MSME CAMPAIGN | TECHNOLOGY | WORKPLACE CLEANUP

IndianEngineeringExports

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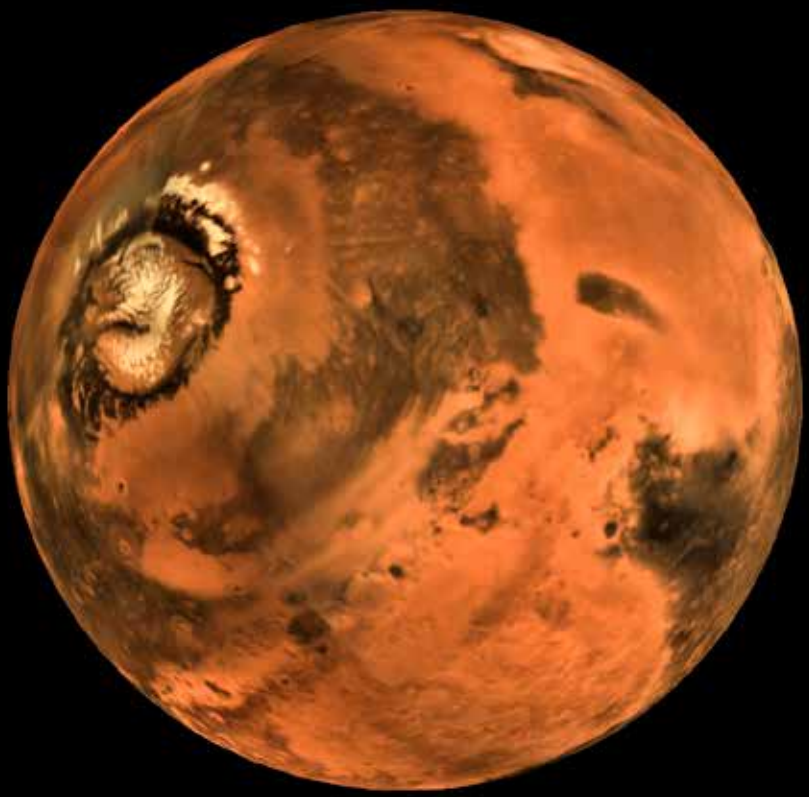

A photo from the camera onboard India's Mars orbiter spacecraft, Mangalyaan

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EXCLUSIVE MEMBER SECTION AT www.eepcindia.org

An exclusive member's section has been introduced on EEPC India's website. The User ID and Password has been sent to members on their email ID that is on record with EEPC India. If any member has not received it, please contact EEPC India at: eepcho@eepcindia.net.

The email IDs of some members are not available with EEPC India. Please provide your email ID at eepcho@eepcindia.net so that we can mail the details to you. It is also recommended that all members view their details in the Member's Directory on EEPC India's website and verify their email ID.

All members are also requested to provide mobile numbers of key contact persons over email. This will enable EEPC India to send important alerts and messages on SMS.

EXPORTS UNDER ADVANCE LICENCE

Notifications no.53/2018 and no.54/2018 dated 10 October 2018 have the following major implications effective 9 October 2018. An exporter exporting under Advance Licence will necessarily have to export under LUT and not IGST paid shipping bill. Frankly, this is very unfair to the exporter since it basically assumes that the exporter is only using imported raw material that has been prior imported

Normally the exporter is using both domestic duty paid material as well as imported material and to the extent of shortfall of duty is actually paying the IGST and then exporting under IGST paid shipping bill. Hence, there is no loss to the exchequer since the shortfall in IGST has been actually received by the government. Also the raw material component is not the only GST payment of exporters. They are paying GST on all services/consumables, labour, etc. used in the manufacture of a product. They are also paying GST on banking services, clearing and forwarding, freight etc. used by them to make payment of IGST and remove the exported product.

Hence, duty will accumulate for which exporters have to make a separate application for refund, which is cumbersome and not cost effective.

The basic motto that we should not export taxes is defeated and in the current balance of payment situation will hamper growth of exports. This is especially true in the case of engineering exports wherein basic steel has to be imported under Advance Licence due to anti-safeguard/ antidumping duties.

I would request you to kindly take up this issue on priority to allow exports under IGST payment shipping bills for exports under Advance Authorisation.

A Council Member

****

INDEE PHILIPPINES FRUITFUL

Our participation in INDEE Philippines organised by you was very fruitful. We are executing orders worth $300,000 yearly and there's much more to be got. Thank you for your cooperation and we hope to participate in more such events.

Mitesh Narendra Joshi, CEO (Sales & Marketing), Meetu-Raj Industries, Rajkot

****

ECB POLICY REVIEW

External Commercial Borrowings (ECB) Policy – Review of Minimum Average Maturity and Hedging Provisions

Attention of Authorised Dealer Category-I (AD Category-I) banks is invited to paragraphs 2.4.1, 2.4.2 and 2.5 of Master Direction No.5 dated 1 January 2016 on 'External Commercial Borrowings, Trade Credit, Borrowing and Lending in Foreign Currency by Authorised Dealers and Persons other than Authorised Dealers.'

The extant provisions have been reviewed and it has been decided, in consultation with the Government of India, to amend the following provisions of the ECB framework:

i. *Minimum average maturity*: Reduce the minimum average maturity requirement for ECBs in the infrastructure space raised by eligible borrowers under paragraph 2.4.2 (vi) of the aforesaid Master Direction from 5 years, as stipulated under paragraph 2.4.1(iv), to 3 years; and

ii. *Hedging requirements*: Reduce the average maturity requirement from extant 10 years to 5 years for exemption from mandatory hedging provision applicable to ECBs raised by above referred eligible borrowers. Accordingly, the ECBs with minimum average maturity period of 3 to 5 years in the infrastructure space will have to meet 100% mandatory hedging requirement. Further, it is also clarified that ECBs falling under the aforesaid revised provision but raised prior to the date of this circular will not be required to mandatorily roll-over their existing hedges.

Ajay Kumar Misra, Chief General Manager-in-Charge, Reserve Bank of India

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5 millennia of Indian science

India's 5000-year story of science spans religions and philosophies and takes in mathematics, medicine, medieval astronomy, modern physics, the computer revolution, and space exploration

(Right) The Susruta-Samhita or Sahottara-Tantra (A Treatise on Ayurvedic Medicine) – 12th-13th Century

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From the Chairman's Desk

THE last month of the year provides an opportunity to introspect on how the year went by, ponder over the hits and misses, and then, perhaps, take recourse to those immortal words from Shloka 19, Chapter 3 (Karma Yoga) of the Bhagavad Gita:

Tasmaad asaktah satatam
Kaaryam karma samachara
Asakto hyaacharan karma
Paramaapnoti purusah

(What is recommended for you, however, is to work without attachment to the results of your action. Such action without attachment leads to attainment of perfection of the highest consciousness.)

Indeed, just when we were celebrating our success of achieving some record highs of engineering exports growth in the last fiscal, came the double whammy of the imposition of import duties under Section 232 of the US Trade Expansion Act on Steel and Aluminium and the uncertainty over the continuation of the GSP benefits for our exports to the USA. That was not all. Countervailing measures were imposed in addition to the hiked import tariff on a key steel product that was doing well and required by oil and gas industry in the US. The second-round impacts began with the next major market, the European Union, initiating safeguard measures on a range of steel and steel products and, thereafter, imposing quotas for 200 days on Indian exports of these products.

The USA also took India to the WTO alleging it was violating the Agreement on Subsidies and Countervailing Measures (ASCM) as India had already moved out of Annex VII criteria and could no longer subsidise its exports. News reports indicate that India's negotiation with the USA has failed over its Section 232 action and we have also lodged a dispute under the Dispute Settlement Body of the WTO in this regard. The outcome of these two disputes may herald substantive changes in our foreign trade policies in the future.

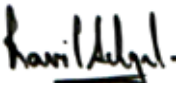
There was, however, some cushion for the exporters. The Indian rupee depreciated by 9 percent in the last six months to give some comfort to our exporters; while the Prime Minister, in his pre-Diwali address on 2 November 2018, announced that the interest subvention under the RBI's Interest Equalisation Scheme for Packing Credit in Rupee will be raised from 3 percent to 5 percent to support the MSME sector. The RBI's notification on the same has just come out and this is timely given that the Rupee seems to have halted its depreciation vis-à-vis the USD and has started appreciating and is currently below Rs70 per USD, thereby suddenly reversing the future gains and raising uncertainties for those exporters who were hoping that the Rupee would be range-bound in the Rs73-75 to a USD zone and had become the new normal!

The other major issue that has been a cause of concern which I have also been highlighting in this page periodically is the problem of GST refund. While the IGST mode of refund has become smooth, some backlog of refunds still remain; problems of scrolls going back, errors made during the transition period due to asymmetric information, are still haunting exporters, especially those belonging to the small and medium scale sector. Equally, the illogical diktat that an exporter using Advance Authorisation, or under SEZ, or those merchant exporters exporting under 0.1 percent rate of GST, must export only under LUT, should be withdrawn and such exporters should also be allowed to export under IGST. I do believe that the Central Board of Indirect Taxes and Customs (CBIC) would do well to 'nudge' the exporters to take the IGST route of exports as that will reduce transaction costs, bring in faster revenues for the government, refunds for the exporters, and further enhance our Ease of Doing Business Ranking.

I also appeal to the Prime Minister to give a big push to exports the way he has done for the MSME sector by a set of measures that will help us tide over the challenges that we face due to a combination of confusing signals, such as the volatility in the Rupee and the growing global protectionism. The WTO has already lowered the global trade growth forecast from 3.9 percent in 2018 to 3.7 percent in 2019 and we must ensure that our share in world trade in 2019 doesn't dip consequently.

Global leaders, as they converge for the G-20 meetings at this moment of writing, must also realise that protectionism is hurting common people across the globe. They will do well to remember that cardinal principle of international trade theory – a tax on your imports is equivalent to a tax on your exports. Collectively, everyone loses, even if in the short run there are some blips in growth and in employment data in few countries.

Let me end by wishing you a very happy 2019 and do hope that the path of knowledge will drive the future path of action.



Ravi Sehgal

Novel initiative to reach out to MSME sector

The Union Government is implementing a 100-day support and outreach programme for the MSME sector in an attempt to solve the various problems troubling the sector, especially those arising from the introduction of GST

IN a significant development of far-reaching advantage to the micro, small, and medium enterprise (MSME) sector, the Government of India has commenced a 100-day programme in 80 selected districts of the country to support and reach out to the MSMEs. The implementation of this support and outreach programme will be intensively monitored over the next 100 days.

To assist the implementation of this programme, the GST Policy Wing of the Central Board of Indirect Taxes & Customs (CBIC) appointed nodal officers in the 80 districts where the 100-day programme was launched and created a Feedback and Action Room (FAR) to facilitate GST Helpdesks setup by CBIC for MSMEs.

Launching the historic support and outreach programme for the MSME sector on 2 November 2018, Prime Minister Narendra Modi unveiled 12 key initiatives that will help the growth, expansion and facilitation of MSMEs across the country. The Prime Minister said the 12 decisions that he was announcing would mark a new chapter for the MSME sector. Noting that MSMEs are one of the principal employment generators in India, the Prime Minister recalled the glorious Indian traditions of small-scale industry, including Ludhiana's hosiery, and Varanasi's saris.

FIVE ASPECTS, 12 INITIATIVES

The newly-launched 100-day programme covers five key aspects for facilitating the MSME sector. These include

- access to credit;
- access to market;
- technology upgradation;
- ease of doing business; and
- a sense of security for employees.

The Prime Minister said as a Diwali gift for the sector, his 12 announcements would address each of these five categories.

The Prime Minister stated that the success of economic reforms launched by the Union Government can be gauged from the rise in India's Ease of Doing Business rankings, from 142 to 77 in four years.

Access to credit

The ***first*** of the 12 initiatives was the launch of the 59-minute loan portal to enable easy access to credit for MSMEs. Loans up to Rs1 crore can be granted in-principle approval through this portal, in just 59 minutes, and a link to this portal would be made available through the GST portal. The Prime Minister asserted that in New India, no one should be compelled to visit a bank branch repeatedly.

The ***second*** initiative was a 2 percent interest subvention for all GST-registered MSMEs, on fresh or incremental loans. For exporters who receive loans in the pre-shipment and post-shipment period, the Prime Minister announced an increase in interest rebate from 3 percent to 5 percent.

The ***third*** initiative was that all companies with a turnover of more than Rs500 crore, must now compulsorily be brought on the Trade Receivables e-Discounting System (TReDS). The Prime Minister said joining this portal would enable entrepreneurs to access credit from banks, based on their upcoming receivables. This would resolve their problems of cash cycle.

Access to markets

On access to markets for entrepreneurs, the Union Government had taken a number of steps already. In this context, the Prime Minister announced his fourth initiative – that public sector companies have now been asked to compulsorily procure 25 percent, instead of 20 percent, of their total purchases from MSMEs.

The ***fifth*** initiative was related to women entrepreneurs. The Prime said that out of the 25 percent procurement mandated from MSMEs, 3 percent must now be reserved for women entrepreneurs.

More than 1.5 lakh suppliers have now registered with GeM (Government e-Marketplace), out of which 40,000 are MSMEs, and transactions worth more than Rs14,000 crore have been made so far through GeM, the Prime Minister said. The ***sixth*** initiative was to make all public sector undertakings of the Union Government compulsorily a part of GeM. The Prime Minister said they should also get all their vendors registered on GeM.

Technology upgradation

On technological upgradation, the Prime Minister said that tool rooms across the country are a vital part of product design. His ***seventh*** initiative was that 20 hubs would be formed across the country, and 100 spokes in the form of tool rooms would be established.

Ease of doing business

On ease of doing business, the Prime Minister said his ***eighth*** initiative was related to pharma companies. Clusters would be formed of pharma MSMEs and 70 percent cost of establishing these clusters would be borne by the Union Government.

The ***ninth*** initiative was on simplification of government procedures – returns under eight labour laws and ten Union regulations must now be filed only once a year.

The ***tenth*** initiative was that now establishments to be visited by an Inspector would be decided through a computerised random allotment.

On the ***eleventh*** initiative, the Prime Minister, noting that as part of establishing a unit, an entrepreneur needed two clearances – environmental clearance and consent to establish, said that under air pollution and water pollution laws, now both these have been merged as a single consent. He further said that the returns would be accepted through self-certification.

As the ***twelfth*** initiative, the Prime Minister mentioned that an Ordinance has been brought, under which, for minor violations

under the Companies Act, the entrepreneur would no longer have to approach the Courts, but can correct them through simple procedures.

Social security for MSME sector employees

The Prime Minister also spoke of social security for the MSME sector employees. He said that a mission would be launched to ensure that they have Jan Dhan accounts, provident fund and insurance. These decisions would go a long way in strengthening the MSME sector.

PROBLEMS BESETTING MSME SECTOR

The MSME sector has been under stress following the introduction of the Goods and Services Tax by the Union Government on 1 July 2017, facing severe cash crunch especially as GST refunds were inordinately delayed. The government has been gradually ironing out the glitches in the system with the assistance of and inputs from various stakeholders, EEPC India being one of them, and the situation has improved considerably. However, some problems remain and the 100-day support and outreach programme will go a long way in improving the situation.

GST helpdesks

The GST Helpdesks/Facilitation Centres were set up at the same venue where the MSME outreach programme is being held. The CBIC-appointed nodal officers and their team were expected to tie-up with the Prabhari officers/District Collectors and keep with them the requisite GST guidance material/computers for the facilitation of MSME trade.

While the Commissioner (GST Policy Wing), CBIC, is on standby for further queries and guidance, the DGTS has been asked to make available adequate GST-related publicity/guidance material for the MSME sector, on the CBIC website.

Feedback and Action Room (FAR)

The Feedback and Action Room to facilitate GST Helpdesks setup by CBIC for MSMEs was created to record and process all grievances raised by MSMEs. As the DG GST is the nodal agency to run the FAR, the Feedback and Action Room was set up in the office of the DG GST. The FAR will remain open till the nodal offices remain open in the districts covered by the 100-day programme.

The primary work of the FAR is to receive and compile all the issues raised by these nodal officers. These nodal officers would report all the grievances on real time basis to the FAR in a grievance sheet. Further, the FAR would try to provide solutions to these issues on its own. If it is not able to do so, then it may escalate these issues to the offices concerned in CBIC or GSTN. Thereafter, the FAR would follow up the issues with these offices and on receipt of the solution, they would send the same directly to the taxpayer with a copy to the nodal officer concerned. The FAR is also expected to compile a master record of all grievances, at various stages of resolution, and send a summary report to the CBIC on daily basis. In a nutshell, the FAR would be the facilitating the office for these 80 nodal offices.

RBI directive

Among the various steps taken earlier to ease the burden of MSMEs, the Reserve Bank of India issued a directive on 7 February 2018 to all banks and NBFCs regulated by the RBI regarding relief for MSME borrowers registered under GST. The RBI directive stated:

'Presently, banks and NBFCs in India generally classify a loan account as Non-Performing Asset (NPA) based on 90 day and 120-day delinquency norms, respectively. It has been represented to us that formalisation of business through registration under GST had adversely impacted the cash flows of the smaller entities during the transition phase with consequent difficulties in meeting their repayment obligations to banks and NBFCs. As a measure of support to these entities in their transition to a formalised business environment, it has been decided that the exposure of banks and NBFCs to a borrower classified as micro, small and medium enterprise under the Micro, Small and Medium Enterprises Development (MSMED) Act, 2006, shall continue to be classified as a standard asset in the books of banks and NBFCs subject to the following conditions:

(i) The borrower is registered under the GST regime as on 31January 31, 2018.

(ii) The aggregate exposure, including non-fund based facilities, of banks and NBFCs, to the borrower does not exceed Rs250 million as on 31 January 2018.

(iii) The borrower's account was standard as on 31 August 2017.

(iv) The amount from the borrower overdue as on 1 September 2017 and payments from the borrower due between 1 September 2017 and 31 January 2018 are paid not later than 180 days from their respective original due dates.

(v) A provision of 5% shall be made by the banks/NBFCs against the exposures not classified as NPA in terms of this circular. The provision in respect of the account may be reversed as and when no amount is overdue beyond the 90/120 day norm, as the case may be (consequent upon transition to 90-day delinquency norm with effect from 31 March 2018 for NBFCs, provision reversal will be with reference to the 90-day norm).

(vi) The additional time is being provided for the purpose of asset classification only and not for income recognition, i.e. if the interest from the borrower is overdue for more than 90/120 days, the same shall not be recognised on accrual basis (consequent upon transition to 90-day norm with effect from 31 March 2018 for NBFCs, restriction on income recognition on accrual basis will be with reference to interest overdue for more than 90 days).'

MSME Act

There are several sections in the Micro,

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The Port of Antwerp is not your average transport partner. Every challenge you bring drives us to serve you even better. By constantly adapting to your needs we achieve faster distribution, smarter logistics, smoother customs, greener activities and clearer processes. Improved solutions that keep inspiring you. At the Port of Antwerp standing still is no option. Moving is.

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Applications filed on MSME Samadhaan portal (as on 21 November 2018)			
Applications filed by micro and small units (MSEs)			
Applications filed by MSEs	9649	Amount involved in applications	Rs2722.83 cr
Mutual settlements with buyer	615	Amount involved in mutually settled cases	Rs90.09 cr
Applications disposed by MSEFC Council	224	Amount involved in disposed cases by MSEFC Council	Rs43.81 cr
Applications visible to Council after 15 days of filing	3677	Applications filed in last 15 days	358
Applications converted into cases by MSEFC Council	3004	Applications rejected by MSEFC Council	1771
Cases filed in MSE Facilitation Council (MSEFC)			
Cases filed	8232	Amount payable	Rs2800.77 cr
Cases disposed	2501	Amount involved in disposed cases	Rs626.37 cr

Small and Medium Enterprise Development (MSMED) Act, 2006 that deal with delayed payments to micro and small enterprises.

Section 15-24 of the Act contains provisions of delayed payment to micro and small enterprise (MSE). Section 20-21 of the Act requires state governments to set up a Micro and Small Enterprise Facilitation Council (MSEFC) for settlement of disputes on getting references/filing on delayed payments.

The state MSEFC, after examining the case filed by a MSE unit has to issue directions to the buyer unit for payment of due amount along with interest as per the provisions under the MSMED Act, 2006. All micro or small enterprises having valid Udyog Aadhar (UAM) can approach the MSEFC.

Under Section 16 of the Act, the buyer is liable to pay compound interest with the monthly rests to the supplier on the amount at three times the bank rate notified by RBI in case he does not make payment to the supplier for his supplies of goods or services within 45 days of the acceptance of the goods/service rendered.

State governments were to notify (i) Authority for filing Entrepreneur Memorandum; (ii) Rules of MSEFC; and (iii) Constitution of MSEFC. All states/UTs have notified the Authority for Filing Entrepreneur's Memorandum; 33 states/UTs (i.e. except Arunachal Pradesh, Assam, and Manipur) have notified rules of MSEFC; and all the 36 States/UTs have constituted MSEFCs, as per provisions laid down under the MSMED Act 2006.

Every reference made to MSEFC is to be decided within a period of 90 days from the date of making such a reference as per provisions laid in the Act.

If the appellant (not being the supplier) wants to file an appeal, no application for setting aside any decree or award by the MSEFC shall be entertained by any court unless the appellant (not being supplier) has deposited with it 75% of the award amount. (Section 19)

The provisions under the Act are implemented by the MSEFC chaired by the Director of Industries of the state/UT having administrative control of the MSE units. The state governments/UTs are requested to ensure that the MSE Facilitation Council hold meetings regularly and delayed payment cases are decided by the Councils within a period of 90 days as stipulated in the MSMED Act, 2006.

MSME Samadhaan

The Union Ministry of MSME has taken up the issue of delayed payments by setting up a portal MSME Samadhaan for ease of filing applications under MSEFC.

The Ministry of MSME has taken the initiative for filing online application by the supplier MSE unit against the buyer of goods/services before the MSEFC concerned of his/her state/UT. These will be viewed by MSEFC Council for their actions. These will be also visible to central ministries, departments, CPSEs, and state government concerned, for pro-active actions.

– From government documents and websites

EEPC INDIA JOINS 100-DAY MSME CAMPAIGN

EEPC India joined the 100-day MSME support and outreach programme following a directive from the government to all Export Promotion Councils. A letter from the Department of Commerce, Union Ministry of Commerce and Industry, stated that the campaign was launched to support MSMEs and reach out to them through credit plus services. While the benefits of the campaign and the decisions taken would be for MSMEs across the country, intensive monitoring would be done in 100 districts (in the case of poll-bound states/districts, monitoring would be done post elections) for strengthening the ecosystem for MSMEs. While the duration of the campaign would be 100 days, the initiatives will be sustained thereafter.

The 100 districts have been divided among the Export Promotion Councils according to the concentration of their industries. The Government has appointed Prabhari Officers for each of these districts. The directive stated that 'the EPCs must closely associate themselves with the campaign of the government and must ensure the following:

(i) The Executive Director (ED)/Secretary of each EPC shall get in touch with the Prabhari Officer of the concerned districts related to their products latest by 31 October 2018, where the sector allotted is covered by the EPC. A compliance report in this regard shall be sent by ED/Secretary of the EPC at email id: jsadmin-doc@gov.in by 31 October 2018.

(ii) The ED/Secretary/Other senior officers shall attend launch of the campaign at district level function to be organised on 2 November 2018 and inform the concerned Prabhari Officer about the same. Where there is more than one district to be supported by an EPC, the ED/Secretary may attend the event in one district and shall depute officer(s) of EPC to the other district(s).

(iii) Throughout the 100 days of the campaign, the ED/Secretary/other designated officer of the EPC shall fully support and cooperate with the Prabhari Officers in executing the Action Plan for promoting MSME in the concerned districts.'

Districts allotted to EEPC India

Sector	District	Prabhari Officer
Electrical Equipment	Okhla	Jalaj Srivastava, AS, DACFW
Foundry	Rajkot	Niranjan Kumar, JS M/o Mines
Auto component	Faridabad	Shyamal Misra, JS Do Commerce
Auto component	Manesar	Rajni Sekhri Sibal, AS MHA
Steel Ancillary	Bokaro	Sanjay Prasad, JS, Defence Prod
Auto Components	Jamshedpur	Alka Tiwari, AS, Do Fertilisers
Auto Component	Hoskote	Vandana Gurnani, JS Do HFW
Auto Component	Malur	Atul Kumar Tiwari, JS Mo Textile
Auto component	Pune	Samir Kumar Biswas JS Do Ch & PetroC
Steel furniture	Nashik	Kunal Kumar JS Mo HUA
Agri equip.	Barnala	Vijoy Kumar Singh, JS DoPT
Electrical Equipment	Ludhiana	Anurag Agarwal, JS, DEA
G Engineering	Kapoorthala	Anjali Bhawara, AS MCA
Electrical & Agri equip.	Coimbatore	B Suman, JS M/o Tourism
Electrical equipment	Haridwar	Jyotsna Sitling, JS MSDE
Auto component	Udham Singh Nagar	Sukhbir Singh Sandhu, AS MHRD (DHE)

EEPC India has been allotted 16 districts to conduct the 100-day campaign.

All offices of EEPC India across the country joined in the campaign, and have begun holding seminars, workshops and interactive sessions in the selective districts, and elsewhere. The places where meetings have already been held, region-wise, are:

Northern Region: Gurugram, Okhla, Kundli, Meerut, Barnala, and Jammu

Western Region: Pune, Ahmedabad, and Nashik

Southern Region: Coimbatore, Malur, Hoskote, and Kolar

Eastern Region: Bokaro and Jamshedpur.

The meetings co-organised by EEPC India, dwell on a wide range of issues. For instance, the meeting with Kundli Industries Association in Kundli, Haryana that included the Hong Kong Trade Development Council, acknowledging the importance of the medium and small scale enterprises (MSME) in India's manufacturing sector, discussed how the DGFT (under Niryat Bandhu Scheme) and EEPC India could assist MSMEs (all industrial clusters) in finding business opportunities throughout the world.

The seminar in Kundli was attended by owners, entrepreneurs, partners, managing directors, senior decision-makers, international trade division heads, export heads and purchase heads, supply chain personnel, corporate communication heads and so on. It focused on the following sectors: Steel kitchenware and dessert utensils; Industrial and textile machinery; Industrial packaging and processing; Fabric and yarn production; and Manufacturer and exporter of stainless steel products of flatware and hollow ware.

EEPC India (Northern Region)

Gurugram: (**1**) EEPC India NR office in Delhi joined the MSME Support and Outreach Programme in Gurugram, where Rao Narvir Singh, PWD Minister, Government of Haryana was the Chief Guest (centre). On his left, Ms Rajni Sikri, Additional Secretary, Union Ministry of Home Affairs, and Mr Rakesh Suraj, Regional Director (NR), EEPC India.

Okhla: (**2**) MSME Support and Outreach meeting in Okhla. (**3**) Ms Pallavi Saha, Sr Deputy Director, EEPC India, addressing the meeting in Okhla.

Kundli: A session was held with Kundli Industries Association (KIA) in Kundli, Haryana. (**4**) Mr Kholi, a senior exporter and member of KIA, felicitating Mr NC Fan, Sr Manager, Hong Kong Trade Development Council (HKTDC). (**5**) Mr Subhash Gupta, President, KIA, welcoming Mr Rakesh Suraj, Regional Director (NR), EEPC India; and Mr Rajinder Jain, President, MSME Chamber of Commerce, Haryana, welcoming Mr NC Fan, Sr Manager, HKTDC. (**6**) Mr Rakesh Suraj, Regional Director (NR), EEPC India, addressing the audience. (**7**) The session in progress in Kundli. (**8**) Mr Opinder Singh, Deputy Director, Jalandhar SRO, EEPC India, addressing the audience at an MSME Support and Outreach Programme in Barnala, Punjab. (**9**) The audience.

EEPCINDIA
NIRYAT
4

EEPCINDIA
RAKESH SURAJ
EEPCINDIA
NG CHEUK FAN
RAJINDER JAIN
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MSME
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EEPC India (Northern Region)

Meerut: A session on PM's MSME Outreach, Niryat Bandhu Initiatives and IESS VIII was held in Meerut. (**10**) Mr Ashrut, Branch Manager, ECGC; Mr RP Meena, Joint DGFT; and Mr Sanjay Beswal, Regional Committee Member (NR), and Mr Rakesh Suraj, Regional Director (NR), EEPC India.

(**11**) Mr Rakesh Suraj; Mr Udayee Ram, Addl Commissioner Industry, PIEMA; Mr VK Kaushal, Deputy Commissioner Industry, Meerut; and Mr Ashwani Gera, President, PIEMA. (**12**) Mr Rajat Mangla, CA addressing the session.

Jammu: (**13**) Mr Rakesh Suraj, Regional Director (NR), EEPC India, addressing a meeting in Jammu.

EEPC India (Western Region)

Pune: (**14**) EEPC India Mumbai RO (WR) personnel joined the MSME Support and Outreach Programme in Pune, in the presence of Mr Anil Sheroli, BJP MP, Pune and Mr Rajat Srivastava, Regional Director (WR) & Director (Marketing & Sales), EEPC India.

Rajkot: (**15**) (**16**) & (**17**) EEPC India Ahmedabad SRO personnel present in Rajkot MSME Support and Outreach programme

Nashik: An MSME Camp was held at Nashik Industries & Manufacturers' Association (NIMA), at Nashik. (**18**) Dignitaries on the dais.

(**19**) A view of the audience.

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सूक्ष्म, लघु और मध्यम उद्यम
सहयोग एवं संपर्क
Micro, Small and Medium Enterprises
SUPPORT AND OUTREACH
Friday, 2nd November, 2018 : Vigyan Bhawan, New Delhi
वित्तीय सेवाएं विभाग, वित्त मंत्रालय
भारत सरकार
Department of Financial Services, Ministry of Finance
Government of India
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MSME-CAMP
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EEPC India (Southern Region)

Coimbatore: (**20**) EEPC India Chennai RO (SR) office joins the MSME Support and Outreach programme in Coimbatore.

Malur: (**21**) EEPC India Bangalore SRO (SR) office meets Mr AK Tiwari, IAS, JS, Ministry of Textiles and Prabhari Officer, in Malur, Karnataka.

Kolar: An MSME outreach programme was held at Kolar. (**22**) Mr JV Raja Gopal Rao, Sr Deputy Director, EEPC India, addressing the gathering. (**23**) A section of the audience.

Hoskote: (**24**) An MSME session was held at Hoskote. (**25**) Mr D Karthikeyan, Asst Head, EEPC India Technology Centre, Bengaluru, addressing the session. (**26**) Mr Shankar Kumar, AGM, Canara Bank (centre). (**27**) Mr Yeshwanth, LDM Hoskote Cluster (right).

EEPC India (Eastern Region)

Jamshedpur: (**28**) & (**29**) EEPC India Kolkata RO (ER) office joins the MSME Support and Outreach event in Gopal Maidan, Bistupur in Jamshedpur, for the auto components sector.

Bokaro: (**30**) & (**31**) EEPC India Kolkata RO (ER) joins the MSME Support and Outreach event in Bokaro.

Challenges in bank mergers

The proposals for the consolidation and merger among public sector banks face many a hurdle – from software incompatibility to differing human resource policies among others. It is, therefore, imperative that all stakeholders such as customers, employees, and management are involved in such discussions from the beginning

EXPERTEYE

T R SHASTRI

Prof. Shastri is Joint Director, Manipal Academy of Banking, Bengaluru

THE suggestion of consolidation among public sector banks (PSBs) has been doing rounds for quite some time. The Narasimham Committee Report in 1991 recommended a three-tier banking structure in India through the establishment of three large banks with international presence, eight to ten national banks, and a large number of regional and local banks, though, of course, these were not scientifically arrived at numbers. The Narasimham Committee Report in 1998 also reiterated the earlier recommendations.

'Consolidation and restructuring of PSBs for better efficiency, governance and capital efficiency' has been a fixed agenda in every 'Gyan Sangam' since 2015, the two-day offsite held each year for PSB CEOs involving the Ministry and RBI officials and ministers. In the first such meeting in 2015, it was published that 'the government may consider merging small PSBs with big ones; although the decision was left to the banks' board of directors, the government could provide a timely nudge to create big, well-run global banks.' At the end of the second such exercise on 5 March 2016, the Finance Minister had said that consolidation in the banking sector was discussed at the meeting and bankers themselves suggested that an expert group should be set up soon to look into the issue and identify the right matches for consolidation.

In the budget speech for 2016-17, the Fi-

nance Minister mentioned that a roadmap for consolidation of PSBs would be spelt out. On 1 November 2017, the government announced that the Union Cabinet had given in-principle approval for PSBs to amalgamate through an Alternative Mechanism (AM). It would facilitate consolidation among such banks to create strong and competitive banks. The proposals received from banks for in-principle approval to formulate schemes of amalgamation will be placed before the Alternative Mechanism. A report on the proposals cleared by Alternative Mechanism will be sent to the Cabinet every three months. Interestingly, the scheme also stated that 'Alternative Mechanism may also direct banks to examine proposals for amalgamation.'

Till recently, there was only one instance of merging of two PSBs – New Bank of India (NBI) was merged in 1993-94 with Punjab National Bank (PNB), both of which had been nationalised earlier in 1980 and 1969 respectively. NBI was a loss-making bank and its capital and deposits had eroded. NBI had reached a precarious state of liquidity. PNB was 12 times bigger than NBI in book size. It was not a voluntary merger; it was a case of a stronger bank protecting a weaker one. PNB had been a strong bank then, with an uninterrupted record of profits, but it suffered a net loss of Rs96 crore in 1996 following the merger, a large figure then. It had to face several problems and litigation relating to absorbing the staff of NBI in its stream. It reportedly took PNB five years or more to get over the merger effect, as per records of the Lok Sabha Secretariat. RBI has gone on record to state that 'the post-merger experience was considered to be not altogether satisfactory on account of the problems in effective integration of the two entities.' The next merger was that of five associate banks and Bharatiya Mahila Bank (BMB) with SBI itself. Even though there is an impression created that the merger materialised within just seven months of decision, at the back end, preparation was going on for years. The treasuries had been integrated. The software systems were synchronised. Movement of people was happening regularly at mid and senior levels. Product and process features were standardised. But sadly none of these was given credit while announcing 'quick and successful' merger.

CHALLENGES OF MERGERS

Public sector banks' business models are very similar. There are no PSBs which specialise in or are devoted to any specific banking sector like an exclusive PSB for financing SMEs or exports. In fact, one CEO had remarked in the Gyan Sangam that if anyone enters the branch of any PSB, they all look very similar. Only the banks' financial results differ due to variation in geographical spread, sectoral exposure, and, possibly, differing human resources quality, leading to varying operational efficiencies. Hence logically, it should be seamless to merge such banks. Merger of two cement companies or two established hotels does not pose much of challenge but banks' mergers need to be handled carefully. There are a number of reasons for this.

Software

Banks evolved independently and developed their own processes and systems. Over the decades when the operations were automated, each bank maintained its own workflows and customised the software to meet this requirement rather than adopting any industry standard process. There are mainly three core banking solution (CBS) products that are being used by banks in India – Finacle developed by Infosys, Flexcube by Oracle and BaNCS by TCS. But even when two banks have implemented the same CBS software, they are so much customised that what is in vogue in one bank looks much different from that in another bank using the same CBS. The architecture of different CBSs is so different that merger of banks using different CBS packages will be a humungous task and similar to repairing a car which is on the move. Beside the CBS, banks use a variety of other ancillary tools for CRM, HRM, treasury, and other areas. Integration of them will be an added challenge.

When associate banks merged with SBI, there were no issues on this ground because they were using the same CBS. The government carefully chose the three PSBs with the same CBS in the recent announcement for merger. **Chart1** shows the CBS used by different PSBs and it can be seen that there are not many combinations left over for possible merger from this perspective. The IT service providing companies may actually be happy with varying processes and substantial customisation as that would result in richer engagement.

Manpower challenges

This is the second toughest challenge for merger of service industry units like banks which have to be manpower intensive. Several case studies have shown that merger announcements trigger confusion, anxiety, and insecurity in staff, leading to possible slowdown in business. It takes years for the 'outsider' feeling to subside. PSBs are surely not known for best HR practices. Poor talent management and lack of communications are likely to exacerbate this misunderstanding.

Since one of the objectives is to optimise the efficiency of cost of operations, it results in closure or merger of geographically overlapping branches all over the country, resulting in surplus branch managers; there surely can't be greater promotion opportunities due to merger. SBI had almost 24,000 branches after the merger of the five associate banks and a small other PSB – BMB. As per the Finance Minister's statement, '6950 branches have merged with SBI post amalgamation of banks,' though he hastened to add that there was no retrenchment. This situation gets multiplied at lower levels from entry-level officers to general managers to executive directors to the CEO.

For example, of the three banks identi-

Chart1: CBS used by different public sector banks

CBS: Finacle	Health	CBS: BaNCS	Health	CBS: Flexcube
Andhra Bank		SBI		Canara bank
Bank of Baroda		Allahabad Bank	PCA Bank	Syndicate bank
Bank of India	PCA Bank	Bank of Maharashtra	PCA Bank	
Corporation Bank	PCA Bank	Central Bank of India	PCA Bank	
Dena Bank	PCA Bank	Indian Bank		
IDBI Bank	PCA Bank			
Indian Overseas Bank	PCA Bank			
Oriental Bank of Commerce	PCA Bank			
Punjab and Sind Bank				
Punjab National Bank				
UCO Bank	PCA Bank			
Union Bank of India				
United Bank of India	PCA Bank			
Vijaya Bank				

fied for the merger recently, the tenure of the largest of the three has been extended by one year till October 2019, apparently to enable him to oversee the merger process. The CEOs of the other two banks have their appointments valid till January and June 2020. The merger process is expected to be completed latest by mid-next year. Since the combined entity cannot have more than one CEO and since the CEOs of both the smaller of the banks may not be found suitable to head the resultant behemoth, rehabilitating these two for the short residual period will be a challenge, unless some other PSB CEO position opens up. The government does not want to publicly admit this suicidal process as the reason for no voluntary bank merger proposals emanating from banks, though many CEOs were 'asked' to make presentations on possible mergers.

Barely two days following the Finance Minister's announcement of the proposal to have 'strong banks rather than numerically large numbers,' bank employee unions threatened to resort to strikes if the process is kicked off. According to the unions, the question is; if the government's plan was to avoid 'large number' of banks, why did it issue licences to companies to set up payments and small finance banks and also to keep the new bank licensing process on tap?

Fortunately, the compensation structure is similar across all PSBs and does not add a new challenge. However, the performance appraisal systems vary in their sophistication. The training, transfer, and talent management policy is also likely to be different across banks. This will necessitate substantial redeployment and retraining efforts.

As associate feature normally mentioned is the 'culture' of the organisation. This does not mean the language majority of the staff speak, or the caste and creed mix of the bank. It essentially reflects the DNA of the bank like dynamism versus conservatism, compliance culture, attitude towards customers and employees, growth pattern, customer profiles, etc. Academic studies generally indicate that organisations with similar culture blend well in mergers. However, in our country where diversity in unity is the ethos, searching for and merging banks with similar 'culture' will only result in resultant large banks each of one 'culture' which will then lose its all-India image. Hence if this feature is not taken into account, that will help in generating large truly all-India banks.

Financial health

There is an often repeated argument that consolidated banks will be stronger due to bigger size and hence can manage the combined NPAs, clearly confusing between size and strength. It is like saying if we merge all private sector electricity producers, they

will become big and hence strong enough to overcome all inherent challenges like fuel availability, inefficient distribution, inflexible grid, etc. In a service sector like banking, where all assets are intangible, such mergers could only lead to chaos.

What can temporarily help is if a stronger bank, i.e. with adequate capital, can effectively spare its excess capital to a weaker bank in this merger pair and can rescue the latter for a couple of years from violation of the Basel requirements. This distribution of capital obviates providing scarce government resources. Eleven of the PSBs are classified under prompt corrective action (PCA) by RBI, one of the parameters for so classifying being capital inadequacy. As can be seen from the chart enclosed, the number of residual combinations available for merger from this 'health' angle is very limited. The government has already 'exhausted' two 'healthy' banks from its arsenal to rescue just one PCA bank! Even a deputy governor of RBI stated in April 2016 that 'It is not that a large size is always beneficial for the banking system and overall economy.'

Geographical distribution

After nationalisation, banks expanded away from their original geographical area of concentration. This was deliberately achieved through the branch licensing policy. Thus most PSBs are now all-India banks, though in percentage terms, there may be concentration in hinterlands of their places of origin. But surely all PSBs have, for example, presence in most of the 719 district HQs. This meets most business customers' requirements. Purely from a retail customers' perspective, it is immaterial whether the same bank has a branch in an interior village in Andhra Pradesh and also, say, in West Bengal. Anyway interbank remittances can be done electronically. Even portability of accounts across banks and universal KYC depository are being contemplated. Hence ideally, this geographical distribution should not be a consideration for mergers.

Brand name

Surely a customer recognises her bank better than other banks. Marketing experts try to encash this as a brand value. However, since ownership is common and due to availability of risk insurance, in the long run, customers care for more mundane features like interest rates, costs, and levels of service before choosing a bank rather than name of a bank. Otherwise, banks like Andhra Bank or Karur Vysya Bank would not have flourished outside their regional or community influences. Previously existing Bharatiya Mahila Bank would have grown much more rapidly if all women had supported it due to its name. Having said this, it becomes necessary for the merged entity to link the previous and present names in its publicity exercises leading to added cost. Thus dropping existing name and assuming new name in a merger process is not an issue, though specialist consultants may try to magnify, in their own interest.

Customer perspective

Depositors are likely to have initial apprehension about safety of their funds; but will soon realise that the majority ownership continues to be the same government. Their interest yield may change after merger and there is no guarantee that becoming big will enable the bank to pay higher interest rate. They could have one-time hassle of changing the mail IDs, branch details, seeing new faces, and other documentation issues. The borrowers are likely to face greater challenges. A corporate prefers to deal with more than one bank for diversity and for better terms. This benefit will go away if the banks in the consortium merge.

The advantage of access to multiple treasuries will vanish. Even for a corporate with single lender, the merger of the branches may result in the need to re-establish the credentials with new sets of people. A best customer of the branch may not continue to be so because of the merged branch with influx of other borrowers. There will also be one-time hassle of changing the SWIFT code, IFSC code, and other standard settlement instructions (SSIs).

In the extracts of the Annual Report for 2017-18, the Ministry of Finance cleverly stated (in the context of associates merging with SBI) that 'the merger has benefitted the customers of the associate banks, by offering products not earlier available to them and by enhancing access through a bigger branch network, etc. and thus improving the customer services' without referring to benefits, if any, to the much larger number of customers of the main bank, i.e. SBI.

A large number of PSBs are officially not in good health. The rest of the PSBs are not strong enough with all but two having incurred loss during the latest financial year. Across banks, this was solely due to credit quality, which is a reflection of the economy. Merger arising out of necessity for rescuing a weak bank or for redistribution of capital among banks cannot be avoided but merger merely to reduce the number of banks or to make them big just to appear in the global lists is fraught with risk. Instead of deciding mergers purely based on bookish data, discussion with other stakeholders such as customers, employees, and management will bring out the challenges.

RBI itself has gone on record to state that 'Any plan for merger or acquisition has to be a Board-led process in which all stakeholders have to be involved from beginning.' Scientific study of the outcome of the merger, e.g. of SBI group, is to be done, though it may be difficult to sharply link the reduction of headcount (and consequent benefits) to merger, separating it from retirement, digitisation, and routine voluntary retirement scheme. These need to be analysed before any policy decision on future mergers. On a lighter note, it may be noted that during the second offsite of bank chiefs, Gyan Sangam in 2016, the morning session on the second day began with a talk by Swami Sukhabodhanandji on 'Spirituality in turbulent times.' The need for this address is all the more now.

How the dollar became king of global finance

The Fed has virtually become the world's central bank. Now nations, including India, are looking to rely less on the dollar

COMMENTARY

AJAY SRIVASTAVA

Ajay Srivastava is with the Indian Trade Service

INDIA and Japan have agreed to raise the value of currency swap from the $50 billion (agreed in 2013) to $75 billion during Prime Minister Narendra Modi's two-day visit to Japan on 28-29 October 2018. This means India can now readily borrow up to $75 billion from Japan in exchange for rupees. This was the latest measure taken by the government to dampen the rupee's slide against the dollar.

But India is not the only country taking measures to reduce dependence on the dollar. Many countries have started settling trade transactions in local currencies.

Germany and France are setting up a Euro-based trading system to continue trading with Iran in the wake of the US call to punish countries having any trade relation with Iran.

Every few years, local currencies across the world face intense pressure in the forex

market. This pressure has a direct link to the US-controlled global financial system. As if connected through an umbilical cord, countries prosper and decline in sync with the US Federal Reserve's actions. But how did the dollar become the centre of global finance? And, what does it mean for India and the world?

The roots

Since the early 19th century, countries struggled to find the best way to settle trade balance. It was not easy as each had its currency with no check on more printing. Finally, most countries agreed to settle trade deficits through the exchange of gold. This system continued up to Word War I.

Then many countries stopped their currencies' convertibility to gold so they could print more money to finance the war effort. Disappearance of gold as a common anchor led to the collapse of the global financial system and became one of the reasons leading to great depression in the early 1930s.

Bretton Woods

Realising the importance of an anchor like gold for promoting stable trade and finance, countries on the winning side of World War II agreed to establish a robust global financial system. They considered many options. John Maynard Keynes on behalf of Britain proposed creating an International Clearing Union (ICU) to keep account of countries' exports and imports. The unit of account for such transactions would be Bancor (French for Bank Gold).

Exports would add Bancors while imports would subtract these in a country's ICU account. Limits were proposed on the amount of deficit, and if it exceeded, the country's currency was allowed to depreciate. It was a currency neutral system.

But the US rejected Keynes' proposal and proposed that the new system should rest on both gold and the US dollar.

No one liked this idea as this would make the dollar the supreme currency of the world. But the US, the principal financier of the victorious side of the war, prevailed. And except for the Soviet Union, all 44 participating nations signed the Bretton Woods agreement in 1944 at Bretton Woods, New Hampshire, US.

The member-countries agreed to maintain a fixed exchange rate which could be adjusted if deficits or surpluses persisted. The International Monetary Fund (IMF) was created to lend to member-countries in need of foreign exchange.

The price of gold was fixed at $35 per ounce. The US agreed to supply gold at this price in the exchange with dollars held by other countries.

Delinking of gold and dollar

The gold for dollar system worked during 1950-70. But it came under strain as the US started printing and spending a large value of dollars on post-war reconstruction efforts. When countries holding these dollars went for exchange with gold, the US gold reserves started vanishing.

Gold supply was finite, but the dollar printing knew no limits. The story came to an end in August 1971 when the US reneged from its commitment to convert the US dollar to gold.

Delinking gold with dollar made the US the lynchpin of global finance. Other countries need to earn foreign exchange by exporting; the US Fed has just to hit the print button. Fed has almost become the central bank of the world. Central banks all over the world must calibrate their policies to be in sync with the Fed's.

It could print dollars without bothering about domestic inflation or balance-of-payments as over two-thirds of all dollars in circulation are held outside the US. It could carry out massive expenditures on military activities and foreign aid to achieve its political objectives.

The Soviet Union was the only major country opposing the dollar's status, and that was the main reason for the Cold War. Europe and Japan reluctantly joined the US political and military umbrella, and accepted dollar as the de facto world currency.

Impact of $-centric system

A country's economy is ransom to Fed's actions. If Fed increases the interest rate, dollars flow back to the US, and if it lowers rates, dollars move to the world to take advantage of growth stories or interest rate arbitrage of individual countries.

Trillions of dollars loaned to corporates at near zero interest rate transfer wealth from the people to corporates, a key reason for the concentration of wealth in the top one percent of the population.

US actions are being emulated by China and other countries which have also printed and offloaded large volumes of money in the past 10 years. Awash with cheap loans, Chinese firms export subsidised goods with no relation between cost and price. This has distorted the world trading pattern.

India's options

The key to managing the rupee are: One, avoid the lure of hot money that comes for investment in debt market and shares. It leaves the economy devastated while leaving.

Two, reduce our $90-billion annual crude oil import bill. This is possible through transparent regulation, investment in domestic oil exploration and switching to green energy options. Many countries, including the US, have turned from energy importers to net energy exporters using these strategies.

And, three, India is batting far below its potential in exports. Make export a national do-or-die priority.

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Engineering exports bounce back to growth path

While engineering exports registered healthy growth in October 2018, volatility of the rupee and threat of a trade war continue to dog the engineering exporting community

OVERSIGHT

POLICY WONK

INDIA's merchandise exports revived significantly from its negative growth recorded last month and registered a growth of 17.86 percent in October 2018 compared to October 2017 in dollar terms. Overseas shipments from India increased by 33.35 percent in rupee terms in October 2018, over the same period last year. Exports during October 2018 increased to $26.98 billion from $22.89 billion during the same period last year. In dollar terms, the growth was less at 17.86 percent in October 2018 over October 2017.

Surge in exports in October 2018 over the same month last fiscal was led by expansion in shipments of Petroleum products (49.38), Electronic goods (72.26),Ceramic products and glassware (50.62), Iron ore (13.31), Engineering goods (8.87), Organic and inorganic chemicals (34.01), Drugs and pharmaceuticals (12.83), Spices (17.43), Oil meals (21.01), Carpet (34.13), RMG of all textiles (36.26), Cotton yarn/fabs./made-ups, handloom products etc (10.23), and Plastic and linoleum (31.86) percent respectively. However, some major commodity groups like Cashew (-41.16), Meat, dairy and poultry products (-22.39), Coffee (-18.52), Rice (-15.98), and Tobac-

co (-11.04) percent respectively, portrayed negative growth in exports during the reporting month.

India's merchandise imports during October 2018 were valued at $44.11 billion, which was 17.62 percent higher in dollar terms over the level of imports valued at $37.50 billion in October 2017.

Major commodity groups of imports showing high growth in October 2018 over the corresponding month last year includes Petroleum, crude and products (52.64), Machine tools (57.38), Sulphur and unroasted iron pyrites (41.87), Organic and inorganic chemicals (26.63), Chemical material and products (34.77), Newsprint (53.2), and Silver (51.77) percent respectively.

Oil imports during October 2018 were valued at $14.21 billion, which was 52.64 percent higher than oil imports at $9.31 billion in October 2017. In this connection it is mentioned that the global Brent price ($/bbl) has increased by 39.66 percent in October 2018 vis-à-vis October 2017 as per World Bank commodity price data (The pink sheet).

Non-oil imports during October 2018 were estimated at $29.90 billion which was 6.05 percent higher than non-oil imports of $28.19 Billion in October 2017.

Trade deficit for October 2018 increased significantly at $17.13 billion as against the deficit of $14.61 billion during October 2017, registering growth of 17.2 percent. Cumulative trade deficit also surged by 22.1 percent to $111.46 billion during April-October 2018-19, from $91.28 billion in the same period last fiscal.

Engineering exports

Indian engineering exports bounced back to the growth path once again in October 2018 with 8.56 percent year-on-year growth in dollar terms. Engineering exports recorded 4.5 percent decline in September 2018 over the same month last fiscal.

During October 2018, engineering exports from India were recorded at $6155.02 million as against $5669.59 million in October 2017.

The share of engineering exports in India's total merchandise exports was estimated at 22.8 percent in October 2018. However, on a cumulative basis, it was higher at 24.33 percent during April-October 2018-19.

The monthly engineering figures for 2018-19 vis-à-vis 2017-18 are depicted below as per the latest availability of data.

INDIA'S MERCHANDISE TRADE SCENARIO

- **India's merchandise exports revived significantly from its negative growth recorded last month and registered a growth of 17.86 percent in October 2018 compared to October 2017 in dollar terms.**
- **Overseas shipment from India increased by 33.35 percent in rupee terms in October 2018 over the same period last year. Exports during October 2018 increased to $26.98 billion from $22.89 billion during the same period last year. In dollar terms, the growth was lesser at 17.86 percent in October 2018 over October 2017.**
- **Surge in exports in October 2018 over the same month last fiscal was led by expansion in shipments of Petroleum products (49.38), Electronic goods (72.26),Ceramic products and glassware (50.62), Iron ore (13.31), Engineering goods (8.87), Organic and inorganic chemicals (34.01), Drugs and pharmaceuticals (12.83), Spices (17.43), Oil meals (21.01), Carpet (34.13), RMG of all textiles (36.26), Cotton yarn/fabs./made-ups, handloom products etc (10.23), and Plastic and linoleum (31.86) percent respectively. However, some major commodity groups like Cashew (-41.16), Meat, dairy and poultry products (-22.39), Coffee (-18.52), Rice (-15.98), and Tobacco (-11.04) percent respectively, portrayed negative growth in exports during the reporting month.**
- **India's merchandise imports during October 2018 were valued at $44.11 billion, which was 17.62 percent higher in dollar terms over the level of imports valued at $37.50 billion in October 2017.**
- **Major commodity groups of imports showing high growth in October 2018 over the corresponding month last year include Petroleum, crude and products (52.64), Machine tools (57.38), Sulphur and unroasted iron pyrites (41.87), Organic and inorganic chemicals (26.63), Chemical material and products (34.77), Newsprint (53.2), and Silver (51.77) percent respectively.**
- **Trade deficit for October 2018 increased significantly at $17.13 billion as against the deficit of $14.61 billion during October 2017, registering growth of 17.2 percent. Cumulative trade deficit also surged by 22.1 percent to $111.46 billion during April-October 2018-19 from $91.28 billion in the same period last fiscal.**

INDIA'S ENGINEERING EXPORTS SCENARIO

- **Indian engineering exports bounced back to the growth path once again in October 2018 with 8.56 percent year-on-year growth in dollar terms. Engineering exports recorded 4.5 percent decline in September 2018 over the same month last fiscal.**
- **During October 2018, engineering exports from India were recorded at $6155.02 million as against $5669.59 million in October 2017.**
- **The share of engineering exports in India's total merchandise exports was estimated at 22.8 percent in October 2018. However, on a cumulative basis, it was higher at 24.33 percent during April-October 2018-19.**

INDIA'S ENGINEERING IMPORTS SCENARIO

- **India's engineering imports for fiscal 2018-19 were valued at $8.6 billion during October 2018 compared to $7.8 billion in October 2017, registering considerable growth of 10.1 percent in dollar terms.**
- **The share of engineering imports in India's total merchandise imports was estimated at a lower 19.5 percent in October 2018 as against 20.8 percent in October 2017.**

Figure1 depicts the monthly trend in engineering exports for October 2018 vis-à-vis October 2017.

Correlation between engineering exports and manufacturing output

The engineering sector is an important component of the broader manufacturing sector and the share of engineering production in overall manufacturing output is quite significant. Now, as production and exports are directly correlated, some correlation between manufacturing production growth and engineering export growth is very likely to exist. Hence, a broad analysis of industrial production, especially of manufacturing sector is effective in the context of engineering exports analysis as manufacturing has 77.63 percent weightage in India's industrial production.

During the first and second month of fiscal 2018-19, both engineering exports and manufacturing moved in the same direction. Growth accelerated for both in April 2018. During May 2018, both engineering exports and manufacturing growth slowed down sizeably. However, these two moved in opposite directions over June-August 2018. During June and July, manufacturing growth surged but engineering exports growth moderated while in August, just the opposite has happened. Again in the month of September 2018, engineering exports growth and manufacturing growth moved in the same direction. While the former conceded decline, the later observed a slowdown. The manufacturing index in the index of industrial production (IIP) stood at 131.4 in September 2018 followed by 130.4 in August 2018, 127.6 in July, 128.6 in June, 130.1 in May and 123.1 in April 2018.

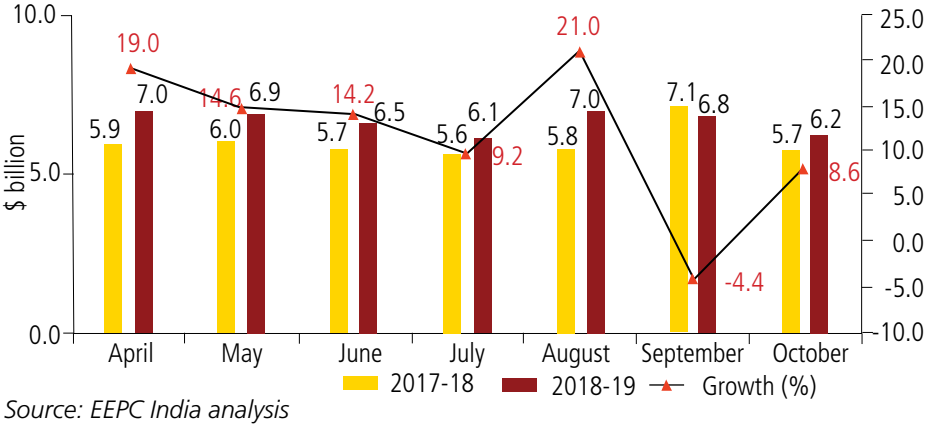
The growth rates in engineering exports and the growth rate of manufacturing in the country during the current fiscal are shown in **Table2**.

We also present the month-wise corresponding revised engineering exports for 2017-18 as opposed to 2016-17.

Table1: Engineering exports ($ million)

Month	2017-18	2018-19	Growth (percent)
April	5902.86	7021.90	18.96
May	6047.26	6929.77	14.59
June	5703.28	6511.69	14.17
April-June	**17653.40**	**20463.36**	**15.92**
July	5595.63	6111.89	9.23
August	5766.60	6979.90	21.04
September	7088.19	6769.57	-4.50
July-September	**18450.42**	**19861.36**	**7.65**
October	5669.59	6155.02	8.56
April-October	**41773.41**	**46479.74**	**11.27**

Figure1: Trend in monthly engineering exports for 2018-19 vis-a-vis 2017-18 ($ billion)



Source: EEPC India analysis

Table2: Engineering exports growth vis-à-vis manufacturing growth, 2018-19

Month/Year	Engg exports growth (%)	Manufacturing growth (%)
April-March 2017-18	**16.81**	**4.5**
April 2018	18.96	4.9
May 2018	14.59	3.6
June 2018	14.17	6.9
April-June 2018	**15.92**	**5.1**
July 2018	9.23	7.0
August 2018	21.04	5.1
September 2018	-4.40	4.6
July-September 2018	**7.68**	**5.5**
October 2018	**8.87**	**NA**

Source: Department of Commerce and CSO

Impact of exchange rate

How has the exchange rate changed in October 2018 vis-à-vis October 2017? In order to find out, we look at the average exchange rate for both October 2018 and 2017. **Table4** provides the data.

During October 2018, the official exchange rate of the rupee vis-à-vis the dollar depreciated by an alarming 13.1 percent over October 2017 as the rupee reached its all-time low vis-à-vis the dollar and continued to weaken. The year-on-year depreciation in September 2018 was around 12.07 percent.

Import analysis of engineering goods

We begin by looking at the engineering panel-wise exports for the month of October 2018 vis-à-vis October 2017. The data is given in **Table5**.

Some factors that need to be noted are:

• During April-October 2018-19, exports of engineering goods registered double-digit growth of 11.27 percent compared to April-October 2017-18, while the monthly engineering exports rose to $6150.66 million in October 2018 compared to September 2017, recording single-digit growth of 8.57 percent.

• Out of 33 engineering panels, 26 panels sharing almost 79 percent of the products recorded growth in exports during April-October 2018-19, over the same period last fiscal, while the remaining seven panels demonstrated decline in exports.

• Products of Iron and steel recorded a growth of 8.4 percent in exports during April-October 2018-19 with overseas shipments of $4129.18 million from $3808.38 million over the same period last fiscal.

• Among the seven non-ferrous metals and products made of non-ferrous metals, more than 50 percent, i.e. four products recorded positive growth in October 2018 compared to October 2017. Tin and products recorded highest growth of 45.65 percent followed by Lead and products at 26.79 percent during October 2018 over the same period last fiscal.

• The Industrial machinery panel as a whole recorded growth in exports of 26.45 percent during October 2018 vis-à-vis the same period last fiscal. All the sectors under this panel have positive growth figures, with sectors like Air condition and refrigerators recording highest growth in exports to the extent of 78.73 percent in October 2018 compared to October 2017. Pumps and valves and Industrial machinery like Boilers, parts, etc. recorded single-digit growth figures of 5.08 percent and 2.43 percent respectively in exports during October 2018 compared to the same period last fiscal. Cumulative figures for Industrial machinery as a whole recorded growth in exports of 19.89 percent during April-October 2018-19 compared to the same period last fiscal, with all sectors recording positive growth.

• The Electrical machinery and equipments panel experienced considerable growth in exports of 20.84 percent during October 2018 over the same period last fiscal. Cumulative exports for April-October 2018-19 recorded 50.93 percent growth, moving up to $5041.92 million from $3340.63 million in April-October 2017-18.

• Exports of Auto and auto components recorded significant growth of 15.31 percent during October 2018, scaling up

Table3: Revised engineering exports for 2017-18 ($ million)

Month	2016-17	2017-18	Growth (%)
April	4744.32	5902.86*	24.42
May	5636.17	6047.26*	7.29
June	5066.99	5703.28*	12.56
Quarter 1	**15447.48**	**17653.40***	**14.28**
July	**4794.12**	**5595.63***	**16.72**
August	4873.71	5766.60*	18.32
September	4917.78	7088.19*	44.13
Quarter 2	**14585.61**	**18450.42***	**26.50**
October	**5133.58**	5669.59*	10.44
November	**4841.37**	6872.54	41.95
December	**5688.32**	7160.88	25.89
Quarter 3	**15663.27**	**19703.01**	**25.79**
January	**5334.66**	6217.67	16.55
February	**6501.99**	6332.64	-2.60
March	**7706.18**	7850.32	1.87
Quarter 4	**19542.83**	20400.63	4.39
April-March	**65239.19**	**76207.46**	**16.81**

Source: DGCI&S

Table4: Average exchange rate

October	Average exchange rate 1 USD to INR
2017	65.08
2018	73.60

Source: Calculated from RBI archive

Table5: Trends in engineering panel exports for October 2018 compared to October 2017 ($ million)

Sl no.	Panel	October 2017	October 2018	Growth %	Apr-Oct 2017-18	Apr-Oct 2018-19	Growth %
1. Iron and steel and products of iron and steel							
A	Iron and steel	941.68	755.8	-19.7	6131.94	5807.08	-5.3
B	Products of iron and steel	504.43	567.31	12.5	3808.38	4129.18	8.4
Subtotal		**1446.11**	**1323.11**	**-8.51**	**9940.32**	**9936.26**	**-0.04**
2. Non-ferrous metals and products							
A	Copper and products	301.99	108.29	-64.14	1968.48	582.31	-70.42
B	Aluminium and products	406.93	487.41	19.78	2553.42	3431.34	34.38
C	Zinc and products	86.6	29.57	-65.85	445.97	358.26	-19.67
D	Nickel and products	6.91	6.06	-12.30	28.39	45.13	58.96
E	Lead and products	30.09	38.15	26.79	191.06	229.31	20.02
F	Tin and products	0.46	0.67	45.65	6.53	4.41	-32.47
G	Other non-ferrous metals	40.43	45.14	11.65	285.24	314.44	10.24
Subtotal		**873.41**	**715.29**	**-18.10**	**5479.09**	**4965.2**	**-9.38**
3. Industrial machinery and parts							
A	Industrial machinery like boilers, parts, etc	50.28	51.5	2.43	331.08	404.37	22.14
B	IC engines and parts	159.17	235.75	48.11	1456.26	1583.96	8.77
C	Pumps of all types	75.44	79.27	5.08	543.54	566.12	4.15
D	Air condition and refrigerators	84.49	151.01	78.73	624.74	1204.45	92.79
E	Industrial machinery for dairy, food processing, textiles etc	419.36	497.97	18.75	2875.6	3391	17.92
F	Machine tools	32.31	38.96	20.58	269.11	282.43	4.95
G	Machinery for injecting moulding, valves and ATMs	113.71	127.59	12.21	851.37	901.87	5.93
Subtotal		**934.76**	**1182.05**	**26.45**	**6951.7**	**8334.2**	**19.89**
4. Electrical machinery			**672.76**	**20.84**	**3340.63**	**5041.92**	**50.93**
5. Automobiles							
A	Motor vehicle/cars	570	646.88	13.49	4329.35	4956.9	14.50
B	Two and three wheelers	155.36	176.71	13.74	1130.37	1284.59	13.64
C	Auto components/part	382.98	454.42	18.65	2818.22	3283.44	16.51
Subtotal		**1108.34**	**1278.01**	**15.31**	**8277.94**	**9524.93**	**15.06**
1.	**Aircrafts and spacecraft parts and products**	**171.44**	**108.41**	**-36.77**	**1135.03**	**1090.09**	**-3.96**
2.	**Ships boats and floating products and parts**	**2.28**	**118.05**	**5077.63**	**2420**	**2621.05**	**8.31**
8. Miscellaneous							
A	Medical and scientific instruments	126.36	130.85	3.55	900.11	969.69	7.73
B	Railway transport	25.93	29.91	15.35	169.79	214.78	26.50
C	Hand tools and cutting tools	52.44	70.71	34.84	401.41	443.74	10.55
D	Electrodes accumulators	3.39	4.3	26.84	24.91	29.43	18.15
E	Accumulator and batteries	20.23	35.02	73.11	142.62	228.18	59.99
F	Bicycle and parts	19.17	30.86	60.98	179.51	216.04	20.35
G	Cranes lifts and winches	26.85	46.42	72.89	185.39	274.52	48.08
H	Office equipments	5.47	10.71	95.80	52.52	71.96	37.01
I	Other construction machinery	114.84	159.52	38.91	738.8	959.46	29.87
J	Prime mica and mica products	1.18	2.01	70.34	12.58	15.41	22.50
K	Other misc. items	176.44	232.67	31.87	1386.97	1506.47	8.62
Subtotal		**572.3**	**752.98**	**31.57**	**4194.61**	**4929.68**	**17.52**
Total engineering exports		**5665.39**	**6150.66**	**8.57**	**41739.32**	**46443.33**	**11.27**

Source: Department of Commerce, Government of India

Table6: Engineering exports country wise, 2018-19 ($ million)

Country	October 2017	October 2018	Growth (%)	Apr-Oct 2017-18	Apr-Oct 2018-19	Growth (%)
USA	693.28	938.44	35.36	5470.77	6740.38	23.21
UAE	191.96	305.69	59.24	2806.38	2772.99	-1.19
Nepal	235.01	282.86	20.36	1295.82	1793.41	38.40
Germany	267.04	278.25	4.20	1714.49	1990.92	16.12
UK	211.41	221.12	4.59	1571.16	1695.76	7.93
Bangladesh	176.58	215.78	22.20	1250.91	1572.96	25.74
Italy	145.66	202.44	38.98	1367.18	1365.59	-0.12
Mexico	192.95	173.78	-9.93	1606.50	1605.22	-0.08
Malaysia	188.05	169.14	-10.06	1105.84	888.12	-19.69
China	309.88	168.77	-45.54	1678.19	993.82	-40.78
Turkey	102.53	158.96	55.04	945.77	1222.20	29.23
Thailand	98.15	144.04	46.75	689.17	957.77	38.97
Korea	147.75	136.61	-7.54	1044.50	1089.58	4.32
Belgium	91.63	130.20	42.10	708.01	1082.33	52.87
Indonesia	169.46	127.64	-24.68	937.10	988.86	5.52
Singapore	214.36	122.17	-43.01	1135.12	1239.09	9.16
South Africa	82.13	106.31	29.43	807.62	1024.68	26.88
France	102.47	103.23	0.74	810.96	818.00	0.87
Nigeria	54.13	102.19	88.78	403.10	690.66	71.34
Spain	86.17	100.30	16.40	638.52	711.44	11.42
Sri Lanka	99.67	98.35	-1.33	830.11	811.49	-2.24
Netherlands	61.53	94.77	54.02	479.84	624.34	30.12
Japan	80.18	84.64	5.56	553.79	731.66	32.12
Saudi Arabia	72.67	84.17	15.84	677.03	770.40	13.79
Vietnam	107.24	79.74	-25.65	670.85	598.90	-10.72
Top 25 countries total	4181.90	4629.59	10.71	31198.76	34780.56	11.48
Grand total	5669.59	6155.02	8.56	41773.41	46479.74	11.27
Share % total engineering exports	**73.76**	**75.22**		**74.69**	**74.83**	

Note: Highlighted figures indicate negative growth
Source: Department of Commerce, Government of India

from $1108.34 million in October 2017 to $1278.01 million in October 2018. Cumulative exports for April-October 2018-19 recorded 15.06 percent growth, moving up to $9524.93 million from $8277.94 million in April-October 2017-18.

• Exports of Aircrafts and spacecraft parts and products recorded negative monthly growth in October 2018 over October 2017 as well as during April-October 2018-19 over the same period last year whereas Ships, boats and floating structures recorded positive growth in both the cases.

• It has been observed that all sectors under the Miscellaneous panel registered positive monthly as well as cumulative growth in exports. Accumulators and batteries recorded the highest cumulative growth of 60 percent during April-October 2018-19 over the same period last year. Cranes, lifts and winches and Office equipments recorded

substantial growth in exports of 48 percent and 37 percent during April-October 2018-19 over the same period last year.

Top 25 destinations for Indian engineering exports

We now look at the export scenario of the top 25 nations that had highest demand for Indian engineering products during October 2018 over October 2017 in absolute value.

The country wise engineering export figures for October 2018 show the following facts:

• Out of the top 25 countries, 18 countries recorded positive cumulative growth in engineering exports from India during April-October 2018-19 over April-October 2017-18.

• USA retained its numero uno position, being the top exporting destination for India's engineering products in October 2018. It registered significant positive cumulative growth during April-October 2018-19 over April-October 2017-18 of 23.21 percent.

• Nigeria and Belgium hold the first and second positions respectively in terms of high cumulative growth during the same period.

• India's engineering exports to China, which has been recording negative growth, once again recorded negative growth in October 2018 over the same month last year. It registered highest negative cumulative growth during April-October 2018 over April-October 2017 of 40.78 percent.

• Among European nations falling under the top 25 engineering exports destinations, exports to Belgium once again recorded the highest growth both on monthly as well as cumulative basis. On cumulative basis, only Italy recorded negative exports growth during April-October 2018-19 vis-à-vis April-October 2017-18.

• Among the ASEAN countries under the top 25 engineering exports destinations, Thailand recorded the highest monthly as well as the highest cumulative growth. Similarly, barring Malaysia and Vietnam, all the ASEAN nations falling under the top 25 engineering exports destinations recorded positive cumulative growth during April-October 2018-19 vis-à-vis April-October 2017-18.

• Out of 221 exports destinations of Indian engineering goods, the top 25 nations accounted for 73.76 percent of India's total engineering exports in October 2018 over October 2017.

• India's total global engineering exports during April-October 2018-19 over April-October 2017-18 is scantily higher compared to India's engineering exports to its top 25 destinations during the same period.

Regional distribution of engineering exports

We now look at the regional distribution of engineering exports for October 2018 as opposed to October 2017. **Table7** and **Figure2** give this picture.

• EU ranked as the region with highest shipment of engineering products from India during October 2018 with a share of 22 percent of total engineering exports.

• India's exports to North America and ASEAN+2 ranked second and third in global shipments of Indian engineering goods that recorded substantial cumulative growth during April-October 2018-19 vis-à-vis April-October 2017-18.

• India's exports to South Asian countries recorded the highest positive monthly growth in October 2018 over October 2017, followed by Africa.

• Barring Northeast Asia, all the other regions recorded positive cumulative growth in exports during April-October 2018-19 vis-à-vis April-October 2017-18.

Engineering panels – country-wise analysis

We now analyse the performance of some of the important products during September 2018. We have taken the major panels and computed the top importers and sharp declines to get an idea of the current trade pattern. (**Tables8-16**)

Export of iron and steel

• Nepal, Italy, and UAE were the top three importers of Indian Iron and steel during April-October 2018 with market shares of 12.47, 8.25, and 7 percent respectively.

• France, Bhutan, and Djibouti recorded more than 100 percent year-on-year growth in exports of Indian Iron and steel during April-October 2018.

• Portugal, Indonesia, and Sri Lanka experienced sharp fall in exports during April-October 2018.

Export of products of iron and steel

• USA, UAE, and Germany were the top three importers of India's Products of iron and steel during April-October 2018 with 22.57, 6.17, and 6.03 percent shares respectively in India's global import of the same.

• Chile, Qatar, Tanzania, and Nigeria were among the nations witnessing significant growth in import of Indian Products of iron and steel during April-October 2018.

• On the other hand, Colombia, Saudi Arabia, and Malaysia conceded substantial decline in imports of the said product group from India during April-October 2018.

Export of industrial machinery

• USA was the largest importer of Indian Industrial machinery during April-October 2018 with 16.04 percent share in India's global imports of the product group, followed by Germany and Thailand with 4.48 and 4.40 percent share respectively.

• Uzbekistan, Hong Kong, Algeria, and Thailand were among the nations witnessing significant growth of imports of Industrial machinery from Indian during April-October 2018.

• Among the major importers, export to Senegal, Finland, Bhutan, and Philippines recorded sharp decline in imports during April-October 2018.

Table7: Region-wise exports trend ($ million)

Region	October 2018	October 2017	Growth (%)	Apr-Oct 2018-19	Apr-Oct 2017-18	Growth (%)
EU	1,358.33	1,150.25	18.09	9,837.49	8,645.78	13.78
North America	1,171.02	934.32	25.33	8,823.95	7,390.21	19.40
ASEAN+2	795.47	990.39	-19.68	5,797.19	5,589.29	3.72
Middle East and West Asia (MEWA)	639.59	517.55	23.58	5,539.62	5,281.40	4.89
Africa	607.04	442.79	37.09	4,629.37	3,891.42	18.96
South Asia	635.25	568.85	11.67	4,538.89	3,659.55	24.03
NE Asia	403.18	559.59	-27.95	2,965.03	3,423.86	-13.40
Latin America	240.59	260.26	-7.56	1,988.99	1,914.68	3.88
Others	246.94	187.76	31.51	1,903.21	1,569.01	21.30
CIS	57.63	57.83	-0.35	456.01	408.20	11.71
Grand total	**6155.02**	**5669.59**	**8.56**	**46479.74**	**41773.41**	**11.27**

*Note: *Figures have been rounded off. **Myanmar has been included in ASEAN+2 and not in South Asia, since ASEAN is a formal economic grouping.*
Source: DGCI&S; Department of Commerce, Government of India

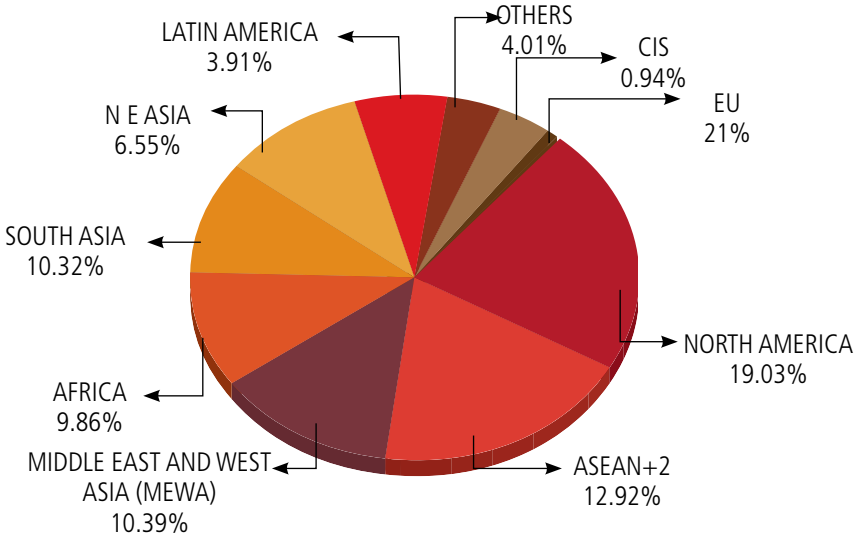
Export of automobiles

• Mexico, USA, and South Africa were the top three importers of India's Automobiles during April-October of 2018, witnessing 14.01, 9.41, and 7.26 percent share respectively. Mexico being the largest importer shared 14.01 percent of imports of automobiles from India.

• Countries like USA, Cambodia, Congo, and Bhutan saw over 100 percent growth in imports of Indian Automobiles during April-October 2018 among major importers.

• Cote d'Ivoire, Netherlands, and Argentina conceded substantial decrease in imports of Automobiles from India during April-October 2018.

Figure2: India's region-wise exports during October 2018



Source: EEPC India analysis

Export of non-ferrous metals

• USA ($608 million), Korea ($563 million), and Malaysia ($423 million) were the top three importers of Indian Non-ferrous metals during April-October 2018 with market shares of 12.24, 11.34, and 8.52 percent respectively.

• Greece, Vietnam, Turkey, and Mexico witnessed highest growth in imports of Indian Non-ferrous metal products during April-October 2018.

• Singapore, China, UAE, and Bahrain conceded significant decline in imports of non-ferrous metals from India during the April-October 2018.

Export of electrical machinery and components

• USA ($1179 million), Germany ($587 million), and Singapore ($359 million) were the three top importers of Indian Electrical machinery and components during April-October 2018 with market shares of 23.4, 11.64,

Table8: Export of iron and steel ($ million)						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
TOP 5 IMPORTERS						
Nepal	106.48	86.18	**23.56**	724.12	450.20	**60.84**
Italy	77.75	44.65	**74.12**	478.80	508.17	**-5.78**
UAE	53.85	41.20	**30.70**	408.11	364.44	**11.98**
Belgium	54.76	49.31	**11.04**	373.39	414.06	**-9.82**
Korea	47.49	35.67	**33.13**	298.50	191.15	**56.16**
HIGH CUMULATIVE GROWTH						
Bhutan	2.63	2.40	**9.47**	29.77	10.56	**181.85**
Djibouti	4.46	2.79	**59.87**	47.08	19.28	**144.20**
France	1.50	0.70	**115.27**	16.53	7.03	**135.28**
Kenya	3.08	4.76	**-35.23**	41.17	22.85	**80.14**
Canada	4.35	3.15	**38.03**	33.63	19.86	**69.34**
Qatar	1.96	2.98	**-34.25**	43.46	26.99	**61.02**
Nepal	106.48	86.18	**23.56**	724.12	450.20	**60.84**
Korea	47.49	35.67	**33.13**	298.50	191.15	**56.16**
SHARP CUMULATIVE DECLINE						
Portugal	1.05	11.97	**-91.21**	35.43	69.28	**-48.85**
Indonesia	16.36	63.69	**-74.31**	165.29	303.64	**-45.56**
Sri Lanka	5.38	26.20	**-79.47**	76.20	131.83	**-42.20**
Vietnam	18.49	66.21	**-72.08**	210.23	354.22	**-40.65**
Singapore	1.59	24.56	**-93.52**	36.65	60.85	**-39.77**
Ethiopia	6.17	15.46	**-60.11**	55.12	88.62	**-37.80**
Iran	4.59	16.39	**-71.98**	52.03	81.75	**-36.35**
Philippines	2.23	57.35	**-96.11**	66.56	103.15	**-35.47**

Source: Department of Commerce, Government of India

Table9: Export of products iron and steel ($ million)						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
TOP 5 IMPORTERS						
USA	133.11	111.24	19.67	932.08	958.44	-2.75
UAE	32.98	29.12	13.28	254.65	240.82	5.75
Germany	37.80	28.64	32.00	249.32	219.76	13.45
UK	27.06	21.32	26.94	180.09	161.54	11.48
Canada	17.88	22.04	-18.91	158.05	105.27	50.14
HIGH CUMULATIVE GROWTH						
Chile	1.48	5.23	-71.67	49.18	14.33	243.26
Tanzania	3.41	2.43	40.19	51.35	21.02	144.33
Qatar	10.10	7.14	41.47	85.46	39.98	113.74
Egypt	5.39	2.54	111.83	68.13	33.15	105.54
Nigeria	6.44	3.48	85.18	56.17	30.66	83.22
Nepal	8.69	5.37	61.72	61.64	38.13	61.65
Canada	17.88	22.04	-18.91	158.05	105.27	50.14

Table9: Export of products iron and steel ($ million) contd.

Country	October 17	October 18	Growth %	Apr-Oct 17-18	Apr-Oct 18-19	Growth %
SHARP CUMULATIVE DECLINE						
Colombia	2.66	7.47	-64.35	9.33	53.95	-82.70
Oman	8.92	19.42	-54.06	51.03	106.46	-52.06
Saudi Arabia	13.45	10.65	26.30	88.23	173.63	-49.19
Malaysia	3.51	2.38	47.33	22.61	35.68	-36.62
Sri Lanka	7.45	5.13	45.30	46.04	62.75	-26.63
Thailand	8.35	5.50	51.74	58.17	66.44	-12.44

Source: Department of Commerce, Government of India

Table10: Export of industrial machinery ($ million)

Country	October 17	October 18	Growth %	Apr-Oct 17-18	Apr-Oct 18-19	Growth %
TOP 5 IMPORTERS						
USA	190.60	124.88	52.63	1,336.58	1,079.50	23.82
Germany	48.99	38.10	28.60	373.10	300.94	23.98
Thailand	62.07	23.39	165.40	367.00	173.35	111.71
Bangladesh	57.79	39.29	47.09	360.33	306.93	17.40
UK	42.24	33.10	27.62	320.09	334.68	-4.36
HIGH CUMULATIVE GROWTH						
Uzbekistan	5.47	2.69	102.93	36.82	10.78	241.73
Hong Kong	1.60	1.12	42.70	28.34	9.15	209.81
Thailand	62.07	23.39	165.40	367.00	173.35	111.71
Algeria	7.42	3.52	110.43	61.08	30.57	99.82
Nigeria	34.20	11.88	187.95	209.21	114.98	81.96
Indonesia	27.09	19.20	41.11	221.86	130.47	70.05
Iran	21.28	12.03	76.95	144.57	85.29	69.50
Spain	19.33	13.27	45.64	149.30	90.38	65.19
SHARP CUMULATIVE DECLINE						
Senegal	1.91	2.09	-8.37	11.65	25.37	-54.09
Finland	0.66	0.35	88.80	7.35	15.63	-52.95
Kuwait	8.10	35.93	-77.46	83.40	153.59	-45.70
Bhutan	1.94	1.77	9.82	16.89	29.15	-42.05
Philippines	5.63	7.71	-26.97	40.89	63.25	-35.35
Hungary	2.11	1.72	23.05	14.43	19.93	-27.63
Malaysia	17.27	21.46	-19.54	99.79	125.05	-20.20
Brazil	19.96	16.09	24.06	129.17	150.27	-14.04

Source: Department of Commerce, Government of India

Table11: Export of automobiles ($ million)

Country	October 17	October 18	Growth %	Apr-Oct 17-18	Apr-Oct 18-19	Growth %
TOP 5 IMPORTERS						
Mexico	89.65	132.64	-32.41	874.62	1,089.32	-19.71
USA	82.59	28.36	191.18	587.25	42.15	1293.09
South Africa	55.51	44.35	25.17	453.25	473.16	-4.21
Bangladesh	68.99	47.74	44.51	406.12	298.45	36.08
Nepal	60.03	48.14	24.71	321.72	265.54	21.16
HIGH CUMULATIVE GROWTH						
USA	82.59	28.36	191.18	587.25	42.15	1293.09
Cambodia	2.39	0.65	267.21	23.45	3.32	605.68
Congo DR.	3.62	2.77	30.84	32.31	12.91	150.22
Bhutan	6.86	0.43	1492.94	49.26	23.09	113.29
Nigeria	33.03	21.43	54.15	225.41	113.78	98.11
Algeria	26.61	6.86	288.01	189.92	101.23	87.61
UAE	19.99	14.21	40.70	131.92	79.42	66.10
Colombia	22.46	11.03	103.54	154.91	106.65	45.25
SHARP CUMULATIVE DECLINE						
Cote d'Ivoire	0.46	6.16	-92.57	7.60	57.57	-86.79
Netherlands	1.02	1.76	-42.06	6.41	31.26	-79.51
Argentina	0.31	8.32	-96.29	26.11	72.99	-64.23
Italy	16.55	6.65	148.89	84.02	189.33	-55.62
Germany	11.06	9.23	19.78	55.76	124.68	-55.28
France	16.12	13.36	20.68	68.80	127.71	-46.13
Peru	6.74	12.04	-44.00	79.65	106.04	-24.89

Note: Automobiles sector includes motor vehicles and two- and three-wheelers
Source: Department of Commerce Government of India

Table12: Export of nonferrous metals ($ million)

Country	October 17	October 18	Growth %	Apr-Oct 17-18	Apr-Oct 18-19	Growth %
TOP 5 IMPORTERS						
USA	93.57	72.99	28.21	608.19	528.72	15.03
Korea	53.38	83.80	-36.30	563.52	651.96	-13.57
Malaysia	95.56	113.98	-16.16	422.91	599.56	-29.46
Turkey	67.71	2.69	2419.76	408.37	117.33	248.06
Mexico	22.22	12.13	83.12	244.13	106.78	128.64
HIGH CUMULATIVE GROWTH						
Bulgaria	1.77	2.59	-31.49	50.54	12.22	313.68
Greece	0.38	0.29	30.53	64.01	15.90	302.68
Turkey	67.71	2.69	2419.76	408.37	117.33	248.06
Vietnam	7.01	1.98	253.25	61.61	19.89	209.68
Netherlands	22.67	4.54	398.84	125.89	43.55	189.05
Mexico	22.22	12.13	83.12	244.13	106.78	128.64

Table12: Export of nonferrous metals ($ million) contd.						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
Spain	23.95	12.56	90.69	144.19	73.21	96.96
Thailand	16.38	13.21	23.98	128.25	70.23	82.62
Japan	13.86	19.57	-29.18	125.21	77.49	61.58
Italy	33.82	21.92	54.29	199.22	140.49	41.80
SHARP CUMULATIVE DECLINE						
Singapore	2.22	92.63	-97.60	12.37	173.60	-92.87
China	48.89	203.69	-76.00	151.28	956.94	-84.19
Iran	2.32	4.55	-49.00	8.29	29.02	-71.44
UAE	21.18	25.27	-16.19	139.09	407.15	-65.84
Bahrain	1.53	0.49	213.41	21.42	46.10	-53.55
Malaysia	95.56	113.98	-16.16	422.91	599.56	-29.46

Source: Department of Commerce, Government of India

Table13: Export of electrical machinery and components ($ million)						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
TOP 5 IMPORTERS						
USA	156.33	115.10	35.82	1,179.26	616.99	91.13
Germany	71.25	110.90	-35.75	587.33	460.93	27.42
Singapore	60.36	28.56	111.33	359.60	107.31	235.09
UK	38.81	38.41	1.04	312.47	195.98	59.43
Belgium	35.04	8.48	313.36	247.65	28.89	757.14
HIGH CUMULATIVE GROWTH						
Belgium	35.04	8.48	313.36	247.65	28.89	757.14
Singapore	60.36	28.56	111.33	359.60	107.31	235.09
Egypt	7.76	2.22	249.66	32.56	10.33	215.39
Indonesia	11.94	5.28	126.01	93.08	32.02	190.68
China	24.92	25.21	-1.16	198.09	98.05	102.04
Japan	10.27	4.81	113.76	142.67	70.75	101.65
USA	156.33	115.10	35.82	1,179.26	616.99	91.13
UK	38.81	38.41	1.04	312.47	195.98	59.43
SHARP CUMULATIVE DECLINE						
Vietnam	6.83	6.77	0.93	39.84	69.93	-43.02
Turkey	2.75	4.08	-32.63	60.19	104.87	-42.60
Kuwait	2.09	4.55	-54.03	29.91	39.95	-25.14
Myanmar	2.87	4.28	-33.01	16.01	20.58	-22.22
UAE	14.23	13.99	1.68	141.97	164.69	-13.79
South Africa	3.89	3.60	7.92	21.57	24.34	-11.37
Hong Kong	3.84	4.49	-14.52	23.67	25.95	-8.76

Source: Department of Commerce, Government of India

Table14: Export of aircrafts and spacecrafts ($ million)						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
TOP 5 IMPORTERS						
USA	30.79	50.80	-39.39	326.10	340.21	-4.15
France	14.61	18.27	-20.03	160.23	133.38	20.13
Singapore	10.74	21.77	-50.67	151.93	150.34	1.06
UK	15.01	33.75	-55.54	139.79	130.17	7.40
Germany	7.45	16.45	-54.68	76.41	131.79	-42.02
HIGH CUMULATIVE GROWTH						
South Africa	0.10	-		7.35	1.11	561.36
Sweden	1.25	0.57	118.34	7.12	3.22	121.35
UAE	1.14	0.40	184.14	5.02	3.67	36.75
France	14.61	18.27	-20.03	160.23	133.38	20.13
UK	15.01	33.75	-55.54	139.79	130.17	7.40
Singapore	10.74	21.77	-50.67	151.93	150.34	1.06
SHARP CUMULATIVE DECLINE						
Russia	0.59	2.37	-75.25	10.92	27.76	-60.66
China	0.70	2.14	-67.03	10.46	24.76	-57.76
Turkey	0.51	1.43	-64.14	5.26	10.14	-48.12
Poland	0.36	1.69	-79.03	10.68	19.44	-45.07
Germany	7.45	16.45	-54.68	76.41	131.79	-42.02
Israel	2.67	7.33	-63.64	19.20	32.56	-41.04
USA	30.79	50.80	-39.39	326.10	340.21	-4.15

Source: Department of Commerce, Government of India

Table15: Export of ships boats and floating structures and parts ($ million)						
Country	**October 17**	**October 18**	**Growth %**	**Apr-Oct 17-18**	**Apr-Oct 18-19**	**Growth %**
TOP 5 IMPORTERS						
UAE	78.74	0.02	380212.09	1,152.95	1,036.27	11.26
Singapore	5.07	-		384.75	371.08	3.68
Oman	-	-		215.84	2.47	8648.20
South Africa	-	-		198.48	-	
Sri Lanka	10.51	-		189.91	156.75	21.16
HIGH CUMULATIVE GROWTH						
Bangladesh	0.41	0.32	29.73	20.48	0.32	6392.69
Israel	-	-		59.57	3.29	1710.81
France	0.15	-		2.76	0.45	506.45
Saudi Arabia	-	-		104.60	19.11	447.45
Indonesia	23.12	-		60.19	36.07	66.86
Sri Lanka	10.51	-		189.91	156.75	21.16
SHARP CUMULATIVE DECLINE						
Cameroon	-	-		-	20.63	-100.00
Egypt	-	-		-	213.77	-100.00
Liberia	-	-		-	84.61	-100.00
Myanmar	-	-		-	21.28	-100.00
USA	0.03	0.01	374.10	0.10	443.66	-99.98

Note: Export figures in case of some nations are showing zero due to rounding off but actually they are very small in value
Source: Department of Commerce and CSO

Table16: Export of auto components ($ million)

Country	October 17	October 18	Growth %	Apr-Oct 17-18	Apr-Oct 18-19	Growth %
TOP 5 IMPORTERS						
USA	103.24	76.80	34.42	707.02	561.36	25.95
Turkey	24.37	29.87	-18.42	206.74	204.94	0.88
Bangladesh	18.48	21.54	-14.22	182.23	138.96	31.13
Brazil	16.81	15.75	6.76	165.99	135.11	22.85
Germany	23.78	15.89	49.65	151.99	122.49	24.09
HIGH CUMULATIVE GROWTH						
Romania	8.32	7.46	11.60	60.30	21.53	180.03
Colombia	2.48	1.08	129.60	20.85	11.28	84.89
Myanmar	2.48	1.08	129.60	20.85	11.28	84.89
UAE	15.81	10.92	44.76	95.22	66.13	43.99
Vietnam	13.93	10.80	29.04	90.89	63.17	43.89
Japan	12.08	10.32	17.07	97.69	70.57	38.44
Egypt	4.94	4.31	14.83	43.78	32.73	33.78
Bangladesh	18.48	21.54	-14.22	182.23	138.96	31.13
Sweden	4.32	3.18	35.98	30.28	23.12	30.99
SHARP CUMULATIVE DECLINE						
Peru	3.30	4.14	-20.39	14.12	21.29	-33.69
Netherlands	2.27	2.93	-22.45	17.90	21.32	-16.02
Poland	3.06	3.18	-3.90	24.29	27.56	-11.87
Canada	6.20	4.79	29.43	44.06	48.09	-8.38
South Africa	6.28	3.42	83.42	49.51	52.68	-6.01

Source: Department of Commerce and CSO

and 7.13 percent respectively.

• Belgium, Singapore, and Egypt recorded highest growth in imports of India's Electrical machinery and components during April-October 2018.

• On the other hand, Vietnam, Kuwait, UAE, and Turkey conceded highest decline in imports of India's Electrical machinery and components during April-October 2018.

•

Export of aircrafts and spacecrafts

• USA, France, and Singapore were the top three importers of India's Aircrafts and spacecrafts during April-October 2018-19 with around 29.9, 14.70, and 13.94 percent shares respectively in India's total global exports of the product.

• South Africa and Sweden continued to register substantial growth in imports of the product group during April-October 2018-19 as compared with the same period last fiscal.

• On the flipside, demand for India's Aircrafts and spacecrafts from China, Russia, and Turkey dropped significantly on a year-on-year basis during April-October 2018 along with some other nations.

Export of ships, boats and floating structures and parts

• UAE was the largest importer of India's Ships, boats and floating structures and parts during April-October 2018-19 with 44 percent share in India's total global exports of the product followed by Singapore with 14.67 percent share. Oman emerged as

the third largest importer with 8.23 percent share.

• Bangladesh, Israel, France, and Saudi Arabia recorded robust growth in imports of Ships, boats and floating structures and parts during April-October 2018-19.

• Liberia and Egypt were among the nations that recorded no imports during April-October 2018 against substantial imports during the same period last fiscal. The USA also saw significant fall in imports from India.

Export of auto components

• USA was the topmost importer of auto components/parts from India during April-October 2018 with a share of 21.53 percent in India's global exports of auto components. Turkey and Bangladesh were the immediate followers of USA with 6.29 and 5.54 percent shares respectively.

• Romania, Colombia, and Myanmar were among the prominent nations that recorded significant increase in imports of Indian Auto components/parts during April-October 2018-19 over April-October 2017-18.

• Peru and Netherlands conceded highest decline in imports during April-October 2018-19 over the same period last fiscal, followed by Poland and Canada.

Import analysis of engineering goods

India's engineering imports during October 2018 were valued at $8599.86 million compared to $7812.5 million in October 2017, registering considerable growth of 10.08 percent in dollar terms.

Engineering imports for the year 2017-18 was recorded at $92,692.1 million as against $81834.8 million during the same period the previous fiscal, registering cumulative growth of 11.6 percent.

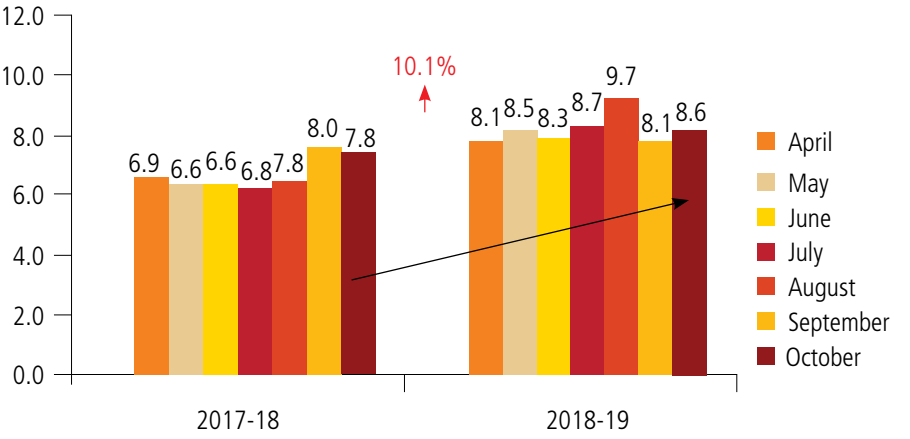
The share of engineering imports in India's total merchandise imports was estimated at a lower 19.5 percent in October 2018 as against 20.8 percent in October 2017. The share of engineering exports for the year 2017-18 stood at around 20.2 percent compared to 21.3 percent in 2016-17.

Table 17: Engineering imports ($ million)

Month	2017-18	2018-19	Growth (%)
April	6936.7	8139.45	17.34
May	6628.73	8535.98	28.77
June	6567.1	8268.14	25.90
Quarter 1 (April-June)	**20132.53**	**24943.57**	**23.90**
July	6811.16	8683.39	27.49
August	7769.3	9667.6	24.43
September	8028.2	8064.26	0.45
Quarter 2 (July-September)	**22608.66**	**26415.25**	**16.84**
October	**7812.5**	**8599.9**	**10.08**
April-October	**50553.69**	**59959**	**18.60**

Source: Department of Commerce, Government of India

Figure3: Trend in monthly engineering imports for 2018-19 vis-à-vis 2017-18 ($ billion)



Source: EEPC India analysis

The monthly engineering import figures for fiscal 2018-19 vis-à-vis 2017-18 are depicted in **Table17** as per the latest availability of data. **Figure3** depicts the monthly trend in engineering imports for 2018-19 vis-à-vis 2017-18.

Trend in two-way engineering trade

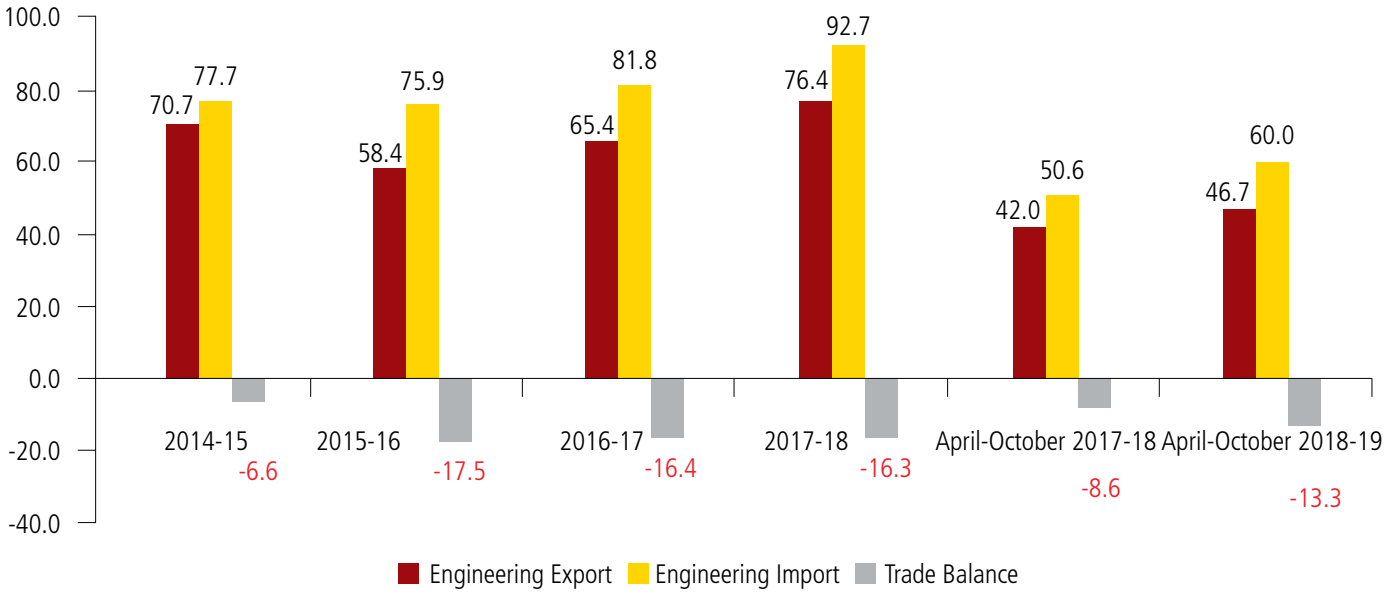
We now present the trend in the two-way yearly trade for the engineering sector from 2014-15 to 2017-18 as well as the current fiscal of 2018-19 as depicted in **Table18. Figure4** depicts the yearly trend in engineering trade from 2014-15 to 2017-18 and

Table18: Engineering trade ($ billion)

	2014-15	2015-16	2016-17	2017-18	Growth %	Apr-Oct 2017-18	Apr-Oct 2018-19	Growth %
Engineering exports	70.7	58.4	65.4	76.4	16.81	42.0*	46.7*	11.3
Engineering imports	77.3	75.9	81.8	92.7	13.27	50.6	60.0	18.6
Trade balance	-6.6	-17.5	-16.4	-16.3		-8.6	-13.3	

**Both the engineering export and import figures for April-October 2018-19 v/s 2017-18 are updated as per latest Quick Estimate values*

Figure4: Trend in monthly engineering trade ($ billion)



April-October of the current fiscal 2018-19.

Conclusion

India's merchandise exports as well as engineering exports registered year-on-year growth in October 2018 vis-à-vis October 2017. The high growth in October has come about on the back of a favourable base effect even as trade deficit widened to $17.13 billion. The engineering sector registered 8.56 percent growth in exports during October 2018 compared to same period last fiscal. On a cumulative basis, during the April-October period, merchandise exports grew by 13.3 percent and engineering exports grew by 11.31 percent.

India's engineering imports registered 10.1 percent growth in October 2018 and cumulative growth of over 18.6 percent during April-October 2018-19 compared to the same period last fiscal. India's engineering trade deficit widened to $13.3 billion during April-October 2018-19 compared to $8.6 billion in April-October 2017-18.

However, the external threats to foreign trade still persist as the fear of an imminent tariff war that started with trade protectionist measures by the US and China, intensified further with the initiation of safeguard investigation by the European Commission on a number of steel products imported by the EU. The US investigation on India's compliance with the norms under Generalised System of Preference is another external shock for the exporting community. These two concerns along with the volatile trend of the rupee clouded the outlook for global exports.

Back home, rising raw material costs and post-GST fund shortage for the exporters is apprehended to weigh on Indian overseas shipment for some more months.

Ductile iron is used in many automotive components, where strength must surpass that of aluminium but do not necessarily require steel

Formation of spheroidal graphite iron without magnesium treatment

TECHNOLOGY

ANJAN PRODHAN

Dr Prodhan is with the CSIR–National Metallurgical Laboratory, Jamshedpur

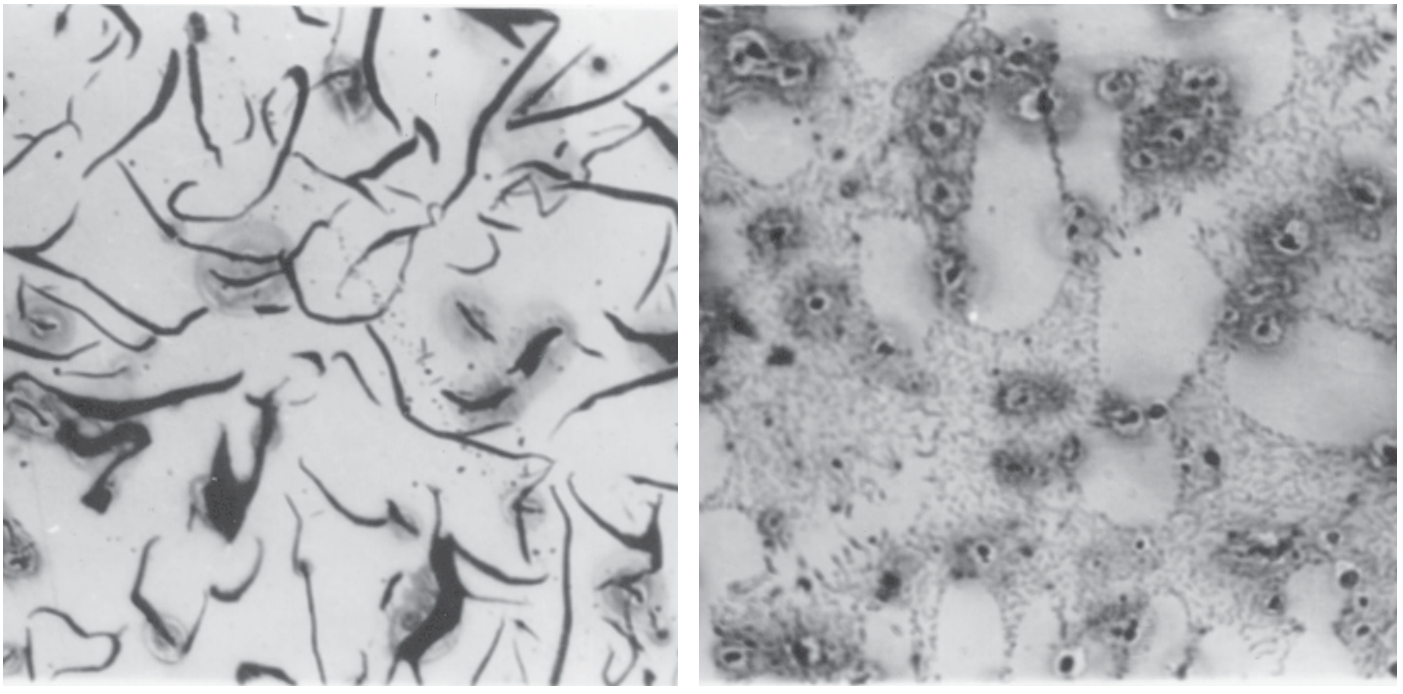
This study reports the effect of Electric Current Treatment (ECT) on cast iron melt during freezing in a sand mould. It is observed that the ECT modifies the shape of flake graphite to nodular graphite due the removal of dissolved gases from molten iron. This process changes cast microstructure from pearlitic to ferrite-pearlitic, which indicates that ECT modifies the equilibrium diagram of Fe–C/G system

CAST irons as construction material are still maintaining the standard of usability, because they provide a wide range of usable properties and also be-

Figure1: Effect of ECT during freezing of molten cast iron in sand mould

(a) Without any treatment

(b) With electric current treatment (ECT)



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cause they require less expensive metallurgy (technology) and in many cases they provide a more economically convenient solution. Ductile or spheroidal graphite (SG) cast iron was discovered in 1943 by Keith Millis. While, most varieties of cast iron are low tensile strength and brittle, ductile iron has much more impact and fatigue resistance, due to its nodular graphite inclusions. Ductile iron is used in the form of ductile iron pipe for water and sewer lines. Ductile iron is also used in many automotive components, where strength must surpass that of aluminium but do not necessarily require steel. Other major industrial applications include off-highway diesel trucks, agricultural tractors, and oil well pumps. In wind power industry nodular cast iron is used for hubs and structural parts like machine frames. Nodular cast iron is suitable for large and complex shapes and high (fatigue) loads.

Literature

Vondrak et al (1) showed that cupola melt contents dissolved gases like N (101-103 ppm), O (64-104 ppm) and H (1.0-1.1 ppm). According to Goodrich (2), nitrogen level in gray cast iron normally has equilibrium of 70 ppm. When the dissolved N increases to 150 ppm, fat flake graphite is produced. Nitrogen is generally controlled by Ti. At high N content, if Ti is present, the graphite structure will be normal flake graphite.

Ten (3) established that oxygen influences the structure and properties of cast iron. Oxygen, initially present in molten melt in chemically combined state (as non-metallic inclusion), does not have a significant effect on the cast iron crystallisation. It acts as a graphite crystallisation substrate and also increases the graphitisation degree of the cast iron. Dissolved oxygen deactivates the potential graphitisation centres that increases chilling tendency of cast iron. At the same time, the more cast iron is saturated by oxygen, the higher its tendency for graphitisation modification.

Yamamoto et al (4) conducted extensive trials to verify the hypothesis of the formation of nodular graphite inside gas bubbles to establish it as a gas bubble theory of nodularisation of graphite. It was found that graphite nodules can be obtained by four methods:

(a) addition of deleterious elements such as S, Se, Te, Pb, and Bi

(b) addition of Ce, La, Y, Ti, and Zr which have absorbed a large amount of hydrogen

(c) direct injection of gases into the melts

(d) precipitation of nitrogen from super-saturated molten cast iron.

The formation of gas cavities and hollow graphite nodules was observed and attrib-

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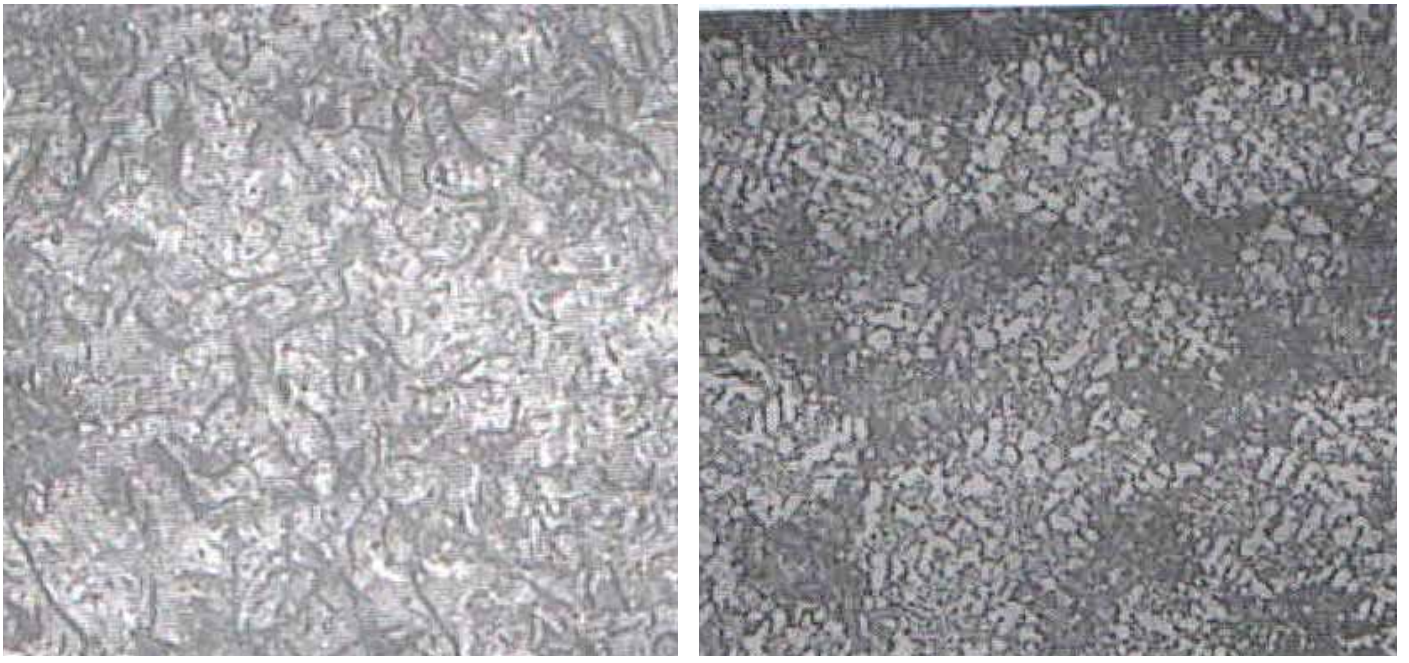
Figure2: Modification of matrix phase with ECT

(a) Without any treatment

(b) With electric current treatment (ECT)



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uted to the dearth of graphite in bubbles or to its absence. Some characteristics of graphite nodules could be best explained by the proposed gas-bubble theory.

Prodhan (5&6) has established that dissolved gases in molten metal/alloys can be removed by electric current (DC) treatment (ECT). This process has been successfully implemented at RAPSRI Industry (a copper die casting foundry) in Bangalore, India.

Present work

This report describes the effect of ECT during freezing of molten cast iron in a sand mould. **Figure1** shows that the flake graphite (**Figure1a**) has been modified to nodular graphite (Figure1b) by ECT. The author feels that the dissolved gases like nitrogen and oxygen are been removed by ECT (5&6). In the absence of these elements, graphite in excess of the solubility limit (of molten iron) will be separated and form its own crystals which would be spherical due to lowest surface area to volume ratio.

In Figure1, (a) untreated sample shows flake graphite, but (b) ECT treatment shows nodular graphite.

Melting was done in Induction Furnace at CSIR – National Metallurgical Laboratory.

However, the etched microstructure (**Figure2**) showed the modification of matrix phase with ECT. The untreated sample (**Figure2a**) shows fully pearlitic structure which can be modified to ferrito-pearlitic structure by ECT. It may be concluded that ECT modifies iron-carbon equilibrium phase diagram.

In **Figure2**, (a) untreated sample shows pearlitic matrix with flake graphite, but (b) ECT treatment shows ferrito-pearlitic matrix and nodular graphite.

Melt was taken from Cupola Furnace at Sett Iron Works, Howrah

Conclusion

This study reveals that flake graphite in cast iron can be converted to nodular iron by electric current treatment (ECT) during sand casting. This study was conducted both in laboratory (induction furnace melt), as well as in a foundry (cupola furnace melt). This process does not require any magnesium treatment. It is a low cost and pollution-free process. Post inoculation is not required for this process.

References

1 doc. Ing. Vladimír Vondrák, CSc. doc. Ing. Jiří Hampl, Ph.D. Ing. Aleš Hanus VŠB – Technical University of Ostrava Faculty of Metallurgy and Materials Engineering, Department of Metallurgy and Foundry. Metallurgy of Cast Irons: Out-of-furnace processing of molten cast iron, 2014

2 GM Goodrich,' Cast Iron Microstructure Anomalies and Their Causes Cast Iron

Workplace cleanup drive in EEPC India

Mr Ravi Sehgal, Chairman, EEPC India, giving his Welcome Address at the awareness session on 5S. On his left, Mr S Malik, Regional Director, National Productivity Council, Kolkata; and on his right, Mr BD Agarwal, Regional Chairman (ER), and Ms Anima Pandey, Regional Director (ER) & Director (Membership), EEPC India

EEPC India joined the Department of Commerce, Union Ministry Commerce and Industry, in their observation of Swachchata Pakhawada across India for a fortnight over 1-15 November 2018. This was an initiative of the Government of India to strengthen the five-year-long Swachh Bharat Mission of the Prime Minister. All offices of EEPC India across the country enthusiastically participated in the initiative, cleaning up their office and its environs, shredding paper, updating files, clearing matter stored under desks, organising stocks, cleaning up dirty corners and overflowing refuse bins, polishing floors, and sprucing up work surfaces within the office, and sweeping and cleaning the surrounding carparks, roads and pavements without. At the Head Office in Kolkata, an Awareness Session on Industrial Housekeeping was organised as part of the fortnight observation to discuss and deliberate on the most popular method of workplace cleaning – 5S! 5S is a workplace organisation methodology based on five Japanese words:

- Seiri – Sorting
- Seiton – Set in order
- Seiso – Shine
- Seiketsu – Standardising
- Shitsuke –Sustaining

The aim of the awareness session was to explore the 5S objectives, techniques, and its benefits; the reasons for its popularity; and the role of the management in implementing 5S. In his Welcome Address, the EEPC India

Mr S Malik, Regional Director, National Productivity Council, Kolkata addressing the session on 5S. Among those present from EEPC India are Mr Adhip Mitra, Additional Executive Director & Secretary; Ms Anima Pandey, Regional Director (ER) and Director (Membership); Mr BD Agarwal, Regional Chairman (ER); Mr Ravi Sehgal, Chairman; Mr Bhaskar Sarkar, Advisor, EEPC India Technology Centre; and Mr Dhruba Jyoti Basu, Sr Joint Director

Chairman, Mr Ravi Sehgal, explained the 5S concept. The 5S concepts consistently produce an organized workplace, resulting in:

- An increase in quality
- An increase in productivity
- A cleaner and safer workplace
- A reduction in required floor space

Extending thanks to Mr S Mallik, Regional Director, National Productivity Council, Kolkata, who despite his busy schedule had taken the time to attend the session and address EEPC India members, Mr Ravi Sehgal said, 'Cleanliness is next to Godliness is a cliché – EEPC India has joined the Department of Commerce of Union Ministry of Commerce and Industry in their celebration of Swachchata Pakhawada for a fortnight over 1-15 November 2018 across India.'

He went on to add: 'With the ever-changing economic climate, many organisations are periodically adjusting their resources to align with business strategy. This often results in the need to achieve more work with fewer resources. In order to remain successful, businesses must become more efficient, reduce waste and thereby reduce cost.' The Chairman said: 'We must find ways to do what we are currently doing in less time and at a lower cost. One way we can accomplish this is through the use of 5S Principles. The 5S Principles are very effective at identifying and eliminating waste and increasing efficiency.' Describing the roots of the 5S principles, Mr Ravi Sehgal said: 'There is a lot of information about 5S and how it came to be. The popular belief is that the Japanese invented the 5S Methodology because the letter 'S' stands for five Japanese words, that when translated to roman script, start with the letter 'S'. In actuality, the principles within 5S

Mr D Karthikeyan, Assistant Head, EEPC India Technology Centre, expounding on the 6S House Keeping practices to Mr JV Raja Gopal Rao, Sr Deputy Director (SR), Mr S Karthik, Executive Officer, and Staff members of EEPC India Bengaluru SRO

were being utilized decades before by Mr Henry Ford. It has been reported that prior to 1920, Mr Ford was using CANDO in his manufacturing processes. The acronym CANDO stands for Cleaning up, Arranging, Neatness, Discipline and Ongoing improvement. In the 1950s, representatives from Toyota visited the Ford facilities to be trained in automotive mass production methods. The Japanese later adapted the CANDO methods and applied them in their production facilities. Some commonly used words describing the steps in 5S are Sort, Set, Shine, Standardise, and Sustain.'

Numerous companies implement variations of these words to improve productivity and efficiency. 'Throughout different companies, various words are used that have similar meanings. No matter what specific words are used to identify the steps in 5S, the purpose remains the same: create a clean, organised and efficient work environment,' the Chairman concluded.

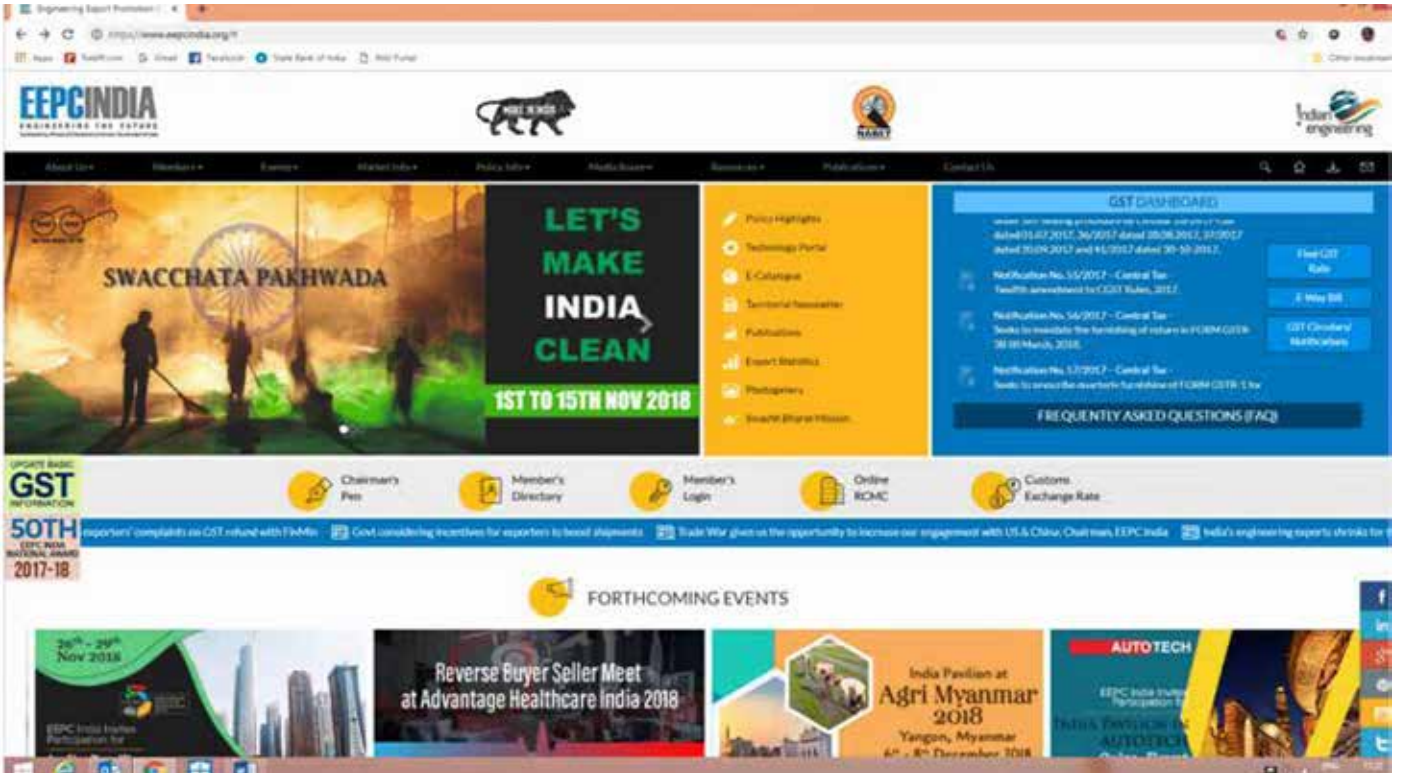
Safety – the sixth 'S'

In observation of the Swachchata Pakhawada fortnight, EEPC India's Bengaluru SRO organised an awareness session on 6S – House-Keeping Practices for the staff and executives. One of the most popular methods of workplace housekeeping is 5S+Safety (6S), a workplace organisation methodology that uses the five Japanese words – Seiri (Sort), Seiton (Set in order), Seiso (Shine), Seiketsu (Standardising), Shitsuke (Sustaining) – followed by ensuring the practice of adequate Safety in the workplace, the 6th S.

The aim of the session was to explore the methodology of 6S, which help in the day-to-day office management activities of an organisation.

The 6S concepts consistently produce an organised and safe work environment, resulting in an increase in workspace hygiene, work satisfaction, and employee safety. Mr D Karthikeyan, Assistant Head – EEPC India Technology Centre, who is trained in Six Sigma Black Belt, addressed the session on 6S House-Keeping Practices.

EVENT SPECIAL



EEPC India HO, Kolkata designed a web banner on Swachh Bharat for the EEPC India website; created a webpage showing photographs of different activities conducted under Swachh Bharat; display Standees on Cleanliness; and cleared and organised storage space among other activities

EEPCINDIA
PLEASE
keep our
city clean.
It is home to
all of us.
EPC INDIA

Standee at the entrance of Delhi HO cell

Standee at the entrance of Delhi HO cell

Standee at the entrance of Delhi HO cell

Delhi HO cell – before...

... and after

Delhi RO – Standees and T-shirts for Swachh Bharat

Delhi RO cell – before...

... and after

EVENT SPECIAL

Mumbai RO – The entire office working to keep the city clean

Mumbai RO – The entire office working to keep the city clean

Mumbai RO – Mr Rajat Srivastava, Regional Director (WR) & Director (Marketing & Sales) lends a hand

Kolkata RO – Standees at the entrance

Kolkata RO – Standees at the entrance

Chennai RO – Mr CH Nadiger, Regional Director (SR), shows the way, clearing his desk of accumulated papers

Chennai RO – Spruced up entrance to the office building with Standees

Chennai RO – Working together to keep the city clean

Bengaluru SRO – Shining corridors...

...floors and walls

Bengaluru SRO – before...

Bengaluru SRO – ... and after

Jalandhar SRO – Sweeping the carpark

Jalandhar SRO – Sweeping the carpark, hands on

Ahmedabad SRO – Keeping the city clean

Hyderabad SRO – A clean workplace is a safe workplace

FOCUS

5 MILLENNIA OF INDIAN SCIENCE

INDIA'S 5000-YEAR STORY OF SCIENCE SPANS RELIGIONS AND PHILOSOPHIES AND TAKES IN MATHEMATICS, MEDICINE, MEDIEVAL ASTRONOMY, MODERN PHYSICS, THE COMPUTER REVOLUTION, AND SPACE EXPLORATION

Imagination is not only the uniquely human capacity to envision that which is not, and therefore the fount of all invention and innovation. In its arguably most transformative and revelatory capacity, it is the power that enables us to empathise with humans whose experiences we have never shared.

JK Rowling

THE civilisation of the subcontinent, one of the oldest in the world, has a strong tradition of science and technology. Ancient India was a land of sages and seers as well as a land of scholars and scientists. From making the best steel in the world to teaching the world to count, India was actively contributing to the field of science and technology ages before modern laboratories were set up. Many theories and techniques discovered by the ancient Indians have created and strengthened the fundamentals of modern science and technology. The breadth and depth of the 5000-year story of Indian science is as fascinating as it is vast, sure to take one's breath away. This article provides a brief overview of the march of science in India over five millennia.

Astronomy

Indian astronomy has a long history stretching from prehistoric to modern times. Some of the earliest roots of Indian astronomy can be dated to the period of the Indus Valley Civilisation or even earlier. Astronomy later developed as a discipline of Vedanga or one of the 'auxiliary disciplines' associated with the study of the Vedas, dating to 1500 BCE or even earlier. The Vedāṅga Jyotiṣa, attributed to Lagadha and considered one of the oldest astronomical texts dating from 1400-1200 BCE (with the extant form possibly from 700-600 BCE), details several astronomical attributes generally applied

Bakhshali manuscript is a mathematical text written on birch bark. It is notable for being 'the oldest extant manuscript in Indian mathematics' and contains the earliest known Indian use of a zero symbol

for timing social and religious events. It also details astronomical calculations, calendrical studies, and establishes rules for empirical observation.

Since the Vedānga Jyotiṣa is a religious text, it has connections with Indian astrology and describes several important aspects of the time and seasons, including lunar months, solar months, and their adjustment by a lunar leap month of Adhikamāsa. Ritus and Yugas are also described. According to the Historical Atlas of South Asia, 'Twenty-seven constellations, eclipses, seven planets, and twelve signs of the zodiac were also known at that time.'

Indian astronomy was influenced by Greek astronomy beginning in the 4th century BCE and through the early centuries of the Common Era, for example by the Yavanajataka and the Romaka Siddhanta, a Sanskrit translation of a Greek text disseminated from the 2nd century.

Indian astronomy flowered in the 5th-6th century, with Aryabhata (476-550 CE), whose Aryabhatiya represented the pinnacle of astronomical knowledge at the time. Later Indian astronomy significantly influenced Islamic astronomy, Chinese astronomy, European astronomy, among others. Other astronomers of the classical era who further elaborated on Aryabhata's work include Brahmagupta, Varahamihira, and Lalla.

An identifiable native Indian astronomical tradition remained active throughout the medieval period and into the 16th or 17th century, especially within the Kerala School of astronomy and mathematics.

Mathematics

Mathematics emerged in the Indian subcontinent from 1200 BCE. In the classical period of Indian mathematics, important contributions were made by scholars such as Aryabhata, Brahmagupta, and Bhaskara II. The decimal number system in use today was first re-

Ayurveda, an ancient system of medicine, has persisted even in the 21st century, and in recent years, has gained popularity across the world as a complementary and alternative system of medicine

corded in Indian mathematics. Indian mathematicians made early contributions to the study of the concept of zero as a number, negative numbers, arithmetic, and algebra. In addition, trigonometry was further advanced in India, and, in particular, the modern definitions of sine and cosine were developed there. These mathematical concepts were transmitted to West and Central Asia, China, and Europe and led to further developments that now form the foundations of many areas of mathematics.

Pingala (300-200 BCE) was a musical theorist who authored a Sanskrit treatise on prosody. There is evidence that in his work on the enumeration of syllabic combinations, Pingala stumbled upon both the Pascal triangle and binomial coefficients, and a description of binary numbers is found in his works. Indian mathematicians were the first to establish by the 7th century CE the 'law of signs' with regard to the multiplication of positive and negative numbers, which did not appear in East Asian texts until 1299, and their role in mathematical problems of debt was understood. Mostly consistent and correct rules for working with negative numbers were formulated, and the diffusion of these rules led the Arab intermediaries to pass it on to Europe.

A decimal number system using hieroglyphics dates back to 3000 BCE in Egypt, and was later in use in ancient India where the modern numeration system was developed. By the 9th century CE, the Hindu-Arabic numeral system was transmitted from India through West Asia to the rest of the world. The concept of zero as a number, and not merely a symbol for separation, is attributed to India. In India, practical calculations were carried out using zero, which was treated like any other number by the 9th century CE, even in case of division. Brahmagupta (598-668 CE) was able to find (integral) solutions of Pell's equation. Conceptual design for a perpetual motion machine by Bhaskara II dates to 1150 CE. He described a wheel that he claimed would run forever. The trigonometric functions of

sine and versine, from which it was trivial to derive the cosine, were used Aryabhata in the late 5th century. The calculus theorem now known as 'Rolle's theorem' was stated by Bhāskara II in the 12th century.

Physics

The root to the concept of atom in ancient India is derived from the classification by ancient Indian philosophers of the material world into five basic elements – earth (prithvi), fire (agni), air (vayu), water (jaal) and ether or space (aksha). This classification has existed since the Vedic times, around 3000 BCE and earlier. The elements were also associated with human sensory perceptions – earth with smell, air with feeling, fire with vision, water with taste and ether/space with sound. Later on, Buddhist philosophers replaced ether/space with life, joy, and sorrow.

From ancient times, Indian philosophers believed that except ether or space, all other elements were physically palpable and hence composed of small and minuscule particles of matter. They believed that the smallest particle which could not be subdivided further was paramanu, a Sanskrit word which is a combination of param meaning ultimate or beyond and anu meaning atom. This was a concept at an abstract level which indicated the possibility of splitting the atom, which is now the source of atomic energy.

During the 1st millennium BCE, the Vaisheshika School of Atomism was founded. The most important proponent of this school was the philosopher Kanada, who lived around 600 BCE. The school proposed that atoms are indivisible and eternal, can neither be created nor destroyed and that each one possesses its own distinct viśeṣa (individuality). It was further elaborated on by the Buddhist school of atomism, of which the philosophers Dharmakirti and Dignāga in the 7th century CE were the most important proponents. They considered atoms to be point-sized, durationless, and made of energy. Later, philosopher Pakudha Katyayana, who was a contemporary of Buddha, also propounded the ideas about the atomic constitution of the material world. Similarly, the principle of relativity (not to be confused with Einstein's theory of relativity) was available in an embryonic form in the Indian philosophical concept of sapekshavad – the literal translation of this Sanskrit word being theory of relativity.

These theories have attracted attention of the Indologists, and veteran Australian Indologist AL Basham concluded that they were brilliant imaginative explanations of the physical structure of the world and, in a large measure, agreed with the discoveries of modern physics.

Chemistry

Ancient India's development in chemistry was not confined at an abstract level like physics, but found development in a variety of practical activities. In any early civilisation, metallurgy has remained a central activity – from the Bronze Age and Iron Age, to all other civilisations that followed. It is believed that the basic idea of smelting reached ancient India from Mesopotamia and East Asia. Numismatic evidence of the advances made by smelting technology in ancient India can be found before the 5th century BCE, with coinage (400 BCE-100 CE) being made of silver and copper, bearing animal and plant symbols on them.

In the 5th century BCE, the Greek historian Herodotus observed that the Indian and Persian armies used arrows tipped with iron. Ancient Romans were using armour and cutlery made of Indian iron.

The advance nature of ancient India's chemical science also finds expression in other fields, such as distillation of perfumes and fragment ointments, manufacturing of dyes and chemicals, polishing of mirrors, preparation of pigments and colours. Paintings found on walls of Ajanta and Ellora (both World Heritage sites), which look fresh even after 1000 years, also testify to the high level of chemical science achieved in ancient India.

Medicine and surgery

Ayurveda, meaning the 'science of life,' is a traditional school of medicine, invented and practised in India for over 5000 years. It helps people attain good health and living, without the use of prescription drugs. This ancient system of medicine has persisted even in the 21st century, and in recent years, it has gained popularity across the world as a complementary and alternative medicine. Ayurveda constitutes ideas about ailments and diseases, their symptoms, diagnosis and cure, and relies heavily on herbal medicines, including extracts of several plants of medicinal value. This reliance on herbs differentiates Ayurveda from systems like Allopathy and Homeopathy. Ayurveda has also always disassociated itself from witch doctors and voodoo.

Ancient scholars of India like Atreya, and Agnivesa have dealt with principles of Ayurveda as long back as 800 BCE. Their works and other developments were consolidated by Charaka, renowned as the Father of Medicine, who compiled a compendium of Ayurvedic principles and practices in his treatise Charaka-Samahita, which remained like a standard textbook for almost 2000 years and was translated into many languages, including Arabic and Latin. The Charaka-Samahita deals with a variety of matters covering physiology, etiology and embryology, concepts of digestion, metabolism, and immunity. Preliminary concepts of genetics also find a mention, for example, Charaka has theorised that blindness from birth is not due to any defect in the mother or the father, but its origin lies in the ovum and the sperm.

In ancient India, several advances were also made in several fields of medical surgery such as plastic surgery, extraction of cataracts, and even dental surgery. Shushruta, a medical theoretician and practitioner, lived 2000 years earlier, in the ancient Indian city of Kasi, now called

Varanasi. He wrote a medical compendium called Shushruta-Samahita. This ancient medical compendium describes at least seven branches of surgery – excision, scarification, puncturing, exploration, extraction, evacuation, and suturing. The compendium also deals with matters such as rhinoplasty (plastic surgery) and ophthalmology (ejection of cataracts). The compendium also focuses on the study the human anatomy by using a dead body.

Stone Age cartography

The use of large-scale constructional plans, cosmological drawings, and cartographic material was known in India with some regularity since the Vedic period (2nd-1st millennium BCE). Climatic conditions were responsible for the destruction of most of the evidence; however, a number of excavated surveying instruments and measuring rods have yielded convincing evidence of early cartographic activity. On the subject of surviving maps, Joseph E Schwartzberg, editor and principal author of the Historical Atlas of South Asia, stated: 'Though not numerous, a number of map-like graffiti appear among the thousands of Stone Age Indian cave paintings; and at least one complex Mesolithic diagram is believed to be a representation of the cosmos.'

The Sanchi Stupa: The stupas were the precursor of the pagoda and were constructed by the 3rd century BCE

Dams and bridges

The Arthashastra of Kautilya (c. 4th century BCE) mentions the construction of dams and bridges. The use of suspension bridges using plaited bamboo and iron chain was visible by about the 4th century BCE. The stupa, the precursor of the pagoda and torii, was constructed by the 3rd century BCE. Rock-cut step wells date from 200-400 CE. Subsequently, the construction of wells at Dhank (550-625 CE) and stepped ponds at Bhinmal (850-950 CE) took place.

Linguistics

During the 5th century BCE, the scholar Paṇini, Sanskrit philologist, grammarian, and revered scholar, considered the father of Indian linguistics, had made several discoveries in the fields of phonetics, phonology, and morphology. Pāṇini's morphological analysis remained more advanced than any equivalent Western theory until the mid-20th century.

Metal work

Zinc mines of Zawar, near Udaipur, Rajasthan, were active during 400 BCE. Diverse specimens of swords have been discovered in Fatehgarh, where there are several varieties of hilt. These swords have been variously dated to periods between 1700-1400 BCE, but were probably used more extensively during the opening centuries of the 1st millennium BCE. Archaeological sites in such as Malhar, Dadupur, Raja Nala Ka Tila, and Lahuradewa in present-day Uttar Pradesh show iron implements from the period between 1800 BCE and 1200 BCE. The Rasaratna Samuccaya (800 CE) explains the existence of two types of ores for zinc metal, one of which is ideal for metal extraction while the other is used for medicinal purpose.

Early iron objects found in India can be dated to 1400 BCE by employing the method of radio carbon dating. Some scholars believe that by the early 13th century BCE iron smelting was practised on a bigger scale in India, suggesting that the date of the technology's inception may be placed earlier. In southern India (present-day Mysore) iron appeared as early as 11th to 12th centuries BCE. These developments were too early for any significant close contact with the northwest of the country.

Weapons of war

Damascus sword: Wootz originated in the region before the beginning of the Common Era. Wootz was exported and traded throughout Europe, China, the Arab world, and became particularly famous in West and Central Asia, where it became known as Damascus steel used to make swords. Archaeological evidence suggests that the manufacturing process for Wootz was also in existence in southern India before the Common Era.

Akbarnama (c.1602), depicts the defeat of Baz Bahadur of Malwa by the Mughal troops in 1561. The Mughals extensively improved metal weapons and armour used by the armies of India.

Hyder Ali of Mysore developed war rockets with an important change: the use of metal cylinders to contain the combustion powder. Although the hammered soft iron he used was crude, the bursting strength of the container of black powder was much higher than the earlier paper construction. Thus a greater internal pressure was

The first iron-cased rockets in the world to be successfully deployed for military use, Tipu Sultan's Mysorean rockets handed the British some of their worst defeats in India

possible, with a resultant greater thrust of the propulsive jet. The rocket body was lashed with leather thongs to a long bamboo stick. The range was perhaps up to three-quarters of a mile (more than a kilometre). Although individually these rockets were not accurate, dispersion error became less important when large numbers were fired rapidly in mass attacks. They were particularly effective against cavalry and were hurled into the air, after lighting, or skimmed along the hard dry ground.

Hyder Ali's son, Tipu Sultan, continued to develop and expand the use of rocket weapons, reportedly increasing the number of rocket troops from 1200 to a corps of 5000. In the battles at Seringapatam in 1792 and 1799, these rockets were used with considerable effect against the British.

Glass and gems

By the beginning of the Common Era, glass was being used for ornaments and casing in the region. Contact with the Greco-Roman world added newer techniques, and local artisans learnt methods of glass moulding, decorating, and colouring by the early centuries of the Common Era. The Satavahana period further reveals short cylinders of composite glass, including those displaying a lemon yellow matrix covered with green glass.

The mining of diamonds and their early use as gemstones originated in India. Golconda served as an important early centre for diamond mining and processing. Diamonds were then exported to other parts of the world. Early reference to diamonds comes from Sanskrit texts. The Arthashastra also mentions diamond trade in the region.

Weaving

Evidence for using bow-instruments for carding comes from India (2nd century CE). The origins of the spinning wheel are unclear but India is one of the probable places of its origin. The device certainly reached Europe from India by the 14th century. The cotton gin was invented in India as a mechanical device known as charkhi, the 'wooden-worm-worked roller.' This mechanical device was, in some parts of the region, driven by water power. The Ajanta caves yield evidence of a single roller cotton gin in use by the 5th century. This cotton gin was used until further innovations were made in the

The cashmere woollen shawls from the Kashmir region find written mention between 3rd century BCE and the 11th century CE

Chinese documents confirm at least two missions to India, initiated in 647, for obtaining technology for sugar-refining

form of foot-powered gins.

The cashmere wool fibre, also known as pashm or pashmina, was used in the handmade shawls of Kashmir. The woollen shawls from Kashmir region find written mention between 3rd century BCE and the 11th century CE.

Muslin was named after the city where Europeans first encountered it, Mosul, in what is now Iraq, but the fabric actually originated from Dhaka in what is now Bangladesh. In the 9th century, an Arab merchant named Sulaiman makes note of the material's origin in Bengal (known as Ruhml in Arabic).

Jute was also cultivated in India. Historical documents (including Ain-e-Akbari by Abul Fazal in 1590) state that the poor villagers of India used to wear clothes made of jute. Simple handlooms and hand spinning wheels were used by the weavers, who used to spin cotton yarns as well. History also suggests that Indians, especially Bengalis, used ropes and twines made of white jute from ancient times for household and other uses. It is highly functional in carrying grains or other agricultural products.

Sugar

Crystallised sugar was discovered by the time of the Gupta dynasty, and the earliest reference to candied sugar comes from India. Chinese documents confirm at least two missions to India, initiated in 647, for obtaining technology for sugar-refining. Each mission returned with different results on refining sugar.

The postal runners

The earliest use of 'runners' for the delivery of post in India is lost in antiquity. But there is evidence of runners when the Mughals came (c. 16th century), if not earlier. The earliest runners were used to gather intelligence for rulers; later, they were used to convey messages and also began to be used by merchants for trade-related work. Gradually, runners also were used to carry private mail.

By the end of the 18th century this system had reached high levels of efficiency. It is said that the Maharaja of Jodhpur sent daily offerings of fresh flowers from his capital to Nathadvara, 320 km away, and they arrived in time for the first darshan at the shrine at dawn.

Later, with the advent of the British, the 'dawk' system formalised the designation of 'runner' and paid these men according to the distance travelled and the weight of the letters carried. The relay system was also introduced at this time – a runner would run a stipulated number of miles, and hand over his mailbag to a waiting runner at a designated time and place. The Post Office Act XVII of 1837 enabled the Governor-General of India to convey messages by post within the territories of the East India Company. The Indian Post Office service was established in 1837. With the introduction and expansion of roads and railways, runners started becoming redundant. That's why they only exist today in the remotest regions of the country.

Modernisation of science

The education system introduced by the British, primarily to create a cadre of able civil servants, opened a window to the world of science for many Indians. Jagadish Chandra Bose (1858-1937), M Visvesvaraya (1860-1962), Prafulla Chandra Ray (1861-1944), Satyendra Nath Bose (1894-1974), Meghnad Saha (1893-1956), PC Mahalanobis (1893-1972), CV Raman (1888-1970), Subrahmanyan Chandrasekhar (1910-95), Homi Bhabha (1909-66), Srinivasa Ramanujan (1887-1920), Vikram Sarabhai (1919-71), Har Gobind Khorana (1922-2011), Harish Chandra (1923-83), and Abdus Salam (1926-96) were among the notable scholars of this period. The discoveries of some of these sharp minds range from profound theories in advanced mathematics to modern-day nuclear physics.

Space research

The Indian Space Research Organisation, popularly known as ISRO, is considered to be one of the best space agencies in the world. Many scientists of the space agency worked together to make the nation proud with projects such as the Mars Mission and the Moon Mission among others. The achievements of these intelligent minds have also garnered a lot of appreciation from world over. In the field of space science, India has the capability to launch GSLV satellite.

India's achievements in the field of IT and software are recognised all over the world. During recent times, science and technology in India has also focused on automobile engineering, information technology, communications, as well as research into space and polar technology.

Today, the Government of India is extensively promoting research parks (RPs) and technology business incubators (TBIs), which would promote the innovative ideas till they become commercial ventures. India is the world's third-largest technology startup hub with the incorporation of 1000 new companies in 2017. The engineering R&D and product development market in India is forecast to grow at a CAGR of 20.55 percent to reach $45 billion by 2020 from $28 billion in FY18.

The GSLV-F05 take off: ISRO is considered to be one of the best space agencies in the world

Scientific research conducted in India by Indian citizens have transformed the way the world works, from healing and eradicating lethal diseases to understanding the world. While some of these groundbreaking contributions have been acknowledged, some are still unknown to most.

The various fields in which the Indian scientists have excelled include mathematics, warfare, geometry, astronomy, medicine, space science, physics, chemistry, and botany. These incredible phenomena have bequeathed the country a marvellous legacy that is conspicuous through its wonderful monuments, buildings, and sites, the beauty of which makes one fully comprehend the fabulous spells of time through which the country has passed and the exciting marvels that the future beholds.

Of many such exceptionally rich inventions, we bring you our compilation of a few stunning technological marvels in India that are not only fascinating but also demonstrate the great innovative minds that produced them.

The Iron Pillar in the Qutb complex, Delhi

REVOLUTIONARY INVENTIONS

World's first wireless communication

This invention revolutionised the way we communicate. While historians credit Guglielmo Marconi with inventing the wireless radio communication, Acharya Jagadish Chandra Bose was actually the first person who demonstrated the use of radio waves for communication publicly, way back in 1895, exactly two years before Marconi gave a similar demonstration in England. In other words, Bose invented wireless communication technology, which enables people to communicate quickly and transmit information over a distance without the need for electrical conductors, wires or cables.

Universal Serial Bus (USB)

Ajay V Bhatt, an Indian-American computer architect with many accolades under his belt, devised the USB, a little removable storage device that is capable of holding a large chunk of data storage and transfer. Plus, it's easy to carry and use.

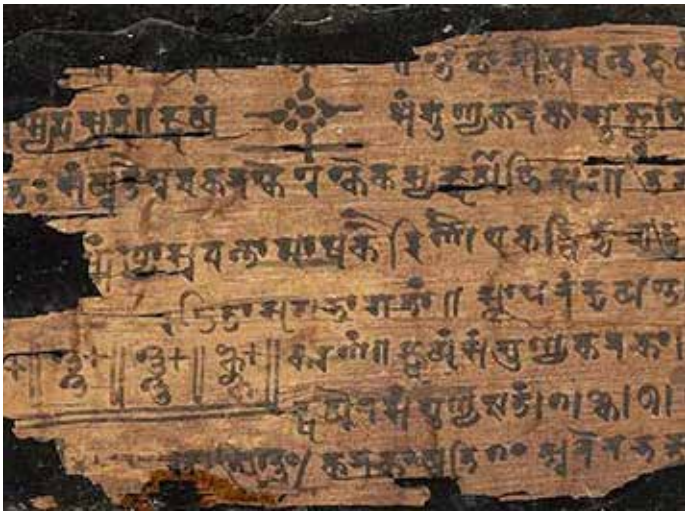
'0' – the magic numeral

The biggest and the most important contribution to the history of mathematics is 'zero,' which is literally nothing, but without it, there would have been no binary system and subsequently, no computers. The origin of the symbol zero has long been one of the world's greatest mathematical mysteries. New carbon dating research into the ancient Indian Bakhshali manuscript has revealed it to be hundreds of years older than initially thought, making it the world's oldest recorded origin of the zero symbol that we use today.

The Bakhshali manuscript is a mathematical text found in 1881 in the village of Bakhshali, Mardan (near Peshawar in present-day Pakistan). It is notable for being 'the oldest extant manuscript in Indian mathematics.' It contains the earliest known Indian use of a zero symbol. It is written in Sanskrit with significant influence of local dialects.

Radiocarbon dating reveals the fragmentary text, which is inscribed on 70 pieces of birch bark and contains hundreds of zeroes, dates to as early as the 3rd or 4th century CE – about 500 years older than scholars previously believed. This makes it the world's oldest recorded origin wof the zero symbol that we use today.

The zero symbol evolved from a dot that was used in ancient India and can be seen throughout the Bakhshali manuscript. The astrologer mathematician Aryabhata first used the place-value sys-



tem to signify zero without using the symbol '0.' While the use of zero as a placeholder was seen in several different ancient cultures, such as among the ancient Mayans and Babylonians, the symbol in the Bakhshali manuscript is particularly significant for two reasons. Firstly, it is this dot that evolved to have a hollow centre and became the symbol that we use as zero today. Secondly, it was only in India that this zero developed into a number in its own right, hence creating the concept and the number zero that we understand today – this happened in 628 CE, just a few centuries after the Bakhshali manuscript was produced, when the Indian astronomer and mathematician Brahmagupta wrote a text called Brahmasphutasiddhanta, which is the first document to discuss zero as a number.

Iron Pillar

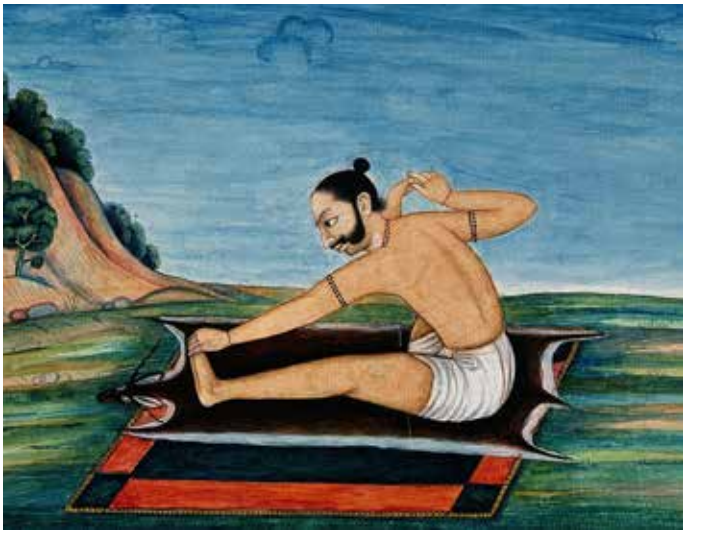
By the side of Qutb Minar, a World heritage site, in Delhi, stands an Iron Pillar. The pillar is believed to be cast in the Gupta period, during the rule of Chandragupta II Vikramaditya (375-413 CE). The pillar is 7.32 metre tall, tapering from a diameter of 40 cm at the base to 30 cm at the top and is estimated to weigh six tonnes. It has been standing in the open for the last 1500 years, withstanding wind, heat and weather, but still has not rusted, except very minor natural erosion. This kind of rust proof iron was not possible till iron and steel was discovered just a few decades earlier.

Board games

Board games such as the classic Chess and Snakes and Ladders have their roots in India. Chess as a game of intellectuals originated as Ashtapada during the Gupta period around the 6th century CE. Gyandev, a 13th-century poet, invented Snakes and Ladders, originally known as Mokshapat. The snakes represent vices, while ladders denote virtues. It was during British rule in India that these ancient Indian games made their way to England and later to the United States and other countries.

Yoga

A significant contribution in the field of healthy living, India introduced the world to yoga, discovered and practised in the country since ancient times, with origins tracing back to Lord Shiva (also known as Adi Yoga), the first yoga guru. Today, people practice this spiritual, physical, and mental exercise across the world on a daily basis for healthy living. Moreover, the world celebrates 'International Yoga Day' on 21 June every year. It was Prime Minister Narendra Modi, who initiated the concept of practising yoga and celebrating it as Yoga Day.

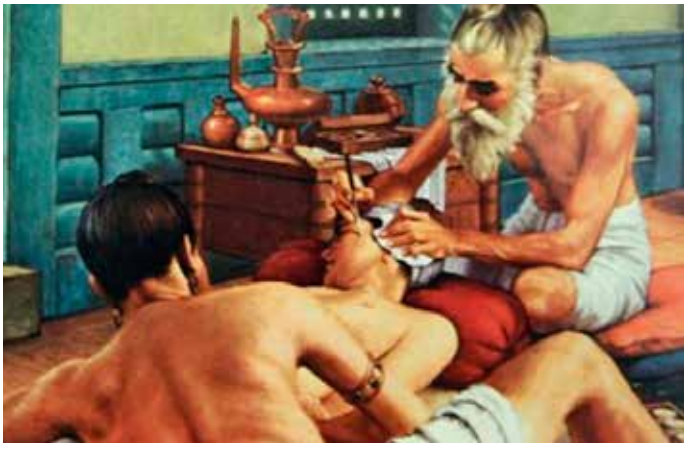


Buttons

You will be surprised to learn that buttons also come from India. Yes, it's true! The origins of buttons trace back to the Indus Valley Civilisation in 2000 BCE. Some 5000 years ago, they were made out of seashells and formed into geometric shapes with tiny holes bored into them. In the past, they were used for ornamental purposes, but gradually, people started to use them for fastening clothes.

Cataract surgery

This is another breakthrough in the field of medicine. For cataract surgery, the world can thank Sushruta, an Indian physician who developed this operation in the 3rd century CE. He was also the main contributor to the Sushruta Samhita. He performed this surgery using a curved needle (called Jabamukhi Salaka) that loosened the lens and then pushed the cataract into the back of the eye. The surgeon used warm butter to soak the eyes and then placed bandages on them until they were healed. This method was successful; however, Sushruta advised everyone to perform this surgery only when necessary. Eventually, this operation was extended to the West and across the world.



Shampoo

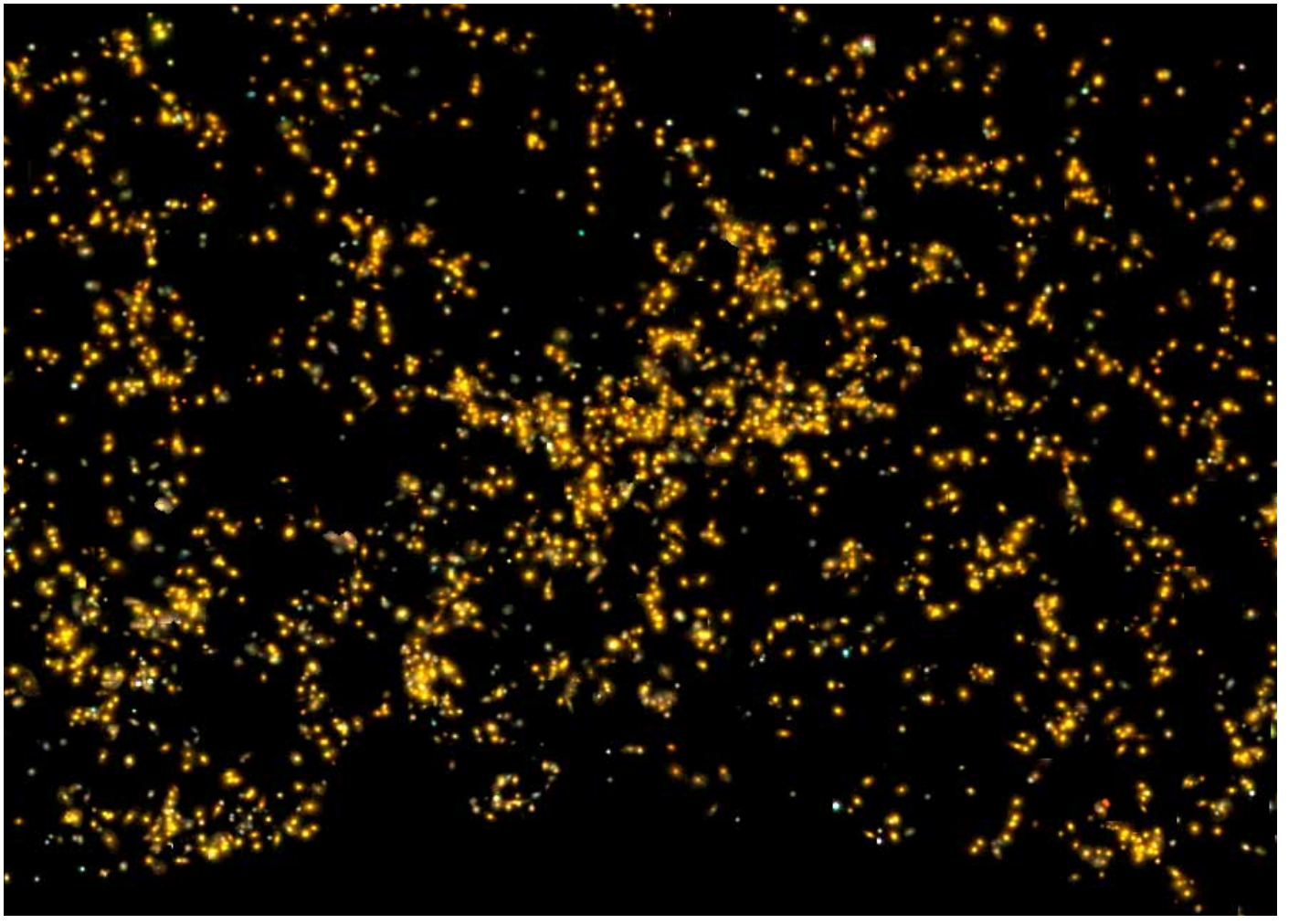
Yes, you have India to thank for shampoo, invented in 1762 in the eastern parts of the Mughal Empire and used as a 'head massage,' comprising natural oils and herbs. The English word 'shampoo' derives its name from 'chāmpo' in Hindi, which comes from the Sanskrit word 'chapayati,' meaning massage or knead.

Cure for leprosy and lithiasis

India has been contributing substantially to the field of medicine for centuries. Indians first identified and cured leprosy by using ancient remedies mentioned in the Atharva Veda (1500-1200 BCE), though its inventor's name remains unknown. Lithiasis refers to the formation of stones in the body, and India was the first to treat this disease in a treatment described in the Sushruta Samhita (6th century BCE), a textbook on ancient surgery.

Natural fibres

The products made from natural fibres, such as jute, cotton, and wool, all have their origins in India. The finest wool – cashmere wool – came from the Kashmir region of India and was used for making woollen shawls. The country also pioneered jute and cotton cultivation. The inhabitants of the Indus Valley Civilisation grew cotton during the 5th millennium–4th millennium BCE and converted the cotton into threads, which were later woven into fabric. Also, since ancient times, India has been growing jute and exporting raw jute to the West.



The Saraswati galaxy supercluster, almost 650 million light years across, discovered by a team of Indian astronomers clearly visible here as a very high density of galaxies in the central region of the image

CLOSE ENCOUNTERS: PUSHING TECHNOLOGICAL BOUNDARIES

INDIA is a land where numerous brilliant brains have made significant contributions in the field of science and technology, enhancing its position around the globe. India has the second-largest group of scientists and engineers in the world. In the context of technological advancements and scientific achievements, Indian scientists have developed several projects to augment the life of people around the world. India belongs to the select group of countries who have developed indigenous nuclear technology. India is among the few countries that have developed ballistic missiles.

Today, India is among the topmost countries in the world in the field of scientific research due to its talent pool and infrastructure in the country. The country has much to be proud of its scientific and technological developments; kudos to all those minds behind these breakthrough achievements.

ISRO's atomic clock

The development of an atomic clock has made ISRO one of the

few space organisations in the world to have gained this sophisticated technology. ISRO's atomic clock will be used in navigation satellites to measure precise location data. The space agency currently imports atomic clocks from European aerospace manufacturer Astrium.

Super cluster of galaxies

A team of Indian astronomers has discovered an extremely large super cluster of galaxies. This is one of the largest known structures in the neighbourhood of the universe – as immense as 20 million billion suns. It is a path-breaking discovery and the cluster has been named Saraswati.

104 satellites launched on a single rocket

ISRO demonstrated its capability of handling complex missions by successfully launching a record 104 satellites on a single rocket. This is the highest number of satellites ever launched in a single mission by any other country in the world.

The PSLV rocket launch that carried 104 satellites, the highest number of satellites ever launched on a single single mission – *photo credit ISRO*

Indigenous GSLV-Mk III

ISRO launched the country's heaviest rocket GSLV-Mk III, whose cryogenic engine was developed indigenously. The rocket is described as a 'game-changer' in the first of its kind space mission and is yet another major step towards being self-reliant in the country's space program.

World's smallest satellite

Rifath Sharook, an 18-year-old from Karur in Tamil Nadu, scripted history by designing the world's smallest satellite. The tiny 3D-printed satellite is called Kalamsat, after former President Abdul Kalam, and was flown by NASA into space in one of its missions.

Indigenous supercomputer PARAM

PARAM – India's first-ever indigenous supercomputer was a major milestone in modern India's technological journey. India faced a technology-denial regime in the 80s. It was then that the Centre for Development of Advanced Computing (C-DAC) was set up with the clear mandate to develop an indigenous supercomputer to meet high-speed computational needs.

Unmanned satellite Aryabhata

Aryabhatta – the first unmanned satellite built by India was a breakthrough achievement in India's space programme. Aryabhata was built by the ISRO to conduct experiments in X-ray astronomy, aeronomics, and solar physics and opened new possibilities for ISRO.

Indigenous seeker for BrahMos

India developed an indigenous seeker for supersonic BrahMos, the world's fastest and most formidable anti-ship cruise missile. This marks a big achievement and breakthrough for the supersonic missile as this is the first time the country has developed a seeker for a missile of this calibre and class.

First on Mars

The Mars Orbiter Mission made India the only nation in the world to reach Mars in its first attempt. Mangalyaan-1, the indigenously built space probe, marked India's first venture into the interplanetary space. It also made India first in Asia, and fourth in the world to reach the surface of Mars.

Lunar exploration

Chandrayaan-1, India's first lunar exploration mission, made it possible for ISRO to go beyond the geostationary orbit. With this mission, India emerged as the fourth country in the world to hoist its flag on a lunar surface. It also provided the needed thrust to basic science and engineering research in the country.

Scramjet rocket engine

ISRO successfully test-fired its Scramjet rocket engine, a breakthrough technology in air-breathing propulsion. Air-breathing rocket systems use atmospheric oxygen from their surroundings, burn it with the stored fuel to produce a forward thrust in contrast to the conventional chemical rocket systems which carry both the oxygen and the fuel. The development of this high-technology sys-

The launch of India's INSAT 3 satellite

tem will go a big way in meeting India's futuristic space transportation needs.

Space capsule recovery

The Space Capsule Recovery Experiment Mission established India's technological capability to recover an orbiting satellite. It was a remarkable achievement and the technology will now be used to develop recovery technologies for future human and robotic missions.

INSAT system

India's INSAT system is one of the largest domestic communication satellite systems owned by any country in the Asia-Pacific region. It initiated a major revolution in India's communications sector. At present, it is serving several crucial sectors of our economy, including telecommunication, education, and meteorology.

Regional navigation satellite system

The Indian Regional Navigation Satellite System (IRNSS) helped India realise its dream of having independent satellite navigation capability. It has freed India from its dependence on navigation satellite systems operated by other countries. By all means, a homegrown GPS system like IRNSS could serve as a strategic asset and of tremendous significance for the military, too.

Cryogenic engine technology

The successful demonstration of the use of cryogenic engine technology put India among a league of only five other such nations. With the successful launch of GSLV-D5, India has gained the capability to launch heavy satellites without foreign assistance. It will also pave the way for sizeable savings for the country's future launch costs.

Energy-efficient car

Kavya Vignesh

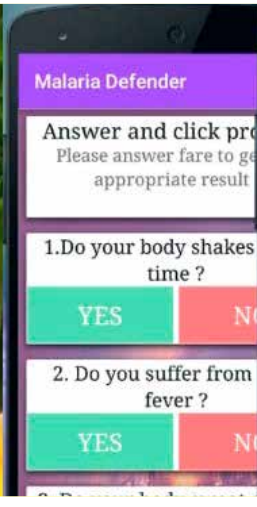
Kalyani Shrivastava

Abhik Saha

Jonna Venkata Karthik Raja

Arman Gupta

Akash Manoj



Naman Tiwari

Gursimran Singh

Avneet

GOOD THINGS COME IN SMALL PACKAGES

Young Indians who are busy creating innovative solutions to improve our daily lives

Anang Tadar's Goggles for the Blind

Samay Godika

Sikanto Mandal

3-D printed sanitary napkin dispenser

THE Indian startup and innovation landscape has over the past few years, seen young inventors blossom. While some of them have found simple and quirky solutions to problems that have stumped adults, others have triggered dialogue on important social and environmental issues. Their keen observations combined with a deep sense of empathy and a flare for action has enabled them to make long strides towards creating an impact.

While we were engrossed in our daily mundane tasks and humdrum lives, a handful of young Indians were busy creating innovative solutions to improve our daily lives. These young budding talents have been silently working to ease our troubles with their inventions. Here we introduce you to a few of these most promising young trailblazers, aged 10-21 years, on the horizon.

Arman Gupta (10) – remote controlled cleaning machine

Ten-year-old Arman Gupta built a remote controlled cleaning machine to help his mother! This youngster developed the machine, which mops and dries a surface, to help his mother clean up after him. A keen interest in robotics kept him working in the design innovation lab in his school even through holidays, where he tinkered with mechanical toys and other devices.

This mobile device, which was built in the span of a month, has detachable sponges and can be used to clean different surfaces. Arman now hopes to connect with potential investors and corporates who can help him scale his basic model and make his device a more 'consumer durable product.'

KavyaVignesh (12) – robot to save bees

Working with a team of six fellow students and two teachers, 12-year-old KavyaVignesh has built a robot to save bees. Her interest in robotics and a flare for solving real life problems is what led to the creation of this Bee Saver Bot. While it is common practice to burn or destroy an unwanted beehive, killing a lot of bees in the process, this bot can relocate a beehive without harming the bees.

Her team Supercalifragilisticexpialidocious was India's youngest ever to qualify for the First Lego League (FLL) – European Open Championship (EOC) held in Denmark in May 2017. She further wishes to reach out to the authorities in India and collaborate with them to roll out this bee saver device.

Avneet (13) – solar bike

Avneet, a 13-year-old from Haryana, used a bicycle to build a fully functional solar bike. The initial prototype was built by mounting a solar panel onto a children's bicycle to propel it. His bike, currently in its nascent stages, is a single seater and runs at 20 km per hour.

Conscious at this early age of the problems posed by air pollution from vehicles running on conventional energy sources and aware of the leaps and strides the world is making towards the use of clean energy; he dreams of continuing the momentum to build a low cost, solar car in the future.

J Naman Tiwari (14) – developer of 22 apps

Fourteen-year-old J Naman Tiwari started his journey from Shahjahanpur, a town in Uttar Pradesh, and is now credited with building 22 applications covering a variety of subjects from entertainment and education to malaria detection and security for women. He picked up coding at the young age of 11 as a hobby and learnt different languages for mobile app development on his own.

Today 22 of his applications are available on the Google Play Store and he has 2500 users in all. He dreams of a future as an entrepreneur, running his own software development company and creating an impact in the lives of people.

Sikanto Mandal (15) – garbage collection device

Sikanto Mandal, an enterprising 15-year-old from Mathura, was triggered into developing a manual garbage collection device by his daily routine of picking waste from his school premises and grounds. The initial model of this manual, lightweight device, built using scrap – wooden parts from old furniture, bicycle brakes and chains, has customised spaces to keep the broom, a water bottle, and other waste materials.

Journeying through innovation fairs and exhibitions across the country, the device has been picked up by a Gujarat-based startup for mass production and will be rolled out by city municipalities across the country.

Samay Godika (15) – taking autophagy to the world

Samay Godika, a teenager from Bengaluru, an avid science enthusiast and Youtuber, has grabbed eyeballs for his video on autophagy – a self-cleansing mechanism that could help fight dreaded diseases like cancer, Alzheimer's, and Parkinson's. Autophagy, Samay explains, is a process which occurs inside our body that breaks down dead and decaying organelles, and converts them to energy. It is triggered by regular fasting.

This video is among 30 finalists chosen for the Breakthrough Junior Challenge, which received 8000 original videos from across the world on complex topics in the field of life sciences, physics, and mathematics. Samay has also been selected by the Massachusetts Institute of Technology (MIT) for their Launch Entrepreneurship Programme 2017 and has received accolades and support from prominent Indians.

Abhik Saha (15) – entire search engine

Abhik Saha, a young entrepreneur from Jalpaiguri in West Bengal, has a complete search engine, built from scratch, to his credit. He became interested in computer programming at the young age of 11 and pursued its learning with passion. By age 13, he ran Arnabhik Corp, a website designing company with international clientele.

He quickly progressed to building a security and antivirus system to protect his school

computers from viruses, then to building gaming and learning applications for android phones. He has also to his credit, an agriculture app and a reminder app. He is now working towards making his search engine, Origgon, the best in the world.

Kalyani Shrivastava (16) – low-cost air conditioner

Kalyani Shrivastava, a young crusader, has brought relief and cheer to the poor suffering extreme summers in the towns around Jhansi, by building a solar powered air conditioner costing just Rs1800. The air conditioner has an icebox made of thermocol where air is released from a 12 volt DC fan. It results in a temperature drop of 4-5 degrees if used for an hour.

The Indian Institute of Science, Delhi and the Uttar Pradesh government, have recognised her work. She has received an invitation from the Japanese government for a seminar. She is also a household name because of her participation in the popular Indian reality show, Indian Idol.

Gursimran Singh (16) – helping the visually impaired read

Sixteen-year-old Gursimran Singh has invented EyeScribe, an assistive device that helps the visually impaired experience the joy of reading. Seeing the visually impaired struggle with voluminous books printed in Braille and the general lack of resources, led him on this path of innovation.

Eyescribe is a wearable technology that captures images using a camera and produces an audio output using a text to speech engine. It was first screened at the Atal Tinkering Lab Innovation Challenge by NITI Ayog in the FICCI Auditorium in 2016 and has received a string of awards, recognitions, and funding since. He is now working to take his technology to the market.

Akash Manoj (16) - Skin patch to detect silent heart attacks

Akash Manoj, a student from Tamil Nadu, has developed a skin patch that can detect silent heart attacks. His skin patch that can be attached to the ear or the wrist will release a positive electrical impulse, which will attract the negatively charged protein released by the heart to signal a heart attack. Manoj participated in the Innovation Scholars In-Residence Programme at the Rashtrapati Bhavan.

3-D printed sanitary napkin dispenser

Three Class XII students of Mumbai's Cathedral and John Connon School built and set up a 3D printed sanitary napkin dispenser for their school in June 2017. The innovator trio, Devika Malhotra, Malini Dasgupta, and Aditi Arya, built the 3D printed dispenser, which uses a coil and light sensor to release sanitary napkins.

The girls plan to approach NGOs to examine ways to make their product available to underprivileged girls in the country.

JVK Raja (18) – India's largest newspaper aggregator

Jonna Venkata Karthik Raja, 18 years old, is the founder of Paperboy, a mobile app that features the widest range of Indian newspapers and magazines uploaded on a platform in real time. His entrepreneurial instincts were activated when he realised that he had no access to his favourite newspapers while travelling. He floated his venture of a mobile platform featuring news sources across languages which soon became popular, as news reading on mobile platforms is catching up among Indians.

With over 400 newspapers listed, his venture currently employs 50 young minds and hopes to take this solution to audiences across the world as the platform is language agnostic and can be scaled to accommodate any language.

Energy-efficient car

In March 2017, a team of 15 girl students from Indira Gandhi Delhi Technical University for Women won honours at the Shell Eco Marathon in Singapore for their creation, an energy-efficient vehicle.

Touted to be the only all-woman team from Asia, Team Panthera, comprising 15 engineers aged 18-21, won the Perseverance and Spirit of the Event Award for Iris 2.0 – a three-wheeled vehicle with a mileage of 300 kmpl.

Anang Tadar (21) – Goggles for the blind

Anang Tadar's Goggles for Blind (G4B) uses two ultrasound sensors and an infrared sensor to help the visually-impaired navigate. A student from Arunachal Pradesh, Tadar has developed a pair of glasses to help the visually-impaired navigate 'hands-free.' His goggles, referred to as G4B, use echolocation technology – which mimics the way bats sense their surroundings – to alert visually-impaired wearers to objects within two metres of its field view.

His innovation won him the Dinanath Pandey Smart Idea Innovation Award in March 2017 and, according to reports, UNICEF has expressed interest in refining his prototype in order to make it ready for the market.

Tadar told UNICEF: 'Blind people wear goggles anyway, but unfortunately they wear them to hide their eyes. Now I have created something to make the goggles useful.'

Afterword

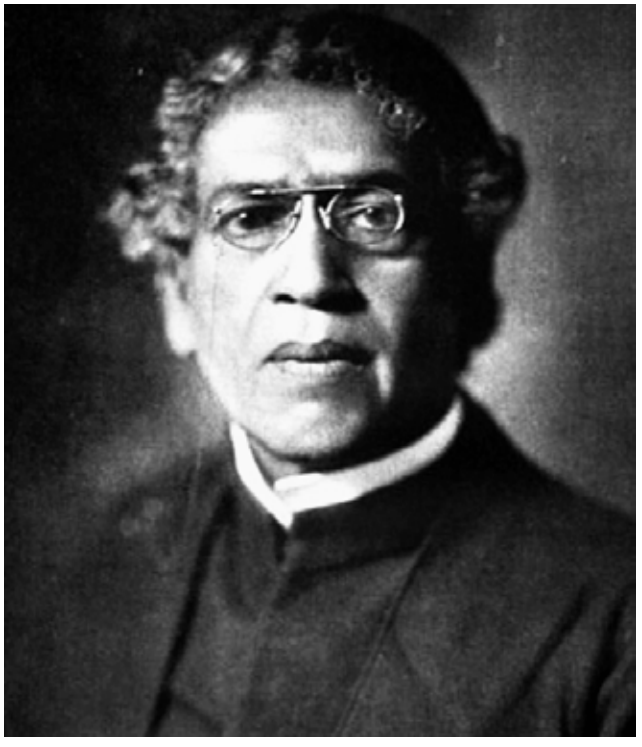
By 2020, India will become the world's youngest country, with over 60 percent of the population under the age of 35. Now that even the government is encouraging startups, and with more and more innovators (from diverse backgrounds & profiles) like these on board, the future looks bright, to say the least. So what are you waiting for? Go ahead and work on that project you've been putting off, throw yourself into that research project, and write that book, launch that startup, develop that app – the time is now!

Turn to page 76 for profiles of a few of the geniuses who have left their indelible mark on the world of science and technology
– From the Internet and other sources

INDIAN SCIENTISTS WHO CHANGED THE WORLD

Science is an important part of our everyday life, even more so than we notice. From our fancy gadgets to the technologies we can't live without, from our humble light bulb to space explorations, all are gifts of science and technology.

We may wonder what we would be doing if none of these things were invented. How often do we take out the time to think about those extraordinary minds that made life easier for us? Here we profile 14 Indian scientists who achieved global recognition.



JAGADISH CHANDRA BOSE (1858-1937)

ACHARYA Jagadish Chandra Bose Kt, CSI, CIE, FRS, was a man of many talents. Born on 30 November 1858 in Bikrampur, West Bengal, he was a polymath, physicist, biologist, botanist, and archaeologist. He pioneered the study of radio and microwave optics, made important contributions to the study of plants and laid the foundation of experimental science in the Indian subcontinent. He was the first person to use semiconductor junctions to detect radio signals, thus demonstrating wireless communication for the first time. His work may have contributed to the development of radio communication. What's more, he is also probably the father of open technology, as he made his inventions and work freely available for others to further develop. His reluctance for patenting his work is legendary.

Another of his inventions is the crescograph which measured plant response to stimuli and hypothesised that plants can feel pain, understand affection, etc.

While most of us are aware of his scientific prowess, we might not be aware of his talent as an early writer of science fiction! He is, in fact, considered the father of Bengali science fiction.

MOKSHAGUNDAM VISVESVARAYA (1860-1962)

BORN on 15 September 1860, , Sir Mokshagundam Visvesvaraya KCIE, FASc, was a notable Indian engineer, scholar, statesman, and the Diwan of Mysore during 1912 to 1918. He was a recipient of the India's highest honour, the Bharat Ratna.

He was knighted as a Knight Commander of the British Indian Empire (KCIE) by King George V for his contributions to the public good. 15 September is celebrated as Engineer's Day in India in his memory. He is held in high regard as a pre-eminent engineer of India. He was chief engineer responsible for the construction of the Krishna Raja Sagara dam in the North-West suburb of Mysuru city and chief engineer of the flood protection system for the city of Hyderabad.

Visvesvaraya suggested that India try to be at par with industrialised nations as he believed that India can become developed through industries.

He is credited with the invention of 'automatic sluice gates' and 'block irrigation system,' which are still considered to be marvels in engineering. Each year, his birthday 15 September is celebrated as Engineer's Day in India. Since riverbeds were costly, he came up with an efficient way of filtering water through 'collector wells' in 1895, which was rarely seen anywhere in the world.

SRINIVASA RAMANUJAN (1887-1920)

BORN on 22 December 1887 in Tamil Nadu, Srinivasa Ramanujan FRS, was an Indian mathematician and autodidact who, with almost no formal training in pure mathematics, made extraordinary contributions to mathematical analysis, number theory, infinite series, and continued fractions.

By age 11, he had exhausted the mathematical knowledge of two college students who were lodgers at his home. He was later lent a book on advanced trigonometry written by SL Loney. He completely mastered this book by the age of 13 and discovered sophisticated theorems on his own. During his short life (he died at the young age of 32), Ramanujan independently compiled nearly 3900 results (mostly identities and equations). Many were completely novel; his original and highly unconventional results, such as the Ramanujan prime, the Ramanujan theta function, partition formulae, and mock theta functions, have opened entire new areas of work and inspired a vast amount of further research. He became one of the youngest Fellows of the Royal Society and only the second Indian member, and the first Indian to be elected a Fellow of Trinity College, Cambridge.

We hadn't known before that he faced a lot of health problems while living in England due to scarcity of vegetarian food. He returned to India and.

Ramanujan's home state of Tamil Nadu celebrates 22 December (Ramanujan's birthday) as 'State IT Day,' memorialising both the man and his achievements.

CV RAMAN (1888-1970)

CHANDRASEKHARA Venkata Raman won the Nobel Prize for Physics in 1930 for his pioneering work on the scattering of light. Born in Tiruchirapalli on 7 November 1888, he was the first Asian and first non-White to receive any Nobel Prize in the sciences. Raman also worked on the acoustics of musical instruments. He was the first to investigate the harmonic nature of the sound of Indian drums such as the tabla and the mridangam.

He discovered that when light traverses a transparent material some of the deflected light changes in wavelength. This phenomenon is now called the Raman scattering and is the result of the Raman effect.

In October 1970, he collapsed in his laboratory. He was moved to a hospital and the doctors gave him four hours to live. He survived and after a few days refused to stay in the hospital as he preferred to die in the gardens of his Institute (the Raman Research Institute in Bangalore) surrounded by his flowers. He passed away on 21 November 1970.

Raman's last words to his students were: 'Do not allow the journals of the Academy to die, for they are the sensitive indicators of the quality of Science being done in the country and whether science is taking root in it or not.'

BIRBAL SAHNI (1891-1949)

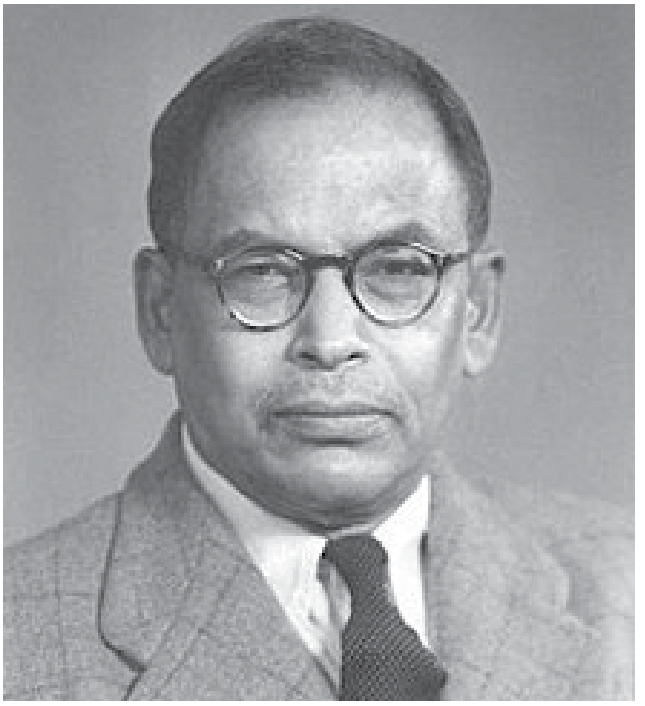
BORN on 14 November 1891 in West Punjab, Birbal Sahni FRS, was an Indian paleobotanist who studied the fossils of the Indian subcontinent. He was also a geologist who took an interest in archaeology. His greatest contributions lie in the study of the plants of India in the present as well as the historical context.

He was elected a Fellow of the Royal Society of London (FRS) in 1936, the highest British scientific honour, awarded for the first time to an Indian botanist.

He was also involved in the establishment of Indian science education and served as the President of the National Academy of Sciences, India and as an Honorary President of the International Botanical Congress, Stockholm.

Sahni was interested in music and could play the sitar and the violin. He was also interested in clay-modelling and in playing chess and tennis. At Oxford he used to play tennis for the Indian majlis. Other interests included geology, archaeology and numismatics.

He was a founder of the Paleobotanical Society which established the Institute of Palaeobotany on 10 September 1946 and which initially functioned in the Botany Department of Lucknow University. Sahni died on 10 April 1949 of heart failure.



MEGHNAD SAHA (1893-1956)

BORN on 6 October 1893 in Dhaka, the best-known work of Meghnad Saha FRS, concerned the thermal ionisation of elements, and it led him to formulate what is known as the Saha Equation. This equation is one of the basic tools for interpretation of the spectra of stars in astrophysics. By studying the spectra of various stars, one can find their temperature and from that, using Saha's equation, determine the ionisation state of the various elements making up the star.

He invented an instrument to measure the weight and pressure of solar rays. He helped to build several scientific institutions, such as the Physics Department in Allahabad University and the Institute of Nuclear Physics in Calcutta. He founded the journal Science and Culture. A lasting memorial to him is the Saha Institute of Nuclear Physics, founded in 1943 in Kolkata.

Saha was one of the prominent scientists who worked on Halley's Comet.

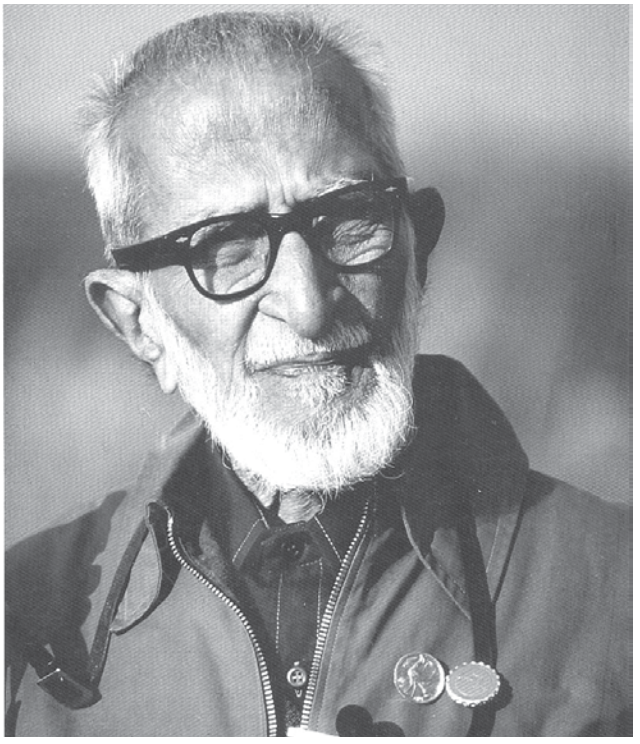
But did you know, he was also the chief architect of river planning in India? He prepared the original plan for the Damodar Valley Project. Saha was nominated as many as six times for the Nobel Prize in Physics, but was turned down by the Nobel Committee.

SATYENDRA NATH BOSE (1894-1974)

BORN on 1 January 1894 in Calcutta, Satyendra Nath Bose FRS was a physicist specialising in quantum mechanics. He is, of course, most remembered for his role played in the class of particles 'bosons,' which were named after him by Paul Dirac to commemorate his work in the field.

Bose adapted a lecture at the University of Dhaka on the theory of radiation and the ultraviolet catastrophe into a short article called 'Planck's Law and the Hypothesis of Light Quanta' and sent it to Albert Einstein. Einstein agreed with him, translated Bose's paper into German, and had it published in Zeitschrift für Physik under Bose's name, in 1924. This formed the basis of the Bose-Einstein Statistics and the theory of the Bose-Einstein condensate.

In 1937, Rabindranath Tagore dedicated his only book on science, Visva Parichay, to Satyendra Nath Bose. The Government of India awarded him India's second highest civilian award, the Padma Vibhushan, in 1954.



SALIM ALI (1896-1987)

SÁLIM Moizuddin Abdul Ali, born on 12 November 1896 in Bombay, was an ornithologist and naturalist. Salim Ali was among the first Indians to conduct systematic bird surveys across India and his bird books helped develop ornithology in the subcontinent.

This Birdman of India was the key figure behind the Bombay Natural History Society after 1947 and used his personal influence to garner government support for the organisation.

In 1967 Salim Ali became the first non-British citizen to receive the Gold Medal of the British Ornithologists' Union. In the same year, he received the J Paul Getty Wildlife Conservation Prize consisting of a sum of $100,000, which he used as a corpus for the Salim Ali Nature Conservation Fund. In 1969 he received the John C Phillips memorial medal of the International Union for Conservation of Nature and Natural Resources. The USSR Academy of Medical Sciences awarded him the Pavlovsky Centenary Memorial Medal in 1973 and in the same year he was made Commander of the Netherlands Order of the Golden Ark by Prince Bernhard of the Netherlands. The Indian government decorated him with a Padma Bhushan in 1958 and, India's second highest civilian honour, the Padma Vibhushan, in 1976.

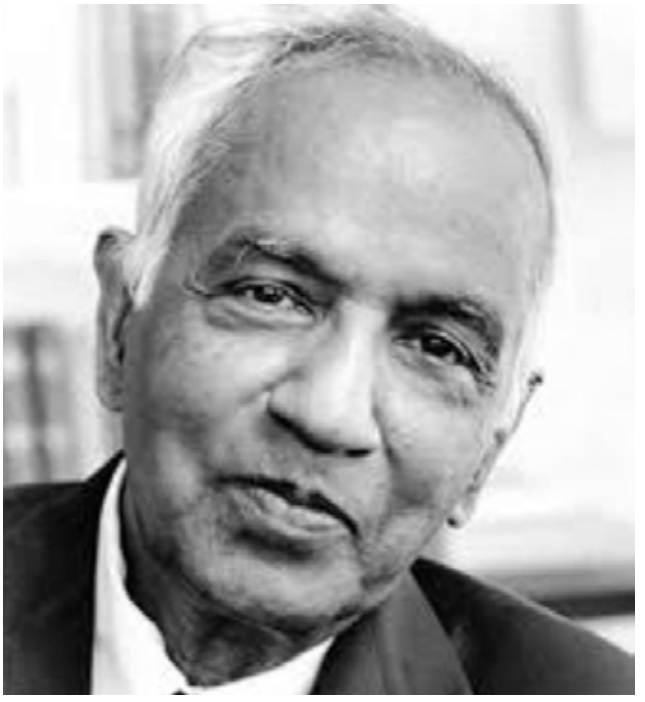
HOMI J BHABHA (1909-1966)

BORN on 30 October 1909 in Bombay, Homi Jehangir Bhabha played an important role in Quantum Theory.

He was the first person to become the Chairman of the Atomic Energy Commission of India. Having started his scientific career in nuclear physics from Great Britain, Bhabha returned to India and played a key role in convincing the Congress Party's senior leaders, most notably Jawaharlal Nehru, to start the ambitious nuclear programme.

Bhabha is generally acknowledged as the father of Indian nuclear power. But few people know that he was absolutely against India manufacturing atomic bombs, even if the country had enough resources to do so. Instead he suggested that the production of an atomic reactor should be used to lessen India's misery and poverty.

He died when Air India Flight 101 crashed near Mont Blanc on 24 January 1966. Many possible theories of the crash came up including a conspiracy theory in which the Central Intelligence Agency (CIA) was involved in order to paralyse India's nuclear programme.



SUBRAHMANYAN CHANDRASHEKAR (1910-1995)

BORN on 19 October 1910 in Lahore, Subrahmanyan Chandrashekar FRS, was awarded the 1983 Nobel Prize for Physics for his mathematical theory of black holes. The Chandrasekhar limit is named after him. He was a nephew of Sir CV Raman. Chandrashekar became a US citizen in 1953.

Besides black holes, Chandrasekhar worked on a wide variety of physical problems, contributing to the contemporary understanding of stellar structure, white dwarfs, stellar dynamics, stochastic process, radiative transfer, quantum theory of the hydrogen anion, hydrodynamic and hydromagnetic stability, turbulence, equilibrium and the stability of ellipsoidal figures of equilibrium, general relativity, and theory of colliding gravitational waves. At the University of Cambridge, he developed a theoretical model explaining the structure of white dwarf stars that took into account the relativistic variation of mass with the velocities of electrons that comprise their degenerate matter. He showed that the mass of a white dwarf could not exceed 1.44 times that of the Sun – the Chandrasekhar limit.

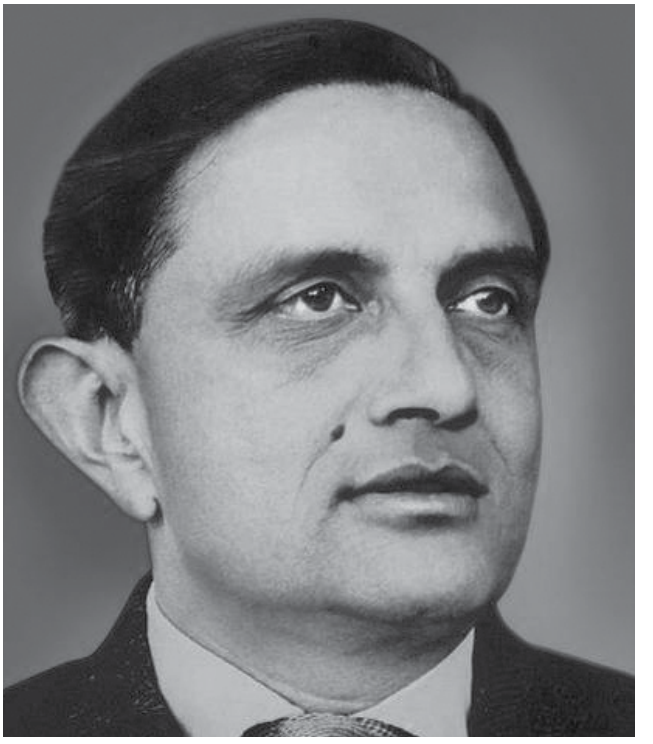
His most celebrated work concerns the radiation of energy from stars, particularly white dwarf stars. He was awarded the Padma Vibhusan in 1968. He died on 21 August 1995, at the age of 82 in Chicago.

VIKRAM SARABHAI (1919-1971)

CONSIDERED the Father of India's space programme, Vikram Sarabhai was born on 12 August 1919 in Ahmedabad. He was instrumental in the setting up of the Indian Space Research Organisation (ISRO), when he successfully convinced the Government of India of the importance of a space programme for a developing nation after the launch of the Russian Sputnik. He stated: 'There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in the exploration of the moon or the planets or manned space-flight.

'But we are convinced that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society.'

He was awarded the Padma Bhushan in 1966 and the Padma Vubhushan posthumously in 1972. While everyone knows of his primary role in the establishment of ISRO, perhaps many of us do not know that he was also the force behind the establishment of many other Indian institutes of repute, most notably the Indian Institute of Management, Ahmedabad (IIM-A) and the Nehru Foundation for Development.

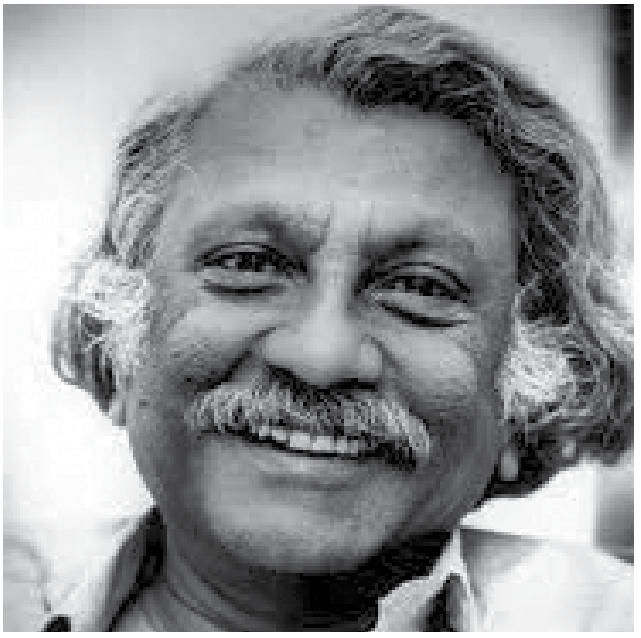


HAR GOBIND KHORANA (1922-2011)

BORN on 9 January 1922 at Raipur village in West Punjab (now in Pakistan), Har Gobind Khorana was an Indian-American biochemist who shared the 1968 Nobel Prize for Physiology or Medicine with Marshall W Nirenberg and Robert W Holley for research that helped to show how the order of nucleotides in nucleic acids, which carry the genetic code of the cell, control the cell's synthesis of proteins.

In 1970, Khorana became the first to synthesise an artificial gene in a living cell. His work became the foundation for much of the later research in biotechnology and gene therapy.

How many are aware that the University of Wisconsin-Madison, the Government of India (DBT Department of Biotechnology), and the Indo-US Science and Technology Forum jointly created the Khorana Program in 2007? The mission of the Khorana Programme is to build a seamless community of scientists, industrialists, and social entrepreneurs in the United States and India. Khorana died of natural causes on 9 November 2011 at the age of 89.



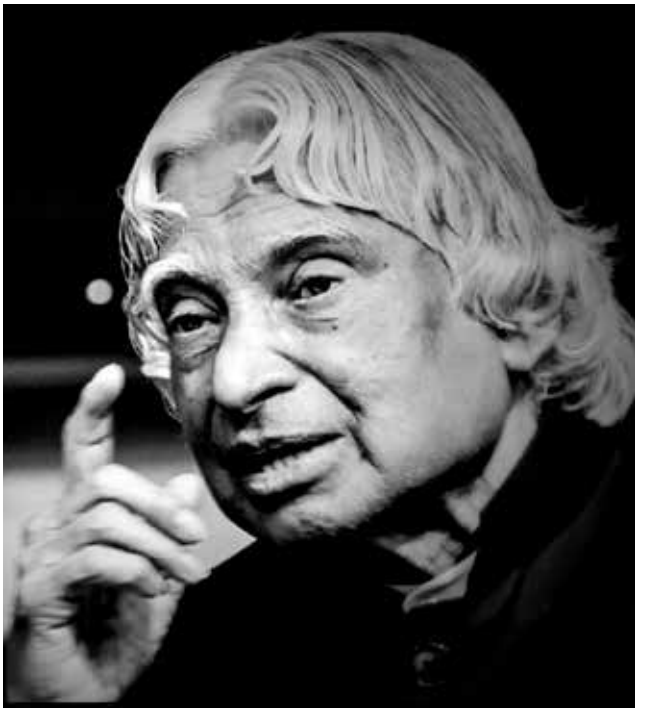
VENKATRAMAN RADHAKRISHNAN (1929-2011)

VENKATRAMAN Radhakrishnan was born on 18 May 1929 in Tondaripet, a suburb of Madras. Venkataraman was a globally renowned space scientist and a member of the Royal Swedish Academy of Sciences.

He was an internationally acclaimed Astrophysicist and also known for his design and fabrication of ultralight aircraft and sailboats.

Radhakrishnan was one of the most respected radio astronomers in the world during his time, in that he was associated in one capacity or other with the world's biggest radio telescopes. He was a member of the Foreign Advisory Committee for the Netherlands Foundation for Radio Astronomy, Steering Committee of the Australia Telescope National Facility, CSIRO, Australia, and Advisory Committee for the Green Bank Radio Telescope, National Radio Astronomy Observatory, USA. He was also the Member of the Governing Council of the Physical Research Laboratory, Ahmedabad and the Scientific Advisory Committee of the Inter-University Centre for Astronomy and Astrophysics. During the period of 1973-81 he was a member of the Indian National Committee for Astronomy.

His observations and theoretical insights helped the community in unravelling many mysteries surrounding pulsars, interstellar clouds, galaxy structures, and various other celestial bodies. He died at the age of 81 in Bangalore.



APJ ABDUL KALAM (1931-2015)

FORMER President of India and scientist, Avul Pakir Jainulabdeen Abdul Kalam, born on 15 October 1931, worked as an Aerospace Engineer with the Defence Research and Development Organisation (DRDO) and the Indian Space Research Organisation (ISRO).

Kalam started his career by designing a small helicopter for the Indian Army. Kalam was also part of the INCOSPAR committee working under Vikram Sarabhai, the renowned space scientist. In 1969, Kalam was transferred to ISRO where he was the project director of India's first indigenous Satellite Launch Vehicle (SLV-III) which successfully deployed the Rohini satellite in near earth's orbit in July 1980.

He also served as the 11th President of India from 2002 to 2007. Kalam advocated plans to develop India into a developed nation by 2020 in his book India 2020. He received several prestigious awards, including the Bharat Ratna, India's highest civilian honour. Known for his love for children, did you know that Kalam had set a goal of meeting 100,000 students in the two years after his resignation from the role of scientific advisor in 1999?

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ECOWATCH

Inflation

Retail inflation moderated to 13-month low in October 2018

CPI inflation surprised the market by moderating to 13-month low of 3.31 percent in October 2018 from a higher 3.7 percent in the previous month and remained below the medium-term target of RBI's Monetary Policy Committee (MPC) at 4 percent for the third month in a row. Lower inflation was attributed to month-on-month (m-o-m) decline in inflation on Food and beverages, Clothing and footwear, Housing, and Fuel and light. Inflation in the Food and beverages group recorded a year-on-year disinflation of 0.1 percent in October 2018 after 15 months.

Core CPI inflation (CPI excluding Food and beverages, Fuel and light group, as well as Petrol and diesel prices for vehicles), however, bucked the broader trend by rising to a three-month high of 6.1 percent in October 2018 after declining in the three previous months. This sudden upsurge was led by rise in inflation on miscellaneous items and Pan, tobacco, and intoxicants. Core CPI was recorded at 5.7 percent in September 2018, 5.9 percent in August, 6.3 percent in July 2018, and a 47-month high of 6.4 percent in June 2018. It was recorded at 6.2 percent in May, 5.9 percent in April, 5.4 percent in March, 5.2 percent in February and 5.1 percent in January 2018.

CPI inflation: October 2018

	Index	Change m-o-m (%)	Change y-o-y (%)	Financial year average	
				2016-17	2017-18
Combined CPI	140.6	0.29	3.31	4.54	3.58
Rural (2012=100)	142.2	0.07	2.82	5.00	4.00
Urban (2012=100)	138.8	0.51	3.97	4.00	3.58
CPI: Occupation-wise					
CPI for industrial workers (2001=100)	301 (Sep 2018)	0	5.61	4.14	3.08

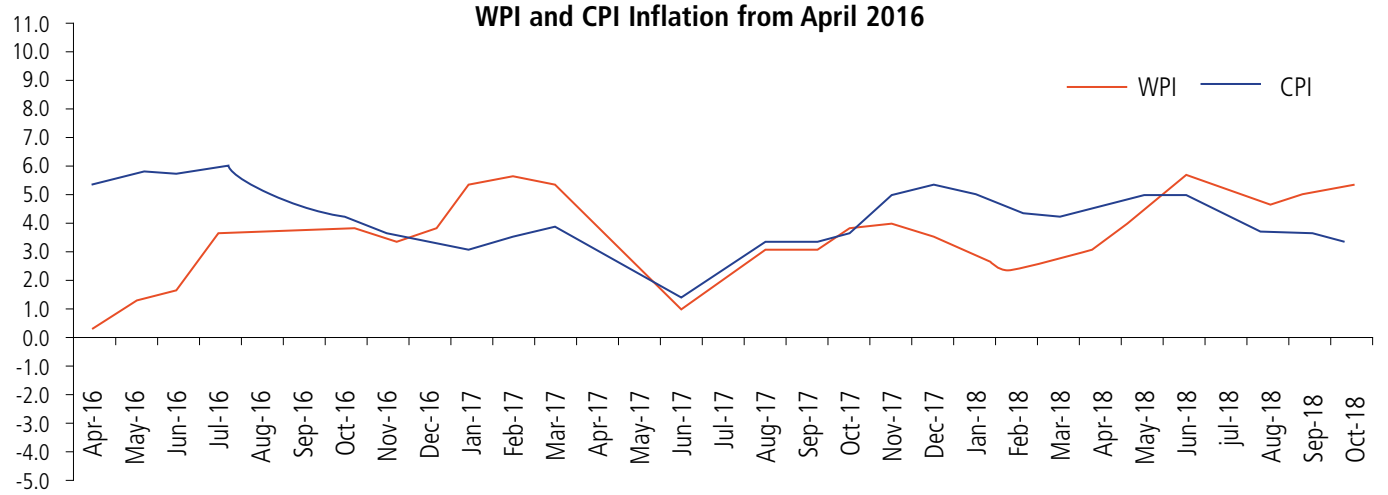
Source: CSO, MOSPI, Labour Bureau, Govt of India

Wholesale price index-based inflation continued to surge

Unlike CPI, the wholesale price index-based (WPI) inflation in India continued to surge to 5.28 percent in October 2018 from 5.13 percent in September 2018 and 4.62 percent in the previous month, led by rise in inflation on Minerals, Fuel and power, and Manufactured products (both Food and Non-food). Inflation on food articles, however, declined during the month.

Core WPI inflation (inflation on Non-food manufactured articles), after falling for two months, rose to 5.1 percent in October 2018 from 4.8 percent in September 2018 and 5 percent in August 2018. This higher core inflation contains the adverse impact of rupee depreciation on the landed cost of imports. Core WPI were recorded at 4.83 percent and 4.75 percent in July and June 2018 respectively, 4.4 percent in May 2018, 3.6 percent in April 2018, 3.9 percent in February 2018, and 3.4 percent in January 2018.

WPI and CPI Inflation from April 2016

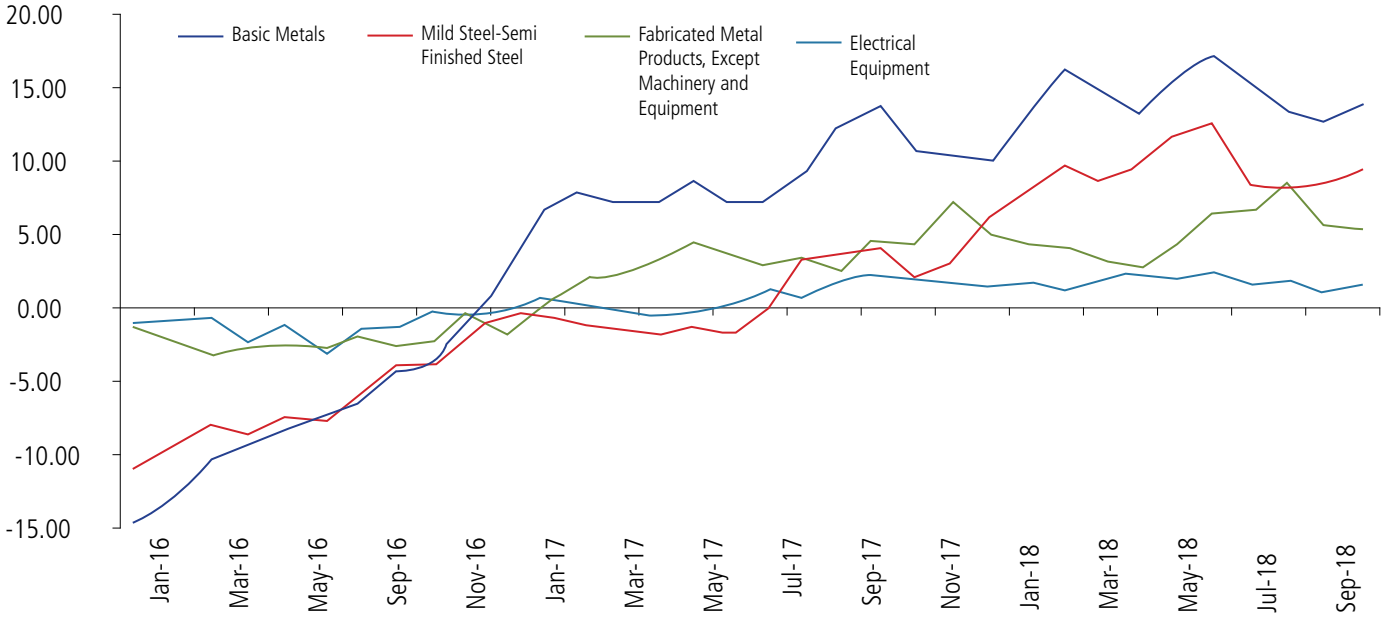


Source: EEPC India analysis

WPI inflationary trend for manufactured items (product-group wise) related to engineering

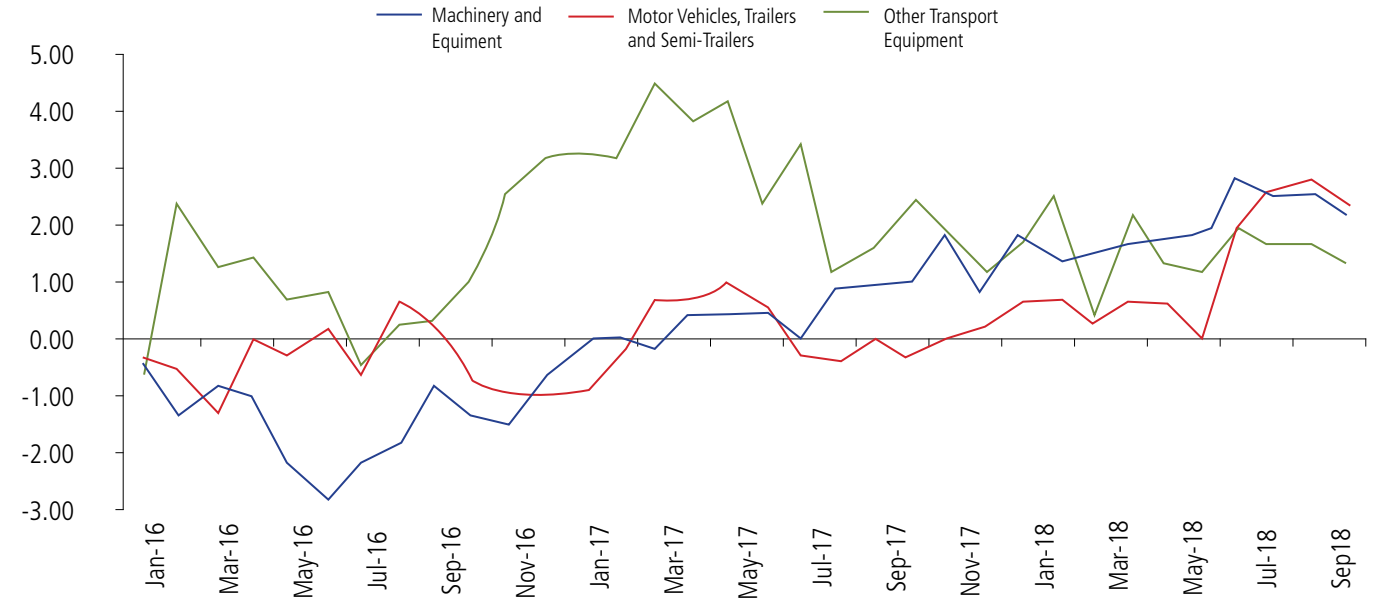
The following two charts represent the trend of WPI-based inflation for some important manufactured product groups that fall under the engineering sector.

Trend of WPI-based inflation for some manufactured products – I



Source: Office of the Economic Advisor, Govt of India

Trend of WPI-based inflation for some manufactured products – II



Source: Office of the Economic Advisor, Govt of India

Industrial production

Industrial output growth declined further to a four-month low of 4.5 percent during September 2018 from an upwardly revised 4.7 percent (as against the preliminary estimate of 4.3 percent) in August 2018. This marginal slowdown in output growth was driven by disruption caused by flood in some parts of the country, coupled with later start in festive production in 2018. Manufacturing output declined to 4.6 percent in September 2018 from an upwardly revised 5.1 percent (from 4.5 percent) in August 2018. Mining sector came back to growth while electricity generation witnessed decent growth in the said month.

As per use-based industries, infrastructure/construction goods and consumer durables recorded higher year-on-year growth in September 2018 while considerable decline in the pace of output growth was noticed in case of primary goods, capital goods, consumer non-durables and intermediate goods on a year-on-year basis during September 2018.

Cumulative industrial growth during April-September 2018-19 was at 5.1 percent as compared to 2.6 percent over the same period last year.

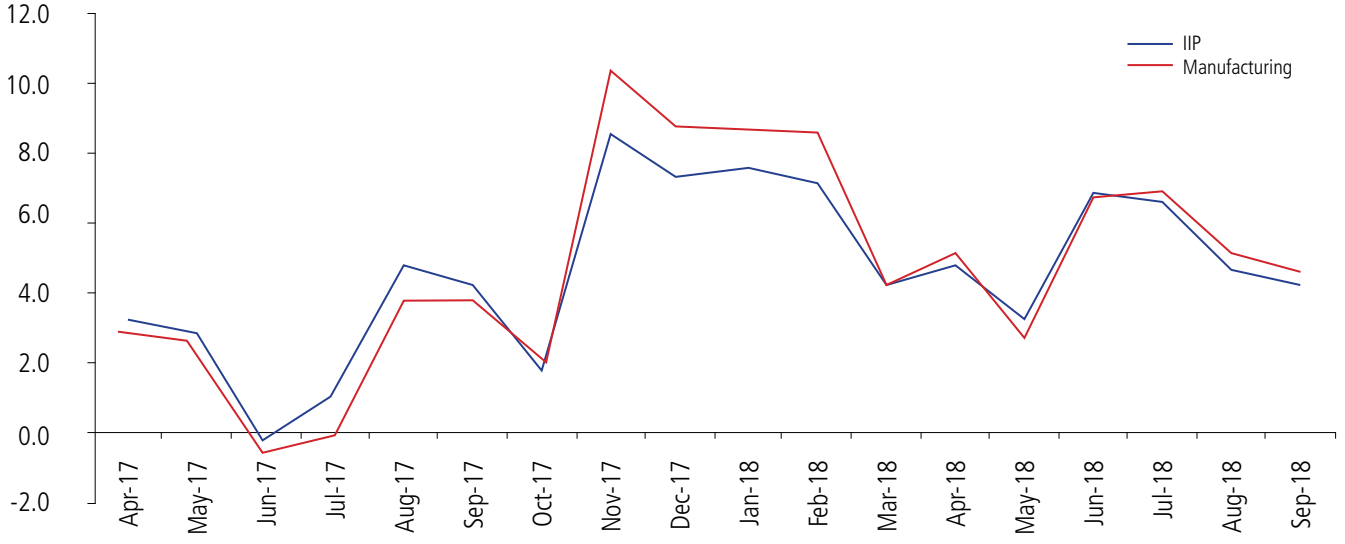
In terms of industries, 17 out of the 23 industry groups (as per two-digit NIC-2008) in the manufacturing sector witnessed positive y-o-y growth during September 2018.

Sector-wise industrial growth (measured by IIP): September 2018

	Weight (%)	Y-o-y growth (%)	Cumulative (Apr-Sep)	
			2017-18	2018-19
General index	**100**	**4.5**	**2.6**	**5.1**
Mining	14.37	0.2	3.9	3.3
Manufacturing	77.63	4.6	2.0	5.3
Electricity	7.99	8.2	5.7	6.2
Primary goods	34.05	2.6	3.7	4.8
Capital goods	8.22	5.8	0.3	7.3
Intermediate goods	17.22	1.4	0.3	1.2
Infrastructure/construction goods	12.34	9.5	2.1	8.7
Consumer durables	12.84	5.2	-1.0	8.1
Consumer non-durables	15.33	6.1	7.5	4.0

Source: CSO, MOSPI, Govt. of India

Trend of overall IIP and manufacturing growth from April 2017



Source: CSO, EEPC Research

Output Growth in Engineering Sector as measured in IIP

The following table depicts y-o-y production growth of the subsectors of manufacturing that fall under the engineering sector. All six industry groups (as per two-digit NIC-2008) that apparently come under the engineering sector recorded positive y-o-y growth during September 2018 other than Electrical equipment. However, all six subsectors registered positive growth on a cumulative basis.

Output growth in subsectors of manufacturing that falls under engineering sector

Industry code	Description of the segment	Weight in IIP (%)	Y-o-y growth Sep 2018	Growth Apr-Sep 2018-19
24	Manufacture of basic metals	12.80	4.2	3.1
25	Manufacture of fabricated metal products, except machinery and equipment	2.65	1.2	7.1
27	Manufacture of electrical equipment	3.00	-3.2	4.1
28	Manufacture of machinery and equipment	4.77	5.8	4.6
29	Manufacture of motor vehicles, trailers and semi-trailers	4.86	9.5	16.9
30	Manufacture of other transport equipment	1.78	11.4	13.0

Source: CSO, MOSPI, Govt. of India

India's foreign trade: October 2018 (merchandise)

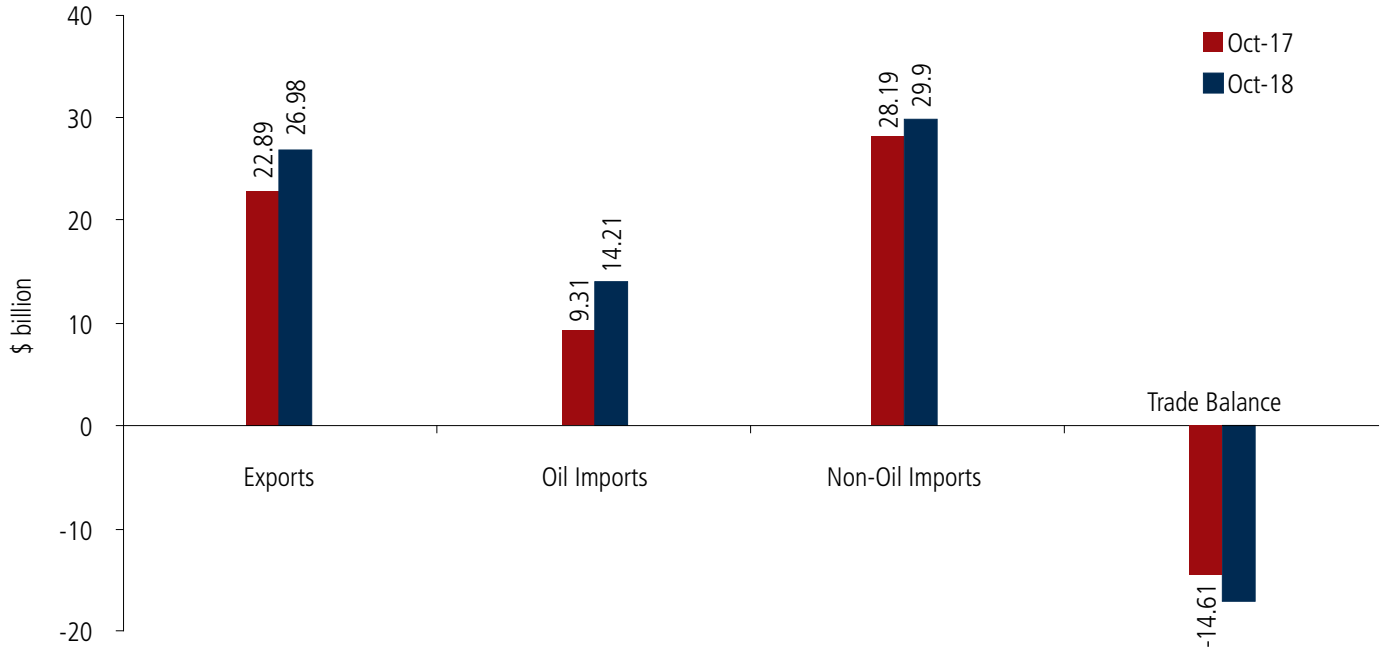
- India's merchandise exports revived significantly from its negative growth recorded last month and registered growth of 17.86 percent in October 2018 compared to October 2017 in dollar terms.
- Overseas shipment from India increased by 33.35 percent in rupee terms in October 2018 over the same period last year. Exports during October 2018 increased to $26.98 billion from $22.89 billion during the same period last year. In dollar terms, the growth was less at 17.86 percent in October 2018 over October 2017.
- Surge in exports in October 2018 over the same month last fiscal was led by expansion in shipment in Petroleum products (49.38), Electronic goods (72.26), Ceramic products and glassware (50.62), Iron ore (13.31), Engineering goods (8.87), Organic and inorganic chemicals (34.01), Drugs and pharmaceuticals (12.83), Spices (17.43), Oil meals (21.01), Carpet (34.13), RMG of all textiles (36.26), Cotton yarn/ fabs./made-ups, handloom products etc (10.23), and Plastic and linoleum (31.86) percent respectively. However, some major commodity groups like Cashew (-41.16), Meat, dairy and poultry products (-22.39), Coffee (-18.52), Rice (-15.98), and Tobacco (-11.04) percent respectively, portrayed negative growth in exports during the reporting month.
- India's merchandise imports during October 2018 were valued at $44.11 billion, which was 17.62 percent higher in dollar terms over the level of imports valued at $37.5 billion in October 2017.
- Major commodity groups of imports showing high growth in October 2018 over the corresponding month last year includes Petroleum, crude and products (52.64), Machine tools (57.38), Sulphur and unroasted iron pyrites (41.87), Organic and inorganic chemicals (26.63), Chemical material and products (34.77), Newsprint (53.2), and Silver (51.77) percent respectively
- Trade deficit for October 2018 increased significantly at $17.13 billion as against the deficit of $14.61 billion during October 2017, registering growth of 17.2 percent. Cumulative trade deficit also surged by 22.1 percent to $111.46 billion during April-October 2018-19 from $91.28 billion in the same period last fiscal.

Merchandise trade: October 2018 ($ million)

	Oct 2018	M-o-m growth (%)	Y-o-y growth (%)	
			Oct 2018	Apr-Oct 2018-19
Exports	26.98	-3.5	17.86	13.27
Imports	44.11	5.2	17.62	16.37
Trade deficit	17.13	22.5	17.25	22.11

Source: Ministry of Commerce, Govt of India

Trend of WPI-based inflation for some manufactured products – I



Source: Ministry of Commerce, Govt of India; EEPC Research

Foreign Exchange Rates - Indian Rupee against Major Traded Currencies during Sep 2018

Currency/time period	USD	GBP	EUR	JYP (=100)
% change in Oct 2018	1.99	-0.85	-0.61	2.28
Direction	Depreciation	Appreciation	Appreciation	Depreciation
% change in 2018	15.75	9.34	9.87	15.23
Direction	Depreciation	Depreciation	Depreciation	Depreciation

Source: RBI reference rates

Rupee witnessed some recovery in October 2018 after touching historic low

The Indian rupee witnessed some recovery after touching its lifetime low at around Rs74.5 per dollar during the first half of October 2018. However, the rupee has depreciated by around 16 percent against the greenback in 2018 till October.

According to economists, this alarming fall of the rupee was attributed to the strengthening dollar, high commodity prices especially of crude oil, rising US rates on the global front, coupled with domestic factors such as widening trade/current account deficit, inflationary pressures, and likely fiscal slippage. Measures adopted by the government to arrest the fall may start yielding fruit going forward.

Note: For real time data and statistics, please visit EEPC India website: https://www.eepcindia.org/forex-rate.aspx?id=none&ms=26&page=Forex-Rates

Credit growth of scheduled commercial banks (SCBs) year-on-year (%)		
Sector	**Between 30 Sep 2016 and 29 Sep 2017**	**Between 29 Sep 2017 and 28 Sep 2018**
Gross bank credit	**5.5**	**11.3**
Non-food credit	**6.1**	**11.3**
Industry	**-0.4**	**2.3**
Micro and small (mfg only)	1.7	-1.4
Medium	-8.0	3.3
Large	-0.4	2.9
Priority sector	**3.7**	**6.6**
Micro and small enterprises	3.8	9.5
Manufacturing	1.7	-1.4
Export credit	-7.0	-51.3

Source: RBI

- Credit disbursal towards industry continued to see a weak but steady y-o-y growth in September 2018 on a negative base.
- Credit disbursal towards manufacturing sector has been increasing on a negative base.
- Export credit disbursal from foreign banks continued to be dismal.

Prevailing policy rates, ratios and interest rates as on 27 November 2018	
Instruments	**Existing rates (%)**
Policy repo rate	6.50
Reverse repo rate	6.25
Marginal standing facility rate	6.75
Bank rate	6.75
Cash reserve ratio (CRR)	4.00
Statutory liquidity ratio (SLR)	19.50
Lending / Deposit Rates	
Base rate	8.85-9.45
MCLR (overnight)	8.15-8.45
Savings deposit rate	3.50-4.00
Term deposit rate > 1 year	6.25-7.50

Source: RBI

DO YOU KNOW?

This is the first instalment of our newly-launched multiple choice quiz section, which will appear every month. We look forward to your active participation, so send us your answers asap. The names of the first three winners will appear in our next issue. **Mail your answers to: dgupta@eepcindia.net.**

1 Who invented the Ballpoint Pen?

A. Biro Brothers
B. Waterman Brothers
C. Bicc Brothers
D. Write Brothers

2 In which decade was the first solid state integrated circuit demonstrated?

A. 1950s
B. 1960s
C. 1970s
D. 1980s

3 What did JB Dunlop invent?

A. Pneumatic rubber tyre
B. Automobile wheel rim
C. Rubber boots
D. Model airplanes

4 Which scientist discovered the radioactive element radium?

A. Isaac Newton
B. Albert Einstein
C. Benjamin Franklin
D. Marie Curie

5 When was barbed wire patented?

A. 1874
B. 1840
C. 1895
D. 1900

6 What did James Watt invent?

A. Diving bell
B. Steam boat
C. Hot air balloon
D. Rotary steam engine

7 Name the CalTech seismologist who invented the scale used to measure the magnitude of earthquakes.

A. Charles Richter
B. Hiram Walker
C. Giuseppe Mercalli
D. Joshua Rumble

8 What did Galileo invent?

A. Barometer
B. Pendulum clock
C. Microscope
D. Thermometer

8 This statesman, politician, scholar, inventor, and one of the early presidents of the USA invented the swivel chair, the spherical sundial, the mouldboard plough, and the cipher wheel.

A. George Washington
B. Alexander Hamilton
C. John Adams
D. Thomas Jefferson

10 What did Benjamin Franklin invent?

A. Bifocal spectacles
B. Radio
C. Barometer
D. Hygrometer

11 Who invented the Jet engine?

A. Sir Frank Whittle
B. Gottlieb Daimler
C. Roger Bacon
D. Lewis E Waterman

12 What invention caused many deaths during its testing?

A. Dynamite
B. Ladders
C. Racing cars
D. Parachute

TRADE SNIPPETS

India emerged as the top recipient of greenfield FDI inflows as per a trade review released by the Commonwealth in 2018. Some of the recent significant FDI announcements are as follows:

- In August 2018, Bharti Airtel received approval of the Government of India for sale of 20 percent stake in its DTH arm to a United States-based private equity firm, Warburg Pincus, for around $350 million.
- In June 2018, Idea's appeal for 100 percent FDI was approved by the Department of Telecommunication (DoT) followed by its Indian merger with Vodafone, making Vodafone Idea the largest telecom operator in India.
- In May 2018, Walmart acquired a 77 percent stake in Flipkart for a consideration of $16 billion.
- In February 2018, Ikea announced its plans to invest up to Rs4000 crore ($612 million) in the state of Maharashtra to set up multi-format stores and experience centres.
- The Department of Economic Affairs, Government of India, closed three FDI proposals leading to a total foreign investment worth Rs24.56 crore ($3.8 million) in October 2017.
- Kathmandu-based conglomerate CG Group is looking to invest Rs1000 crore ($155.97 million) in India by 2020 in its food and beverage business, stated Mr Varun Choudhary, Executive Director, CG Corp Global.
- International Finance Corporation (IFC), investment arm of the World Bank Group, is planning to invest about $6 billion through 2022 in several sustainable and renewable energy programmes in India.

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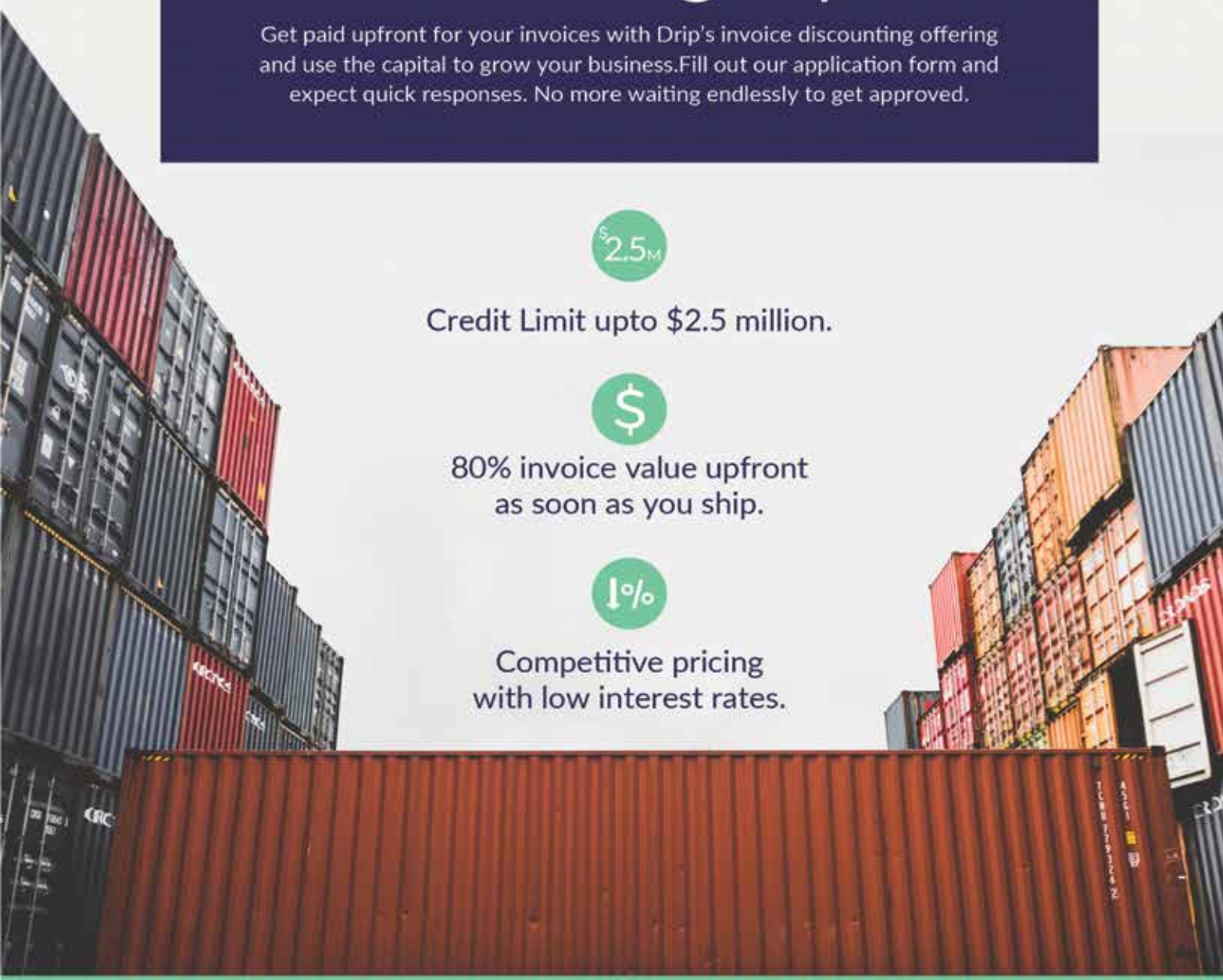

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Meeting on non-tariff barriers

EEPC India organised a Meeting on Non-Tariff Barriers and other trade-related issues in New Delhi. (**1**) The dignitaries at the meeting were Mr Suranjan Gupta, Executive Director, EEPC India; Mr Rajeev Kher, Former Commerce Secretary, Government of India; Dr Harsha Vardhan Singh, DG, WTO; Dr Viswanathan, Consultant, WTO; Mr Sanjay Beswal, Regional Committee Member (NR), and Mr Rakesh Suraj, Regional Director (NR), EEPC India; and Mr Rajesh Khandelwal, Chartered Accountant (**2**) Mr Rajeev Kher, Former Commerce Secretary, Government of India; Dr Harsha Vardhan Singh, DG, WTO; and Dr Viswanathan, Consultant, WTO. (**3**) A view of the meeting.

Interactive Session with RBI

EEPC India held an Interactive Session with RBI in Bengaluru. (**4**) Mr R Seshagiri, Dy Regional Chairman (SR), EEPC India, welcoming the speakers and participants in the session. (**5**) Mr B R Devanandan, Manager, RBI, and (**6**) Mr R Sudeep, General Manager, RBI, addressing the session.

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Export awareness and opportunities at IESS VIII

Continuing its promotional activities in view of the forthcoming IESS VIII, EEPC India organised an Export Awareness Seminar (under Niryat Bandhu Scheme) & Business Opportunities at IESS VIII in Rohtak, Haryana.
(**7**) The speakers at the seminar: Mr Sanjay Beswal, Regional Committee Member (NR), EEPC India; Ms Niranjana Nagpal, Branch Manager, ECGC Ltd; Mr Rakesh Suraj, Regional Director (NR), EEPC India; Mr Ravi Vasdev, Regional Committee Member (NR), EEPC India; and Mr Kapil Wadhwa, Regional Head, IndusInd Bank. (**8**) Mr Sanjay Beswal, Regional Committee Member (NR), and (**9**) Mr Rakesh Suraj, Regional Director (NR), EEPC India addressing the participants.

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Meet on Hannover Messe 2019

EEPC India and representatives from the Embassy of Sweden and the media among others were invited to a press conference and meeting in Mumbai by Hannover Milano Fairs India (HMFI) for discussions on Hannover Messe 2019, scheduled to be held over 1-5 April 2019 in Hannover, Germany. (**10**) The meeting in progress. (**11**) Ms Ashwini Mistry, Project Manager – HMFI; Ms Geeta Bisht, Director – HMFI; Ms Ulrika Sundberg, Ambassador of Sweden in India; and Mr Mukesh Samtani, Assistant Director (WR), EEPC India.

EEPC India at World Trade Expo 2018, Mumbai

EEPC India participated in the multiproduct trade fair, World Trade Expo 2018, in Mumbai. (**12**) Mr Rajat Srivastava, Regional Director (WR) & Director (Marketing and Sales) (right), participating in an open house discussion on 'Ease of Doing Business.' On his right Mr Subhash Aggarwal, IRS, Commisioner, Mumbai Port; Mr Ramesh Chander, IRS, Commissioner, JNPT; Mr Vijay Kalantarivijay, Vice-President, WTC Mumbai; and Mr Sambhaji Chavan, ITS, Dy DGFT, Mumbai. (**13**) & (**14**) Mr KL Dhingra, Regional Chairman (WR), EEPC India (right), interacting with visitors at the EEPC India booth. (**15**) Mr Rajat Srivastava and Mr Mukesh Samtani, Assistant Director, EEPC India, discussing prospects of collaboration with officers of the Malaysian External Trade Development Corporation. (**16**) Mr Rajat Srivastava with Mr Rajan Kumar, Advisor – Business Development, Department of Trade and Industry, South Africa, in the EEPC India booth and (**17**) with Ms Lerato Mashile, Consul-Political, Department of Trade and Industry, South Africa, in the South Africa booth. (**18**) Mr Mukesh Samtani with Ms Tshering Lhaden from the Bhutan Chambers of Commerce & Industry and (**19**) with Mr Kpodar Messanvi and Mr Kondi Mani from the Embassy of the Republic of Togo.

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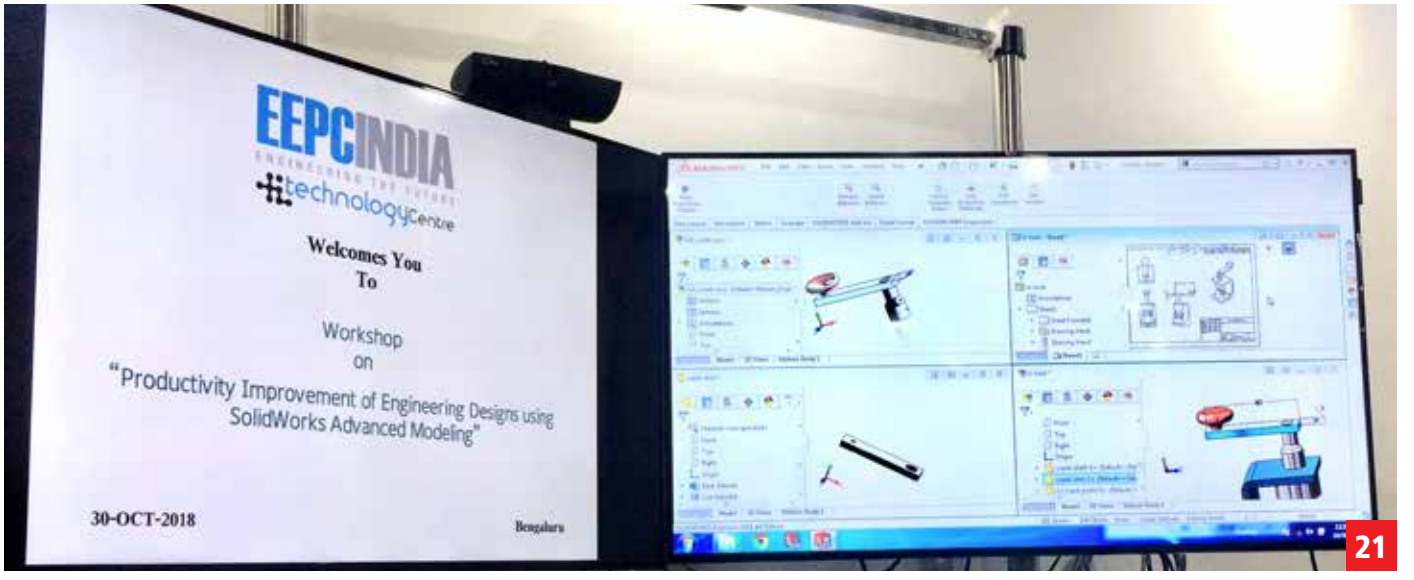

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Workshop on Engineering Designs using Solid Works tools

EEPC India Technology Centre, Bengaluru, conducted a Workshop on Productivity Improvement of Engineering Designs using Solid Works Advanced Modelling. (**20**) The workshop participants. (**21**) The workshop in progress.

Workshop on Export Credit

EEPC India participated in a Workshop on Export Credit organised in Kolkata by the State-Level Bankers Committee led by the United Bank of India. (**22**) Ms Anima Pandey, Regional Director (ER) & Director (Membership), EEPC India, briefing Mr Sanjay Kumar, Executive Director, UBI, about the activities of EEPC India. (**23**) Mr Imtiyaz Ahmad, DGM, RBI; Mr Mukti Ranjan Ray, GM – PRISEC & SLBC Convenor from UBI; Ms Anima Pandey, Regional Director (ER) & Director (Membership), EEPC India, and Mr Ramendu Bhattacharjee, DGM – PRISEC from UBI at the workshop.

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Certification Course in Foreign Trade

EEPC India conducted a Certification Course in Foreign Trade (Module 1) – International Marketing in its Mumbai office. (**24**) Mr Pratap Singh Bharda, Executive Officer, EEPC India, welcoming the Mr Arvind Khedkar, who conducted the training. (**25**) Participants at the Training Programme.

New Members' Meet

A New Members' Meet was held in EEPC India's Regional Office in Mumbai. (**26**) Ms Varsha Baria (right foreground) and (**27**) Mr Pratap Singh Bharda (right foreground), Executive Officers, EEPC India, welcoming the new members and informing them about EEPC India's activities.

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Vice President visits Global Expo Botswana 2018 ...

Mr Muppavarapu Venkaiah Naidu, Vice-President of India, visited the India Pavilion, organised by EEPC India at Global Expo Botswana 2018.

(**1**) Mr Rohinton R Engineer, Working Committee Member, EEPC India, greeting the Vice-President of India, Mr Muppavarapu Venkaiah Naidu at the India Pavilion in Global Expo Botswana 2018.

(**2**) Dr Rajesh Ranjan, High Commissioner of India in Botswana, touring the India Pavilion. Mr Rohinton R Engineer, Working Committee Member, and Mr V C Ravish, Sr Executive Officer, EEPC India are seen.

(**3**) The India-Botswana CEOs Roundtable welcoming Mr Muppavarapu Venkaiah Naidu, Vice-President of India. Dr Rajesh Ranjan, High Commissioner of India in Botswana, and Mr Rohinton R Engineer, Working Committee Member and Mr V C Ravish, EEPC India, were present among others. (**4**) Mr Slumber Tsogwane, Vice-President of Botswana, accompanying Mr Muppavarapu Venkaiah Naidu, Vice-President of India, on his tour of the India Pavilion.

Visit of Hon'ble Vice President of India
Shri M. Venkaiah Naidu to Botswana

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... Vice President visits Global Expo Botswana 2018

(**5**) & (**6**) VIP tour of the India Pavilion. (**7**) Mr Muppavarapu Venkaiah Naidu, Vice-President of India, being felicitated by Mr V C Ravish, Sr Executive Officer, EEPC India, at the EEPC India booth. (**8**) Visitors at the EEPC India booth.

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INTERNATIONAL ENGINEERING SOURCING SHOW VIII
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Elmia Subcontractor 2018, Sweden ...

EEPC India organised the India Pavilion in Elmia Subcontractor 2018, held in Jönköping, Sweden. (**9**) Mr Mukesh Kaushik, Second Secretary, Commercial and Culture, Indian Embassy in Sweden, inaugurating the India Pavilion. On his left, Mr R Seshagiri, Dy Regional Chairman (SR), and Mr C H Nadiger, Regional Director (SR), EEPC India. (**10**) Mr Mukesh Kaushik, Second Secretary, Commercial and Culture, Indian Embassy in Sweden interacting with Indian exhibitors. (**11**) Mr Mukesh Kaushik, Second Secretary, Commercial and Culture, Indian Embassy in Sweden, in discussions with Mr R Seshagiri, Dy Regional Chairman (SR), and Mr C H Nadiger, Regional Director (SR), EEPC India, at the EEPC India booth.
(**12**) VIP tour of India Pavilion.

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Proliferation of segments
Improved supply chain infrastructure
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INDIA-SWEDEN BILATERAL TRADE
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POP-UP expo

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... Elmia Subcontractor 2018, Sweden

(**13**) Mr C H Nadiger, Regional Director (SR), EEPC India, entertaining a visitor at the EEPC India booth. (**14**), (**15**) & (**16**) Glimpses of the India Pavilion.

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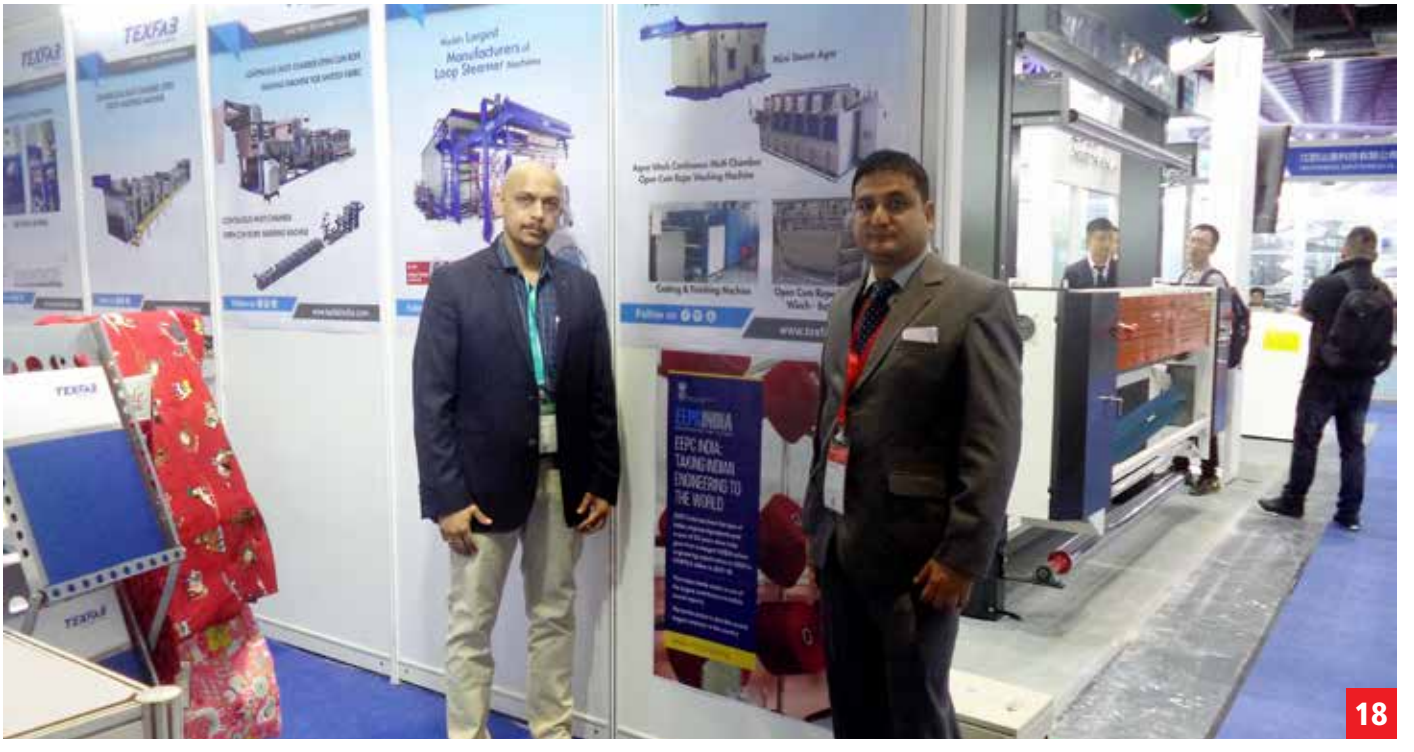

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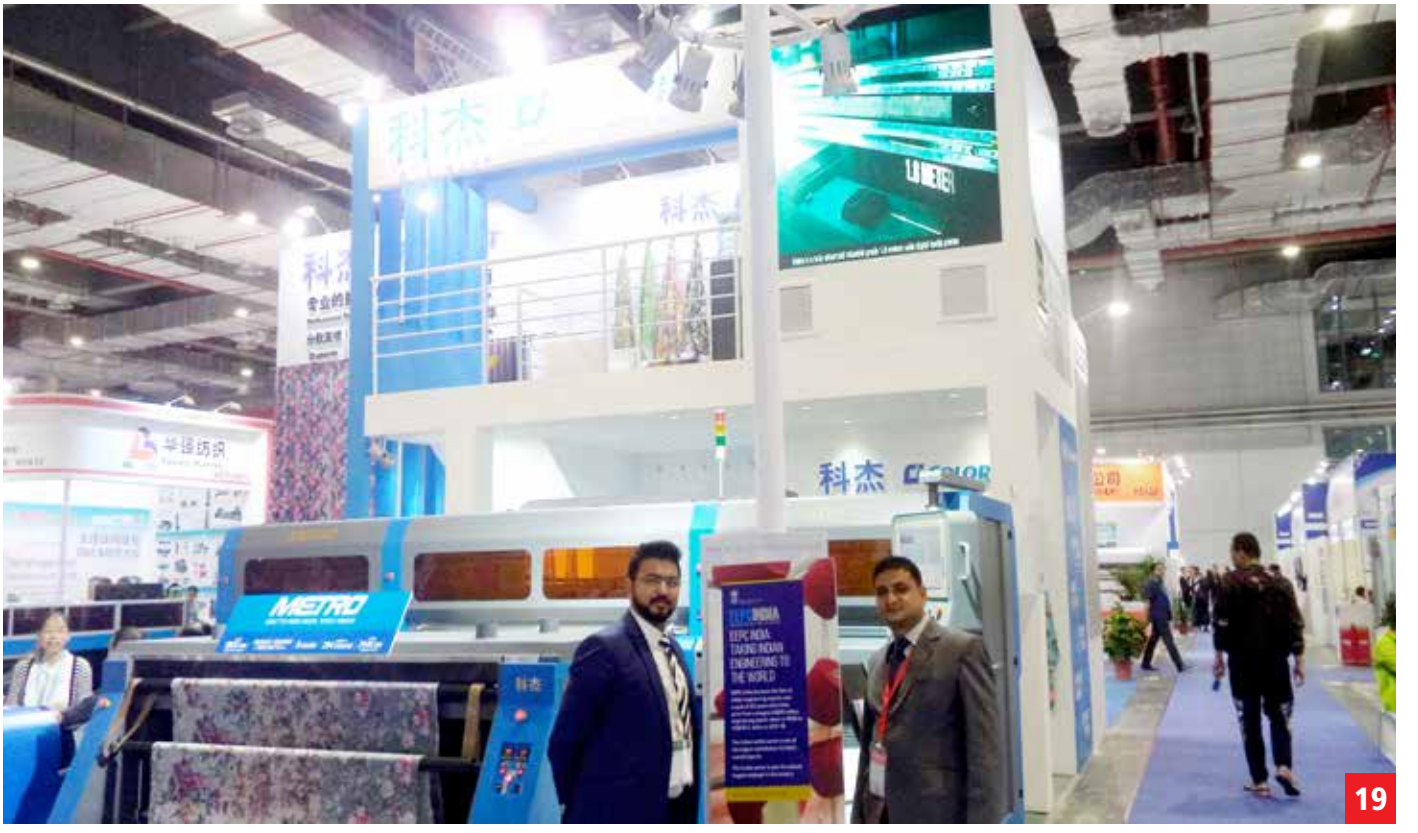
ITMA ASIA + CITME 2018, Shanghai

EEPC India organised the India Pavilion at ITMA ASIA + CITME 2018 in Shanghai, China. (**17**) Dr J Arvind, Consul, Consulate-General of India in Shanghai (right) on a tour of the India Pavilion at ITMA ASIA + CITME 2018 accompanied by Mr Pratap Singh Bharda, Executive Officer, EEPC India. (**18**), (**19**) & (**20**) Glimpses of the India Pavilion.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EEPC INDIA CALENDAR OF EVENTS

Name of the Event	Place	Date
India Pavilion at Autotech 2018	Cairo, Egypt	14 - 16 December 2018
RBSM at Imtex 2019	Bengaluru, India	24-30 January 2019
India Pavilion at Arab Health 2019	Dubai, U.A.E	28-31 January 2019
India Pavilion at Asia Pharma Expo 2019	Dhaka, Bangladesh	31 January - 2 February 2019
India Pavilion at Aquatherm 2019	Moscow, Russia	12-15 February 2019
India Pavilion at Middle East Electricity 2019	Dubai, U.A.E	5 - 7 March 2019
International Engineering Sourcing Show VIII (IESS - VIII)	Chennai, India	14 – 16 March 2019

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