

The Future of Paper-Making: New Challenges for Technology

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ABSTRACT

The history of the paper industry has shown a strong technological evolution which has been an essential factor in achieving low cost, high quality paper products and in sustaining the strength of the industry. In the last decades paper machine development has been rapid. This has helped to establish paper as a "low cost" material. In future, the pressure from the competing media will only accelerate the technological efforts to improve cost and functionality of paper.

In addition, in the future, technological advances will be combined with innovation in business concepts. Certain production methods are likely to be developed which will distribute current process stages outside the paper mill. Papermakers can begin to reduce their investment risk by subcontracting large-scale base paper production but taking responsibility for the higher value finishing process stages. Finishing will be more closely integrated with the final use.

The role of technology supplier to the paper industry will naturally evolve to reflect all these changes. Metso is already actively collaborating downstream in the different paper-related business chains. This collaboration will be crucial for implementation of new business and technology innovations in P&P industry and Metso will certainly benefit from its catalyst role in this transition.

1. Introduction

The evolution of the use of paper and the printed word in daily life is one of the world's greatest achievements. Today the pulp, paper and printing industries are truly global. They are responsive to consumers and are closely intertwined with national and regional economies. They have found solutions to new demands for paper and the new environmental constraints. Paper has become

a flexible, low cost, environmentally friendly medium.

But evolution has changed to revolution. With unrelenting force, science and technology has moved on. New information and communications technologies have arrived. The consumer is experiencing new ways to communicate and live with these new technologies. Paper is no longer essential to create, transfer and store 'the printed word'.

Consequently paper, for the first time in its

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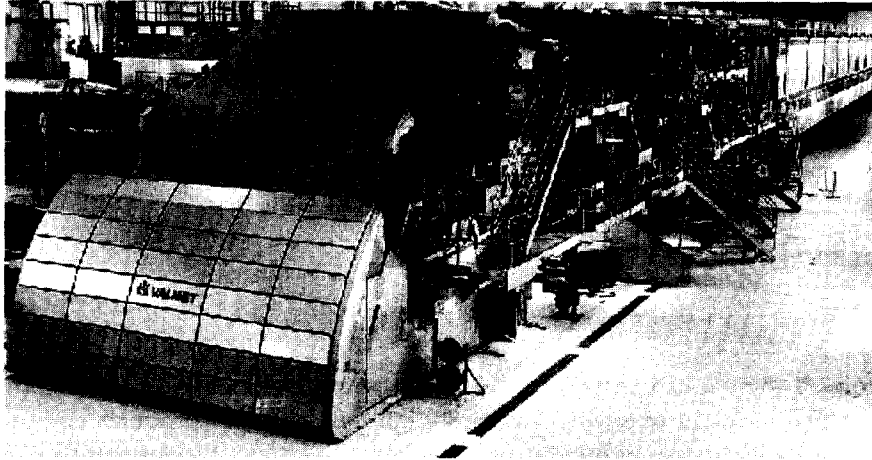


Fig. 1. Valmet OptiConcept.

history, is being challenged, as the 'modern medium'. Can it survive with the growth in electronic media? How can the pulp, paper and printing industries respond and transform their products and services quickly enough to redefine paper and establish its new role in this electronic world?

Once again the answer is being found in technology. This article summarises the status and new thinking in the technology of papermaking which is transforming paper to serve this new modern world.

Today	Future
Low controllability of sheet structure (z-direction)	Multilayering - additives and fibres
Low value added product	Increase in on-line surface treatment - coating in headbox, wet-on-wet (WOW) - wet end drying, scaling calendaring
Unit processes separate from each other	Integration between unit processes - drying + pressing = impulse technology
'End of pipe' approach	System closure - 'Clean technology approach'

Fig. 2. Integration of unit processes.

2. New Challenges for Technology

2.1 High speed technology

OptiConcept, launched in 1998, represents the latest Valmet technology and business thinking in high-speed papermaking. OptiConcept focuses on the fully integrated papermaking line with a strong mill-wide perspective.

Fig. 2 illustrates a number of future focus areas in paper-making technology development. Valmet OptiConcept includes multi-

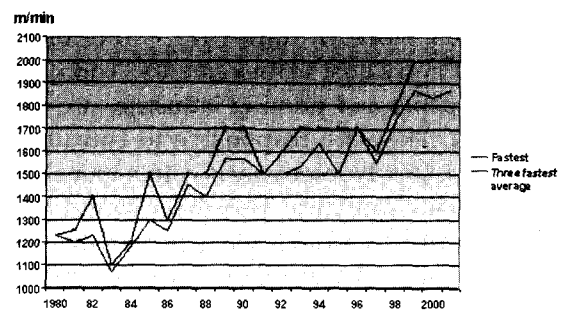


Fig. 3. Development of papermachine speed.

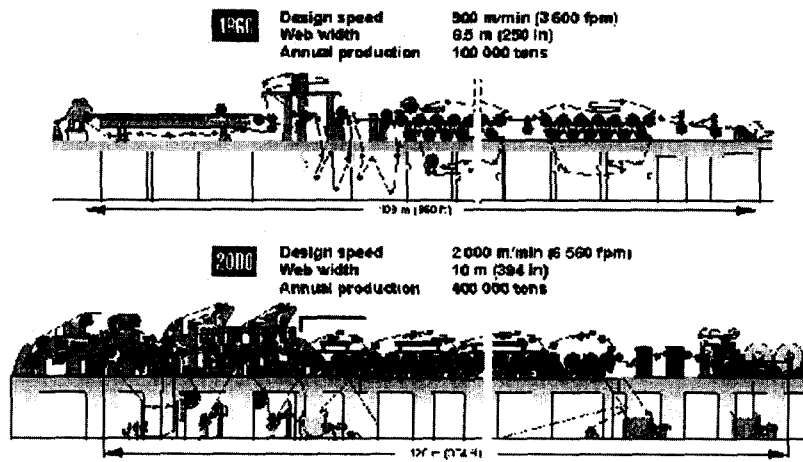


Fig. 4. Development of a newsprint machine 1966-2000.

layering of additives, on-line surface treatment, integration between unit processes and system closure, however, much more is to come.

Speed increase is a vital factor in boosting productivity. Increases in running speeds must of course be paralleled by improvements in paper quality, technology and runnability to ensure adequate efficiency.

The history of the paper industry has shown a strong evolution in production effectiveness which has been an essential factor in achieving low cost, high quality paper products and in sustaining the

strength of the industry. In the last decades paper machine development has been rapid. Development of a newsprint machine is illustrated in Fig. 4.

These advances have raised the profitability benchmarks for the industry and led to a systematic reduction in real price of paper, as illustrated here for Europe. This has helped to establish paper as a “low cost” material.

3. Fiber and Paper Structure

3.1 Fibers of the future

An increasing number of fibers, natural and synthetic, are under consideration as raw materials for paper. Fibers from agricultural production are prime candidates for exploitation in papermaking.

Certain fibers have better physical and chemical properties for certain characteristics and types of papers. Raw material mixes will be optimised and paper structures engineered to achieve very specific paper qualities for example in bank notes and tobacco papers

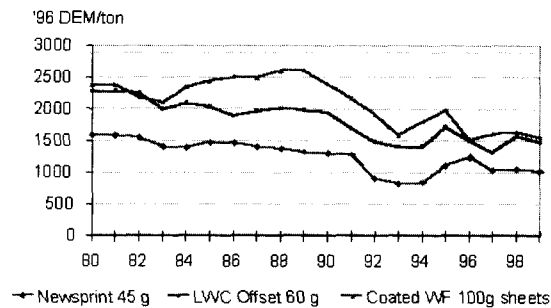


Fig. 5. Real price development of news-print and coated papers in Europe source: Jaakko Poyry Consulting and Valmet.

3.2 Low grammage papers

Valuable virgin wood fibers will be saved by using new raw material mixes containing less new wood, and achieving lower grammage papers. In the future, the fiber composition will be increasingly tailored for end-use functionality.

In particular, the z-direction structure of paper will continue to be a main development focus to improve the technical properties and competitiveness of paper. By optimizing the structure and raw material components of paper, the same strength, printability and opacity grades can be achieved with smaller amounts of raw material.

Reduction of grammage in newsprint from 40 g/m² to 20 g/m² with equivalent technical properties can be possible, and in fine paper to 30 g/m². Technology for such low grammages rests on understanding the fibrils and the development of bulk refiner technology and chemistry.

In addition nanotechnology will contribute significantly to the engineering of paper structures. Use of nanoparticles is likely to become more common to fill fibers,

shape fiber walls or correct architecture of fiber structure. By placing nanoparticles between the fibers grammage can be further dropped and if, for example, these particles promote light scattering other key paper properties will also be improved.

3.3 Are we investing enough in R&D?

Today, the papermakers invest 1-2% of net sales in research and development, and machine makers 3-4%, while in growth-propelled sectors the amount is as much as 10%. Sufficient investment in research and development is now vital to the competitiveness and growth of the pulp and paper sector.

Basic research will have an important role in the future with active networking with universities and research institutes. This process is being reinforced by the rapid globalisation of paper companies. An important challenge for the paper industry will be how to keep attracting money and creative resources in research that supports its long-term competitiveness.

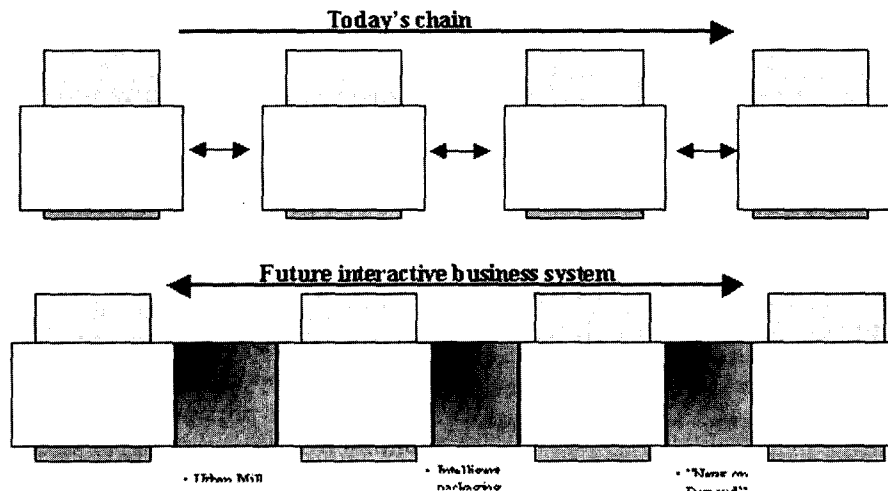


Fig. 6. How machinery and systems suppliers' role will change.

3.4 New products and processes

Papermakers are focusing on product development for new end uses rather than on development of the manufacturing process. This work is aimed at developing paper properties to the point of quite radical advances in paper functionality. One example is achieving 'smartness' in board packaging and printing papers.

Equipment suppliers will have greater, if not all the responsibility of developing manufacturing processes including significant improvements in life-cycle performance.

4. New Challenges for Business

4.1 New way to operate

In the future process machinery and system suppliers for P&P industry will play an increasingly important role in improving the industry competitiveness.

Traditional business chain will be transformed to an interactive two-way business system, Fig. 6. This transition will be crucial for implementation of new business and technology innovations in P&P industry

5. Summary

The history of the paper industry has shown a strong technological evolution which has been an essential factor in achieving low cost, high quality paper products and in sustaining the strength of the industry. In the last decades paper machine development has been rapid. This has helped to establish paper as a "low cost" material. In future, the pressure from the competing media will only accelerate the technological efforts to improve cost and functionality of paper.

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