

CNC TECHNOLOGY: CURRENT SCENARIO AND FUTURE TRENDS

**By- Mr. P. Ramadas, Managing Director
Ace Manufacturing System limited.**

Machine Tool History & Genesis: No other countries were more responsible for the Industrial Revolution than England, Europe and USA. In 1769, Englishman James Watt sparked the Industrial revolution. Another Englishman, John Wilkinson invented a precision Horizontal Boring machine in 1775, which made efficient Steam Engine Possible (Curt Anderson, 1999). The steam Engine cylinder could not be manufactured until machine Tools had been devised that was capable of producing accurate parts. An English man Henry Maud Slay developed first engine lathe and developed, improved micrometer. Later in 1818 American, Whitney invented the first milling machine. Also in the same year, Thomas Blanchard of Worcester invented a copying machine for turning the stocks of rifles (Curt Anderson, 1999). Thus, without Machine Tools, some of the early inventors would not have been able to make their dreams become a reality.

Today, Machine Tools have become the back bone of Automobile sectors & Engineering Industries world wide. The concept of standardization has perhaps the greatest influence on the Manufacturing Industry as we know it. Machine tools have enabled us to come a long way since 17th century. Without Machine tools and standardization, there wouldn't have been any Boeing 747 Jet made up of its 6 Million Component parts from 33 separate countries! Machine Tools that produce consistent, standardized parts are the reason that all those parts fit together. It really is amazing feat of Engineering and Manufacturing when you think about it, but most of us take it for granted. We all have an idea of what a Machine Tool is, which is something that is used to bore, turn or carve metal. Like most things, Machine Tools have evolved over time. They have been with us for centuries, evolving from hand held machines to larger hand controlled machines. As technologies advanced, machine tools advanced to mechanically controlled machines – which were much more precise than their human controlled counterparts and were not dependent on human reflexes. Today, the advanced CNC technology machines can work with precision and accuracy which is beyond human ability. Historically, machine tools provided the impetus for the advances that made industrialization possible, and they continue to have a tremendous impact on our day to day lives.

The evolution of CNC technology in Machine Tool is not a succession of gadgets and tricks regularly displayed at the shows. It responds to the driving force of the Society, which constantly requires more quality goods in larger Quantities and at lower price. Lower price means less effort, less human involvement. When the social incentive is missing and people don't want a product or cannot afford to pay for it, no technical progress is possible. CNC Technology developed in the shadow of other industries like Defense, Automobile, Aerospace Industries etc. Accuracy in NC Machines made a real breakthrough in the year 1960. While the ammunition factories required highly specialized productive and, automatic machine, the - Transfer line Technology was born. The technology is not stand alone stuff. Answering an Industrial demand, it produces new possibilities and on its turn it imposes the industry to constantly reconsider its status. All improvements in CNC Machine Tool Technology can be summarized as follows: to design a reliable and accurate machine, able to produce Components in less time. Hereto the machine has to withstand higher forces and higher speeds, hence provide larger power. The real revolution of present days CNC Technology is the full use of the Information theory and Electronics to control sequences, motions and positions. As in the beginning of last century physical efforts were drastically replaced by servo technology, intellectual operation, as sensing, controlling, and handling. The evolution has changed from initial Data Processing to Canned intelligence to artificial Intelligence. This includes sensing – interpretation – decision making. The sensors are built to see, to hear, to feel, so as to make diagnosis.

The future trend in CNC Machine Tool technology is the reduction of the direct human involvement in the production itself. The bond between man and machine is loosened. Man is not the slave of the machine. Yet, Man and Machine will still need each other, but their work will be timely disconnected in such a manner that both will be working at their own rhythm. The main objective of CNC technology is no longer to shorten operating times, but to increase the amount of time spent doing useful, productive work.

ROAD MAP - FOR CNC TECHNOLOGY DEVELOPMENT.

- A) **High Speed Machining, Multiple operation Machining** in single setup and Hard Machining are gaining ground. The emerging technologies are Non Conventional machining or water jet machining.

- B) **Industrial Robots:** This bears a little resemblance to the Science fiction concept of futuristic Machines – They are the second stage of Machine Tool Development except that their prime function is handling but not making components.
- C) **Artificial Vision** (Visual Servoing)
- D) **Assembly by a robot:** Assembly being a highly skilled operation, demands high performance from Robots with sensory interaction and Mechanical Dexterity.
- E) **Unmanned automatic Factories for the future:** The aim here is for machining of Variable Cylindrical and prismatic Components.
- F) **Computer Aided Design CAD:** All data on the part drawing is contained in an internal computer model.
- G) Computer Aided Design and Programming with **Automatic creation of programs** in the CAD Computer.
- H) **Flexible Manufacturing System FMS:** is a group of Computer numerically controlled machine Tools linked by a common material handling system and a central control system.
- I) **Flexible Manufacturing Cell FMC:** Is normally associated with combination of machine tools capable of complete machining of components from raw material to finished component.
- J) **Computer Integrated Manufacture CIM:** The linking of a company's operating and control data into a totally interactive system is clearly ultimate in CIM.

CNC MACHINE TOOL BUSINESS:- ADVANTAGE INDIA:

Engineering & Manufacturing Sector in India has a strong Engineering and capital goods base. In the developed countries Engineering Industries contribute about 25 to 35% of the GDP. Production of CNC Machine Tools in India is on the increase, but it is still negligible when compared to the world production. The demand for CNC Machines is increasing rapidly. It is a forecast that India will become the fifth largest producer of Machine tools in the world by 2010 and 60% Machine Tools produced will be CNC and by 2020 it will be 80%. Considering various strengths in the Design and Development of Precision Machine Tools, the Vision is that India can become a net exporter of Technologies by 2010. This is an exciting challenge for the Industry, researchers in the country. The Indian Machine Tool

Industry has undergone a radical shift in its thinking paradigm, the Industry is now recognized as a low cost high Quality lean Manufacturing solution provider on the global map. The Industry resiliently supports all its users to enhance productivity as well as improve competitiveness, for the betterment of the final customer. Being an integral sector, growth of the Machine Tool Industry Technology has an immense bearing on the entire economy, especially India's manufacturing Industry. CNC Technology is even more crucial for the development of the country's strategic segments such as Defence, Railways, Space and Atomic energy. World over too, Industrialized advanced countries have created market niches on the back of a well developed and supportive Machine Tool sector. In India as well, indigenous machine tools have the highest impact on capital output ratios. Machine Tool consumption of more than Rs. 2500 Crore truly supports the advancement of the country's Engineering sector, output of which is estimated to be worth over Rs. 1,50,000 Crore.

The Indian Machine tool Industry manufactures almost the complete range of metal cutting and metal forming machine tools. Customized in nature, the products from the Indian basket comprises conventional Machine tools as well as computer numerically controlled (CNC) machines. There are other variants offered by Indian Manufacturers too, including special purpose machines, robotics, handling systems, and TPM friendly machines. With the growing demand today, Indian Machine tool builders are exporting machines to the leading developed countries like Japan, Germany, USA, Australia, France, Netherlands, East Asian and host of others. And this is what the industry is hoping to leverage so as to post an optimistic export turnover in the next few years. In the coming days the growth of China in CNC manufacturing will surpass every other nation, with manufacturing growth in India a close second. China and India may record the GDP growth rate of 6 to 12%, whereas US and Europe is expected to grow at 4%. So growing economies are feeding competition, and the fieriest competitors, whether they are in China – India – US or Europe, will adopt and run the latest technologies available for Machine Tools in the brutal Competition ahead. The machine tool Industries are growing at 20 – 25%. In spite of rising input cost, the industry today is in a position to offer lower prices continuously. This has been possible due to sustained efforts in building competitiveness. About 50% of the machine tools are consumed in the Automobile and Auto Component sector. 15 to 20% are the supplies to Defence production and the railways. Rest is consumed by other Engineering industries.

THE CHALLENGE OF CHANGE

The last one decade has seen a dramatic change in the Machine Tool Business. Optimists see a bright future as technology creates new efficiency and productivity breakthroughs. Pessimists see two – thirds of the nation’s workforce gone to sell burgers failing to keep afloat in a sea of constant change. A talented, adaptive, ingenious work force is the key to making technological innovation work for our economy. The skill expected in the people who work in the industry is that of Team Building – Problem solving and critical thinking. How do young budding engineers acquire these skills? Not in the Institutions at all. Institutions can’t teach behavioral skills like problem solving, ability to communicate, interpersonal skills, and leadership, despite the fact that professionals want them. These simply don’t fit into the passive learning format traditional in institution. You can buy the equipment but not the people; you can copy the technology but not the work culture. The basic required skills are of literacy – Numeracy- Technical Knowledge – Analytical Skills – Sociability. It is surprising that most still believe that they were hired for their hands, not their heads. The process should focus on Experimental learning-with simulation, role playing and a post evaluation that is a behavioral in nature.

We live in the knowledge worker age and **Human capital is our greatest asset**. Success today, depends highly on our ability to gain the vision for the future by leveraging the present human resources thus inspiring everybody to release their energy from body, mind, heart and spirit towards greater purpose. We should believe in the strength of people, their culture, their Discipline, Determination, Dedication and quality in every walk of life. The flexibility, open mindedness, physical & mental health, confidence, urge to Excel of the people are the main criteria for Organizational success.

In today’s competitive world, no technology can substitute a creative inspired mind. The technology in the hands of inspired creative mind can assume unknown forms, perform explored functions and create unimagined realistic visions. **Technology assumes real meaning only in the hands of creative mind**. We have to create a working environment where Risk & Change are greeted as Opportunity & Challenges rather than as problems. The **“New spirit with a new sense of Enthusiasm every day”** is a buzzword. Thus, we can minimize the struggle and expand the enjoyment available in living each day. This can only strengthen our vision with a strong conviction towards its realization so as to meet New Challenges of coming days. It is worth to recall with caution the words of Scientist, Philosopher, Mathematician and Nobel laureate Bertrand Russell **“Knowledge &**

Technology is power for good just as much as for bad unless men increase in Wisdom. Increase of Knowledge & Technology will be Increase of Sorrow unless wisdom prevails upon us. “

P. RAMADAS , Managing Director , Ace Manufacturing Systems Limited, Bangalore 58
SUCCESS IS NOT A MATTER OF DESIRE - IT IS THE PRODUCT OF“HARD WORK & SACRIFICE”

Trends in Indian Machine Tool Industry
Metal-cutting and Metal-forming Machine Tools

[Value in Rs. million]

Year	Production	Import	Export	Consumption	Share of prod. (Less exp.) to total consump.(in %)
1987	2,454	1,118	592	2,980	62.5
1988	2,752	1,300	301	3,752	65.3
1989	3,393	1,518	493	4,418	65.6
1990	4,132	3,404	809	6,727	49.4
1991	5,043	3,126	449	7,720	59.5
1992	4,998	3,729	236	8,491	56.1
1993	4,116	3,619	158	7,577	52.2
1994	5,990	5,537	408	11,119	50.2
1995	7,198	5,976	445	12,729	53.1
1996	8,080	11,003	249	18,834	41.6
1997	7,963	7,221	321	14,863	51.4
1998	6,712	8,405	606	14,511	42.1
1999	5,970	4,727	382	10,315	54.2
2000	6,307	4,258	330	10,232	58.4
2001	5282	3103	373	8012	61.3
2002	5175	4332	508	8999	51.9
2003	6782	6768	463	13087	49.8
2004	10122	16001	491	25632	37.6