THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
MASTER OF TECHNOLOGY IN INDUSTRIAL ENGINEERING – LEVEL07
FINAL EXAMINATION – 2006/2007
MEX 7118 – TECHNOLOGY MANAGEMENT
DATE : ***16 March 2007***
TIME : ***0930 hrs – 1230 hrs***
DURATION : ***Three (03) hours***

This paper consists of six (06) questions. Answer Question No. 1 and any Three (03) others.

Q 1) You are required to read the following case study and answer the questions given below:

Case study: "Plug into technology"[1]

In 1967, Dr. Kim Joo Jin was teaching in the United States when his father, a Korean businessman, asked for his help with a new business idea, semiconductor packaging. Thus, in 1968, Anam Industrial Co. came into being as a semiconductor (or chip) packaging firm in Korea. It is one of the largest semiconductor packaging firms in the world. In 1992, its sales were US $1.8 billion and it employed over 6,000 staff. Anam now controls about 40% of the world market for contract semiconductor packaging. Its customers include Motorola, Philips, Siemens, NEC and Toshiba.

When Anam was first established in 1968, Korea did not have an electronics industry. Thus, Anam could be said to have started off with a clear strategy of pursuing export-led development.

From 1968 to about 1980, Anam offered low cost operation for semiconductor assembly. The firm started off by utilizing depreciated equipment shipped over from American customers. It also imported the wafers from Texas Instruments and RCA. Most of the design skills and related production skills were obtained as part of the subcontracting operation. Very little product and process innovation was carried out during this period. However, Anam moved from the assembly of simple diodes and transistors to more complex integrated circuits mainly with the assistance from the overseas buyers. In short, during this period, Anam established a reputation for being a very reliable Original Equipment Manufacturer (OEM).

During the early 1980s the chip industry boomed throughout the world. In 1982, Kim joined the board of VLSI, a California-based semiconductor firm, that has since helped Anam get into the Application Specific Integrated Circuit (ASIC) design business. During this period there was very little product innovation at Anam. However,

[1] Adapted from *Anam Industrial Co. of South Korea - Plug Into Technology*, K Ramanathan, University of Western Sydney

incremental process innovations, to improve output rates, were introduced with the assistance of the big overseas buyers. During this period, other than subcontracting, Anam used people-based mechanisms, such as focused training of existing staff, recruitment of PhD's and hiring of experts as consultants, extensively for acquiring technology.

During 1984 to 1985, the demand on Anam for better quality output increased. To respond to the increased demands, people-based mechanisms for acquiring technology were strengthened. Also, in 1984, the firm commenced organized Research and Development (R&D) efforts by establishing its Engineering and R&D Department (ERD) with the assistance of its largest US client – Texas Instruments. The establishment of ERD witnessed the beginning of product innovation but still the emphasis was on process innovations aimed at developing improved processes for packaging.

From 1985 to 1988 Anam went through a period of "accelerated in-house learning" which reflected its desire to firmly establish itself as a major international player in semiconductor packaging. Anam continued to emphasize people-based mechanisms. The hiring of expatriate nationals was emphasized in addition to extensive training of its engineers. Increasing complexity of packaging, rapid growth in demand, and intensifying pressures for high quality and reliability led to process and product innovations on a much higher scale than in the previous stage. However, Anam still emphasized process innovations during this period.

Since 1989, Anam has been trying to gain recognition not only as a leading chip packager, but also as a major product innovator. Anam has established alliances with IBM, Texas Instruments, and Motorola to jointly develop future packages and processes. Extensive use is made of CAD facilities for circuit designs and process modeling. Anam also does complex ASIC design work for Samsung and Lucky Goldstar, two leading Korean firms in the electronics industry. Today, Anam makes semiconductors for a variety of applications that includes computer memory cards and cellular phones.

Kim has also formed corporate engineering, automation and mechanization teams in South Korea, Europe, and the United States to keep Anam at the cutting edge of relevant technologies. These teams, which include highly trained PhDs, have been trained to anticipate customers' needs one to two years in the future.

Today Anam is expanding with a view towards getting into trunked radio systems for use by commercial vehicles. Its technology partner in this venture is Geotek Communications Inc. Anam is also working with Australia's Cedcom Network Systems on a very energy efficient wireless networking system aimed at the portable computer market. These are untested, unproven technologies. Yet, Kim believes that if Anam waits until products become successful the large corporations will get the business. Kim says that his recipe for success is to plug in very early into future technologies with great potential, before others clamber upon the bandwagon. Considering Anam's track record, there seems to be no reason to doubt the eventual success of Kim's new thrusts.

a) Explain how the company has accumulated its technological capabilities over the years with specific references to key milestones in the development of the company. (20 marks)

b) Critically analyze the soundness of their technological strategies with specific references to the technology life cycle. (20 marks)

Q 2)

a) Describe the scope of Management of Technology highlighting the need for the integration of science and engineering with business administration. (10 marks)

b) With the help of simple examples, explain the interrelationships between the components mentioned in each of the following three pairs: technoware and humanware; humanware and inforware; and humanware and orgaware. (10 marks)

Q 3)

a) Define the term "technology transfer" in the context of a developing country. (8 marks)

b) Discuss three means of technology transfer, highlighting their advantages and disadvantages. (12 marks)

Q 4)

a) Discuss how a developing country firm could develop its research and development capabilities under the current economic environment. (10 marks)

b) Identify the possible stakeholders of a cluster that could be formed in an industry known to you, mentioning real life examples wherever possible. (10 marks)

Q 5) Explain the role of forecasting in the development of a technology known to you, comparing the advantages and disadvantages of different methods of forecasting that could be used in this context. (20 marks)

Q 6) Identify the key elements and linkages in the innovation triangle, and explain, with suitable examples, how these could be used effectively for the technological development of a country. (20 marks)