

Executive Summary

The European Advanced Display Roadmap

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Executive Summary

The global display industry has grown dramatically over the past decade, as the CRT has been replaced by flat panel displays and projection systems based upon microdisplays. Asian companies now dominate the manufacture of displays and many of the European jobs in the production of CRTs have been lost. On the other hand, European companies and universities have maintained a significant presence in research & development, in the supply of materials and equipment, and in the integration of displays into final products. The global display industry has been dynamic, not only in the rapid rise in sales of flat panels, but also in the continual change of leadership. Despite the prevalence of European and U.S. companies in the invention of liquid crystal and plasma discharge display technologies, large-scale production was dominated by Japan in the 1990's. Japanese universities also performed the bulk of the applied research. However, within a few years, industry leadership was captured by Korea, both in production and in R&D. This leadership is now being challenged by Taiwan and large-scale manufacturing is beginning in China.

Although the rate of change in the industry may slow as important sectors mature, there are no impenetrable barriers to greater European participation in any part of the industry. Flat panel display fabrication techniques are based upon extensions of the techniques, such as photolithography, developed in the microelectronics industry. They rely on expensive materials and are not necessarily optimal for large area displays. European experience in printing technologies and organic materials, such as plastics, could open up new markets for large area displays as well as more economic fabrication of current products.

European companies have excelled in making and developing products that are really designed for use by people, especially when compared with the technology driven design seen in parts of Asia. Human factors, sustainability and environment protection have always played a higher role in Europe than elsewhere. European RTD and an innovative and yet competitive materials and supply sector in the displays area are of high value and need to be strengthened beyond FPDs for the next-generation smart displays.

Progress in any industry can be classified as evolutionary or revolutionary development. The former carries higher probability of success and lower risk and is often favoured by incumbent industry leaders, whereas the latter offers the possibility of greater rewards for small companies and new entrants. Since Europe has a small number of display industry leaders and a large number of innovators and entrepreneurs with radical new ideas, it is important to enable European participation in both modes of progress. To compete with Asian companies, a high level of infrastructure is needed to support companies using either approach.

The last century has brought almost incredible progress in the development of optical and electronic techniques to capture, store, transmit and display images. One will soon be able to view events from across the world, in one's living room, office or airplane seat, with an image quality that is limited by the performance of the human eye and not by any of the electronic components.

The electronic display has also become the human interface for many of the devices that form our technological environment. It is through the instruments on the dashboard that drivers monitor the performance of their vehicle. The safety of airplane passengers depends critically upon the performance of the screens in air-traffic control centres as well as those in the aircraft cockpit. The flat panel display has replaced paper tape and punched cards in the control of computers, and the output is no longer limited by the constraints of line printers.

The development of flat panel technologies not only displaced CRTs in many applications, such as computer monitors and television, they also led to the creation of many new devices, such as laptop computers and video phones. New display technologies are required to open up new markets, by supporting new form factors, providing portable eye-quality displays for

bright outdoor conditions, and enabling inexpensive manufacturing of displays for new applications. Many ideas are emerging from universities and corporate laboratories in Europe, but coordinated strategies need to be developed if these innovations are to be brought to market and not ceded to the major Asian manufacturers.

One of the most important characteristics of disruptive technologies is that they are not fully appreciated by experts in the field. Too much central planning or peer review can often be counter-productive. However, certain trends have been identified in the emergence of successful disruptive technologies. They are first applied to niche applications or simple products that do not warrant serious attention by the entrenched industry leaders. Success in these initial endeavours leads to improved performance and manufacturing efficiencies through which some established markets can be entered. What is required is the creation of an environment in which new ideas can flourish and be tested first in simple ways, through collaboration between researchers, manufacturers, suppliers of materials and equipment and designers of new products.

The purpose of this document is to review the progress made in the global display industry from a European perspective taking the emerging field of organic electronics into account, and to identify opportunities for further growth over the next fifteen years. The discussion will not be confined to technical issues, since the industry will be driven by the needs of the users as well as the capabilities provided by new technologies.

The adria advanced displays roadmap highlights some of the major European strengths. The adria Competence Mapping Synthesis Report, published separately, provides more details on the research and industrial capabilities residing in Europe in the field of advanced displays and organic electronics and is worthwhile to be taken into account for the views expressed here.