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COMPARATIVE STUDY OF CHINA AND INDIA IN THE APPLICATION OF RAPID PROTOTYPING AS ON 15 AUGUST 2010

Vikas Gupta
Lecturer, CDLMGEC, Panniwala Mota, Sirsa, Haryana, India

Abstract: Rapid Prototyping is a technology where parts are made layer by layer directly from CAD models. This paper tries to compare how RP has developed in China and India. The comparison is done on the basis of installed machines, market, industrial use, research work, problems and government support. From the available data it is seen that China had many more RP machines and also local companies making RP systems. Most of the use in China was in manufacturing for export. In India the number of machines was less and all machines were imported. The use was mainly in automotive, aerospace and in colleges for research. Both countries had problems like high cost, material issues and lack of trained people. The paper concludes that China was ahead, but India can improve with better policy and by developing its own machines.[1][2][6][4][11]Keywords: Rapid Prototyping, SLA, SLS, FDM, China, India, Manufacturing1. IntroductionRapid Prototyping means building a model layer by layer using CAD data. After the first RP process came, other methods like SLA, SLS, FDM and LOM also became available. Slowly RP was not only used for models but also for testing, tooling and some end-use parts. In Asia, China and India are the two big economies. But their way of using RP was different. China used RP more for factories and exports. India used it more in cars, aerospace and in academic labs. This paper compares the situation in both countries based on reports and papers available at that time.[1][11][2][6][4].

2. **Installed Base and Market:** As per industry reports, China had around 800 to 1000 RP machines. This was the second biggest number in Asia after Japan. China also had its own companies like UnionTech, Beijing Longyuan and Shenzhen Createproto who were making low cost SLA and FDM machines. Most of the service bureaus were in Guangdong, Shanghai and Beijing for electronics and toys. The government was also funding RP research under the "863 Program".[2][6]India had far less machines, about 150 to 200. All the big machines were imported from USA, Germany and Singapore. Companies like Stratasys, 3D Systems and EOS were the main suppliers. Service providers such as Cimetrix, Imaginarium and RPS were working in Pune, Bangalore and Delhi. IIT Bombay, IIT Kanpur, IIT Madras and some CSIR labs also had RP machines. So China had about 4 to 5 times more machines than India. China had local builders and many service centers. India did not have any Indian company making RP machines and had very few service centers. Funding in China was from the 863 Program. In India funding came from DST and AICTE. Research papers from China were also much more.[4][5][10][9]

Table 1: Overall Status of RP in China and India

Parameter	China	India
Estimated Installed Base	800 - 1000 Systems	150 - 200 Systems
Local Machine Builders	Yes	No
Service Bureaus	50+	10-15
Government Support	863 Program	DST, AICTE
Research Papers	~300+	~80-100

3. **Industrial Applications:** In China, RP was used directly in factories. In Guangdong, SLA and SLS were used for mobile covers and toys for export. Car companies like BYD and Chery used RP for dashboards and other parts. RP was also used to make patterns for molds to reduce time. Some universities were also working on medical models.[6][7] In India, RP was mostly used for R&D. Tata and Mahindra used FDM and SLA for concept models. HAL, ISRO and DRDO used RP for wind tunnel testing models. AIIMS and IITs tried RP for surgical planning. Jewelry people used it for wax patterns. Colleges used it for student projects. So in China the use was high in electronics, auto and toys. In India it was medium in auto and aerospace and low in other areas.[5][4]

Table 2: Sector-wise Level of RP Adoption

Sector	China	India
Consumer Electronics	High	Low
Automotive	High	Medium
Aerospace / Defense	Medium	Medium
Medical	Research	Research
Toys	High	Very Low

4. **Academic Research:** China had RP labs in many universities. Tsinghua University was working on slicing and process control. HUST was working on SLS and LENS. China had published many papers and also filed many patents related to RP.[8][6][9]In India, research was only in few places like IIT Bombay and IIT Kanpur. Work was done on FDM parameters and RP

for casting. CSIR labs and CMTI also did some government projects. Number of papers was much less than China. IIT Bombay made a prototype FDM machine but it was not commercialized.[4][10]

5. **Problems and Government Support:** Both countries had same kind of problems. Metal RP machines were very costly. Materials were also costly and not easily available. There were accuracy issues and parts needed post processing. Trained people were also less.[1][11]China had included RP in its national programs and universities were working with industry. India did not have a separate policy for RP. Some support was given through DST and AICTE grants. RP was called an enabling technology but there was no special fund for it.[6][4]

6. **Conclusion:** From the study it is clear that China was ahead of India in RP. China had more machines, local manufacturers, service industry and more research. China's growth was due to manufacturing. India's growth was due to research. India was dependent on imports. Both had cost and technical issues. India is good in software and design, so with proper policy and by making machines in India, the gap can be reduced.[2][6][4][1]

7. **Future Scope:** It was expected that China will grow more in metal RP for aerospace and will make more low cost machines. India may see growth in medical and auto sector. Small companies may also start using RP services. If machine cost comes down and standards are made, then RP can grow faster in both countries.[6][4][1][2]

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