# Indigenization: Key to Self-Sufficiency and Global Power

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**Abstract**

The changing nature of threats necessitates the Armed Forces to constantly plan and upgrade their military arsenals. Currently our defence acquisitions have more than 2/3rd of import content, which, to be realistic, is alarming. As India's geo-political and economic ambitions grow, it needs to develop robust indigenous manufacturing capabilities and ecosystem to secure its ambition for self-reliance in the Aerospace and Defence industry. Indigenisation is the key to self-sufficiency and strategic capability. Creation of innovation culture in the country will further accelerate the process of indigenisation. Government has undertaken number of steps including Make in India programme to facilitate investment, foster innovation, protect intellectual property, and build best-in-class manufacturing infrastructure. The research gives glimpse of current position of defence industry and brings out the necessity and the challenges involved in indigenisation. A case study of defence industry of Israel and China's has also been elucidated. Accordingly, a framework in the form of recommendations for developing India's defence industry has been specified.

**Keywords:** Defence Industry and Technological Base (DITB), indigenisation, self-reliance, self-sufficient, Make in India (MII)

## 1. Introduction

The changing nature of threats from other nation states and non-state actors, the ever increasing capabilities and weapon acquisition programmes of the potential adversaries and the ongoing continuous research and emergence of new military technologies around the world, are a few of the key drivers that necessitate the Armed Forces to constantly plan and upgrade their military arsenals.

The military hardware and software is either developed by a home grown Defence Industry and Technological Base (DITB) or is procured from other foreign sources and is expected to provide the desired combat edge and the technological superiority over its adversaries. To achieve superiority over the entire spectrum of conflict, ie conventional, strategic or non-conventional domains of warfare, military capability development programmes need to be innovative in planning, contemporary and revolutionary in design, comprehensive and yet flexible to accommodate the ever dynamic parameters at the development stage of the project itself. Further, the indigenously developed or procured military hardware/software needs to optimally exploited and effectively sustained throughout its entire life cycle [1].

An ideal arrangement for sustaining military systems could be argued to be the one where, the Original Equipment Manufacturer (OEM) or the Production Agency (PA) itself performs the life cycle maintenance engineering and logistics management functions. However, such an arrangement when tried out by the Armed Forces in the US, Australia, Canada and the UK, met with little success and the Forces soon had to revert back to their in-house Maintenance, Repair and Overhaul (MRO) agencies, to deliver time bound and effective support services. A comprehensive military equipment life cycle support should span from the womb (i.e. the identification of the need for acquisition of a military system) to the tomb (i.e. the disposal of that very military system after its full exploitation). It should ideally be delivered by a modern and vibrant scientific, technological and industrial base that is autonomous in nature and indigenous in make i.e. home-grown within the country. "Indigenisation is the key to self-sufficiency and strategic capability". Largest weapons suppliers and recipients in the world are as shown in figure 1.

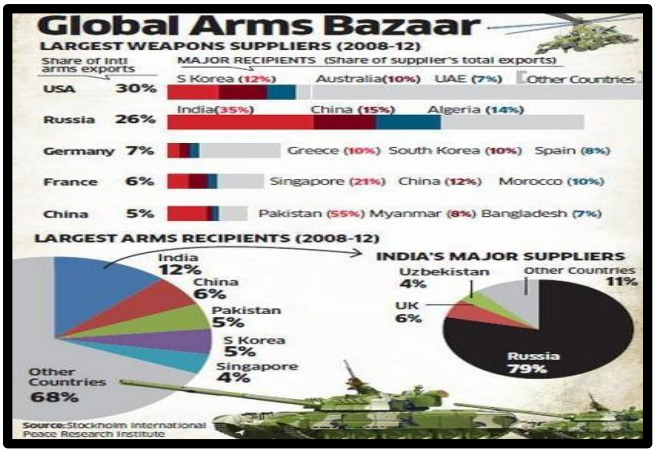


Figure 1: Largest weapons suppliers and recipients

Indigenization, Self-Reliant, Self-Sufficient

The capability to design, develop and manufacture equipment within the country, using our own skills and resources, constitutes indigenization. This implies, the domestic industry must develop in-house capacities, resources and skill sets that will not only help manufacture or produce the country's civil and defence requirements but also assist the nation in creating a long term advantage by providing a competitive export business for such products. The capability to maintain and repair these, as well as the equipment sourced from abroad, makes us self-reliant. Not depending on the foreign suppliers for anything makes us self-sufficient. Indigenization is the process of shortening supply chain and ensuring reliable product support. Indigenization is more of a Make in India then Made in India

## 2. INDIAN DEFENCE INDUSTRY

India is at the cusp of metamorphosing from a top regional player to one with global clout. As India's geo-political and economic ambitions grow, it needs to develop robust indigenous manufacturing capabilities and ecosystem to secure its ambition for self-reliance in the Aerospace and Defence industry. Presently, Most of the platforms and weapons are of foreign origin-primarily from Russia. The majority of India's tanks, ships and fighter aircraft are ex- Soviet design. While some of them have been assembled in India, in reality India is yet to acquire appropriate skills to design and manufacture even the basic inventory like personal weapons and artillery guns.

The current acquisition process targets procurement of weapon platforms and equipment for modernization while according reasonable priority for in-house research and development. However, the change in defence technology base and production capability of Defence Public Sector Undertakings (DPSUs) and Ordnance Factories (OFs) can at best be described as 'Incremental' and not 'transformative'. The weapons & equipment procured from Israel, Russia and certain other countries needs constant support from their engineers for repair and maintenance. Even in the case of tanks, aircrafts and vehicles that are manufactured in India, under license from the original manufacturer, the Transfer of Technology (ToT) has not taken place in the true sense. In many cases, the Indian companies are merely assembling completely knocked down or semi-knocked down kits under the banner of Made in India. There is also slippage in timelines of ammunitions and weapon systems supplied by DPSUs and OFs.

However, there is a sense of urgency, clearly evident in the defence establishment for facilitating the participation of Private Industry in defence products with ToT. In order to make up for the lack of highly sophisticated technology, ToT is essential, as an interim measure, till indigenous enterprises gain sufficient expertise. In Indian defence industry Indigenization gained impetus post break up of USSR in 1994-95 due to depleting product support from OEMs. It is a Key Result Area (KRA) of GoI. In last few years, GoI has taken number of steps to promote indigenisation by encouraging Private Sector participation in Defence Sector. Releasing Long Term Integrated Perspective Plan (LTIPP), initiating 'On-line' application for issue of Industrial Licenses and enhancing FDI limit in Defence Sector. The effort is aimed to encourage private industry to venture into design & development and manufacture of weapons, equipment, specialist vehicles and warplanes. R&D spending in India has grown by double-digit percentage points in recent years while innovative capacity lags. Innovation is about culture and this is a factor over which government has only peripheral control. Despite its low rankings in the Global Innovation Index (GII), India appears to have a healthy startup environment.

Currently, the country allocates about 1.56 percent of its GDP (2017-18) to defence spending and imports about 70 percent of defence equipment. Owing to the dynamic security environment, India's defence requirements are likely to increase, making indigenous development of modern defence hardware and technology a top priority for the government. Figure 2 depicts the progress of Indian Defence budget [2].

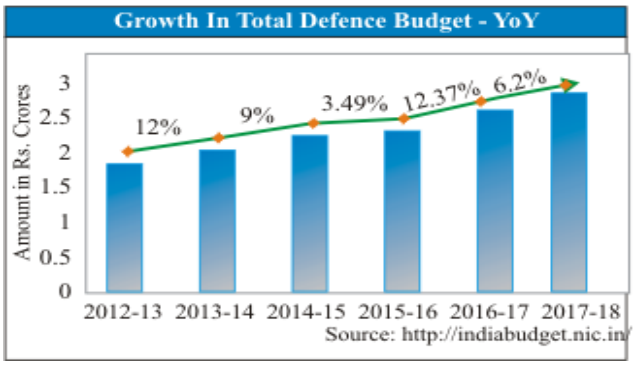


**Figure 2: Indian Defence Budget**

### 3. NEED FOR INDIGENIZATION

Self-reliance in defence technology and production is a pre-requisite for any nation that aspires to become a great power and have an enviable standing in the comity of nations. Thus the need for indigenization is as follows:

(a) Currently our defence acquisitions have more than 2/3rd of import content, which to be realistic, is alarming.

(b) The drying up of spares and assemblies after the break-up of USSR is a stark reminder of heavy dependence on imported weapons systems.

(c) Critical deficiency of Artillery ammunition during the Kargil War was made up by import from South Africa.

(d) Indigenisation will reduce dependency on foreign vendors and save valuable foreign exchange.

(e) It will propel technological advancement and improve capabilities of domestic industry.

(f) It will foster culture of innovation and nurture unorthodox thinking and its application

(g) It will improve overall confidence through self-reliance.

### 4. CHALLENGES IN INDIGENISATION

The changing nature of threats in the emerging geopolitical scenario, India has to focus on building capacity for continuous modernisation of the Armed Forces.The priority should be to maximise its indigenous production while ensuring quality of defence equipment [3]. The challenges it is likely to face are as follows:

(a) The Indian defence budget allocates approximately 6% towards R&D spend as compared to 15% by France and 12% by the US.

(b) High R&D costs with long gestation periods for realising R&D benefits have deterred private involvement and investments in R&D.

(c) India is faced with limited expertise in designing critical equipment in advanced technology.

(d) India lacks innovation culture, adequate infrastructure and trained human capital to support R&D initiatives.

(e) End users not fully involved in the decision-making process with key R&D agencies like the DRDO.

(f) Existing agencies have not been very successful in sharing R&D capabilities with private players.

(g) Lack of competition within R&D agencies.

(h) Low order Quanitity (MOQ) from defence forces.

(i) Non availability of required raw materials.

(j) Non availability of required Technology

(k) Stringent qualification and certification requirements

(l) Non availability of testing facilities

### 5. MAKE IN INDIA (MII)

Make in India is an initiative undertaken by Government of India (GoI) to make India a Global Manufacturing Hub. It can be considered as one of the steps for the self-reliance [4].

**Aim of the MII Initiative**

To facilitate investment, foster innovation, protect intellectual property and build best-in-class manufacturing infrastructure [5].

(a) To create 100 million jobs over the next decade and bring manufacturing up to 25% of Indian GDP.

(b) To maintain high quality standards and minimise the impact on the environment.

(c) To achieve self reliance.

(d) To make for India and for the world.

Enablers For Make In India

(a) Extensive modernization plans with focus on homeland security.

(b) Introduction of new category for capital procurement - Buy Indian —IDDM and preference to local manufacturing categories over total imports [6].

(c) Requirement of indigenous content has been enhanced.

(d) Foreign OEM can now select his Indian partner.

(e) Introduction of mandatory offset of 30 % for capital purchase beyond 2000 Cr for building an eco-system of suppliers domestically.

(f) The initial validity period of industrial licenses has been increased from 3 to 15 years.

(g) Tax incentives to manufacturing companies for expenditure on R & D and for money paid to National laboratory, University etc for scientific research.

(h) Additional incentives from state Govt like subsidised land cost, relaxation in stamp duties, power tariff etc

(i) Export incentives like duty remission, export promotion capital goods scheme etc.

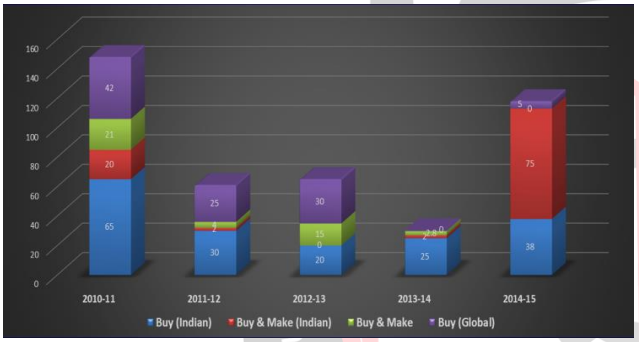


**Figure 3: Indian Defence Budget: Category-wise-Acceptance of Necessity**

The intent of the government is reflected through 75 % of grant of AON to Buy and make (Indian) over 5 % to buy (Global). Category-wise Indian defence budget with based on acceptance of necessity is shown in figure 3.

## 6. SWOT ANALYSIS OF INDIAN DEFENCE INDUSTRY

Strengths

(a) Favorable Government policies and intentions.

(b) Large domestic market.

(c) Strong R&D set-up of DRDO, 52 Defence Labs / Establishments.

(d) 09 DPSU & 39 OFs, DPSUs contributing approximately 63% of manufacturing output.

(e) 200 Major Firms/ 1000 MSMEs

(f) Large pool of talented scientists and engineers

(g) Skilled and Cheap Labour

Weaknesses

(a) High dependence on import of capital equipment

(b) Low absorption and ToT by DPSUs and OFs

(c) Limited indigenous machine tool building capability

(d) Talent attraction and retention

(e) No National Security Strategy Doctrine

(f) DRDO Budget less than 10% of Defence Budget

(g) DPSUs bidding despite orders spilling timelines.

(h) Lack of experience in Defence manufacturing

(i) Private Sector lacks Testing & Evaluation facility.

(j) OFs/ DPSUs still depended on imports for core technologies.

**Opportunities**

(a) Shrinking defence budgets in the US and Europe.

(b) Offset policy can stimulate domestic value-chain.

(c) Allowing private participation in MToT will create domestic industry in MRO

(d) Large import bills

(e) India & China likely to spend half of the world's total Defence spending by 2045.

(f) Defence technology has Commercial Spin Offs.

(g) JVs with foreign companies started with FDI upto 49%

Threats

(a) Competition from emerging economies for OEM investments and ToT.

(b) Adversaries also investing in acquisition and development of a defence industrial base.

(c) Near to specs technology available in neighborhood.

(d) Accelerated obsolescence of current technologies.

(e) Cost prohibitive investment to keep the edge.

(f) Life Cycle Costs of Operations and Maintenance constitute 60-80 per cent of the total Life Cycle Costs.

## 7. CASE STUDY: ISRAEL

Israel is a country that was born in a war and since then has more or less never stopped being in a war. Israel's arms industry is older than the state itself, tracing its origins back to the days of covert workshops of the Hagana and other resistance groups in the pre-independence era of the 1930s. After attaining independence in 1948, procurement of highly sophisticated arms remained a principal factor of Israeli military preparedness. The French arms embargo in six day war in 1967 came as a shock to Israel's leadership and public that caused a shift in policy towards self-sufficiency in major battlefield platforms through indigenous research, development and fabrication. Within a few years, the nation had developed an advanced arms industry unmatched in the third world in terms of technological sophistication [7].

Israel is currently one of the world's leading exporters of defence goods and services. Israel's defense-related exports in 2017 totaled $9.2 billion (Figure 4). Israel's defense industries are highly valued, respected and trusted throughout the world.

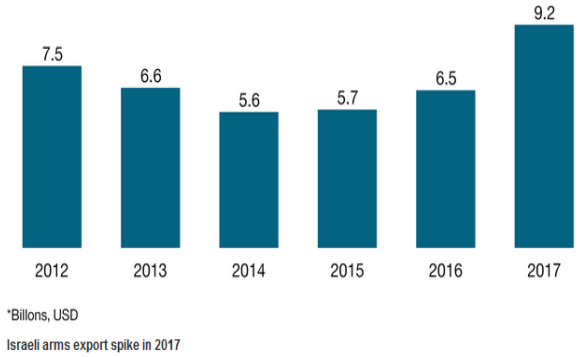


**Figure 4: Israel Arm exports (in Billion)**

Salient Features

(a) The sense of powerlessness felt by the Jews, served as a potent factor in the ideas of the Jewish nationalism and self-emancipation.

(b) A series of wars that Israel was involved in made it natural for it to develop a defence industry of its own for survival.

(c) Rearming of Arabs in 1960 and Frequent Arms sanction/ Embargos pushed Israel to develop Indigenous capability.

(d) Early infrastructure was provided by Govt. which expanded to 150 Companies/ 03 SOEs( IAI, IMI & Rafael)/ Elbit Pvt Ltd

(e) Massive Losses during 1980 crises led to development of niche systems.

(f) Allocation of 4.2 % of GDP on R&D of Science & Technology.

(g) Runs conscription Army / Skills learned are transferable to civilian life.

(h) Implementation of Mandatory Industrial Co-op Regulation

(i) Industrial Co-op must if imports > 05 million

(ii) Offset clause also in follow up contracts is 50%

(i) Israel's defence requirements placed a tremendous burden on Israel's economy that acted as a catalyst.

Strengths

(a) Highly educated people with comprehensive knowledge base.

(b) Reverse Engineering

(c) Synergy between Industry and Israel Defence Industry

(d) Allocation of 7.5% of Defence Budget for R&D.

(e) Quick Ops solutions through fast tracked development process

(f) Cordial relation with USA.

(g) Partnership with Private companies to develop commercial applications of Military Technology.

(h) Exports aimed at developing Countries (Vietnam, Azerbaijan, India, Brazil and Poland) (Figure 5).

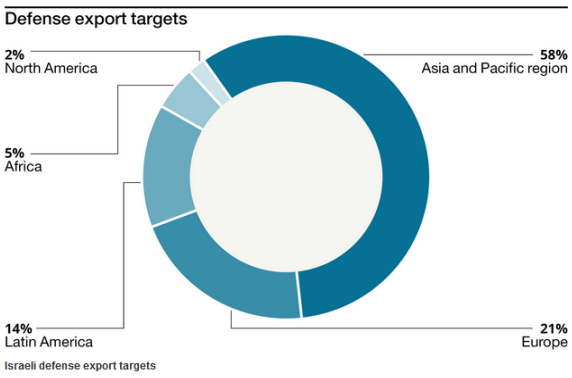


**Figure 5: Israel export targets**

## 8. CASE STUDY: CHINA

China's DTIB is unique and is shaped by requirements of the principal consumer of its products and services, the PLA. The demands placed on China's DTIB are

more complex and challenging than elsewhere due to the sheer size of the PLA and the late point at which it embarked upon a programme of defence modernization [7].

China's defence modernisation constitutes something of a moving target for the PLA as it seeks to develop capabilities on a par with other major powers such as the United States and Russia. As the pace of defence modernisation accelerates, the demands on China's DTIB are increasing. The Chinese government expects the DTIB to provide the full range of armaments operated by the PLA. China moved quickly to develop arms production capabilities following the establishment of the People's Republic in 1949. Initial strategy was based on import substitution. However, in the wake of its political break with the Soviet Union in 1960, which ended China's access to Soviet arms and highlighted the importance of industrial security in the form of defence-industrial autonomy. Self-reliance in defence was regarded as indispensable to China's security. This propelled defence R&D efforts as well as indigenous production of a comprehensive range of arms that made China self-sufficient in every category. Annual Chinese defence expenditure is as shown in figure 6.

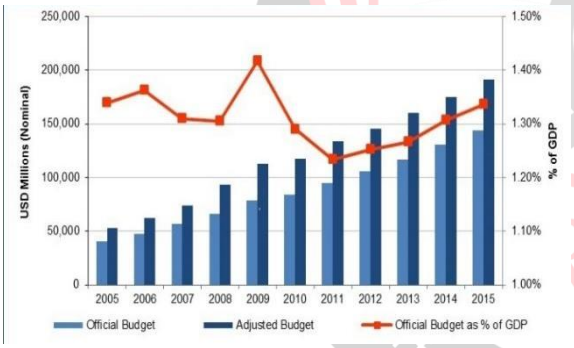


**Figure 6: Chinese Defence Expenditure**

Salient Features

(a) DTIB began with creation of PLA-1930.

(b) Platforms build based on Soviet designs and help between 1950-1997.

(c) Largest importer of defence equipment between 1998- 2005.

(d) Larger Defence Industry Enterprise Groups (DIAG) formed with Domain expertise responsible for Profit or loss

(e) Double digit military spending ie four times Indian Defence budget

(f) During Russian disintegration they hired job less scientist, bought soviet technology and equipment.

(g) Willingness to defy the IPR rules and adopt "Imitation innovation "approach.

(h) The Innovation plan is pushed from highest level of Political and Military leadership.

(i) A well thought Science and Technology roadmap and thus greater funding for R & D.

(j) They have adopted "Introduce / Digest / Absorb / Re-innovate" Philosophy.

(k) Revitalised defence industry by exponential increase in defence funding and by building of a civilian sector capable of meeting military needs.

(l) Vocational training centers for absorbing foreign technology.

(m) Technology acquisition through JVs / Illicit Transfers / Reverse engineering.

(n) Focused R & D resulted in filing close to 15000 patents in 2010.

(o) More than 400 Analysis & Diffusion Centers to Assimilate and Absorb foreign Technology.

(p) Exports aimed at developing Countries ( Pakistan, Bangladesh, Africa and Myanmar)

(q) Accepts flexible payment/ Counter Trade Linking/ Loans from EXIM bank of China to buyers for Offset.

## 9. RECOMMENDATATIONS

Based on the study of our defence industry and the study of growth of defence industries in Israel and China, following steps need to be undertaken by India to develop our in-house capability to become self-sufficient.

1) Establish a Defence Minister's Council on Production (DMCP) to bring all the stakeholders on one platform and subscribe to the vision of MII.

2) Convert the Technology Perspective and Capability Roadmap (TPCR), published in April 13 and the Long Term Integrated Perspective Plan (LTIPP) of the Indian armed forces into a defence manufacturing and R&D plan.

3) Department of Industrial Policy and Promotion (DIPP) should focus on building capability and infrastructure to absorb future offsets by handholding small to medium scale industries. Offsets must be prioritized for acquiring state-of-the-art technologies and offset policy must build customer base.

4) The offset policy has to be rethought entirely. Like Israelis and Japanese, our offset engagements must forge strategic alliance with the foreign vendors. It must be mutually beneficiary and not obligatory in nature.

5) Increase FDI limit in defence gradually and cautiously to encourage high-end technology transfers from foreign OEMs.

6) Single Vendor Scenario is an emerging reality and ways must be thought to integrate it in the procurement procedure.

7) There is a requirement to create innovation culture in the country. R & D needs to be included as an offset to promote innovations, modifications and upgradations.As part of the offset obligation, the OEMs must be made to contribute to the Defence Technology Fund and a pool of funds must be created for Defence Start Ups.

8) Promote a certain degree of defence research and development outside DRDO. Ease process of contracting R&D from academia and private industry. Also, enable term hiring of best talents for projects

9) Hasten up the setting up of Indian National Defence University (INDU) to meet the vast human resource requirement of defence. Frame policies to create an ecosystem for building industrial base through skill development and capability building.

10) Increase investment in establishing credible DITB. Major emphasis on developing Technologies than platforms. Reform DRDOs, OFs and DPSUs. DPSUs/ OFs management should focus on profits. Energise the Commercial spin-off of DRDO technology.

11) Treat private sectors as equal partners and provide them incentives for manufacturing defence systems. Increase outsourcing to create supply chain of Tier I, Tier II vendors.

12) Sponsor R&D of critically advanced technologies at private industry to encourage R&D. Ease process of contracting R&D from academia and private industry.

13) Technology being transferred should have current and futuristic defence applications and free of issues like IPRs, Patents and Sanctions.

14) ToT to a local defence industry if implemented in true spirit, will result in leapfrog on the existing technology lag.

15) Create a technology adaptation and transfer group. The knowhow of software intensive products and sub-systems need to be addressed.

16) Create a Tri Services Interaction Group

17) Issue security guidelines to allay security concerns while allowing higher FDI participation by foreign OEMs

18) Address indirect tax issues to make indigenous defence manufacturing competitive vis-à-vis foreign vendors

## 10. CONCLUSION

Threats from neighboring states leave India with no other option but to augment its defence capabilities to secure its national interests. There is an urgent need to review the whole concept of indigenisation and self-reliance and it is time to go beyond the idea of looking at Indigenisation purely as import substitution of components and subassemblies. India rightly deserves to graduate from an importer of defence products to a self-sufficient nation and finally aspire to become a net exporter to other friendly foreign countries. This graduation would be expedited by adopting consortium approach, encouraging private sector industry to participate in defence R&D and production, creating a culture of innovation, synergizing the R & D efforts of Industry, Academia and Govt agencies, streamlining the process of issue of Industrial License, relaxation in FDI policy, forging public-private partnerships and liberalizing export of defence products to friendly foreign countries.

Testing, Adjusting and Balancing (TAB) is one of the important activities during Project Management of HVAC (Heating, Ventilation and Air conditioning) system, used for comfort or process application. Testing indicates to evaluate the quantitative performance of the equipment. Adjusting refers to modulating the flow rates and balancing indicates proper distribution of air and water flow within the HVAC system.

India has seen exponential growth in HVAC segment in the past few years. In tropical country like India, the need of air conditioning is more significant than heating. Hence, the present study focuses on TAB for air conditioning systems. TAB ensures that the occupant comfort is achieved at lower energy cost (Gladstone and Bevirt, 2008).This results in huge savings in the energy requirement for air conditioning system. TAB also avoids the cost overruns in a project.

The initial and supplementary testing and balancing requirements for commissioning must be considered at

the design stage (ASHRAE, 2007). Balancing of an air or water based HVAC system will make it more energy efficient, provide better thermal comfort and reduce the operating cost (ECBC, 2009).

The present study deals with few cases, wherein the lessons learned are discussed and recommendations are highlighted. The scope of the present study is limited to balancing of AHU (Air handling unit) of air conditioning systems.

The cases cited are based on authors own research experience as well as with the discussions with the experts in this area.The authors wish to highlight the limited literature available that summarizes the lessons learned in TAB of air conditioning systems.

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