €0.2 million, a high figure in the industry.

For the Swedish furniture industry, the vision is based on the possibility of further improving international competitiveness and that the turnover of €2.2 million in this way could increase to €2.7-3.3 billion with a potential for a jobs increase of several thousand. To achieve this goal, competition from low-price countries must be met and compensated by increased efforts regarding design, function and quality. The increased import competition must be matched by increased Swedish export and also internationalisation in the form of establishment abroad. The furniture industry's locomotives – IKEA, the office segment and the beds segment - will continue to develop till 2015, which helps the rest of the industry along. In addition, the Swedish home furniture and design furniture segments will have built up a more stable export. An internationalisation of the Swedish retail furniture chains alongside IKEA will have also made a positive contribution to this development.

## **4.2 New Build**

### **4.2.1 Industrialised building – cost advantages**

The building sector has not developed like other major industrial sectors during the second half of the twentieth century. Due to its national and local roots it has retained its traditional craft-based organization. The sector stagnated during the 70s and 80s all over Europe, and has since then had a low or non-existent increase in production. This has – particularly in housing – meant that relative costs in relation to other capital goods have increased. It has also meant that the system of housing subsidies which has existed in most European countries has become very expensive for the state finances and in practically all countries has been reduced or wholly withdrawn.

Without subsidies, the building industry has turned to less price-sensitive segments rather than increasing effectivity. Numerous Docklands-style developments show that this has been an international trend. It is however a niche market, for which reason housing construction as a whole has declined in most countries – the exceptions are those who have been favoured with EU subsidies or had a stable economic growth.

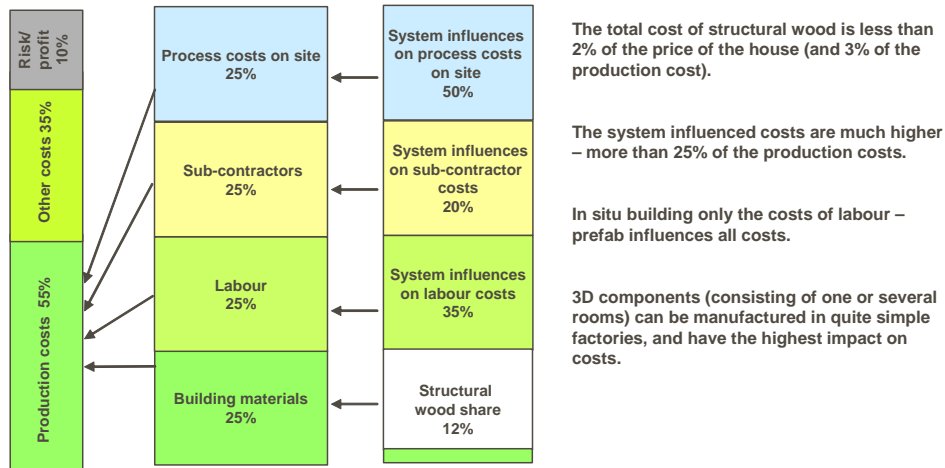
In Sweden the concept of housing construction has been on the agenda since the 60s, but it has now become of immediate interest both to the players and to society. It has been triggered by a simultaneous reduction in the demand for exclusive flats for wealthy people born in the 40s, and the increasing need for housing for young people. The "Building Commission's" enquiry "Skärpning gubbar" (Pull your socks up, chaps!) focuses on the lack of competition and development apparent in the building industry. Questions of quality are also highlighted in the debate.

Industrialised building in its first phase means that most of the work which is today carried out on site is moved into a factory and is carried out by a workforce which can work effectively without regard to craft boundaries.

Figure 4.1 Industrialised housing construction (from NTC's study "Building Europe")

### Industrialised building... a first step towards a new building sector.....

Cost share principles for a house



This illustration shows the marginal effect of the cost of material in the total cost of a house – and the effects of the system-related costs. The wood material in a house accounts for not more than 3% of its cost of production. On the other hand, 25% of the cost is affected by the cost of the choice of system/material.

The principle of the figure, with a 25% share each for material, labour, sub-contractors and site costs has been tested against real projects and the divergences have been found to be small. There is however a dearth of projects built entirely with on-site methods.

With industrialised building, considerably increased effectivity can be obtained in comparison with the present on-site technique. It is above all procurement/logistics and a reduction of unproductive time/cost of mistakes that are affected. An analysis of the procurement process under different methods of production and following-up the amount of time required for various operations under different degrees of prefabrication shows how large the differences are.



**Table 4.1 Analysis of the procurement and production process in building a small group of houses**

## Industrialised building – Purchasing and production

Analysis of the production process for building a small group of houses  
The analysis covers about 10 houses

	In situ building Conventional organization	Frame prefab Conventional organization	3D prefab Modified organization	CM-purchase (divided purchase)	Collaborating System Suppliers (responsible for complete sub- systems in the finished product)
Number of purchases Building materials	>40	About 30	1	0	System co-ordinator Landscape contractor Foundations contractor
Number of purchases Sub-contractors (material + labour)	7	7	2-4	7-10	Frame contractor Service contractor Fitting-out contractor
Number of site- related process purchases	About 10	About 10	3	10	3

**Table 4.2 Analysis of time consumption in building a small group of houses**

## Industrialised building – Time consumption

Analysis of time consumption for building a group of houses  
The analysis covers about 10 houses of 120 m<sup>2</sup>. All figures in m<sup>2</sup> are interior sizes (BOA in accordance  
with Swedish Standard 021052)  
Site works are not included in this study

	In site building Conventional organization	Frame prefab Conventional organization	3D prefab (Conventional factory process) Modified building organization
Site per m <sup>2</sup>	10	6	1 (in the factory 4 including traditional sub-contractors' work)
Sub-contractors Number/man-hours on site/m <sup>2</sup>	5/4	5/4	2 (in factory)/0.1 Total man-hours 2/m <sup>2</sup>
Total building time	About 40 weeks	About 20 weeks	About 10 weeks

As the analysis shows, effectivity increases considerably with 3D-prefabrication. Under this system of production most of the work of building construction is moved to the controlled conditions of the factory. It appears that the increased time-effectiveness is accompanied by a corresponding effec-

tivity in terms of cost. All the noted low-price products which have been introduced on the housing market in recent years are now made using this type of production. This also applies to the leading Nordic house manufacturer (Älvsbyhus).

It should however be clearly pointed out that it is the same work which is carried out, with the same components. The industrial option, assembly of the final product using optimised components has still not been utilised. For this reason, comparisons with the motor, aerospace and telecom industries are still halting.

A future vision for the building industry is therefore that the present development of industrialised building is followed up by development of adapted components with system suppliers. Some of these are to be found in other industrial areas – electric supply, heating etc. To emphasise the difference in the system we can call it "lean construction".

#### **4.2.2 System components of wood in relation to alternative materials**

Prefabrication of wood houses has existed ever since the 1850s and there are numerous good historical examples. The present house industry (Swedish Federation of Wood and Furniture Industry) was started in the 1920s as a sawmill-related activity.

Wood thus has easily the longest history as a system base for the manufacture of housing. Its properties and possibilities should however be evaluated against those of other materials used in the building sector.

Concrete prefabrication was developed rapidly in the 1970s. At that time housing construction was on a very large scale and capital-hungry heavy industry could be established. In for example Stockholm at the beginning of the 1970s there were no fewer than 8 concrete factories for housing production.

Since 1993 none of them is in operation any longer. In Sweden there are now only 2 major and a handful of smaller concrete component makers left.

The advantages of concrete were its stability and load-bearing capacity, the disadvantage was its weight. In densely-populated regions with good infrastructure, concrete works as a system base. In countries with a cold winter climate it has obvious advantages over in situ construction (Eastern Europe). For house construction, concrete has seldom been competitive and when terrace house construction declined after 1972 concrete virtually disappeared from the low-rise market.

Steel construction has its place in prefab history from the 1850s onwards, when cast-iron columns and lattice girders became the norm in industrial buildings. Later in the nineteenth century the introduction of rolled steel sections further increased the strength.

In housing, steel has however never been much used, except for a period round 1920 when steel beams replaced wood floors in flats. Steel beams were themselves outmatched by concrete after only ten years. Steel construction has thereafter found its place in industrial and commercial buildings, where its strength and large spans have been utilised.

During the last 20 years, steel in the form of profiled sheets has become a common building material which bit for bit has taken a market share from wood studs. Today, light steel studs have replaced wood studs for non-load-bearing walls – both in office buildings and in housing.

In recent years this technique has been developed so that even a certain amount of load can be taken up by the steel studs. Steel studs can now form the system base in construction which in all important respects resembles that for wood studs. It is therefore no surprise that prefabricated steel systems are now being developed both for flat and 3D components. Light steel studs form the basis of a major 3D component project in Malmö.

Wood has strength characteristics between those of light steel studs and concrete. The wood material has sufficient strength to suffice for ordinary spans in housing and for normal vertical loads up to 5-6 storeys. Wood as the system base can thus be an alternative for more than 80% of housing production.

Research and development in recent years has led to fire and acoustic solutions which are quite as good as those which can be achieved with concrete. Wood components can be manufactured in various degrees of completion in small factories with a relatively small investment. There are already numerous manufacturers, so competition can always be relied upon in this sector.

### **4.2.3 Requirements on wood component suppliers**

During a development phase, there will be a lack of clear steering from the building industry regarding specified requirements on function and properties of all the components which are asked for.

Component manufacturers must therefore be prepared to go into the system with a good knowledge of the building process and the market. It will hardly be a question of pure price bargaining, since a considerable exchange of know-how will be involved.

Those component manufacturers who can deliver a high degree of completion will continue to be well placed in the competition. They are however few in number and one can hardly expect that a new national capacity will arise – possibly better utilisation of that which already exists.

In the long term, industrialised thinking will catch on even in types of building which are not suitable for 3D components. This will call for small firms who can produce less-standard components where a certain amount of work must still be done on site. However, it is likely that even the remaining in situ work will in time be done by the manufacturer at the same time as the building industry reorganizes itself for Construction Management (i.e. without its own manufacturing organization).

The market knowledge which is required consists of designing components which simplify the building process on site and which dissolve the interdependence between various groups of craftsmen which today cause many of the effectivity and quality problems on the site. Bathroom construction usually provides a sample card of all the problems that can arise for a producer when many different craftsmen are involved. In addition, the risk of quality faults is clearly localised to the product Bathrooms.

#### **4.2.4 SWOT**

The vision for 2015 is to a large extent built up on the idea that industrialised building with wood has a stable foothold and contributes to radical effectivisation and price reductions. For this to succeed, an infrastructure of knowledge must be built up, in which knowledge on industrialised building and knowledge on building with wood are widespread (a comprehensive run-through of the conditions required for an increased building in wood is given in von Platen and Nord – Mer trä I byggandet – underlag för en nationell strategi att främja användningen av trä I byggande, Ds 2004:1, Näringsdepartementet).

A systematic SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is given below:

## SWOT analysis New Build

<b>Strength</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>•The prefab timber house is a good starting point</li> <li>•Ongoing development of prefab systems</li> <li>•Political backing</li> <li>•Good characteristic of the material</li> <li>•New stronger trade organization - TMF</li> </ul>	<ul style="list-style-type: none"> <li>•No working Innovation System</li> <li>•Low level of training and education</li> <li>•Serious fragmentation among both suppliers and purchasers</li> <li>•New Build still stuck in its traditional decentralised organization</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>•Great potential for industrialised building</li> <li>•Tendency towards consolidation among prefab timber house manufacturers</li> <li>•Solution to the future shortage of capacity in the building sector</li> <li>•Environmental advantages – trees take up carbon dioxide</li> <li>•Positive effect on the regional job market</li> <li>•Export chances increase with common EU regulations</li> </ul>	<ul style="list-style-type: none"> <li>•Continued low housing production without incentives to increase efficiencies</li> <li>•Sluggishness in the R &amp; D system</li> <li>•Long drawn-out change-over process in the building industry</li> <li>•Intensive lobbying from other materials delays progress</li> <li>•Poor marketing by the timber industry</li> <li>•Shortage of risk capital</li> </ul>

### Strengths

- The Prefabricated House industry has a strong platform on which both to expand the detached house segment and to enter the flats segment. The House segment has come a long way in the direction of prefabrication and building.
- The first formative phase in the creation of an building of flats in wood has been completed. There is now the embryo of an industry for prefabricated wood systems directed towards building flats.
- There exists strong political backing behind a national strategy for encouraging the use of wood in building. The foundations for a working innovation system have begun to be laid.
- Wood has good characteristics as the system base of a prefabricated building component system. Wood is light, sufficiently strong and forms, together with sheet materials, open frameworks with room for insulation and other technical systems.
- The newly-formed Employers' Association of the Swedish Wood Products Industry TMF means a stronger trade organization which spans across the whole area of Wood Manufactures including furniture. TMF is an interesting platform for more co-ordinated action.

## **Weaknesses**

- There is no working innovation system today either for industrialised building or for building with wood. This influences R&D visions and common commitments. What is needed is an infrastructure of knowledge for building with wood and for building.
- The level of education within the innovation system is low. In the short term, those working within the system must be informed and trained. In the longer term a university education in industrialised building in wood must be created. There are platforms for this, inter alia, at Luleå Institute of Technology.
- Fragmentation is considerable both amongst suppliers and clients, which is not unusual in the early stages of establishing a new technique (an unripe innovation system). It is not unusual that the major players, such as the larger building contractors in this case, do not place themselves in the forefront of the new technique.
- A large part of building work remains tied to in situ construction, and the decentralised structure hinders the steps which are necessary to stimulate industrialised building,
- Un-coordinated government policies, where various departments are pulling in different directions. Environment, energy and commercial policies, together with the educational policies coupled to them, are out of phase. This works against the creation of an infrastructure of rules, standards, research and education.

## **Opportunities**

- Industrialised and prefab building with wood as the system base has a great money-saving potential in the building process (up to 30%) and at the same time a potential for improved quality as a result of quality-controlled industrial manufacture and a fast and effective final assembly on site. Experience from other value-adding chains show that this type of development is completely realistic.
- Future consolidation in the House industry would provide extra force to encourage development. An example is that a major house builder, Myresjö, is currently for sale. It is not unreasonable to assume that a future sale would assist increased consolidation.
- Industrialised building is the best strategy to meet the future shortage of building work, which will come out in the open as production rises towards 40,000 dwellings. The same future development applies to the whole of Europe.

- The major environmental threat posed by the greenhouse effect means, paradoxically, an opportunity for wood material which possesses the property of taking up carbon dioxide. Since the building sector accounts for 40% of the Swedish carbon dioxide emission this should be a priority area. Other European countries are carrying out their national wood building programmes in the same way and using similar arguments.
- Industrialised building and an increased building in wood would provide positive employment benefits which also have a regional political aspect, since this type of manufacture is often located in sparsely populated areas.
- Industrialised building and prefabrication of building component systems would also lead to production calculations which are less susceptible to competition from low-price countries. The content of expertise would increase and help build barriers against low-price competition.
- Export is a major possibility. The use of wood in building is even lower abroad, both in houses and flats. A consolidated Swedish industry based on the house and building industry segment has great opportunities for a powerful increase in its internationalisation.

### **Threats**

- A continuation of the present low rate of building would delay development, since increased volume attracts new players who strengthen the concept of industrialised building and reduce market prices.
- Sluggishness in research and educational systems hinders a commitment to industrialised building in general and to building in wood in particular. The necessary infrastructure of knowledge is not created. The problems can apply both to rethinking in research environments and to persuading financiers of research to change their priorities.
- The decentralised building contractors' organization remains in New Build and conserves the prioritisation of local employment before effective operation.
- Substitute materials, particularly concrete, succeed through lobbying in stopping or delaying the development of building in wood. Historically, concrete and steel have had stronger power bases than wood, with few players who have more easily been able to co-ordinate their actions.
- Wood manufactures and industrialised building in wood have difficulty in attracting venture capital and do not get sufficient attention in the media and in marketing to the consumers, who have the final judgement in their hands.

## 4.3 Refurb/DIY

### 4.3.1 Building market chains as system integrators

The Swedish building materials market is going through a major restructuring. The motor in these changes is the international building market chains – Bauhaus, Hornbach, K-Rauta – which are in the process of establishing themselves (Franson: Byggvaruhuskedjors kravställning på sina leverantörer – En studie av bygghandeln i Sverige, Examensarbete Lith-EKI-EX-04/033-SE, Linköpings tekniska högskola, 2004). The Swedish market is of interest to these chains as the local, free-standing building merchants and ironmongers have not kept up with developments in Europe. This opens the market to players with plenty of capital who can survive an establishment period with small profits. This has led to the Swedish builders' merchants joining voluntary chains such as Interpares, Alljörn med Bygg and Byggtrygg. These Swedish chains must in turn become more international both in buying and in establishment in order to achieve the necessary advantages of scale in buying. The builders' merchants are trying to reduce the role of wholesalers by buying direct from the manufacturers.

It is during the last ten years that a shift of power has taken place to the advantage of the building materials trade and the detriment of the manufacturers. During the period from the 60s to the 80s various efforts on the part of the government stimulated demand and both manufacturers and wholesalers built up strong positions. Prices were allowed to shoot upwards and the trade was marked by a discount culture, where the larger building firms were given generous discounts while the private consumer paid full price. Today the international building markets are steering away from discounts and offer the private consumer considerably lower prices.

The home market in building materials has a turnover of about €3.3 billion, of which a third comes from wood and other shares from windows, doors and floors etc. The largest unit on the market is Interpares, a voluntary chain with a turnover of about €1 billion and 125 sales points in Sweden. Other major building material firms are Beijer Byggmaterial (about €0.3 billion), Byggtrygg (about €0.3 billion) and Coop (about €0.25 billion). The largest of the international building markets is Bauhaus with a turnover of about €1 billion.

The demand for building materials is stagnant today after strong expansion during the 90s and into the 2000s. New Build is declining whilst the DIY segment is estimated to grow by 10% annually (98-01). The wood range is profitable, not least the third that goes to DIY.

The building market chains offer their customers a narrow and comparatively shallow range compared with the traditional wood yards, where com-



petence regarding wood is higher and the opportunity of getting customer-tailored advice greater. Compared with competing materials such as concrete and steel the wood industry is regarded as being weak in developing competence round its material. This is reflected both in the development of the range and the accompanying brochure material, and also in the shortage of service engineers out on the building sites. In the future there will be calls for wood products with a higher degree of completion which also command a higher price in the trade. The wood material must focus on a specific use earlier in the value-adding chain – be "productified".

The building materials trade also has ambitions to take over the role of system integrator and offer consumers and other final customers ready-made solutions. In this the various players exhibit differences of approach. The international building market chains cling to a range of consumer products for DIY-ers, e.g. trim, panels etc. More traditional builders' merchants such as Beijer Byggmaterial strive towards a broader role as integrators, to offer functions like "build a patio" or "renovate a kitchen".

#### **4.3.2 Requirements on wood manufactures suppliers**

The building materials trade of the future will to a large extent go in for centralised procurement. This applies also to buying wood material and wood components. The building markets will be offered large volumes and long-term agreements but will at the same time avoid being too dependent on individual suppliers. As has previously been pointed out, these retail companies will try to go direct to the manufacturers and leapfrog the wholesalers.

The building materials trade will expect more of wood suppliers in the matter of developing consumer-friendly products where the function of the product is in focus. It will be important to develop separate solutions for the materials trade and the building industry. Adaptation to local needs will also be important. The range of the wood suppliers must be "productified", which means numbering of each article, information on the characteristics and function of the product, certifying, packaging, bar code marking etc. The international building market chains in particular will pass on responsibility for product development to the suppliers.

The importance of price as a competitive factor is increasing, and in order to guarantee a good development of the price the supplier must be able to point out the possibilities of a strong development of productivity. The building materials trade will continue to sharpen the demands for logistics with a high level of assured delivery, delivery precision, quality control etc. Demands which already exist in other trades and which are strongly influenced by "lean thinking".

Demands are also being made in the building materials trade regarding economic assistance to increased marketing towards consumers. It is asserted that other materials, particularly plasterboard and steel, provide assistance in selling to consumers. Instead, wood suppliers are portrayed as being far too little interested in the home market and as holding stable prices despite fluctuations in the supply and demand situation.

### 4.3.3 SWOT

The vision of 2015 is built up on the Refurb/Rebuild sector following the expansion of New Build. Increased new building leads to an increased turnover of houses, flats and offices. This leads in turn to an increase in Refurb/Rebuild. A special and strongly expansive sector of Refurb/Rebuild is DIY. DIY already has an impressive growth and is expected to increase its share of the Refurb/Rebuild sector. Refurb/Rebuild is becoming more and more internationalised regarding buying patterns and competition. This could be a major opportunity for Swedish suppliers and Swedish value-added wood export.

## SWOT analysis Refurb/Extensions/DYI

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>•Sawmilling has integrated forwards into international DIY-companies</li> <li>•DIY has developed out of the retail timber trade</li> <li>•Sawmilling companies have joined to provide funds for research</li> <li>•DYI has been popularised by TV programmes</li> <li>•Strong regional support</li> </ul>	<p><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>•An obsession with volumes and production</li> <li>•Unfamiliarity with consumer products</li> <li>•Defective training/education systems</li> <li>•Defective commercial research</li> </ul>
<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>•Rapid development of DYI</li> <li>•Environmentally conscious consumers</li> <li>•Centralized purchase – focus on performance</li> <li>•Internationalisation and increased use of wood</li> <li>•Innovative logistics</li> </ul>	<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>•Low rate of growth</li> <li>•Increased import</li> <li>•Unsuccessful new products</li> <li>•Centralized purchase based on price (rather than value)</li> </ul>

### Strengths

- Strong sawmilling firms which have taken the first steps towards value-adding for the building markets and DIY. There exists a potential in terms of resources to go further with consumer-friendly product development for various customer segments and not least DIY.

- DIY has been developed out of the wood trade. Wood has a strong position in the building materials market.
- Sawmills spend collective funds on research, though on a smaller scale than before.
- Increased interest in DIY thanks to TV and other media.
- Strong regional co-operation between society and business on value-adding projects and co-operation between wood manufactures firms.

### **Weaknesses**

- The sawmills conserve a culture which remains tied to production and which focuses on volumes. The challenge is to establish a new pattern of thought regarding wood manufactures alongside sawmilling.
- Unfamiliarity with the development of consumer-friendly products.. There are lessons to be learnt here from other industries, e.g. cars and telecom, regarding focus groups etc.
- Shortcomings in present educational systems, which do not cover the changed demands which can be placed on suppliers and development leading to "lean thinking" philosophy.
- Shortcomings in research on the commercial level, in general on mega-retailers and more specifically the building materials trade. To summarise it is hardly possible to speak of a working innovation system with visions and special commitment areas in the refurb/rebuild part of the wood manufactures industry.

### **Opportunities**

- The rapid development of the DIY segment can work as a growth motor for the refurb/rebuild sector. Those suppliers who at an early stage can engage in market research at consumer level will win important advantages. There will be both volume segments and more specialised niches, where a high level of service and geographic proximity near the major cities will be rewarded.
- Environment-conscious consumers will give priority to products made of wood. The building materials trade is focused on the importance of environmental aspects and will at all costs avoid being associated with products which do not fulfil rigorous environmental requirements.
- Centralised buying of wood products is primarily an opportunity if the procurement centres on characteristics and functions rather than on pressing down prices. A few suppliers will be chosen and offered long-

term contracts, though without creating monopoly-like situations. Price will be an important competitive factor.

- Internationalisation of the building materials trade's procurement is in the same way both an opportunity and a threat. For those suppliers who are competitive, a market opens outside the country's boundaries, for example Bauhaus has 190 building markets across Europe. Interpares co-operated with a European buying organization which buys for €16 billion. The potential for increased use of wood in Europe is large.
- If Swedish suppliers succeed, this means exports with a higher degree of value-adding, which is favourable to the Swedish balance of trade.

### **Threats**

- The level of New Build continues to be low, which also hampers the refurb/rebuild sector and in particular its professional segment. The building sector has low priority with politicians and also with financiers.
- Increasing centralised buying, internationalised buying and increasing focus on price and productivity can only benefit the really large suppliers and among these few or none are Swedish. Focusing on price also means harder import competition on our home market.
- Wood fails to "productify" and to create a "trade mark" amongst consumers. The focusing on customers continues to be weak and competing materials are more skilful in marketing themselves together with the building materials trade.
- Swedish development efforts are fragmented, made by various suppliers without co-ordination and exchange of knowledge. Even if Swedish suppliers compete with one another there is a great deal to be won by a common development of know-how and development of innovative offers.

## **4.4 Furniture and interiors**

### **4.4.1 Channel captains for each sub-segment**

We have earlier made it clear that the furniture industry, though consisting of numerous small firms, is nevertheless dependent on a few major manufacturers and customer firms. IKEA has a special position as channel captain of its value chain and as locomotive for the growth of its suppliers. IKEA has the ambition to grow, not least through the opening of new stores. For a number of years, in the late 90s and into the twenty-first century, the annual growth was 15-20%, which means a doubling every five years. For the suppliers who have succeeded in hanging on as suppliers, this has meant

a doubling of turnover and the opportunity to invest. IKEA is at the pinnacle of the Swedish flat-pack furniture industry at €0.3 billion, and is in addition a heavyweight in beds (mattresses, bed-heads), office chairs etc. An alarming tendency is that IKEA's buying from Sweden is now dwindling, not only percentually but also in absolute terms. Purchases in 2002 were €0.53 billion and 2003 down to €0.47 billion. Measured in percent the decline is long-term and we note 9% for 2003, which for example can be compared with 14% for 2001.

There are other locomotive firms for the Swedish furniture industry. Within office furniture there are, inter alia, Kinnarps, EFG and Martela, all of them amongst the ten largest office furniture firms in Europe, and in the Beds segment we have the Hilding concern, Hästens and Dux. Beds have a special place in brand profiling and profitability. In addition to these firms, Swedish furniture chains – apart from IKEA – are important channel captains. This dominance by the retail level has its pros and cons seen from the perspective of the supplier. The chains provide furniture manufacturers with large volumes but at the same time suppress the suppliers' chances of profiling themselves towards the customers.

#### **4.4.2 Requirements on furniture suppliers**

Requirements on furniture suppliers vary dependent on the segment (strategic group) in which they operate. Within the IKEA group of volume manufacturers it is continued growth coupled with process development and rationalisation which is the key. It is important to compensate for the relatively high Swedish wages by keeping down the wages share of the total cost, under 20% and if possible down to 15%. What would have been very attractive seen from a Swedish perspective, but has so far not fully succeeded, is that suppliers build up competence acquired in collaboration with IKEA which can be exploited in relationships with other customers on the major European markets. This is not to say that no one has tried, but the results have not been particularly good. This is however a potential which must be reckoned with in the future.

The office furniture firms are very advanced on the wood side, while down in Europe more metal and plastics are used. Sweden has been early to consider ergonomics, and today interest in ergonomics has spread further and further southwards in Europe. Office furniture seems to be in the middle of a structural change where our use of modern IT appears to lead to a reduced need of storage space for files and folders. The office furniture which is procured for large projects is the subject of hard price competition, which points to the importance of high operative effectivity.

There are a number of strategic groups which lack clear locomotive firms, but which could well increase their growth and profitability. Traditional furniture, in the sense that it markets itself with quality and tradition, is one of these segments and is directed both at the home and public environments. A similar case is that of design furniture for the home and the public sides. The poorest average profitability is found in the group which gets most attention at furniture fairs – design furniture for public environments.

Design firms need to be more "complete", i.e. be able to couple their competence regarding design with the ability to do business and handle their own production and/or a group of suppliers. In general there is a need for the strategic groups lacking channel captains to increase their export shares.

#### **4.4.3 SWOT**

The vision for the furniture industry includes both a growth in turnover which demands continued internationalisation, and a functional broadening from furniture to complete interiors. However, there is a clear lack-lustre side to the Swedish furniture industry. It is not a good thing that IKEA's Swedish buying is being reduced even in absolute figures, at the same time as which IKEA has an annual growth within the segment of the order of two till three large furniture factories. Other firms whose production is to a large extent placed in Sweden are discussing relocation and outsourcing to low-price countries. Imports from these countries are also rising. It is therefore critical to create a home innovation system which both increases the know-how content in our products and which effectivises our processes in production, logistics, procurement and sales.

## SWOT analysis furniture

<p><b>Strengths</b></p> <ul style="list-style-type: none"> <li>•Strong "locomotive" companies</li> <li>•Swedish Design</li> <li>•Expertise on materials and production</li> <li>•Strong regional base</li> <li>•Co-operation on EU projects</li> </ul>	<p style="text-align: right;"><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>•Fragmented Innovation System</li> <li>•Weak structure of knowledge in certain segments</li> <li>•Blockage at the level of commerce (retailing)</li> <li>•Wood is forced out as a construction material in the absence of innovative development</li> </ul>
<p><b>Opportunities</b></p> <p>Emphasise interiors and function</p> <ul style="list-style-type: none"> <li>•Utilize "locomotive" companies for internationalisation</li> <li>•Increased proportion of moveable fittings in dwellings</li> <li>•The properties of wood</li> <li>•Increased demand for wood furniture (share of wallet), lifestyle</li> </ul>	<p style="text-align: right;"><b>Threats</b></p> <ul style="list-style-type: none"> <li>•Low rate of building</li> <li>•High costs and weak productivity lead to increased import</li> <li>•Closed-down Swedish sheet material industry (particle board)</li> </ul>

### Strengths

- Strong locomotive firms within important strategic groups – IKEA, office furniture and beds. The Swedish furniture industry has a high export share compared with other wood manufactures – 60%.
- Swedish design, even if the design-orientated part of the furniture industry has profitability problems.
- Excellent knowledge regarding materials and production processes. The Swedish furniture industry is noted for its high level of production expertise.
- Strong regional links, numerous EU projects among furniture firms working in co-operation, six industrial development centres dealing with wood.

### Weaknesses

- Fragmented innovation system with many players on the client and manufacturer sides. Weak infrastructure on the educational side.
- Low collective commitment in research and unclear visions and descriptions of the thrust of development. The newly-formed TMF should play an important part in changing this.

- Weakness in internationalisation and in particular in finding sales channels for export.
- Many manufacturers do not get past the retailers in their profiling aimed at consumers.
- Wood as a material has been forced out by competing materials such as plastics, textiles and metal.

### **Opportunities**

- Find new product and commercial concepts with the focus on interiors and function. This rethinking can often emerge in the boundary between movable and fixed fittings. Similarly there is a potential in increased co-ordination between materials.
- Increase internationalisation, in the first place on the European market. Development is partly dependent on the locomotive firms but there is also a potential for co-operation between other (often small) furniture firms.
- The properties of wood as a renewable material and its other environmental characteristics make it possible for wood to expand as a material in furniture making.
- Wood suits modern life-styles.

### **Threats**

- Low production of dwellings is of little assistance to the home market and the same applies to export.
- High costs and a weak development of productivity undermine the competitiveness of the Swedish furniture industry, which is reflected both on the home market and in exports.
- Closure of the Swedish particle board industry would negatively affect Swedish competitiveness and the innovation system's effectivity and development.

## **4.5 Recommendations for a working innovation system**

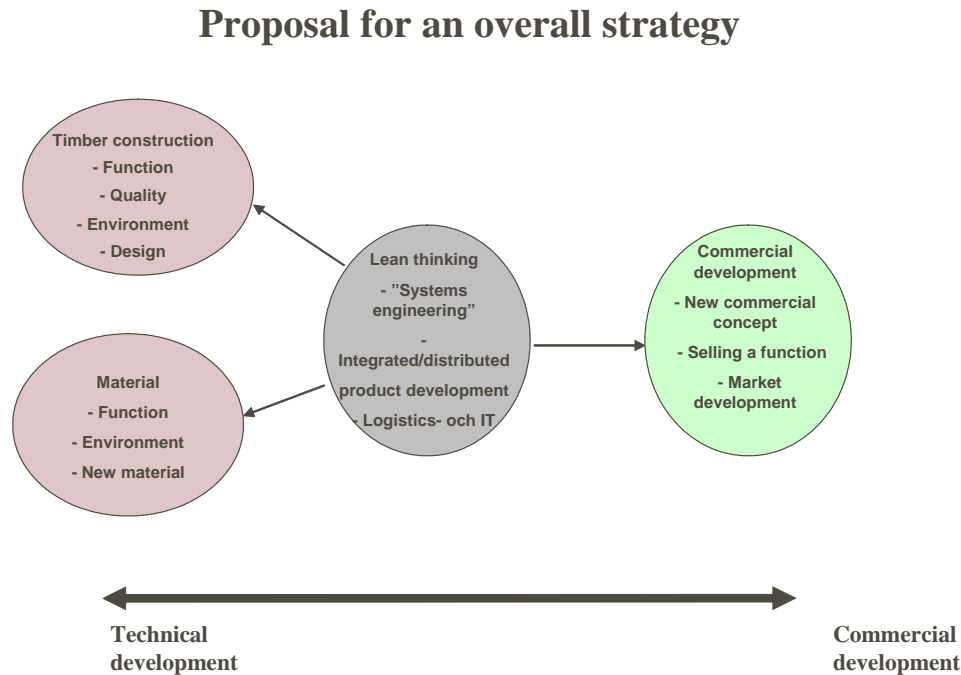
This study shows the need for a number of strategies for the development of a well working innovation system within the area Wood Manufactures.

Forceful measures are needed to create an infrastructure of knowledge round industrialised building in wood and in the development of interiors in dwellings. In the DIY sector there is a need for development of consumer-



friendly solutions, and generally in all sectors there is a need for increased commitments in commercial and marketing development. To strengthen the role of wood as the system base for building systems and interiors there is also a need for development in the field of materials.

Figure 4.2 Overall strategy "lean thinking"



### A core of innovations

By innovations we mean the activities which lead to technical and commercial development in a sequence from the development of new products, services, concepts etc. to the point where this development has been successfully launched on the market. This means that we must have various types of innovations within the area of Wood Manufactures. We see the need of development as follows:

- Product and system innovations in building systems, building components and furniture/interiors. This development has clear traits of "lean production" thinking, where technique and commercial development are welded into an entity.
- New commercial models for market orientation and export in all segments. Profitable value-adding instead of production-orientated finishing is necessary to make the most of the raw material. Thoughtless "value adding" can easily produce more costs than receipts. Willy-nilly consumer-friendliness is seldom profitable; success lies in a modularisation and standardization in the formation of options, which at the same time gives the customer a feeling of freedom of choice and creativity. The

new mega-retailers which are appearing in the building material trade will restructure the supplier level in the same way that the Swedish furniture industry has already adapted itself to IKEA's strategies.

- Organizational innovations which form more lasting integration within networks/clusters and between customers and suppliers. It is important to form integration mechanisms which still work in difficult times, and to identify locomotive firms which pull along other firms in the network/cluster. Even if export efforts have been discussed since the 70s, it is important to find new (new-old) angles. This demands a mixture of staying power, business sense and finance.
- Production innovations in the direction of increased automation etc which strengthen the "high tech" character of the sector regarding process innovations and utilisation of the latest technology (though not in terms of R&D measures). Future challenges lie in the ability to be cost-effective, often in long series ("lean production") but at the same time to be flexible ("agile production") to an ever-increasing extent.
- Wood material innovations and better properties of materials which provide a basis for substitution competition against other materials. Composites provide challenges.

### **An infrastructure which supports the development of innovations**

To achieve a working innovation system at national level, further infrastructural measures are necessary as follows:

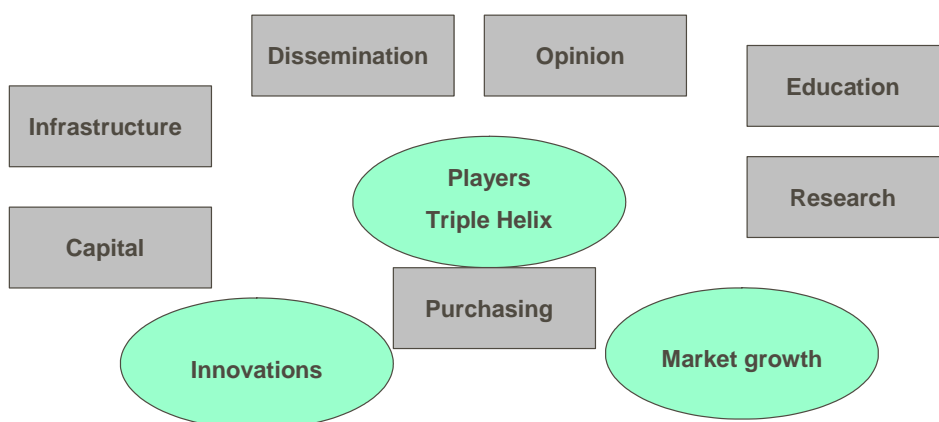
- Further extension of research platforms into the forward parts of the value-adding chain. The emphasis should be placed on building systems, customer-friendly commercial/market strategies, production processes in product and component industries and competitive materials and material properties. Research resources are to too large an extent centred on the rear, forestal part of the value-adding chain.
- The spreading of knowledge can at present be regarded as a weakness and a bottleneck, despite comprehensive efforts on the part of the Swedish Institute for Wood Technology Research and other research organizations. Further intensified co-operation between academics and the industry is needed, where the D in R&D is taken into account in information spreading and benchmarking. In this connection, the industrial development centres can play an important part as brokers with the power to connect and to provide risk capital.
- Competence level and attractivity must be raised across the whole value chain. Recruitment must be beamed at young people with university education and to make this possible the attraction of the sector to these

people must be increased. The commercial profile of the innovation system must be clarified and raised to a level above the stereotyped impressions current today. In addition, the industry must to a larger extent take on responsibility for its image, for educational matters and for the long-term need for recruitment.

- Infrastructure measures must be carried out in terms of rules, standardization and certification. These questions must be followed up vigorously parallel with innovations among firms and in academic research. Both the political system and the great body of consumers must be made conscious of the advantages of wood. Knowledge of system and process innovations must be disseminated within and outside the sector by national building programmes, building manuals, interior and design expertise etc.
- Continued and better co-ordinated government steering measures in the innovation systems of the sector. Earlier financing has had a positive effect on innovation measures and the structure of the sector with numerous small and medium-sized firms accentuates the need for more collective financing.
- Clearer communication to investors and opinion shapers within the financial sector. Future competitiveness will be built on human and financial capital to form competitive constellations of firms which in many cases will operate with the Nordic countries as their home market and Europe as their main market.

**Figure 4.3 Recommendations for Innovation System Wood Manufactures**

### **Recommendation for an Innovation system in Wood Manufacture**



Of central importance to the development of an innovation system is to achieve market growth. The part of Wood Manufactures which is the least developed in this connection is New Build with industrialised building in wood. Here it is important to bring about the continued building of reference schemes, a process which should be co-ordinated with a national perspective (cf the co-ordinating group which is proposed in the draft of a national strategy for furthering wood in building). Here the role of the public sector as procurer is a further important part of the strategy.

## 5 References

Our analysis of Wood Manufactures and its value chains is built on a large amount of material and our list of sources has been kept short so as not to weigh down the report to too great an extent. For a fuller reference list dealing with the growth sector Wood Manufactures area we refer to Eva Esping's basic analysis for Wood Manufactures. In closing, we do however wish to name some of the references which we have found important:

Vinnova's strategy for the Growth Sector Wood Manufactures is given in the following documents (in Swedish):

"Behovsmotiverad forskning och effektiva innovationssystem för hållbar tillväxt -VINNOVAs verksamhetsplanering 2003-2007"

Policy VP 2002:1, VINNOVA

Eva Esping: "Basanalys för TO Trämanufaktur", VINNOVA.



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### VA 2004:

- 01 The Swedish National Innovation System 1970-2003 - a quantitative international benchmarking analysis
- 02 Trämanufaktur - det systembrytande innovationssystemet. *For English version see VA 2005:01*
- 03 Impacts of the Swedish Competence Centres Programme 1995-2003. *For brief versions in English and Swedish see VA 2004:05 and VA 2004:06*
- 04 Telecom Dynamics - History and State of the Swedish Telecom Sectors and its Innovation System 1970-2003. Final Report. *Only available as PDF*
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- 06 Effekter av det svenska kompetenscentrumprogrammet 1995-2003 - Sammanfattande rapport. *Brief version in Swedish of VA 2004:03, for brief version in English see VA 2004:05*
- 07 Effektanalys av nackskadeforskningen vid Chalmers

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- 02 Innovationspolitik för Sverige: mål, skäl, problem och åtgärder (*Innovation policy in Focus*)
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- 05 VINN EXCELLENCE CENTRES. *For Swedish version see VI 2004:04*
- 07 Kompetenscentrum i siffror
- 08 The Swedish Competence Centres Programme. Third International Evaluation - Group 2-6 (19 Centres) and Overall Impressions and Programme-wide Issues.

### VI 2003:

- 01 Verksamhet inom Transporter
- 02 Årsredovisning 2002
- 04 The Competence Centres Programme. Third International Evaluation. Group 1 (8 Centres)
- 05 The Concept of Innovation Journalism and a Programme for Developing it. *Only available as PDF*
- 06 EUREKA

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- 01 Nationell strategi för transportrelaterad FUD

### VP 2003:

- 01 VINNFORSK - VINNOVAs förslag till förbättrad kommersialisering och ökad avkastning i tillväxt på forskningsinvesteringar vid högskolor. HUVUDTEXT. *For appendixes see VP 2003:01.1*
- 01.1 VINNFORSK - VINNOVAs förslag till förbättrad kommersialisering och ökad avkastning i tillväxt på forskningsinvesteringar vid högskolor. BILAGOR. *Main text see VP 2003:01*
- 02 Behovsmotiverad forskning och effektiva innovationssystem för hållbar tillväxt. VINNOVAs verksamhetsplanering 2003-2007. *For English version see VP 2002:04, for full Swedish version see VP 2002:03*
- 03 VINNOVAs forskningsstrategi. Strategi för hållbar tillväxt
- 04 Nationell Innovations- och forskningsstrategi för området Miljödriven teknikutveckling. *Only available as PDF*

### VP 2002:

- 02 Nationellt inkubatorprogram
- 03 Behovsmotiverad forskning och effektiva innovationssystem för hållbar tillväxt. En fördjupad version av VINNOVAs verksamhetsplanering 2003-2007. *For short Swedish version see VP 2003:02, for short English version see VP 2002:04*
- 04 Effective innovation systems and problem-oriented research for sustainable growth. VINNOVA's strategic plan 2003 - 2007. *For Swedish version see VP 2002:03 and VP 2003:02*
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  - 11 Arbetsgivarringar i Sverige - förekomst, funktion och nytta
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  - 13 Det öppna svenska innovationssystemet - en tillgång för Sverige
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VINNOVA's mission is to promote sustainable growth  
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