

**'Strategy Paper on Galvanizing Machine Tools
Industry in India through Technology Development'**

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OCTOBER 2011

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1. Industry Overview

Strategic Industry: The machine tool industry is a strategic industry which plays a vital role in the economic growth through its multiplier effect as high as 1 : 100. It determines the manufacturing competitiveness in important sectors such as automobiles, consumer goods and others. Machine tools play a vital role in countering technology denial as well as develop equipments for strategic sectors such as defence, aerospace and nuclear. A strong machine tool industry is essential to realize ambitions in manufacturing growth, provide gainful employment, provide sustained manufacturing competitiveness and ensure national security.

Early Era: The start of organized sector of the Indian machine tool industry took place in early years of the Second World War. Due to non-availability of imported machine tools, few British owned general engineering firms took up their manufacturing in India. This followed the start of centrally planned economy as reflected in a series of five-year plans. This process of planned economy resulted in the second phase of Machine Tool Manufacturing with start of Public Sector Investment in Machine Tools (HMT Ltd., 1953 & HEC : 1958). These two initial phases of development of the Indian machine tool industry saw the production of general purpose machine tools most of which were produced under technical assistance from foreign collaborators (Oerlikon, Loudon, Ward, Herbert, Jones & Shipman, etc.).

Middle Era: The sixties marked the third phase of machine tool industry, typified by rapid growth in production and horizontal expansion in various types of machine tools such as multi spindle automats, gear cutting machines, SPMs, broaching machines, presses, etc. The Fourth Phase beginning mid-eighties saw the advent of the Japanese machine tool makers through licensing arrangements (Mori-Seiki, Mitsubishi, Hitachi-Seiki, NachiFuji-Koshi, Murata, etc.).

Current Era: The fifth and current phase began in early nineties after the new policies of Open Market Economy were introduced, which saw advent of Technocrats. The market share of companies owned by technocrats steadily increased due to in-house design capability, entrepreneurial spirit, greater technology friendliness, operational flexibility and lean managements. As a result, import of technology declined. This also resulted in the shrinking market share of big companies & Public Sector giants. Thus, the Indian machine tool industry has come a long way in the last decade since liberalization and economic reforms were ushered in.

Profile of the Sector: Data on market size, production, exports, imports etc.

The industry figures of market size, production, exports, imports, Import content, employment, investment intentions and FDI are as given below:

Market Size indicates the total demand of machine tools in India. This demand is met through domestic production and imports. A small portion of domestic production is exported.

The significant feature of domestic production is its import content i.e. even to make a machine tool in India, Indian companies import some critical components and sub –assemblies. These are fitted into their products. Which are then sold in the domestic market and some time exported. It may also be mentioned that the production remained stagnant between 1991 and 2002. 2003 onward the rate of growth in production increased slightly. The production declined in 2008-09 mirroring general decline.

The challenges before Indian machine tools sector is its increasing dependence on imports – on two counts. Firstly, direct import of machine tools. Already in last few years, the import of finished machine tools is 65% - 75% of the total demands. The domestic production is already declining in percentage of total demand. This is because the demand of high technology machine tools is increasing over a time. The Indian companies are not able to keep pace with the technology advancements elsewhere.

Secondly, the import content in the domestic product is also increasing, again on account of technology advancement.

The impacts are losing share of manufacturing and consequently income and employment. Perhaps on long terms more disastrous results are on account of strategic nature of the machine tools industry.

The same trend is reflected in the overall manufacturing sector. Some other underlining reasons are low unit size, costs of doing business, governance issues, taxation & FDI regime favouring imports, totally liberal trade policies, exposure of still developing sectors to global competition even in FTAs and skill scarcity. The Government of India has recently come out with a reactive Manufacturing Policy.

Direct employment in manufacture of machine tools sectors is low, however it cascading effect is five times. This is due to the fact that every machine tools made creates further employment opportunity – direct, secondary & tertiary.

The Industrial Licensing and FDI policies for the sector were liberalized in 1991 reforms. Still very few new interments are planned as reflected in the trends of Investment Intentions data. The FDI is also marginal. FDI during last five years was at Rs 1300 crore (approx). It was mainly for service centres/ representative offices for imported machine tools and not for core manufacturing technologies. FDI failed to spur the sector with technology and management practices, as in some other sectors like Telecom services, automobiles etc. This brings out then issues of present policy set not servicing the industry growth needs.

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	CAGR
Market Size (Rs Cr)	3403	4877	7162	8698	8319	7245	10236	16%
Production (Rs Cr)	1634	2028	2579	2853	2138	2484	3624	12%
Import (Rs Cr)	1821	2899	4656	5992	6271	4842	7245	20%
Export (Rs Cr)	52	50	73	147	90	81	91	13%
Import content in domestic production (%)	30% in standard machine tool (medium technology) 40% in high technology machine tools							
Employment (No. of people)	30,000							
Investment Intentions (Rs Cr)	NA	NA	173	20	228	675	957	(Total) 2053
FDI (Rs Cr)	NA	NA	170	226	206	640	53	(Total) 1295

Source: Report by the Working Group on "Capital Goods and Engg Sector" set up by the Planning Commission for preparing 12th FYP.

Major Indian Manufacturers:

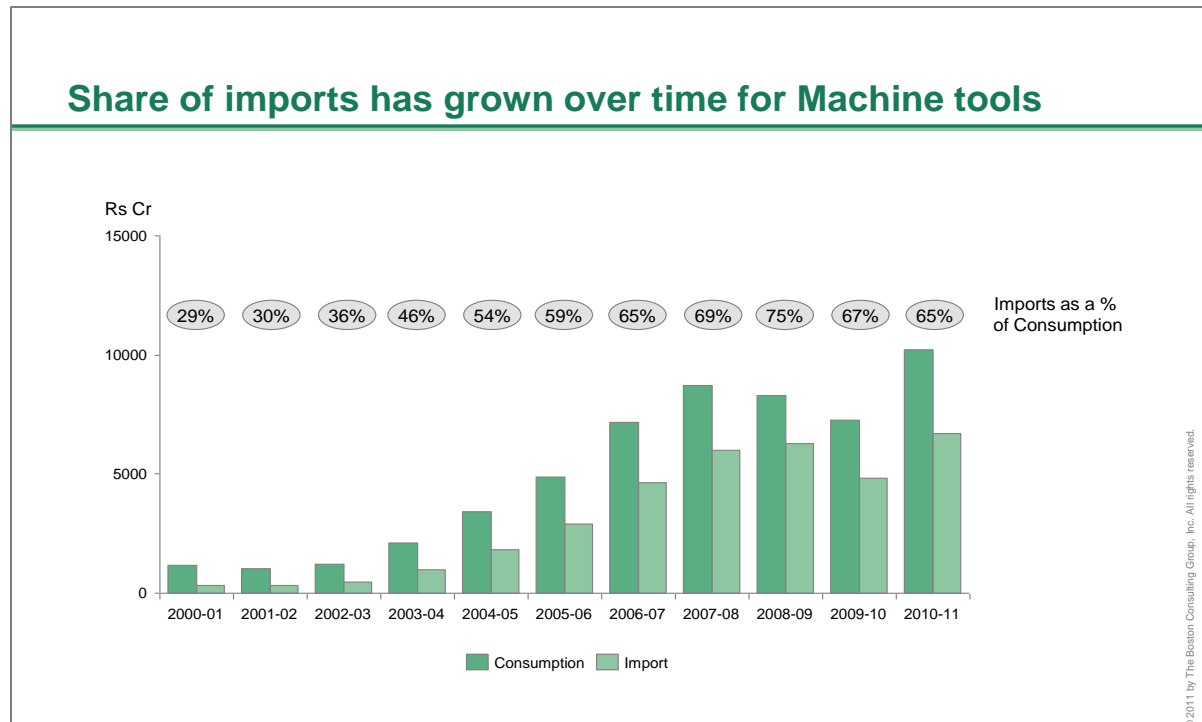
1. M/s. Ace Designers Ltd., Bangalore
2. M/s. Ace Manufacturing Systems Ltd., Bangalore
3. M/s. Bharat Fritz Werner Ltd., Bangalore
4. M/s. Electronica Machine Tools Ltd., Hyderabad
5. M/s. HMT Machine Tools Ltd., Bangalore
6. M/s. ISGEC, Yamuna Nagar
7. M/s. Jyoti CNC Automation Pvt. Ltd., Rajkot
8. M/s. Kennametal India Ltd., Pune
9. M/s. Lakshmi Machine Works Ltd., Coimbatore
10. M/s. Lokesh Machines Ltd., Hyderabad
11. M/s. TAL Manufacturing Solutions Ltd., Pune
12. M/s. Askar Micron
13. M/s. Champkraft Machine Tools
14. M/s. Batliboi Ltd.
15. M/s. Electropneumatics & Hydraulics (India) Ltd.
16. M/s. Galaxy Machine
17. M/s. Gedee Weiler Pvt. Ltd.
18. M/s. Hind Hydraulics & Engineers Ltd
19. M/s. Hindustan Hydraulics Pvt. Ltd.
20. M/s. Macpower Machine Tools
21. M/s. Marshal Machine Tools
22. M/s. Micromatic Grinding Technologies Ltd.
23. M/s. Motor Industries Company Ltd.
24. M/s. Parishudh Machines Pvt. Ltd.
25. M/s. PMT Machine Tool Automatics Ltd.
26. M/s. Singhal Power Presses
27. M/s. Premier Ltd.

Major Machine Tools Manufactured In India:

- Non CNC general purpose machines
- Standard CNC machines
- Gear cutting, Grinding, broaching machines
- Medium sized machines
- Electro Discharge Machine (EDM), Wire-EDM
- Special Purpose Machines (SPMs)
- Medium size machines
- Presses, Press Brakes
- Pipe Bending

Import Dependency: Indian manufacturers are mostly in SMEs sector. They need to increase production volumes in order to survive in global markets. They should also upgrade products and

processes in terms of technology and quality in order to remain competitive at both local and global markets. Domestic players have been losing local market in favour of imports.



Source: Report by the Working Group on “Capital Goods and Engg Sector” set up by the Planning Commission for preparing 12th FYP.

Additionally, there is an import content of 30% in standard equipment and 40% in high-tech equipment. Thus, the machine tool industry faced the dilemma of whether to remain as finished product supplier and face competition from large volume global players or become sub-suppliers of components and/or sub-systems to. The latent potential of this sector and its inherent strengths lent credence to the belief that the Indian machine tool industry can become a significant global player and carve a niche for itself in the high technology sunrise segment of CNC machine tools.

SWOT Analysis:

Strength:

1. Skilled manpower.
2. Economic low volume production.
3. Technical base in diverse fields.
4. Availability of basic raw materials.
5. Wide range of products at industry level,
6. Rising class of technical entrepreneurs.
7. Component manufacturing capabilities (foundry castings)
8. Strong and visible industry association (IMTMA), supportive Central Govt., Central Manufacturing Technology Institute (CMTI)

Weakness:

1. Technology gaps & Weak in technological innovation/R&D
2. Lack of vision & focus on core competencies
3. Low volume

4. Inverted duty structures
5. Liberal policy – tilt towards imports,
6. Insignificant export.
7. FDI – oriented towards domestic markets based on assembly, technical /service centre
8. Poor image – both internal and external
9. Poor Infrastructure
10. Poor workmanship/ Lack of skilled manpower/ poor pay packages in R & D / Tech Dev/ Manufacturing.
11. No support in public procurement, lack of offset & contract development policies
12. High Cost of capital/ doing business and Governance issues

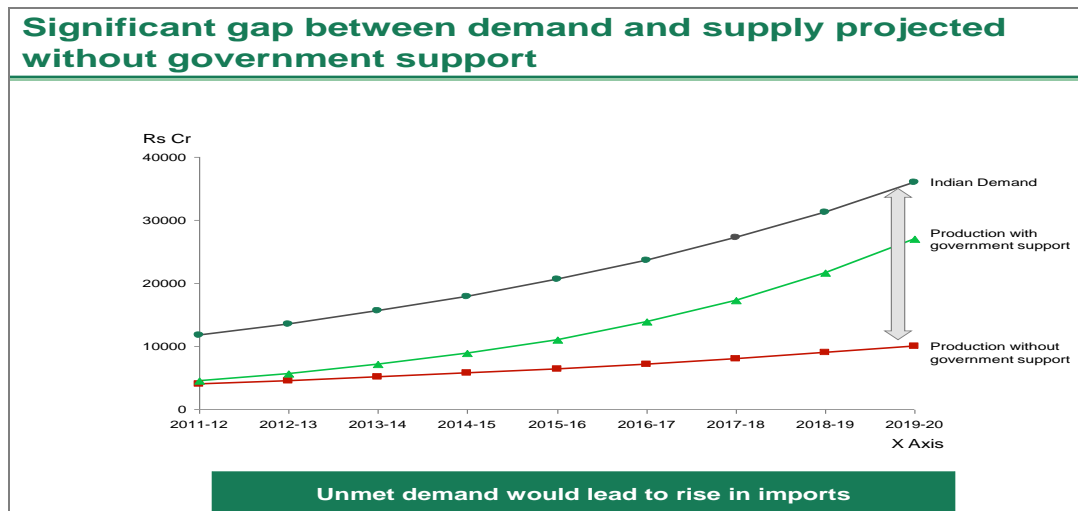
Opportunity:

1. India present one of most growing market
2. 'Product Development Centre' for technology generation and National Manufacturing Policy on the anvil
3. PSUs to be promoted for import substitution
4. Strategic alliances/ JVs, Acquisition of Technology firms abroad
5. Low cost and wide manufacturing base
6. Government sensitivity towards strategic nature of the industry
7. Public Procurement Policy draft – 5% price preference to Public Sector in Government purchases.

Threat:

1. Competition from international players manufacturing/supplying in India.
2. Emerging new machine tool manufacturing countries – China, the Province of Taiwan, and the Republic of Korea.
3. Non tariff barriers/ adverse FTAs
4. High cost of distribution (in export markets).
5. 'Direct' marketing by foreign machine tool manufacturers in India through their own selling set ups.
6. Rise of 'Regional' distributors selling on 'Stock and Sale' basis, on behalf of foreign manufacturers.

Alarm Bells: The machine tools industry in India is currently not attracting investment in the manufacturing of machine tools and needs support. Without an impetus towards technology development and capacity creation, a huge demand supply gap greater than Rs 30, 000 crore is expected to develop in the sector.



Source: Report by the Working Group on "Capital Goods and Engg Sector" set up by the Planning Commission for preparing 12th FYP.

12th Plan Projections:

Recently a Working Group on Capital Goods & Engg. Sector was set up for preparation of XII FYP and according to it the projected target with Government support is as under:-

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	CAGR
Market Size (Rs Cr)	11771	13537	15568	17903	20588	23678	15%
Production (Rs Cr)	4530	5663	7078	8848	11060	13824	25%
Import (Rs Cr)	7355	8016	8668	9277	9806	10201	6.7%
Export (Rs Cr)	114	142	178	222	278	347	25%
Employment (No. of people)	80000						

One of the key objectives for the 12th FYP is Increase manufacturing sector growth to ~ 2-4% more than GDP growth to make it the engine of growth for the economy and increase its share to ~ 25% of overall GDP by 2025. Since the manufacturing Sector is expected to grow at 14%, the Capital Goods Sector must grow at 17 -19% at least. This means that the Machine Tools Sector must also maintain similar growth rate. Indian Machine Tools Manufacturers Association has projected a growth rate of 25% with Government support.

Without Govt support, the domestic production may grow at 11th FYP CAGR of 12% to Rs. 6,387 crore. The import content in the domestic production is estimated to increase to 75% to 85%. This will make Indian production to be assemblies' supply.

The import of finished machine tools is also expected to grow at 11th FYP CAGR of 20% if not more. This means that end Plan imports of finished machine tools will be Rs. 18,028 crore.

This, again means that the end 12th FYP demand of Rs 24, 415 crore (without taking into account exports, re- engineering and in house production) will consist of total imports of Rs 22, 700 crore. Hardly any domestic value addition, this scene must be reversed in the national interest.

With Govt support as proposed the 12th FYP Working Group.**Target size and growth rate**

Demand is projected to grow at an average CAGR of 15% over the 12th Plan period (2012 to 2017). Production is projected to grow at 25% CAGR over the same period with Govt support.

Target export and import levels

Exports are projected to grow at 25% CAGR during the next 5 year plan, whereas imports are estimated to grow at a CAGR of 6.7% with Govt support.

Target employment levels:

The industry has targeted to directly employ an additional 50,000 persons in machine tools and related industries by 2016-17 with Govt support.

Policy and scheme (worth Rs 6500 crore) support are proposed in the 12th FYP.

2. Current levels of technology development

Although India is one of the larger consumers of machine tools, the indigenous machine tool industry holds only around 30% of market share. This is due to the fact that user industries depend on imports for several types of advanced machine tools. Even though industry has good design and manufacturing competence for a wide range of products, the product range and the technologies manufactured in India have a substantial gap with the present levels abroad.

Mix of Technological Capabilities: The Indian machine tool industry has a mix of technological capabilities. At present, the products manufactured by the industry are entirely of indigenous development, pointing to a good strength in product design and development, mainly for the standard products in manual and CNC machines besides metal forming presses. It is also able to design and build low and medium technology special purpose machines for certain specific end users. A hidden strength of the industry is its ability to design, engineer and manufacture a range of special purpose machines (SPMs) by SMEs. Examples are SPMs for cylinder boring, valve seat finishing, conrod boring etc. for auto components, multi-station index machines for defence production, assembly, testing and measuring stations for auto, defence and other industries.

Technology Gaps: But, the industry has large technology gaps in certain areas like grinding, gear cutting, high precision machine tools, multi-axes and multi-function machines, large/heavy duty machines and metal forming machines. These are required for the strategic/defence sectors like aero-space, defence production, power/energy sectors etc. affecting national security.

Use of IT, development of new materials & critical components: Also of importance are software tools for design, analysis and simulation, and the development of new materials for machine tool construction. For all of these the industry is dependent on imports at present, a situation that should be reversed over time. A range of attachments, accessories, sub-systems and parts also need to be developed. Particular mention may be made of the need to develop indigenous manufacture of critical mechanical and electronic elements that are the “heart” of CNC machine tools, for which the industry is entirely dependent on imports. The industry is also subject to technology denials on these elements as well as for the higher technology machine tools. This is a potentially serious weakness which must be overcome.

The user industries expect the latest technologies to produce high quality end products at competitive prices. This has made it imperative for the machine tool industry to take an inventory of present technologies and those it should develop within a five year time horizon. These are summarized in the table below:

Existing Technology	Technologies Required
<ul style="list-style-type: none"> • Non CNC general purpose machines • Standard CNC machines • Gear cutting, Grinding • Medium sized machines • EDM, Wire-EDM • SPMs • Medium size machines • Presses, Press Brakes 	<p>Metal cutting machine tools:</p> <ul style="list-style-type: none"> • Multi axes, Multi tasking machines • High precision machines • Large machines (boring-milling, turning) • Gear cutting and finishing machines • Grinding technology and machines • Electrical and micro-machining <p>Metal forming machines:</p>

<ul style="list-style-type: none"> • Pipe Bending • Hydroforming (limited) • Servo presses (limited) • Rolling, Bending • Measuring, metrology and gaging • Drives and controllers (limited) 	<ul style="list-style-type: none"> • Higher press automation and transfer systems, • Servo presses, • Sheet working machines (including laser, waterjet heads) • Hydroforming, • Fine blanking • Forging machines. • Flow forming Special technologies: <ul style="list-style-type: none"> • Explosive forming, • Electromagnetic forming etc. • Cutting tool technologies • Robotics and automation • Alternative materials (epoxy granite etc.) • Thermally stable welded structures • Hydrostatic spindles, guideways • Motorised and high frequency spindles • Smart machines with embedded sensors • Critical components development: <ul style="list-style-type: none"> ○ Anti-friction linear guideways ○ Ball screws ○ Precision spindle and ball screw support bearings ○ CNC controls ○ Spindle/axes servo motors with controllers ○ Feedback measurement systems
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Source : IMTMA

3. Key issues and challenges

- ◇ **Technology Denial:** It is well known that certain advanced manufacturing technologies like Japan and Germany are not allowing export of high technology Machine Tools to India on the basis that these are “dual use” technologies. The refusal is based on the IAEA Guidelines on the levels of precision and control capability of the machines. The denials were usually applied to certain “entities” in India engaged in the defence, aerospace and nuclear manufacturing activities, and also applied to other manufacturers supplying to these establishments. What is not so well known is that these guidelines have been applied against Indian machine tool companies. CNC controls with more than 3 axes simultaneous interpolation are denied to machine tool companies, even if they are not intended for use on strategic sector supplies. Several cases of precision machine tools being denied to Indian machine tool companies are on record (which have affected the production of hi-tech machine tools). These instances bring out the vital importance of developing these competencies within the country and reduce dependence on foreign machines. A large investment needed for technology development.

- ◇ **Lack of capacity creation through expansion and new units:** While there have been new investments in machine tool units in the last ten years, these are not on a scale required to meet rapidly increasing domestic demand, or make India a significant global player.

- ◇ **High interest rate makes industry non-competitive:** The prevailing interest rates of 14% and more makes the industry non-competitive due to the long gestation period and high capital investment required to set up units.

- ◇ **Reducing/Zero duty imports under FTAs/PTAs:** During recent years a number of FTAs/PTAs have been signed with foreign countries whereby the import duty on machine tools imported from these countries is gradually reduced to zero. This places domestic producers at a disadvantage due to high input costs, high interest rate and the incidence of 7.5% custom duty on imported parts. This in fact leads to a situation of inverted duty structure detrimental to the competitiveness of domestic manufacturers. Also, despite stipulations of local value addition in the partner countries to qualify under FTA/PTA, there is likelihood of machines manufactured in other countries being diverted via these countries to take advantage of the lower duty. Free import does not encourage transfer of technology and local manufacturing/value addition. This stunts the growth and development of the industry

- ◇ **Fragmented nature of the industry:** Given the fragmented nature of the industry, the SMEs find it difficult to invest money in technology because of limited availability of funds to these industries.

- ◇ **Shortage of skilled manpower**
 - increasing pool of available resources
 - increasing quality of resources
 - rationalizing labour policy

- ◇ **Infrastructure issues**
 - power & water supply
 - infrastructure for transportation and logistics

- ◇ **High cost of capital**
 - corpus fund for modernization/expansion/upgradation of units

4. Lessons from China

In giving a new thrust to the Machine tool industry along several fronts, the strategy adopted by the Chinese government may be of great interest. These are summarized as below:

- ◇ China has declared the internal development of precision CNC machine tools as one of the country's strategic needs and targets over the next 15 years
- ◇ Chinese government document has stated that China should reduce its reliance on imported CNC machine tools by developing its own machine tools and computer control systems.
- ◇ Chinese government has identified types of machine tools that it plans to build domestically over the next five years.
- ◇ China follows a carefully crafted strategy while attracting foreign investment, which is designed to ensure eventual technology transfer. Selective acquisition of foreign machine tool companies is adopted by the Chinese companies to get advanced technology and markets at one stroke.

Localization leading to technology transfer

China introduced procurement law to favor domestic products over imported ones

"Article 10 The government shall procure domestic goods, construction and services, except in one of the following situations:

(1) where the goods, construction or services needed are not available within the territory of the People's Republic of China or, though available, cannot be acquired on reasonable commercial terms;

(2) where the items to be procured are for use abroad; and

(3) where otherwise provided for by other laws and administrative regulations."

<Chinese Government Procurement Law 2002>

Government procurement policies spell out the preference for domestic goods

Control over purchase of imported products

- Special procedures and approvals required if government departments or projects are to purchase imported products

Preference for indigenous innovation products

- Domestic innovation will be valued more than that developed overseas, in the eyes of the Government
- Local companies would get preferential treatment in tenders

Despite recent tightening in the procurement process, uncertain outlook remains

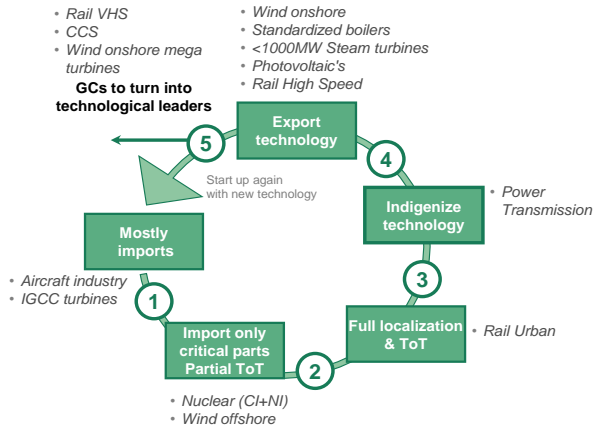
- China is seeking to join the Government Procurement Agreement (GPA) under the WTO framework
- On-going negotiation and battling between China and other WTO member countries

Source: The US-China Business Council, China Procurement Law, literal research

1 Localization leading to technology transfer

After localization in China, all surveyed industries saw systematic transfer of technology

Systematic indigenization of technology after importation of critical parts



Varying but shortening timing between critical parts' importation and Chinese exports

Industry	Technology transferred	3	5
Coal Power	Supercritical steam boiler	1995	2003
	<1000MW steam turbines	1995 <i>JV Westinghouse -SEC</i>	2003 <i>SEC to South-East Asia</i>
Wind Onshore	1,5MW turbine	2005 <i>Sinovel: ToT from Führländer</i>	2009 <i>Export in the USA</i>
T&D Power	Power switchgears GIS • ToTs in conventional & HVDC • UHV mostly own design	1990's	2009 <i>Brazil</i>
Rail High Speed	High Powered electric locomotives – 8 axles, 9600 kW	2005 <i>CNR: ToT from Alstom</i>	2010 <i>Export to Belarus</i>
	Electric Multiple Units Velaro ICE-3	2005 <i>CSR: ToT from Siemens</i>	2010 <i>Export to Thailand</i>

Source: Press researech, BCG analysis

5. Actions Required and Direction Ahead

5.1 Increasing local value-addition

The growing demand of machine tools should be leveraged so that access to Indian market for foreign firms should be linked to improving depth of Indian manufacturing and furthering technology absorption in India. Following levers should be employed to increase value-addition:

- ◇ Regulatory mechanism to stipulate 30% minimum local value addition for large value imports of machine tools along with transfer of technology to an Indian company via JV/JWA
- ◇ Tax holidays for wholly-owned subsidiaries, JVs & overseas companies setting up production base in India with a Phased Manufacturing Program leading to 75% local content over 3 years
- ◇ Higher depreciation after 1st year at 25% on machinery manufactured with 75% local value addition in India.
- ◇ Minimum of 30% local content as a PQ criterion for PSU/government buyers
- ◇ Preference to JV/JWA bids over foreign companies against total import offers on govt. tenders
- ◇ Graded import duty structure in line with the reduction in import content. Higher import duty on products with higher import content should be mandated.

5.2 Establishing Centers of Product Development (CPDs)

The objective of this initiative is generation of technologies which are 'feeder technologies' for all the equipment manufacturing segments.

CPDs would be similar to Fraunhofer Institutions of Germany. Each CPD has a 'specific technology competence' which could help industries across manufacturing sectors. It would service technology and product development requirements of industries which deploy technologies and strengths which are core competences of the particular CPD. CPDs, Academia and Industries form an operational cluster. CPDs will have design, manufacture, assembly and testing infrastructure along with requisite laboratory infrastructure manned by system development engineers and scientists. They will be capable to develop technologies, subsystems, total systems, etc. and even may demonstrate limited series production themes to bring the products to a level of commercialization.

The following technologies need to be developed as 'foundation technology resources' through 'Centers for Product Development' (CPDs):

1. New material adaption technologies
2. Metal working technologies -- Metal machining, deposition, welding technologies including surface coating technologies
3. Metal Casting,
4. Tools and Tooling, Dies and Moulds, etc.
5. Robotics and Automation

6. Measurement Technologies – Sensors, inspection aides/systems, scales, etc.
7. Electrical Drives and Controls, Kinematics
8. Embedded Electronics and Computer Numerical Control (CNC)
9. Tribology, Lubricants, Bearings and guide way related technologies
10. Information and Communication Technology (ICT) and Simulation Technologies – Man-machine interface technologies

These technologies need to be developed with an organized effort and they would be facilitating machine tools development across the sectors.

The Following Centres of Product Development (CPDs) would then help in providing the sectors with the basic technologies.

S.No.	Name of Centre for Product Development (CPD)
(i)	CPD - New material adaptation technologies and products
(ii)	CPD -- Metal working/shaping technologies, Tools, Tooling and Dies and Moulds
(iii)	CPD – Electronics and Controls Technologies and products
(iv)	CPD - Drives and Controls Technologies and products
(v)	CPD – High Fidelity Measurement Technologies and products,
(vi)	CPD – Robotics, Material Handling and Automation technologies and products
(vii)	CPD:- Tribology, Lubricants, Bearings and guideway related technologies
(viii)	CPD -- ICT and Simulation Technologies – Man-machine interface technologies

5.3 PSUs/ Private sector as base for technology development

- ◇ PSUs and some private companies play a vital role. Though, they are required to concentrate on developing and deploying ‘niche’, high-tech and distinguishable products, total manufacturing solutions with advanced technologies above the normal ‘milieu’ that cannot be sourced from international domain due to strategic reasons.
- ◇ PSUs will be the leading the technology generation and ownership aspects. It is proposed that PSUs and some leading private sector companies should interact with academia and R & D institutions like DRDO labs, labs etc. This is needed for development of advanced technology machines.
- ◇ It is also proposed to facilitate a possible ‘co-creation- tie up’ between PSUs like HMT/HEC and BHEL/Railways/Defence etc. The end-users and solution providers are brought together as value addition partners in a strategic and business tie up both in respect of scale of operations and in developing new technologies and advanced machine tools.
- ◇ It is also proposed to support HMT and HEC to transform them to be National / Global Champions. This effort is required to be supplemented with providing simultaneous support to few private sector Indian companies. This will bring advance technology development for the strategic necessity of the country.

5.4 Cluster Development

- ◇ Clusters along with Common Facility Centres (CFCs) are proposed to equip with modern facilities of plant & machineries including advanced testing equipments and Computer Aided Design (CAD) systems to enhance productivity, achieving the desired quality and Industrial Cluster Parks (ICPs) with high growth potential requiring assistance for upgradation of infrastructure to world class standards. Both of these facilities will contribute substantially in enhancement of competitiveness in the machine tool industry. An illustrative list of common plant & machinery for CFCs and infrastructure for ICPs are given below.
- ◇ Common Facility Centres (CFCs)
 - Building for common facilities
 - Plant & Machinery
 - Modern Foundry
 - Heat Treatment facility
 - Product Development
 - Equipment for Testing Laboratories
 - CNC lathe machines for critical machining
 - General and Specific machine shops
 - Special purpose fabrication / forging & welding facility
 - Common Production Processes
 - Centre of Excellence
 - Technical Information Centre including IP related activities
 - Other need based common facilities
- ◇ Sector specific Industrial Cluster Parks (ICPs)
 - Physical Infrastructure
 - Administrative Building
 - Road
 - Water Supply & Storm Water Drainage
 - Common Captive Power Generating Units
 - Transmission and Distribution Infrastructure
 - Common Fuel/Gas Supply System
 - Common Effluent Treatment Plant
 - Solid Waste Management Facilities

5.5 Acquisition of technology

- ◇ Provide incentives for acquisition of advanced technologies which are required for strengthening country's technological capabilities from the long term point of view. The incentive could be among others, in the form of allowable deductions under Income Tax Act, Custom duties exemption and also specific subsidization;
- ◇ Priority treatment be given in respect of a strategic manufacturing sector such as machine tools to provide a dedicated fund for acquiring technology for their tier-2 suppliers.
- ◇ Creation of a Technology Acquisition Fund for use by the machine tools manufacturers.

- ◇ A regular mapping and institutionalization of the Technology Acquisition/Development process is an essentiality.

5.6 Inter-ministerial coordination to develop technology roadmap

- ◇ There is need to have Inter-ministerial coordination to provide an assured demand to domestic players to enable capacity creation & utilization and technology development. The importance of such coordination can be illustrated with following 3 examples:
 - NTPC: NTPC has current capacity of 34, 000 MW and around 15, 000 MW under construction. This capacity is projected to grow to 75, 000 MW upto 2017 and 128, 000 MW up to 2032. This amounts to consolidated demand of Rs 1, 43,000 Cr over the next five year period. If this demand could be consolidated and used as an incentive to promote technological development through say BHEL, it could create huge benefits for the level of technology development in the country. Coal India's annual value of purchase of mining equipment is over \$2 billion every year. It is the largest buyer of mining equipment in India. A concerted effort to develop technology for the equipments that would be required by Coal India over the next 5 years would promote investments in technology in machine tools industry.
 - Ministry of Defence & Ministry of Railways: Ordnance factories and various units under the Ministry of Defence and Railways respectively have large demand of machine tools which are generally met through imports. Action has been initiated with the said Ministries to develop the technology and to meet the requirements by the local machine tool industry.
 - SAIL: Rs 200, 000 crore worth of plant & machinery would be required in the coming 7 – 10 years in order to meet the projected steel production capacity. Players like HEC, HMT and private companies could work in coordination with SAIL to draw out a technology roadmap for the Metallurgical machinery and machine tools industry.

5.7 Machine Tool Technology Development Fund

- ◇ Technology Development Fund required to be set up for modernization, expansion and up-gradation of the SMEs and other companies. The fund can also be used for design development, product development, energy efficiency, green technology development, productivity development, training and such other knowledge development activities.
- ◇ It is proposed to support Capital Goods Sector including Machine Tools related development under DHI through an SPV.

6. Conclusion

In India time has arrived to recognize the strategic and economic importance of the machine tools industry. India must learn from the experiences of China, Germany, Japan, Taiwan and other countries. These countries understood the cascading impact of the machine tools sector in the growth of their economies. They developed synchronized policies, institutional framework, purchase preference programmes, imports tied to technology transfer for domestic manufacturing and other support measures. The financing support for R&D and Technology Development was increased manifold. The result was significant growth in domestic production and employment as well as exports. Technology development of machine tools sector in these countries resulted in long term benefit in increasing global competitiveness of domestic manufacturing industry.

The focus is on generation of technology competence through the proposed product development centres. India has also announced new 'manufacturing policy' recently. This policy will allow eight new manufacturing investment zones to be created and also existing industry clusters to be upgraded. Delhi Mumbai Industrial Corridor, SEZs and cluster development programmes also present fresh opportunities for the machine tools sector. Strategic policy, institutional and funding support proposed in this paper is timely and will go a long way in improving global competitiveness of Indian machine tools sector. This will also have a positive impact on manufacturing industries of the country.

Abbreviation

HMT	Hindustan Machine Tools
HEC	Heavy Engineering Corporation
SPMs	Special Purpose Machines
FDI	Foreign Direct Investment
CNC	Computer Numeric Control
EDM	Electro Discharge Machine
OEMs	Original Equipment Manufacturers
SWOT	Strength, Weakness, Opportunities Threat
IMTMA	Indian Machine Tools Manufacturers Association
CMTI	Central Manufacturing Technology Institute
R&D	Research and Development
PSUs	Public Sector Undertakings
FTAs	Free Trade Agreements
FYP	Five Year Plans
GDP	Gross Domestic Product
CAGR	Compound Annual Growth Rate
SMEs	Small and Medium Enterprises
IT	Information Technology
IAEA	International Atomic Energy Agency
PTAs	Preferential Trade Agreement
GPA	Government Procurement Agreement
WTO	World Trade Organization
BCG	Boston Consultancy Group
Rail VHS	Rail Very High Speed
CCS	Carbon Capture and Storage
MW	Mega Watt
ToT	Transfer of Technology
IGCC Turbines	Integrated Gasification Combined Cycle
HVDC	High Voltage Direct Current
UHV	Ultra High Voltage
JV / JWA	Joint Venture / Joint Working Arrangement
CPDs	Centre of Product Developments
ICT	Information and Communication Technology
DRDO	Defense Research and Development Organization
CSIR	Council for Scientific and Industrial Research
BHEL	Bharat Heavy Electricals Limited
CFCs	Common Facilities Centres
CAD	Computer aided Designs
ICPs	Industrial Cluster Parks
NTPC	National Thermal Power Corporation
SAIL	Steel authority of India Limited
DHI	Department of Heavy Industry
SPVs	Special Purpose Vehicles
SEZs	Special Economic Zones.