Journal of Positive School Psychology http://journalppw.com
2022, Vol. 6, No. 5, 351 – 377

Make-in-India in Defence Electronics, A Reality Check

[1]Commodore Sushil Kumar Patel, [2]Dr Rajesh Tripathi

[1]Sr. Vice President, M/s Marine Electricals India Ltd., B-1, Udyog Sadan-3, M I D C, Marol Industrial Area, Andheri East, Mumbai, Maharashtra, INDIA, Email: skpbp@hotmail.com

Abstract

Purpose: This paper has investigated the impediments of progress of 'Make In India (MII)' programs through literature review, market survey and statistically measured the trueness of findings.

Design/Methodology: Three major Make-In-India projects, namely Futuristic Infantry Combat Vehicle (FICV), Tactical Communication System (TCS), Battlefield Management System (BMS) have been taken as case study. Literature survey on the progress of major MII programs, were classified and categorised under several themes. The factors responsible for impediments in progress were identified. Hypothesis were formulated around these salient factors so arrived, and then administered to a test population of relevant MSMEs in defence electronics. The responses received on Likert scale were analysed using statistical techniques (z-test method). The hypotheses were tested for their acceptance/ rejection and inference drawn.

Research Method:

Business Problem: Make in India in Defence Electronics has not reached the expected success level.

Research Problem: Study the published literature on Make in India in Defence Electronics to identify and analyse the impeding factors using statistical methods.

Research Objective: Identify and analyse the factors from published literature affecting Make in India in Defence Electronics to reach its desired success level and substantiate the findings through primary research methods.

Research Questions: A set of research questions were formulated and served to 51 persons from the target MSME industry segment to respond in a Likert Scale. The uncorrelated stratified random sample responses were quantitatively analysed for their acceptance/ rejection.

Statistical Method: Z-test was applied to test our hypothesis-based test statistic with an acceptance threshold or confidence level of 95% (1-α) i.e. significance level (α) of 5%.

Findings: The reasons for unsatisfactory progress of Make in India initiative, is assessed to be:

(a) Complex and tardy bureaucratic procedures

(b) Lack of funds/ budget

(c) Bureaucracy and Red-Tapism.

Originality/ Value: There are over 200 publications on the subject. Most of them give isolated expert views and opinions. This study gathered views of a wide range of stake holders across policy makers, industry stalwarts, research agencies, government officials, investors etc., through a stratified random market survey and analysis to highlight some of the salient impediments to MII initiatives. The results are expected to be of interest to the global defence majors, the Indian lead participants, the members of the eco-system and enthusiast defence analysts.

Keywords: Make in India, Indigenization, Self-Reliance, FICV, TCS, BM.

INTRODUCTION

Prime Minister, Narendra Modi, in his address from the Red Fort on August 15, 2014, gave a clarion call for 'Make in India'. From satellites to submarines, he said, 'come make in India, we have steel... we have discipline, we have resolve... sell anywhere, (but) make in India.' (Pradip R Sagar, 2019). Pradip Sagar continues to report, despite tall claims of moving towards self-reliance in the defence sector, India's arms imports have shot up by 24% between 2013 and 2017. No major contract under the Make in India category has really taken off and critical defence procurement happened with no transfer of technology. This paper intends an introspection of the reality and principal factors behind the facts.

Background

The Government of India has taken a number of steps since the 1990s, to realise the Make-In-India dream. Facilitating and catalysing Army-industry partnership and Air Force-industry partnership starting from the early 1990s; formulating the Defence Procurement Procedure (DPP) in 1992, which has since been reviewed, revised and updated eight times in 2002, 2003, 2005, 2006, 2008, 2011, 2013, 2016 and 2020 (Dinesh Kumar, 2016, p.2). The DPP-2016 has amplified the Make in India in Defence into Make-I and Make-II categories (Govt of India - DPP, 2016, p.191) and maintained in 2020. The Make-I category as exiting since 2003 is dedicated for Government funded long gestation Projects involving design and development of equipment, systems, major platforms or their upgrades: necessitating harnessing of critical technologies involving large infrastructure investment for development, integration, test and manufacturing facilities (Govt of India - DPP, 2016, p.193). The Make-II category funded projects involve prototype development of equipment/ system/ platform or their upgrades or their sub-systems/sub-assembly/ assemblies/ components, primarily for import substitution/ innovative solutions, for which no Government funding is provided for prototype development purposes. It is industry funded (Govt of India - DPP, 2016, p.191).

Self-Reliance Parameters

Dinesh Kumar (2016) has also stated that for quite some time now, the Narendra Modi Government has been pegging its emphasis on the need for developing greater self-reliance in defence equipment through the 'Make in India' platform. Coining of slogans apart, successive governments in New Delhi have been emphasising this necessity for a nation that aspires to be a major power and is among the world's fastest growing economies. Instead, India in recent years has earned the dubious distinction of being among the world's largest importer of defence equipment. India was the world's largest importer of major arms now, accounting for ≈15 per cent of the global total. This amounted to three times more imports than China and Pakistan, both of which are nuclear weapon states, major adversaries and the country's biggest neighbours. In comparative terms, our meagre export remained less than 1.5% of import. Overall, India's self-reliance index has remained static at about 30 per cent for the last two and-a-half decades, with 70 per cent of the country's defence requirements being sourced to foreign vendors making the Indian armed forces overly import-dependent. Even India's 30 per cent indigenous capacity is suspect as it is based mostly on transfer of imported technology and a 'buy-and-assemble' principle. This has led defence scientists and engineers to derive comfort rather than pursue a quest to create indigenous capabilities (Dinesh Kumar, 2016, p.1).

It is not that previous governments have not made efforts to increase indigenisation. Soon after the disintegration of the Soviet Union, which until then was India's most important source of defence equipment, a specially established 'Self-Reliance Review Committee' conceived a 'ten-year plan for self-reliance in defence systems,' starting from 1995, aimed at

increasing India's self-reliance index to 70 per cent by 2005. This seemingly unrealistic deadline remained a pipe dream. Since then, several studies have been conducted to examine what can be done to increase India's self-reliance capability so as to reduce dependence on imports. More recently, a Ministry of Defence committee has now suggested 2027 to be set as the revised target for achieving 70 per cent indigenisation (Dinesh Kumar, 2016, p.2).

These startling statistics of heavy import dependence on defence hardware prompts researchers and enthusiasts to explore and conduct a reality check on the mega MAKE programs of Indian Defence, product orders of each of these programs will run into several tens of thousands of Crores Rupees. Moreover, a number of Defence Electronics MSMEs are associated with these Systems Integrators as part of the supply chain as Tier-1 and Tier-2 partners, supplying sub-systems and components up to 70% of the aggregate order value.

Research Parameters

From the literature ascribed in the succeeding three major case studies, three salient factors were identified. Opinion samples were collected from uncorrelated stratified random population of MSMEs on Likert scale-based survey questionnaire on the undermentioned factors:

(a) Efficacy of Procedures

(b) Funds Availability

(c) Bureaucracy, red-tapism

Since sample size is 51 and is considered sufficient for application of z-test method on a hypothesis-based test statistic with confidence level of 95% (α=5% level of significance).

The findings and inferences are presented in this paper.

Case Study - Projects

The following three major Make-I projects are analysed as case study for introspection:

(a) Case 1: Futuristic Infantry Combat Vehicle (FICV)

(b) Case 2: Tactical Communication System (TCS)

(c) Case 3: Battlefield Management System (BMS)

Literature Review with Summary of Selected Case Studies

Case 1: Futuristic Infantry Combat Vehicle

Global Security Org (2017) summarises that the backbone of the Indian Army's infantry combat vehicles is the Russian-designed BMP ('Sarath' BMP-2) series which are being made by Ordnance Factory Board (OFB) since its induction in 1980. Approximately, 1900 ICVs BMP-2/2K are in service with the Indian Army and are facing obsolescence. The Indian Army is worried about its operational capability, particularly in terms of rapid deployment post the 2017 scenarios. Infantry Combat Vehicle (ICV) is used to transport infantry into the battlefield and is usually equipped with anti-tank missiles and heavy guns. The Indian Army wants (Xavier Francis, 2020) the FICVs to replace its Russian origin BMP-2 ICV that is not equipped to fight at night, a huge lacuna that the army red-flagged. Thus, the FICV project is a strategic and critical programme which would define Indian Army's mobility, deployability and lethality in the future to come and its ability to execute its proactive strategy.

The FICV project was approved in 2008, but had seen little progress since then. By mid-2013 the Futuristic Infantry Combat Vehicle Request for Proposal (RFP) had been withdrawn and reformulated. Armoured vehicle manufacturers were out in force at DefExpo 2016, lured by the massive Future Infantry Combat Vehicle (FICV) program for the Indian Army. Under FICV some 2,610 vehicles would replace in-service BMP-2/2K Sarath IFVs beginning in 2022. Expressions of interest in the resurrected Rs. 65,000 Crore 'Make in India' project were lodged by six contenders in mid-February: TATA Motors, Larsen & Toubro (L&T), Mahindra Defence, TATA

Power SED (with Titagarh Wagons), Reliance Defence and the Ordnance Factory Board (OFB; joint venture with Russian MBT Manufacturer – Uralvagon Zavod) (Global Security Org, 2017, p.1). In fact, a present Board Member of L&T pronounced that they have moved ahead with development of a self-funded prototype to demonstrate confidence in Government Order Placing Authority, on Make in India capability.

FICV project would help develop a whole eco-system of small and medium sized companies (MSMEs) as suppliers to the winners of the contract. The FICV development would provide a big boost to India's pursuance of self-reliance and indigenisation in the form of a robust domestic defence industrial base (Global Security Org, 2017, p.3). Col Arun Kumar (2018), a practicing subject matter expert at Q-Tech Synergy also reiterates that the success of the project will boost the confidence of foreign investors and defence companies in partnering with Indian industry in keeping with the 'Make in India' vision. The FICV project will be a huge boost to the Indian defence industry in R&D, manufacture, and in developing Tier-1 and Tier-2 suppliers from small and medium sector industries (SMEs) and will create an ecosystem of suppliers extending far beyond the winner of the contract (Col Arun Kumar, 2018, p.4).

Sandeep Unnithan (2018), in his article 'Future shock: Futuristic Infantry Combat Vehicle still seems a distant dream' states that the Indian Army's ambitious Rs 60,000 crore Future Infantry Combat Vehicle project that was launched nearly a decade ago has not even crossed the first stage of ordering process. He concludes after elaborate narration that sometimes, the challenges to make arms indigenously are bureaucratic rather than financial or technological.

Frustrated by the delays and their development investments not accruing any production orders, some private Companies have persuaded the Govt to consider transferring the project from Make-1 (Govt funded development) to Make-2 (Industry funded development) hoping the bureaucratic delay mainly caused by financial constraints will now be overcome. Many participants of an expert group favoured this view.

Bringing the project under 'Make II industry funded category' will entail a savings of about $500 million or more for the Defence Ministry (Nayanima Basu, 2018). This is because, earlier under 'Make-I Govt funded category', the Ministry was required to fund three development agencies to the tune of $75 million each. In additions to cost savings, Nayanima states that 'multiple deviations from the laid down procedure and changing terms of EoI were the main reasons for the decision to withdraw the EoI and move the programme to 'Make II' category' (Nayanima Basu, 2018, p.2). Expert group member working for Mahindra Defence substantiated this saying, the selection criteria was changed after the issue of Expression of Interest (EOI) which would alter the selection result. This was viewed by the Defence Legal Dept. as inadvertent manipulation of rules that suited a different Company than the original, and therefore the EOI (tender) was retracted.

Huma Siddiqui (2018) has also reported that under the original proposal for the FICV, which was earlier under the 'Make-I Govt funded category', the plan was to have three development agencies (DAs) - two from the private sector and one Govt Ordnance Factory Board. As per the procedure laid down, the MoD had to give out minimum of Rs 500crore each to the three DAs. Therefore, by putting the FICV project under the Make-II private Co funded category, the MoD will be saving the money. Secondly, since no government funds are involved, and the project has already been delayed for long, is expected to move faster (Huma Siddiqui, 2018, p.2).

Huma Siddiqui (2019) further says, the fate of the $8-billion (approx Rs 60,000 crore) Future Infantry Combat Vehicle (FICV) project for the Indian Army which has been getting delayed will now be decided by the new government after the general election. Sources have confirmed that the project that had been moved to the Make II (industry funded) category of the DPP-2016 last year in an effort to expedite it.

However, it is stuck due to the lack of decision from both service headquarters and the Ministry of Defence (MoD). The MoD has been pushing the industry to invest 90% funds to develop the prototype of the FICV which is for modernising the Armoured Vehicles of the Indian Army; however, due to lack of any commitment from the end user there has been reluctance from the industry. Industry sources pointed out that there have been long delays as the MoD and the Service Headquarters have yet to decide on the requirement of the vehicles. Sources have said that there have been differences of opinion between the end user the Indian Army – and the MoD which has pushed the critical programme under the Make-II category. (Huma Siddiqui, 2019)

The Expression of Interest (EoI) was sent to Mahindra Defence Systems, Tata Motors, L&T and Ordnance Factory Board (OFB) in 2009, each of whom had submitted their technical and commercial bids (Lt Gen P.C. Katoch, 2019). Considering army's requirement for better and advanced replacements for upgraded BMP-2, FICV project was to be put on fast track. The army was looking at production of 3,000 FICVs to replace the upgraded BMPs at a cost of $10 billion. The project got bogged down because Russia offered the BMP-3 but was not accepted since indigenous firms had invested heavily in the project. Finally, two developing agencies (DAs) are to be shortlisted who would be required to produce five prototypes in the laid down time frame for user trials. Attempt by OFB to partner DRDO as design partner was not accepted on grounds that eventually DRDO will be responsible for technology evaluation and approval. (Lt Gen P.C. Katoch, 2019).

As per earlier reports, the project was not to be a winner-take-all competition since MoD planned to retain two production lines, the winner given 65-70 per cent of the order; the runner-up to build 30-35 per cent of the army's requirement of FICVs, provided the latter company agreed to build the winning design at the same cost as the winner. With two assembly lines operating, India's private defence players expected that the FICV contract will create an eco-system of suppliers extending far beyond the winner of the contract. (Lt Gen P.C. Katoch, 2019).

Follow up of the EoI was stunted because of perceived inconsistencies in evaluation of EoI responses between the Integrated Project Monitoring Team (IPMT) and MoD's Acquisition Wing; MoD scrapped the process saying it would restart it in nine months but took three years before the project was restarted in 2015. With the current impasse, vendors selection may take another 3-4 years after the prototypes are trial evaluated. Therefore, induction of the FICV will likely commence only around 2029-30, provided there are no more hurdles. This indeed is a sad state of affairs. Yet the government is unconcerned that MoD is manned purely by bureaucrats; sans military professionals – an irony peculiar to India. (Lt Gen P.C. Katoch, 2019).

Mr. A.M. Naik, Group Chairman L&T, said during Inauguration of L&T's Armoured Systems Complex by Hon. Defence Minister Shri Rajnath Singh that 'L&T's Defence team has time and again demonstrated L&T's engineering and execution prowess in building this most advanced weapon system to the exacting levels of quality while ensuring on time delivery (L&T press release, 2020). The Hazira Manufacturing Complex has set various international technologies and manufacturing benchmarks'. The Armoured Systems Complex is a state-of-the-art facility to manufacture and integrate advanced armoured platforms such as Artillery Howitzers, Future Infantry Combat Vehicles (FICV), Future Ready Combat Vehicles (FRCV) or, Future Main Battle Tanks (MBT). Spread over 40 acres within L&T's sprawling 755-acre Hazira Manufacturing Complex, the Armoured Systems Complex comprises of high-end machinery and automation aids, feeder shops, and a full-fledged mobility Test Tracks for acceptance and qualification of armoured vehicles. (L&T press release, 2020).

After inordinate delays, the Futuristic Infantry Combat Vehicle (FICV) may finally become a reality in the next 3-5 years in India according to Ordnance Factory Board (OFB) Chairman Hari Mohan. Mr Hari Mohan says the project,

which was conceived in 2009 was caught in the bureaucratic tangle and was scrapped in 2012 only to be resurrected in 2015 to be yet again caught in procedural delays (Xavier Francis, 2020). However, the OFB and Defence Research Development Organisation (DRDO) have finally joined hands to develop the FICV. Features which were a part of drawing board stage will now be included in the FICV, said Mohan. He further added that DRDO and OFB were earlier working separately, but decided to join hands to develop the project. Mohan further said that specifications and features of the project will keep advancing as it is an evolving project and the production will begin once the project reaches a satisfactory stage in tune with the feedback of the Army officials. Mohan said Mark I will be ready in the next 3-5 years whereas the sequel Mark II may take up to a decade in its development. Most of the parts of the vehicle will be developed in India excluding some minor subsystems. An OFB official said the FICVs will boast of an auto-grenade launcher with a range of 1,500 metres, an anti-tank guided missile capability which can fire missiles within a range of 4000 metres with automatic command and a gun control system linked with a thermal imager fire control. (Xavier Francis, 2020)

Military sources said while China has enhanced strength of armoured resources by seven to eight times in the Tibet Autonomous Region bordering India in the last couple of years, Pakistan was bolstering its forces by quick modernisation of its tank (ET E-Paper, 2020). A 10-year-old plan to acquire 2,600 future infantry combat vehicles for the Indian Army at a cost of around Rs 60,000 crore is staring at an uncertain future as it is stuck due 'divergent views' among the stakeholders on its implementation, official sources said. Army said another ambitious programme to indigenously manufacture a feet of modern battle tanks, christened as future ready combat vehicle, is also not moving forward due to procedural delays (ET E-Paper, 2020). Govt sources said a scheduled meeting among top brass of the defence ministry and the Army to discuss ways to take forward the future infantry combat vehicles (FICV) project last month was postponed due to certain differences over the programme. It is learnt that there have been serious differences between the Army headquarters and the defence ministry on implementation of the FICV project. 'The original plan is to induct the FICVs by 2025. The way things are moving, it is unlikely that we will be able to induct them before 2050,' said a military official involved in the project (ET E-Paper, 2020).

'At the moment, the project is going nowhere. The Army does not want it under Make II category as it will further delay the project,' said another official involved in the project. The delay in the decision making process has also been attributed to a complaint filed with the defence ministry by one of the short-listed private firms. It is learnt from an Expert group member belonging to the complainant company that the complaint is about 'change of selection rules, mid-way during the selection process favouring some other Company'. It is also said that once the selection process for the 'Development Agency' is underway, there should not be any changes to the 'rule governing selection process'. Following this valid complaint, the FICV development project was retracted, for re-floating of the enquiry (EoI). The Government said the Army wants the FICVs as soon as possible as both China and Pakistan were significantly enhancing their border infrastructure. (ET E-Paper, 2020).

FICV now seems to have fallen into the chasms of India's delay-plagued procurement process that is riddled with bureaucratic resistance. (Mihir Paul, 2020)

Indian Army Chief General Manoj Mukund Naravane has said (Raunak Kunde, 2020) that Army is making efforts to push its' 10 a year-old plan to acquire 2,600 future infantry combat vehicles for the Indian Army at a cost of around Rs 60,000 crore by 2026-27 and have held interactions with the stakeholders on progressing the procurement case expeditiously. Chief said a fresh RFI stands prepared already which will be shared with the industry in some time from now. Army wants the FICVs to replace its Russian-origin BMP-2 infantry combat vehicles. Tata Motors and

L&T are only two private firms that have developed prototypes of the FICV. According to sources close to IDRW, state-run Ordnance Factory Board (OFB) will be fielding a new FICV prototype (Raunak Kunde, 2020)

An expert group members unanimously agree to the mooted idea of Make-II (Private Company funded) project concept. But, Government Ordnance Factory, which is a big influencer of Government decisions would get left out in Make-II (Pvt. Industry funded) Project. Therefore, Make-II may never get approved, which is a huge loss to indigenous self-reliance. An expert group now unanimously agrees that the prestigious FICV project is now on the back burner for want of Government funds.

Case 2: Tactical Communication System

Lt Gen PC Katoch, ex-Director General Information Systems, Indian Army states that Indian Army's Tactical Communication System (TCS) should have been fielded in year 2000 (Lt Gen PC Katoch, 2016, p.1). The existing Plan Army Radio Engineering Network (AREN) system, earlier designed as the backbone of army's communication is outdated. The TCS was born out of realisation that AREN had to be urgently replaced since an upgrade would not be sufficient. The extraordinary delay of over a decade-and-a-half in TCS is on account of excessive 'red tape' befitting a case study, in that the TCS had been approved thrice by the Defence Ministers but every time the whole case was worked afresh after closing the previous case file - an extreme in red tape-ism and lackadaisical approach to vital issues (Lt Gen PC Katoch, 2016, p.1). The expert group unanimously remembers the TCS Project, as TCS-2K project, symbolically indicating TCS poised to roll out in the year 2000. Tactical Communication is poised to be the back-bone for any Army field formation movement on the battlefield. All communication backward of battalion level is to be dealt by TCS.

Lt Gen Naresh Chand, ex-DG Air Defence, Indian Army also concurs that the TCS project went through many twists and turns, overseen by three Defence Ministers. TCS-2000 became TCS-2010. TCS was also India's first 'make' big-ticket contract ($2 billion). (Lt Gen Naresh Chand, 2016, p.3).

Gen Katoch further stated that The TCS is vital for operational preparedness and force multiplication endeavour (Lt Gen PC Katoch, 2016, p.2). Decisive victory in future conflicts will be difficult to achieve without robust and survivable communications, both in the strategic and tactical domain. We should learn from the TCS in foreign militaries as to how they have tackled the challenges of spectrum, bandwidth, laws of physics, etc. British Win-T programme developed by BAE Systems, Canada's Tactical Command, Control and Communications Systems (TCCCS) developed by CDC Systems of UK, America's JTRS and Contact programme of France, all have lessons for us including how these countries have optimised participation and contribution of private sector, use of commercial off the shelf (COTS), time bound closure of procurement procedures keeping in mind criticality of the project and electronics manufacturing, and IT delivery self-sufficiency (Lt Gen PC Katoch, 2016, p.2)

The development phase of the contract is still not yet awarded till date, though short listing of Development Agencies has been completed in 2015. Lt Gen P Mohapatra, ex-Signal Officer in Charge (SOinC) writes that this can only take place through a concerted drive to smoothen the present day tardy procurement procedure (Lt Gen P Mohapatra, 2017, p.6).

Sandeep Unnithan reports 'two very significant pitches for indigenously developed arms came from the highest levels of the Indian Army'. Addressing a DRDO conference on October 15, army chief Gen. Bipin Rawat said the forces would fight and win the next war with home grown solutions. Addressing the annual Defence Attaches' conclave four days later, Vice-Chief of Army Staff Gen. M.M. Naravane said that the army would accept indigenous technology even if they didn't meet the 'best' parameters. Improvements, he said, could be made later. These major endorsements signal a

welcome shift in the thought process (Sandeep Unnithan, 2019).

Indian industry officials say the army has been the slowest of the three services to embrace indigenous technology (Sandeep Unnithan, 2019). This could also be explained by the fact that it is the least technology-intensive of the three services. Three critical systems-the Tactical Communications System (TCS), Battlefield Management Systems (BMS) and the Future Infantry Combat Vehicle (FICV) have been on for over a decade without a prototype in sight. Sandeep Unnithan (2019) goes on to surmise that the Army's record of embracing local technology leaves much to be desired.

Former Vice Chief of the Army stated, 60% of its weapon systems are vintage. The Army's two major modernization programs - Tactical Communication System (TCS) and Battlefield Management System (BMS), intended to be through 'MAKE' route, has been shelved after more than a decade of work with two consortiums of Indian majors. This is bound to have a huge adverse impact on its modernization efforts. One can't blame the Army, though. Repeated delays in routine procurements and lack of accountability on development programs have cost the army dearly (Air Marshal Matheswaran, 2019).

Now that Project is yet to be awarded till July 2020, the expert group names it as TCS-2020, hoping it may get awarded soon. However, the impact on National economy during ongoing COVID-19 PANDEMIC may not allow Government to invest in this capital-intensive project (Matheswaran, 2019).

Case 3: Battlefield Management System

Battlefield Management System (BMS) is a highly versatile, flexible, multilevel and fully interoperable tactical command and control information system. The system provides integrated situation awareness, a common communication infrastructure, collaborative planning tools and knowledge-based command and control capabilities to ground forces from the level of a Commander down to an individual soldier. The need for a BMS in the Indian Army has been echoing for years and was felt clearly during the Kargil operation. Indian army has the ambition of implementing a reliable Battlefield Management System at a cost of INR 50000 Crore/US $ 8 billion. BMS when implemented effectively provides an integrated 'Common Operating Picture' which can be used by the all-armed forces to plan evasive plans collaboratively. This helps in exercising highly effective control over operations in a dynamic and ever-changing battlefield. (Karthick Kakoor, 2016, p.2-3).

Vivek Raghuvanshi (2016) reports that once fully developed and proved, battlefield management systems will be critical elements of the Army's network-centric warfare program and will link infantry level troops on the battlefield to the command headquarters. It will also network ground troops with the various Army command headquarters and integrate all elements in a battle group, providing real time tactical scenarios. The BMS will be able to receive and transmit data, voice and images from multiple sources, including radar, cameras, laser range-finders and ground sensors, allowing the soldier on the battlefield access to real time information simultaneously with the command headquarters (Vivek Raghuvanshi, 2016, p.2).

The battlefield efficacy of a digitally networked force (BMS) was first demonstrated in the 1991 Gulf War, when Saddam Hussein's vaunted Iraqi army was overwhelmed in 96 hours by a United States military that had married sensor technology with real-time networking, across combat and support units. Stunned by that demonstration of force application, all major militaries began developing networked battlefield systems. (Ajay Shukla, 2018)

A Chinese version of BMS, the Qu Dian, began deployment a decade ago. Pakistan is developing its own BMS, named Rehbar. But the Indian Army, placing traditional weapons above high-technology, says that equipping the army's 800-plus combat units with BMS would cost an unaffordable Rs 500 billion to Rs 600 billion, going by prototype development costs. Industry sources counter that prototype development costs far more than industrial

production, where scale would dramatically drive down prices. (Ajay Shukla, 2018)

On 27 July 2018, the army officially shut down the BMS project that was aimed at transforming it into a 21st century force, which leverages digital communications and information technology to swiftly detect, identify and destroy its foes. Senior generals, including the army's vice-chief, want to scrap the revolutionary Battlefield Management System to save Rs 30 billion it will cost to develop. Instead, they want legacy weapons like rifles and light machine guns. The official foreclosure of the BMS project was declared, ironically, by the Defence Production Board - a defence ministry body charged with promoting the development of futuristic defence platforms stated (Ajay Shukla, 2018)

'Every military worth its salt will be networked in a decade or two. We will have no choice but to be networked too. Foreclosing BMS today will only mean that, instead of Indian companies, it will be the Israelis or the Americans who network us,' says an officer who is part of BMS (Ajay Shukla, 2018)

Huma Siddiqui (2020) says it is time that the Indian Army enhances its Net-Centric Operational (NCO) capabilities, which shall inter-connect the frontline combat soldiers using modern Digital network. India shares more than 3,400 Km long border with China and at many locations there is a lack of clarity on the demarcation. This has been one of the reasons for the recent skirmishes and face-offs along the Line of Actual Control (LAC) on the Eastern Ladakh side. There has been massive troops build-up on both sides of the LAC in areas like Galwan valley in Ladakh and Naku La sector. For decades there has been no exchange of fire in hostilities between the troops of the Indian Army and the People's Liberation Army (PLA) due to the restraint exercised by both. This time, however, the fistfights, and the shoves, failed to reflect the hi-tech Army both the sides have. Therefore, It is time that the Indian Army enhances its Net-Centric Operational (NCO) capabilities which shall inter-connect the frontline combat soldiers using modern Digital network. The much required indigenous Battlefield Management System (BMS) was shelved by the Ministry of Defence (MoD) in 2018, despite approved requirements existing for the system. BMS which was to integrate frontline troops of infantry battalions and armoured corps to efficiently and effectively handle various echelons of combat information so as to deploy armament effectively is presently not digitally robust. In a BMS system, each soldier has a digital identity and interconnected tactical communication network. (Huma Siddiqui, 2020).

Sandeep Unnithan (2019) highlights that all the three critical systems - the Tactical Communications System (TCS), Battlefield Management Systems (BMS) and the Future Infantry Combat Vehicle (FICV), which have been on for over a decade without a prototype in sight, are constrained by a budgetary wall. The army accounts for over half the total defence budget but spends 80 per cent of its share on salaries and running costs. Defence budgets are unlikely to rise for it to be able to fill all its equipment voids. Last year, it shut down a BMS project that would seamlessly link all its fighting formations, citing high project costs. (Sandeep Unnithan, 2019)

An expert group feels it is a big opportunity loss, not harnessing the indigenous competence to develop the system progressively. The group feels that the country will get compelled to import a system much costlier, in future, when adversaries' challenges on the battlefield become an upward mismatch.

Pradip R Sagar (2019) writes ever since the Modi government came to power, it has been talking of self-reliance in the defence sector. Over Rs 4 lakh crore worth of military purchases have been cleared in the past four years and the government asserts that two-thirds of the total approvals are under the Make in India category. The reality, however, is different. In the same period, only 128 contracts worth about Rs 1,19,000 crore have been signed with Indian vendors for capital procurement of defence equipment. This is just more than one-fourth of the total, not two-thirds.

Moreover, all the major contracts the Modi government has signed in the past four and a half years have been off the shelf, with no transfer of technology. This includes the 36 Rafale fighter jets from France, the S400 air defence missile systems from Russia and the attack and strategic lift helicopters (Apache and Chinook) from the US. All the products will come readymade from the foreign players, and nothing would be made in India. (Pradip R Sagar, 2019)

Pradip R Sagar (2019) writes that the government's thrust is evident from the two defence industrial corridors: Tamil Nadu and Uttar Pradesh and the launch of the Innovations for Defence Excellence. A defence planning committee has been constituted under National Security Adviser Ajit Doval, with the three service chiefs, and the foreign, defence and expenditure secretaries. The committee is expected to prioritise modernisation of the armed forces.

Jayant Damodar Patil, the Larsen and Toubro defence head, is supportive of Make in India in defence. He said that, since 2014, of the total programmes cleared for acquisition, the private sector has been allowed to compete for about 35% of them by value. This figure was below 5% in the preceding five years. 'By 2025, the share of manufacturing in India's GDP is targeted to grow from 17% to 25%,' he said. 'To reach 25% in a decade, the manufacturing sector needs to grow at a compound annual growth rate >14%. Make in India can play a major role in achieving this' (Pradip R Sagar, 2019, p.5)

Patil, however, has a grudge. Private players, he said, felt that there was still a continued bias towards PSUs. 'It is worrying that the private sector continues to be denied opportunities to bid. It prevents them from gaining maturity. This was the genesis of the strategic partnership model, but even this is on the verge of being changed to allow the public sector to participate.' (Pradip R Sagar, 2019, p.5)

Ashish Rajvanshi, head of Adani Defence, is more optimistic. 'With the exception of a few programmes of an extremely strategic nature, most programmes have been under Make in India,' he said.

'This has been the case for large multi-billion-dollar programmes as well as smaller programmes. Most conversations with the global OEMs have also been made through Make in India, where they have been asked to make the equipment in India with either one of the PSUs or a private sector manufacturer. This change in mindset from imports to talking about defence manufacturing has been the biggest benefits of Make in India. In spite of several roadblocks, the Indian private sector has achieved a significant level of maturity in locating, acquiring, absorbing and then executing on the transfer of technology from foreign sources. For this to flourish, the defence ministry has to let them prosper, which can only be possible through commercial orders.' (Pradip R Sagar, 2019, p.6).

'The Make in India initiative has simplified the policies for private players,' Laxman Behera (2019) said. 'They have streamlined the DPP provisions from licencing to the basics. On the policy front, the Modi government will get 10/10 for bringing these reforms. Where it has not succeeded so much is in the implementation.' (Pradip R Sagar, 2019, p.6).

Rahul Chaudhry, chairman, Defence Innovators and Industry Association, a conglomerate of small and medium defence companies, said, 'Without the defence industrial base being nurtured through real orders, Make in India in defence remains a mockery.' Chaudhry, who headed Tata Power Strategic Engineering Division till a few months ago, added that the industrial base could only be built by engaging the Indian industry. 'This will be more expensive in the short run compared with imports, as factories have to be built and CAPEX spent,' he said, 'but it will create jobs and boost our economy.' (Pradip R Sagar, 2019, p.6).

A defence ministry official looking after acquisition said (2019): 'Make in India in defence has never been an easy task as it requires niche and state-of-the-art technology. Moreover, global leaders of defence

manufacturing will never allow any country to promote indigenous industry. Wait for some years. The situation will completely change.' (Pradip R Sagar, 2019, p.6).

Hypotheses

While over 200 publications have been studied, only a varied few from people of eminence on the subject is quoted, to elucidate, the chosen factors of influence, which is then subjected to random stratified survey in the target population of research. The survey inputs are then processed as per chosen research methodology.

Basis for Hypotheses 1 to 3: Theme - Efficacy of Procedures

Lt Gen P.C. Katoch (2019) writes the FICV Expression of Interest (EoI) was sent to Mahindra Defence Systems, Tata Motors, L&T and Ordnance Factory Board (OFB) in 2009, each of whom had submitted their technical and commercial bids. Considering army's requirement for better and advanced replacements for upgraded BMP-2, FICV project was to be put on fast track. The army was looking at production of 3,000 FICVs to replace the upgraded BMPs at a cost of $10 billion. The project got bogged down because Russia offered the BMP-3 but was not accepted since indigenous firms had already invested heavily in the project. Finally, two developing agencies (DAs) are to be shortlisted who would be required to produce five prototypes in the laid down time frame for user trials. Attempt by OFB to partner DRDO as design partner was not accepted on grounds that eventually DRDO will be responsible for technology evaluation and approval. (Lt Gen P.C. Katoch, 2019). The lack of procedural clarity and tussle between influential stake holders has not yet resulted in award of the FICV development project.

Follow up of the EoI was stunted because of perceived inconsistencies in evaluation of EoI responses between the Integrated Project Monitoring Team (IPMT) and MoD's Acquisition Wing; MoD scrapped the process saying it would restart it in nine months but took three years before the project was restarted in 2015. With the current impasse, vendors selection may take another 3-4 years after the prototypes are trial evaluated. Therefore, induction of the FICV will likely commence only around 2029-30, provided there are no more hurdles. This indeed is a sad state of affairs. Yet the government is unconcerned that MoD is manned purely by bureaucrats; sans military professionals – an irony peculiar to India. (Lt Gen P.C. Katoch, 2019).

Xavier Francis says after inordinate delays, the Futuristic Infantry Combat Vehicle (FICV) may finally become a reality in the next 3-5 years in India according to Ordnance Factory Board (OFB) Chairman Hari Mohan. Mr Hari Mohan says the project, which was conceived in 2009 was caught in the bureaucratic tangle and was scrapped in 2012 only to be resurrected in 2015 to be yet again caught in procedural delays.

Military sources said while China has enhanced strength of armoured resources by seven to eight times in the Tibet Autonomous Region bordering India in the last couple of years, Pakistan was bolstering its forces by quick modernisation of its tank. A 10-year-old plan to acquire 2,600 future infantry combat vehicles for the Indian Army at a cost of around Rs 60,000 crore is staring at an uncertain future as it is stuck due 'divergent views' among the stakeholders on its implementation, official sources said. Army said [16] another ambitious programme to indigenously manufacture a fleet of modern battle tanks, christened as future ready combat vehicle, is also not moving forward due to procedural delays. Govt sources said a scheduled meeting among top brass of the defence ministry and the Army to discuss ways to take forward the future infantry combat vehicles (FICV) project last month was postponed due to certain differences over the programme. It is learnt that there have been serious differences between the Army headquarters and the defence ministry on implementation of the FICV project. 'The original plan is to induct the FICVs by 2025. The way things are moving, it is unlikely that we will be able to induct them before 2050,'

said a military official involved in the project. (ET E-Paper, 2020)

'At the moment, the FICV project is going nowhere. The Army does not want it under the industry funded, Make II category as it will further delay the project,' said another official involved in the project. The delay in the decision-making process has also been attributed to a complaint filed with the defence ministry by one of the short-listed private firms. It is learnt from an Expert group member belonging to the complainant company that the complaint is about 'change of selection rules, mid-way during the selection process favouring some other Company'. It is also said that once the selection process for the 'Development Agency' is underway, there should not be any changes to the 'rule governing selection process'. Following this valid complaint, the FICV development project was retracted, for re-floating of the enquiry (EoI). The Government said the Army wants the FICVs as soon as possible as both China and Pakistan were significantly enhancing their border infrastructure. (ET E-Paper, 2020).

FICV now seems to have fallen into the chasms of India's delay-plagued procurement process that is riddled with bureaucratic resistance (Mihir Paul, 2020)

The development phase of the TCS contract is still not yet awarded till date, though short listing of Development Agencies has been completed in 2015. Lt Gen P Mohapatra, ex-Signal Officer in Charge (SOinC) writes that this can only take place through a concerted drive to smoothen the present day tardy procurement procedure (Lt Gen P Mohapatra, 2017, p.6).

'The Make in India initiative has simplified the policies for private players,' Laxman Behera (2019) said. 'They have streamlined the DPP provisions from licencing to the basics. On the policy front, the Modi government will get 10/10 for bringing these reforms. Where it has not succeeded so much is in the implementation.' (Pradip R Sagar, 2019, p.6).

Hypotheses 1 to 3: Theme - Efficacy of Procedures

H1a: Maturity of 'MAKE' procedure of procurement impacts the success of developmental make project

H2a: The 'MAKE' procedure of defence procurement has evolved too late

H3a: Delay in developmental 'Make' projects is often due to decision makers rather than the industry

Basis for Hypotheses 4 to 6: Theme - Funds Availability

Sandeep Unnithan (2018), in his article 'Future shock: Futuristic Infantry Combat Vehicle still seems a distant dream' states that the Indian Army's ambitious Rs 60,000 crore Future Infantry Combat Vehicle project that was launched nearly a decade ago has not even crossed the first stage of ordering process. He says frustrated by the delays and their development investments not accruing any production orders, some private Companies have persuaded the Govt to consider transferring the project from Make-1 (Govt funded development) to Make-2 (Industry funded development) hoping the bureaucratic delay mainly caused by financial constraints will now be overcome.

Huma Siddiqui (2018) has also reported that under the original proposal for the FICV, which was earlier under the 'Make-I Govt funded category', the plan was to have three development agencies (DAs) - two from the private sector and one Govt Ordnance Factory Board. As per the procedure laid down, the MoD had to give out minimum of Rs 500 crore each to the three DAs. Therefore, by putting the FICV project under the Make-II private Co funded category, the MoD will be saving the money. Secondly, since no government funds are involved, and the project has already been delayed for long, is expected to move faster (Huma Siddiqui, 2018, p.2).

Huma Siddiqui (2018) has also reported that under the original proposal for the FICV, which was earlier under the 'Make-I Govt funded category', the plan was to have three development agencies (DAs) - two from the private sector and one Govt Ordnance Factory

Board. As per the procedure laid down, the MoD had to give out minimum of Rs 500crore each to the three DAs. Therefore, by putting the FICV project under the Make-II private Co funded category, the MoD will be saving the money. Secondly, since no government funds are involved, and the project has already been delayed for long, is expected to move faster (Huma Siddiqui, 2018, p.2).

Sandeep Unnithan (2019) highlights that all the three critical systems - the Tactical Communications System (TCS), Battlefield Management Systems (BMS) and the Future Infantry Combat Vehicle (FICV), which have been on for over a decade without a prototype in sight, are constrained by a budgetary wall. The army accounts for over half the total defence budget but spends 80 per cent of its share on salaries and running costs. Defence budgets are unlikely to rise for it to be able to fill all its equipment voids. Last year, it shut down a BMS project that would seamlessly link all its fighting formations, citing high project costs. (Sandeep Unnithan, 2019)

An expert group feels it is a big opportunity loss, not harnessing the indigenous competence to develop the system progressively. The group feels that the country will get compelled to import a system much costlier, in future, when adversaries' challenges on the battlefield become an upward mismatch.

Hypotheses 4 to 6: Theme - Funds Availability

H4a: Lack of funds is a major impediment for timely development of 'Make' projects.

H5a: Shortage of Government financing is a handicap for the progress of 'Make' projects

H6a: Industry part-funding of 'Make' projects is less forthcoming due to lack of Govt commitment for the Project

Basis for Hypotheses 7 to 9: Theme - Bureaucracy, red-tapism

Sandeep Unnithan (2018), in his article 'Future shock: Futuristic Infantry Combat Vehicle still seems a distant dream' states that the Indian Army's ambitious Rs 60,000 crore Future Infantry Combat Vehicle project that was launched nearly a decade ago has not even crossed the first stage of ordering process. He concludes after elaborate narration that sometimes, the challenges to make arms indigenously are bureaucratic rather than financial or technological. Frustrated by the delays and their development investments not accruing any production orders, some private Companies have persuaded the Govt to consider transferring the project from Make-1 (Govt funded development) to Make-2 (Industry funded development) hoping the bureaucratic delay mainly caused by financial constraints will now be overcome.

Nayanima Basu (2018) has stated that bringing the project under 'Make II industry funded category' will entail a savings of about $500 million or more for the Defence Ministry. This is because, earlier under 'Make-I Govt funded category', the Ministry was required to fund three development agencies to the tune of $75 million each. In additions to cost savings, Nayanima states that 'multiple deviations from the laid down procedure and changing terms of EoI were the main reasons for the decision to withdraw the EoI and move the programme to 'Make II' category' (Nayanima Basu, 2018, p.2).

Bringing the project under 'Make II industry funded category' will entail a savings of about $500 million or more for the Defence Ministry. This is because, earlier under 'Make-I Govt funded category', the Ministry was required to fund three development agencies to the tune of $75 million each (Nayanima Basu, 2018). In additions to cost savings, Nayanima states that 'multiple deviations from the laid down procedure and changing terms of EoI were the main reasons for the decision to withdraw the EoI and move the programme to 'Make II' category' (Nayanima Basu, 2018, p.2). Expert group member working for Mahindra Defence substantiated this saying, the selection criteria was changed after the issue of Expression of Interest (EOI) which would alter the selection result. This was viewed by the Defence Legal Dept. as inadvertent manipulation of rules that suited a different Company than the original, and therefore the EOI (tender) was retracted.

Huma Siddiqui (2019) further says, the fate of the $8-billion (approx Rs 60,000 crore) Future Infantry Combat Vehicle (FICV) project for the Indian Army which has been getting delayed will now be decided by the new government after the general election. Sources have confirmed that the project that had been moved to the Make II (industry funded) category of the DPP-2016 last year in an effort to expedite it. However, it is stuck due to the lack of decision from both service headquarters and the Ministry of Defence (MoD). The MoD has been pushing the industry to invest 90% funds to develop the prototype of the FICV which is for modernising the Armoured Vehicles of the Indian Army; however, due to lack of any commitment from the end user there has been reluctance from the industry. Industry sources pointed out that there have been long delays as the MoD and the Service Headquarters have yet to decide on the requirement of the vehicles. Sources have said that there have been differences of opinion between the end user the Indian Army – and the MoD which has pushed the critical programme under the Make-II category. (Huma Siddiqui, 2019)

Follow up of the EoI was stunted because of perceived inconsistencies in evaluation of EoI responses between the Integrated Project Monitoring Team (IPMT) and MoD's Acquisition Wing; MoD scrapped the process saying it would restart it in nine months but took three years before the project was restarted in 2015. With the current impasse, vendors selection may take another 3-4 years after the prototypes are trial evaluated. Therefore, induction of the FICV will likely commence only around 2029-30, provided there are no more hurdles. This indeed is a sad state of affairs. Yet the government is unconcerned that MoD is manned purely by bureaucrats; sans military professionals – an irony peculiar to India. (Lt Gen P.C. Katoch, 2019).

Lt Gen PC Katoch, ex-Director General Information Systems, Indian Army (2016) states that Indian Army's Tactical Communication System (TCS) should have been fielded in year 2000. The existing Plan Army Radio Engineering Network (AREN) system, earlier designed as the backbone of army's communication is outdated. The TCS was born out of realisation that AREN had to be urgently replaced since an upgrade would not be sufficient. The extraordinary delay of over a decade-and-a-half in TCS is on account of excessive 'red tape' befitting a case study, in that the TCS had been approved thrice by the Defence Ministers but every time the whole case was worked afresh after closing the previous case file - an extreme in red tape-ism and lackadaisical approach to vital issues (Lt Gen PC Katoch, 2016, p.1). The expert group unanimously remembers the TCS Project, as TCS-2K project, symbolically indicating TCS poised to roll out in the year 2000. Tactical Communication is poised to be the back-bone for any Army field formation movement on the battlefield. All communication backward of battalion level is to be dealt by TCS.

Ashish Rajvanshi, head of Adani Defence, is more optimistic. 'With the exception of a few programmes of an extremely strategic nature, most programmes have been under Make in India,' he said. 'This has been the case for large multi-billion-dollar programmes as well as smaller programmes. Most conversations with the global OEMs have also been made through Make in India, where they have been asked to make the equipment in India with either one of the PSUs or a private sector manufacturer. This change in mindset from imports to talking about defence manufacturing has been the biggest benefits of Make in India. In spite of several roadblocks, the Indian private sector has achieved a significant level of maturity in locating, acquiring, absorbing and then executing on the transfer of technology from foreign sources. For this to flourish, the defence ministry has to let them prosper, which can only be possible through commercial orders.' (Pradip R Sagar, 2019, p.6).

Hypotheses 7 to 9: Theme - Bureaucracy, red-tapism

H7a: Bureaucracy is a major impediment for the technology intensive developmental 'Make' projects

H8a: Red-tapism prevails in bureaucracy while managing the technologically complex and developmental 'Make' projects

H9a: Bureaucracy and re-tapism are common when decision makers do not possess domain knowledge

Hypotheses Test Procedure

Research methodology adopted is based on 'method of survey questionnaire'. Survey data is collected from relevant stake holders through G-docs, e-mail, and personal meetings.

Sources of Data: MSMEs, engaged in Defence Electronics, relevant Government departments, Services personnel, DRDO officials, academia, industry stalwarts, MSMEs etc. In order to ensure the best representation of the population in the sample, care is taken to include samples from widest distribution patterns such as

(a) Geographical strata for a well distributed representation.

(b) Representation of Micro, Small and Medium enterprises as per turn over, closer to their proportions.

(c) Vertical specialization coverage as per type of work within defence electronics such as Design, B2P, Prototyping and Testing specialised Companies.

(d) Urban. Semi-urban and SEZ mix etc.

Secondary data from literature and publications formed the benchmark only to formulate the hypotheses of relevance.

Data have been collected in Likert scale. Refer Table 1 for sample format of Likert scale.

Table 1 Sample Format of Survey Questions

Survey Question: Maturity of 'MAKE' procedure of procurement is inadequate to meet the realities of developmental make project						
Sl.	Survey Input	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	Name of Respondent	1	2	3	4	5
1	Respondent 1					
2	Respondent n (n=51)					

Statistical Method:

Z-Test with Level of Significance (α) = 5% has been chosen. This corresponds to 95% level of confidence (C).

Table 2: *Computation formula for Z-Test*

Table 9.3:
Names of Some Parametric Tests along with Test Situations and Test Statistics used in Context of Hypothesis Testing

Unknown parameter	*Test situation (Population characteristics and other conditions. Random sampling is assumed in all situations along with infinite population*	*One sample*
1	*2*	*3*
Mean (μ)	Population(s) normal *or* Sample size large (i.e., $n > 30$) *or* population variance(s) known	z-test and the test statistic $z = \frac{X - \mu_{H_0}}{\sigma_p/\sqrt{n}}$ In case σ_p is not known, we use σ_s in its place calculating $\sigma_s = \sqrt{\frac{\Sigma(X_i - \bar{X})^2}{n-1}}$

If z ≤1.645 (as per Table 2: Table of area under normal curve for the given confidence level of 95%, α = 5%, level of significance); accept null hypothesis. For, z >1.645; reject null and accept alternate hypothesis.

Calculation

Xbar computed

∑ (Xi-Xbar)2 computed

Ϭs computed

During statistical treatment, permissible assumptions have been made that Ϭp=Ϭs.

μH0 = 3 Population mean, by Likert design

$$z = \frac{\bar{X} - \mu_{H_0}}{\sigma_p/\sqrt{n}} \quad \sigma_s = \sqrt{\frac{\Sigma(X_i - \bar{X})^2}{n-1}}$$

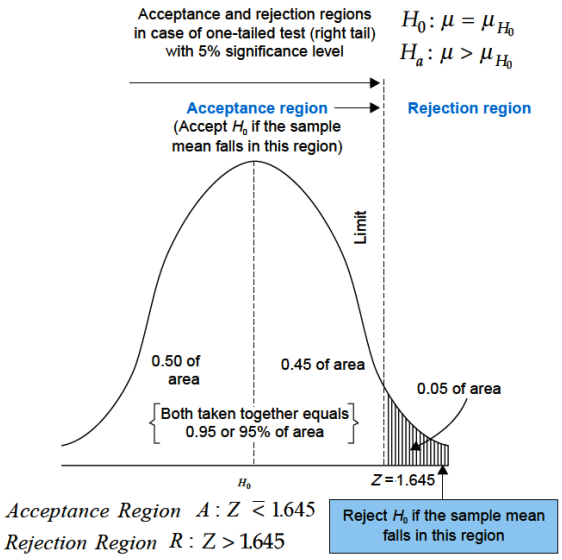

Fig. 9.3

Figure 1 *Principle of Z-test*

Refer Figure 1

Based on a large amount of survey samples (51: i.e. >30 for Z-test) from related stake holders, a test statistic for testing the alternate hypothesis has been developed and tested.

Hypotheses and Computation Summary: Refer Table 3

Table 3 *Hypotheses and Computation Summary: Null and Alternate Hypotheses and Result of Z-Test*

H	Null Hypothesis, H_0	Alternate Hypothesis, H_a	$Z_{computed}$	$Z_{threshold}$	Decision Criteria	Decision
H1	Maturity of 'MAKE' procedure of procurement has no relationship with the success of developmental make project	Maturity of 'MAKE' procedure of procurement impacts the success of developmental make project	5.513	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted

H	Null Hypothesis, H_0	Alternate Hypothesis, H_a	$Z_{computed}$	$Z_{threshold}$	Decision Criteria	Decision
H2	The 'MAKE' procedure of defence procurement has not evolved too late	The 'MAKE' procedure of defence procurement has evolved too late	4.397	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H3	Reason of delay in developmental 'Make' projects is not established	Delay in developmental 'Make' projects is often due to decision makers rather than the industry	3.303	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H4	Development of 'Make' projects and availability of funds have no relationship	Lack of funds is a major impediment for timely development of 'Make' projects	2.943	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H5	Availability of Government financing has never been a handicap for 'Make' projects	Shortage of Government financing is a handicap for the progress of 'Make' projects	2.902	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H6	Industry part-funding for the 'Make' projects and Government's commitment for the Project have no relationship	Industry part-funding of 'Make' projects is less forthcoming due to lack of Govt commitment for the Project	2.553	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H7	Bureaucracy' and 'management of the technology intensive developmental 'Make' projects' do not have any correlation	Bureaucracy is a major impediment for the technology intensive developmental 'Make' projects	3.125	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H8	There is no red-tapism or, delays in decision making while managing the technologically complex and developmental 'Make' projects	Red-tapism prevails in bureaucracy while managing the technologically complex and developmental 'Make' projects	2.671	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted
H9	Bureaucracy and re-tapism are uncommon even if the decision makers do not possess domain knowledge	Bureaucracy and re-tapism are common when decision makers do not possess domain knowledge	2.954	1.645	Reject null if Z>1.645	H_0 rejected, H_a accepted

Analysis:

H1: The null hypothesis that 'Maturity of 'MAKE' procedure of procurement has no relationship with the success of developmental make project' has been contested by the alternate hypothesis that 'Maturity of 'MAKE' procedure of procurement impacts the success of developmental make project'.

Based on a large amount of survey samples (51: i.e. >30 for Z-test) from related stake holders, a test statistic for testing the alternate hypothesis has been developed and tested.

The obtained value of Z=5.513 is significantly large than the decision criteria Z>1.645, meaning that the null hypothesis is rejected in favour of alternate hypothesis with resounding level of reliability and confidence.

Inference for all other hypotheses have been made and presented in Figure 2.

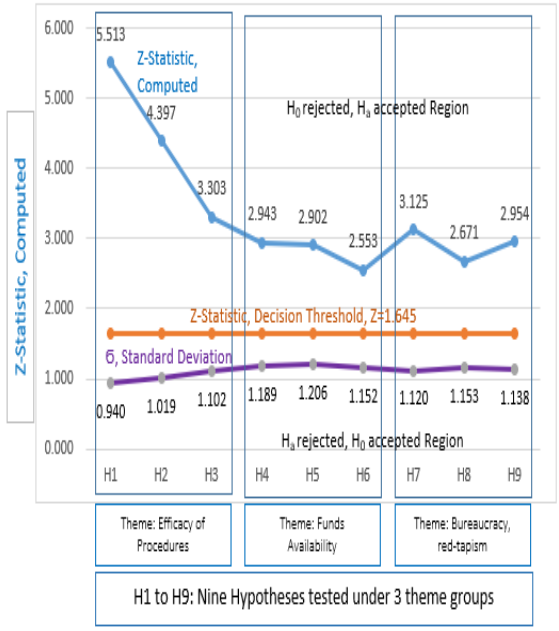

Figure 2 *Result and Summary of Statistical Test(s)*

Hypotheses H1 to H3: Theme - Efficacy of Procedures: The alternate hypotheses have been found true with a very high degree of confidence for all these three hypotheses. H1 indicates overwhelming responses supporting the view that 'Maturity of MAKE procedure' certainly impacts the success of developmental make projects. H2 substantiates that MAKE procedure of defence procurement has evolved too late. Both H1 and H2 complement each other and is logical. H3 proves that there are delays in the developmental 'Make' projects, and it is often due to the decision makers rather than the industry. The sample standard deviation is lowest in these hypotheses, highlights least variation of opinion.

Hypotheses H4 to H6: Theme - Fund Availability: These alternate hypotheses have also been accepted with a high degree of confidence, though lesser than the hypotheses group 1-3. All three hypotheses in this group are on a similar band of acceptance level. H4 proves that lack of funds is a major impediment for timely development of 'Make' projects. Whereas H5 shows there is a shortage of Government financing and it is a handicap for the progress of 'Make' projects. H6 establishes lack of Govt commitment and that the industry part-funding of 'Make' projects is less forthcoming due to lack of Govt commitment for the Projects. Sample standard deviation is relatively highest in these hypotheses, means wider variation of opinion.

Hypotheses H7 to H9: Theme - Bureaucracy, Red-tapism: These alternate hypotheses are also accepted with good level of confidence. H7 proves bureaucracy as a major impediment for the technology intensive developmental 'Make' projects with relatively highest level of confidence. H8 is accepts that red-tapism prevails in bureaucracy, particularly while managing the technologically complex and developmental 'Make' projects. H9 complements the outcome of H8 in that bureaucracy and re-tapism are common when decision makers do not possess domain knowledge. We observe a relatively moderate value of standard deviation (σ), indicating fair variation of opinion spectrum.

Summary of Research Framework: Refer Figure 3

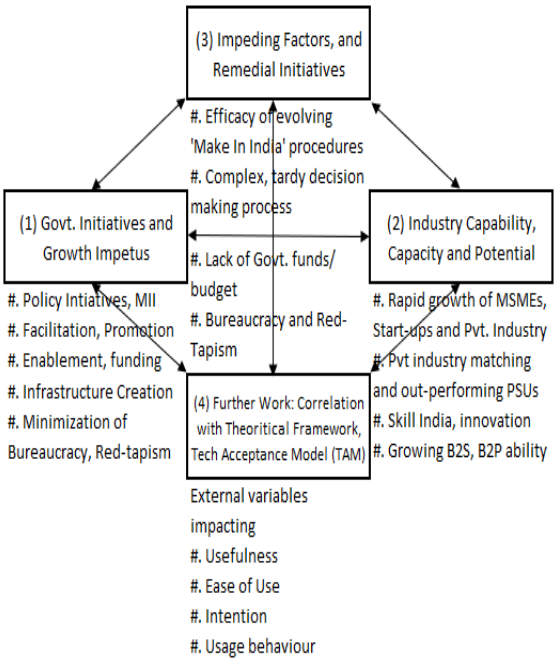

Figure 3: *Summary of Research Framework*

The research publications provided a good overview of Govt initiatives and growth impetus in various forms in a right direction as well as the impediments (see Box 1). We also noted the rapidly growing MSMEs, start-up initiatives and emergence of private industries

participating in MII initiatives in defence electronics (box 2). Hypotheses were framed out of the impeding factors (box 3) so that they could be put to test using survey of opinion from a stratified random population of stake holders. Using statistical techniques, the survey data could be quantified and analysed for acceptance / rejection of hypotheses with certain degree of confidence. The opinion variance was also analysed. The results of all nine hypotheses testing correlate and complement each other reasonably well.

We believe that these inferences, can further be correlated in subsequent work with established theoretical framework (box 4) such as 'Technology Acceptance Model (TAM)' or, 'Unified Theory of Acceptance and Use of Technology (UTAUT)'. TAM and UTAUT are well known theoretical framework and models, which deal with impact measurement of external factors on usefulness, ease of use, user intention, and usage behaviour.

Theoretical Premises

Technology Acceptance Model (TAM) is one of the most frequently employed models for research into new technology acceptance. The TAM suggests that when users are presented with a new technology, a number of factors determine their decision about how and when they will use it.

The TAM model deals with two specific beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Perceived Usefulness is the potential user's subjective likelihood that the use of a certain system (i.e. the digital India initiatives to access and use available resources in this case) will improve his/her/its action (i.e. MSME action here) and Perceived Ease of Use refers to the degree to which the potential user (i.e. MSME) expects the target system to be effortless.

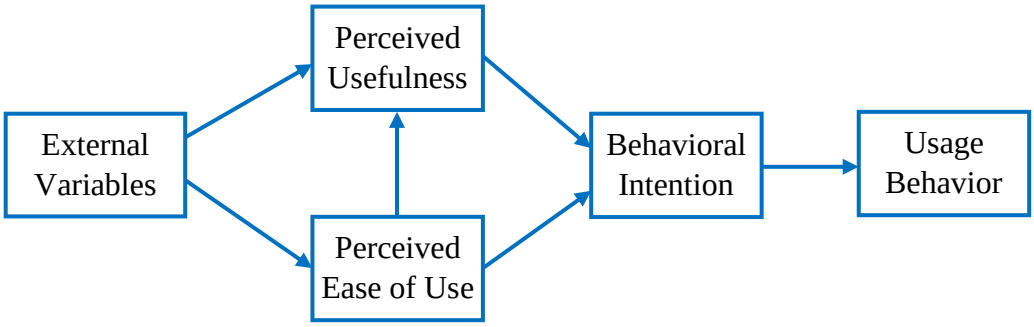

Figure 4: *Technology Acceptance Model (TAM) by Venkatesh and Davis, 1996*

Refer to Figure 4: Technology Acceptance Model (TAM) by Venkatesh and Davis, 1996

External Variables: In this case of MSMEs in defence electronics, some of these variables are as follows. These variables have been categorised with respect to their relevance:

(i) Relevant to 'Perceived Ease of Use'

(a) Computer anxiety, computer playfulness, comfort with the application programs

(b) Fear of exposing own information, fear of hacking

(c) Reluctance and inertia of transition from traditional mindset to digital India schemes.

(d) Learning, accepting and adopting various digital India initiatives

(e) Schemes of registrations and empanelment for getting access to Govt. resources

(ii) Relevant to 'Perceived Usefulness'

(a) Past experience, voluntariness, inhibition

(b) Result demonstratability

(c) Other MSMEs behaviour and their expression of usefulness (neighbour effect)

(d) Degree of relevance and quality of output (benefit)

(e) Effort versus benefit

Extensions of TAM theory: TAM has become so popular that it has been cited in many of the research that deals with users' acceptance of technology (Lee, Kozar and Larsen, 2013). TAM attempts to help researchers and practitioners to distinguish why a particular technology or system may be acceptable or unacceptable and take up suitable measures by explanation besides providing prediction. Even though TAM has been tested widely with different samples in different situations and proved to be valid and reliable model explaining information system acceptance and use, many extensions to the TAM have been proposed and tested. They are as follows:

(i) Technology Acceptance Model (TAM) was introduced by Fred Davis in 1986 for his doctorate proposal.

(ii) The TAM theory was formalised by Davis, Bogozzi and Warshaw, in 1989.

(iii) The final version of Technology Acceptance Model (TAM) was published by Venkatesh and Davis (1996),

(iv) Technology Acceptance Model 2 (TAM2), a amplified version of TAM was introduced Venkatesh and Davis (2000) and Technology Acceptance Model 3 (TAM3) by Venkatesh and Bala (2008).

(v) The Unified Theory of Acceptance and Use of Technology (UTAUT), was published by Venkatesh, Morris, Gordon and Davis (2003)

Some of the most prolific TAM authors include Viswanath Venkatesh, Fred D. Davis, Detmar W. Straub, Elena Karahanna, David Gefen, Patrick Y. K. Chau, Lee, Morris, Kozar and Larsen.

Table 4 *Factors and variables for further research work*

Sl.	Theme (Factors)	Number of Publications Studied	Major Variables, around which test hypotheses can be formulated
1	Regulatory	35	1. Rules, 2. Laws, 3. Policies, 4. Framework, 5. Guidelines
2	Market	28	1. Size, 2. Spread, 3. Opportunity landscape, 4. Statistics 5. Offset, 6. Export potential
3	Technology/ Indigenization	51	1. R&D, 2. Innovation, 3. Technology, 4. ToT, 5. IPR, 6. Patent 7. Build to Print/ Spec (B2P/B2S) 8. Obsolescence Management 9. Reverse Engineering
4	Promotion	38	1. Incentives, 2. Benefits,

Sl.	Theme (Factors)	Number of Publications Studied	Major Variables, around which test hypotheses can be formulated
			3. Concessions for example on finance, tax, training, skill development 4. Concessional policies
5	Production/ Manufacturing	15	1. Licensing 2. Infrastructure, 3. Capacity, 4. Testing, 5. QA, 6. Process Certification 7. Accreditation
6	Challenges	36	1. Unresolved hurdles 2. Ineffective areas 3. Known but, lingering problems 4. Identified areas of focus 5. Future plans not yet implemented 6. Conflicts

Further Work

From the literature study and observations, many other impeding factors to the Make in India programs came to light. We have only researched and collected survey data on the most prevalent three set of factors. However, other factors also could be researched in a similar way. The list of themes / factors and possibilities of formulating hypotheses around the variables are shown in Table 4.

Conclusion

It emerges clear with good level of confidence that the salient handicaps for inadequate progress of Make in India initiatives, as emerged from the afore narrated research analysis is assessed to be:

(a) Complex and tardy bureaucratic procurement procedures

(b) Lack of Govt funds / budget

(c) Bureaucracy and Red-Tapism

In further work, the findings of research can be applied to TAM theory or, its derivatives to test its relevance and application to theories. Some of the other impeding factors emerging from researched publications along with their variable as listed above can be taken up in further research work.

Reference

[1] Dinesh Kumar (2016, February 03), Reality bites make-in-India defence dream, Retrieved from http://www.tribuneindia.com/news/comment/reality-bites-make-in-india-defencedream/191046.html

[2] Government of India, Ministry of Defence (2016. March 28), Defence Procurement Procedure/ Updated Version of DPP-2016, Retrieved from https://mod.gov.in/dod/defence-procurement-procedure

[3] Global Security Org (2017), Futuristic Infantry Combat Vehicle (FICV), Retireved from https://www.globalsecurity.org/military/world/india/ficv.htm

[4] Col Arun Kumar (2018), Future Infantry Combat Vehicle (FICV): Will it 'MAKE' Headway?, Retrieved from http://www.defproac.com/?p=2694

[5] Sandeep Unnithan (2018, March 22), Future shock: Futuristic Infantry Combat Vehicle still seems a distant dream, Retrieved from https://www.indiatoday.in/magazine/nation/story/20180402-future-infantry-combat-vehicle-idian-army-defence-1196430-2018-03-22

[6] Nayanima Basu (2018, April 20), Move to facilitate private sector investments, eliminate delay in project approvals, Retrieved from https://www.thehindubusinessline.com/economy/policy/defence-ministry-to-fast-track-12-b-combat-vehicle-project/article23620056.ece

[7] Huma Siddiqui (2018, May 24), FICV project may come under Make-II category, Retrieved from https://www.financialexpress.com/defence/ficv-project-may-come-under-make-ii-category/1179075/

[8] Lt Gen PC Katoch (2016, November 30), Tactical Communication System for Indian Army, SP Guide Publications MAI Issue No 21-22, Retrieved from http://www.spsmai.com/military/%3Fid%3D4167%26q%3DTactical-Communication-System-for-Indian-Army

[9] Lt Gen Naresh Chand (2016, November 30), Tactical Communication System - An Update, SP Guide Publications MAI Issue No 21-22, Retrieved from http://www.spsmai.com/military/?id=4168&q=Tactical-Communication-System%97An-update

[10] Lt Gen P Mohapatra (2017), Need to bolster tactical communications, Q-Tech Synergy Defence ProAc Biz News, Retrieved from http://www.defproac.com/?p=1505

[11] Kartick Kakoor (2016, January 17), Battlefield Management System - A hawk-eye of the battle field. Retrieved from https://www.saddahaq.com/battlefield-management-system-a-hawkeye-of-the-battle field

[12] Vivek Raghuvanshi - IndianDefence NEWS (2016, March 21), Indian Battlefield Management System Advances, Retrieved from http://www.indiandefensenews.in/2016/03/indian-battlefield-management-system.html

[13] Ajay Shukla (2018, July 20), Army shutting down high-tech project in bid to save Rs 30 billion cost, Retrieved from https://www.business-standard.com/article/economy-policy/army-shutting-down-high-tech-project-in-bid-to-save-rs-30-billion-cost-118072000055_1.html

[14] L&T Press Release (2020, January 16), Hon. RM Shri Rajnath Singh flags-off 51st K9 VAJRA-T Gun from L&T's Armoured System Complex, Retrieved from https://www.lntecc.com/homepage/common/p341.htm

[15] Xavier Francis (2020, March 18), Indian Army to replace Russian BMP-2 ICV with Futuristic Infantry Combat Vehicle, The Asian Age (South Asia), Retrieved from https://eurasiantimes.com/indian-army-to-replace-russian-bmp-2-icv-with-futuristic-infantry-combat-vehicle/

[16] ET, E-Paper (2020, July 18), Indian Army's Rs 60,000-crore FICV project stuck in procedural delays: official sources, Retrieved from https://economictimes.indiatimes.com/news/defence/indian-armys-rs-60000-crore-ficv-project-stuck-in-procedural-delays-official-sources/printarticle/67349313.cms

[17] Mihir Paul (2020, July 18), In the Nation's Interest - The FRCV and FICV programmes need a solid push, The Force Journal, a National Security and Aerospace NEWS Magazine, Retrieved from http://forceindia.net/feature-report/in-the-nations-interest/

[18] Raunak Kunde (2020, January 26), Indian Army is making efforts to achieve FICV induction by 2026-27: Army Chief, Indian Defence Research Wing exclusive publication in NEWS Beat, Retrieved from https://idrw.org/indian-army-is-making-efforts-to-achieve-ficv-induction-by-2026-27-army-chief/

[19] Huma Siddiqui (2019, April 23), Why the $8-billion Future Infantry Combat Vehicle project of the Indian Army continues to be delayed, Retrieved from https://www.financialexpress.com/defence/why-the-8-billion-future-infantry-combat-vehicle-project-of-the-indian-army-continues-to-be-delayed-lead-3/1556477/

[20] Lt Gen P.C. Katoch (2019 February 18), The FICV Story - Ongoing for Decades, Unsure Future, Raksha Anirveda Publication, Retrieved from https://www.raksha-anirveda.com/the-ficv-story-ongoing-for-decades-unsure-future/

[21] Sandeep Unnithan (2019, October 21), Why the Army's changed mindset on indigenous technology is a relief, India Today, Retrieved from

https://www.indiatoday.in/india-today-insight/story/why-the-army-s-changed-mindset-on-indigenous-technology-is-a-relief-1611391-2019-10-21

[22] Air Marshal M Matheswaran (2019, September 22), Time for structural reforms, modernisation, Retrieved from https://www.deccanherald.com/specials/sunday-spotlight/time-for-structural-reforms-modernisation-763125.html

[23] Huma Siddiqui (2020, May 30), Battlefield Management System: A critical technology for Indo-China border, Indian Defence News Publication, Retrieved from http://www.indiandefensenews.in/2020/05/battlefield-management-system-critical.html

[24] Pradip R Sagar (2019, May 25), How 'Make in India' in defence sector is still an unfulfilled dream, The Week Journal. Retrieved from https://www.theweek.in/theweek/current/2019/05/25/how-make-in-india-in-defence-sector-is-still-an-unfulfilled-dream.html

[25] Lt Gen PC Katoch (2018, Jan 10), Foreclosure of Army's Battlefield Management System, SP Guide Publications, Military Aerospace Internal Security. Retrieved from https://www.spsmai.com/experts-speak/?id=482&q=Foreclosure-of-Army-s-Battlefield-Management-System

[26] Sija Binoy (2019, Nov), Significance of Hypothesis in Research, Indian Journal of Holistic Nursing, Volume 10, Issue 1 - 2019, Pg. No. 31-33 (ISSN: 2348-2133). Retrieved from https://www.researchgate.net/publication/338605212_Significance_of_Hypothesis_in_Research

[27] PTI (2022, Apr 07), India releases 3rd list of weaponry to be banned for import to boost self-reliance in defence manufacturing. Retrieved from https://timesofindia.indiatimes.com/india/rajnath-releases-3rd-list-of-weaponry-to-be-banned-for-import-to-boost-self-reliance-in-defence-manufacturing/articleshowprint/90704091.cms?val=3728

[28] Rajesh Tripathi. (2015),"Technology Adoption in Newspaper Industry: A Strategic Thinking View", in the International Conference on 'Advances in Management and Technology: Mapping Strengths with Opportunities' (ICAMT-2015) held at Motilal National Institute of Technology (MNNIT), Allahabad on January 29-31,2015. Also published in book "Advances in Management and technologyy: Mapping Strength with Opportunity" Vol-II, published by The McGraw Hill Companies with ISBN: 978-93-392-2075-4

[29] Rajesh Tripathi (2019) Still Distance matters? A critical examination of CAGE model vis-àvis Indian M&A bids" published in conference proceedings of SSRC with ISBN No: 978-81-920267-4-9 also received BEST Paper award

[30] Devsena Mishra (2017), Indigenous Defence Manufacturing and MSME Sector, Digital India - business and technology promoter, http://a2zstartup.in/indigenous-defence-manufacturing-and-msme-sector/

[31] Rituraj Singh Bhati, Sunipun (2017), Laws and Regulations Related to Defence Procurement in India, https://blog.ipleaders.in/defence-procurement-india/

[32] Anurag Garg (2017), Aerospace & Defence: How MSMEs can build a sustainable business, ET Contributors, http://economictimes.indiatimes.com/small-biz/sme-sector/aerospace-defence-how-msmes-can-build-a-sustainable-business

[33] Knowledge & News Network (KNN)/ Defence Business (DB) (2017), Without an assured place for MSMEs, Strategic Partnership in Defence will be screw driver manufacturing, http://knnindia.co.in/news/newsdetails/msme/without-an-assured-place-for-msmes-strategic-partnership-in-defence-will-be-screw-driver-manufacturing

[34] KPMG, Ministry of Defence-Department of Defence Production-Department of Industrial Policy and Promotion (2017), Defence Manufacturing Sector-Achievements Report : Make in India, http://www.makeinindia.com/article/-/v/defence-manufacturing-sector-achievement-report, https://drive.google.com/file/d/0B-Tv7_upCKANRmtia05TUWsxRms/view

[35] Singhania & Partners (S&P), Indo American Chamber of Commerce (2017), Make in India - An overview of Defence Manufacturing in India,

https://www.gita.org.in/Attachments/Reports/Make-in-India-Defence-Manufacturing-in-India.pdf

[36] Govt of India, Ministry of Commerce & Industry (2017), Annual Report 2016-17 - Towards Sustainable and Lasting Growth, http://commerce.gov.in/writereaddata/uploadedfile/MOC_636281140249481285_annual_report_16_17_eng.pdf

[37] National Institute for Micro, Small and Medium Enterprises (NI-MSME), Hyderabad (2017), National Institute for MSME - Annual Report 2015-16 (Hindi and English), http://msme.gov.in/sites/default/files/MEME%20ANNUAL%20REPORT%202015-16%20ENG.pdf

[38] Govt of India, Ministry of External Affairs (2017), India Defense Sector Opportunities - Economic Diplomacy Division, Ministry of External Affairs, New Delhi

[39] SME Khabar (2016), Analysing the MSME opportunity in the Indian Defence Sector, https://www.power2sme.com/smekhabar/Article/2429/Analysing%20the%20MSME%20opportunity%20in%20the%20Indian%20defence%20sector

[40] Government of India, Ministry Of Defence, DRDO (2016), Standard Operating Procedure (SOP) For Implementing Technology Development Fund (TDF) Scheme of DRDO, https://www.mycii.in/Attachment/F000003214.SOP%20-%20DRDO.pdf https://defenceaviationpost.com/wp-content/uploads/2017/08/TDF_SOP_29_July_V4.pdf

[41] KPMG (2017), Electronics & IT Sector - Achievements Report, 2016_Electronics & IT Sector - Achievement Report.pdf

[42] P. Udayakumar, National Small Industries Corporation (2016), Evolving Need to use Technology Infusion in the MSME Sector & the Barriers, https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiC587nkaHXAhWHQ48KHcVjB1MQFggsMAE&url=http%3A%2F%2Fiica.in%2Fimages%2FNSIC.ppt&usg=AOvVaw2MXUga78F1XBX2H7MUd9ct

[43] Kavita Nagpal, Q.Tech Synergy (2016), MSMEs in Defence - The Rising Stars, http://www.defproac.com/?p=3731

[44] Govt. of India, Ministry of Defence (2016), Department of Defence Production in pursuit of self reliance, http://ddpmod.gov.in/sites/default/files/DDP_Booklet.pdf

[45] Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (2016), European Commission Advisory Expert Group report and recommendations on cross-border access for SMEs to defence and security contracts, https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwik866alKHXAhVCKo8KHSQCAcAQFggvMAE&url=http%3A%2F%2Fec.europa.eu%2FDocsRoom%2Fdocuments%2F20354%2Fattachments%2F1%2Ftranslations%2Fen%2Frenditions%2Fnative&usg=AOvVaw381TcUutnO5yTTeKjPQHu4

[46] Government of India, Ministry of Micro, Small and Medium Enterprises (2016), Govt of India - MSMEs Annual Report 2015-16, http://msme.gov.in/sites/default/files/MEME%20ANNUAL%20REPORT%202015-16%20ENG.pdf

[47] Govt of India, Ministry of MSMEs (2016), MSME at a Glance 2016 - Govt of India, http://msme.gov.in/sites/default/files/MSME_at_a_GLANCE_2016_Final.pdf

[48] National Institute for Micro, Small and Medium Enterprises (NI-MSME), Hyderabad (2016), National Institute for MSME - Annual Report 2014-15 (Hindi and English), http://msme.gov.in/sites/default/files/MSME%20ANNUAL%20REPORT%202014-15_English_1.pdf

[49] National Institute for Micro, Small and Medium Enterprises Hyderabad, Pondicherry Multipurpose Social Service Society (2016), Success Stories of Entrepreneurship and Skill Development (Programmes of ni-msme under ATI scheme of Ministry of MSME, Government of India), http://www.nimsme.org/ranzo/uploads/articles/PMSSS_1060.pdf

[50] Nitin A. Gokhale, Ashok Atluri, Bharat Shakti (2015), MSMEs are cradles of innovation & creativity and need full

encouragement, http://bharatshakti.in/interview-with-ashok-atluri-cmd-zen-technologies/
[51] R. K. Jena Member of Parliament, Wisdom Blow - A complete magazine for Netizens (2015), MSMEs and the Future of India's Economy, http://www.wisdomblow.com/?p=6211
[52] Govt of India-Ministry of Micro, Small & Medium Enterprises (2015), MSME Schemes by Government of India, Ministry of MSMEs, http://msme.gov.in/sites/default/files/MSME_Schemes_English_0.pdf
[53] Govt of India, Department of Commerce (2015), The Foreign Trade Policy Statement 2015-2020, http://dgft.gov.in/exim/2000/policy/FTP_Statement.pdf
[54] Government of India, Ministry of Micro, Small and Medium Enterprises (2015), Good governance initiatives for MSMEs, http://pib.nic.in/archieve/others/2015/jan/d2015010702.pdf
[55] Federation of Indian Micro and Small & Medium Enterprises (2015), FISME's suggestions on MSMEs' access to Defence sector - A two pronged approach, http://fisme.org.in/msme-defence/documents/FISME%E2%80%99s-suggestions.pdf
[56] pwc, ASSOCHAM (2015), Self-reliance in defence production - The unfinished agenda, https://www.pwc.in/assets/pdfs/publications/2014/self-reliance-in-defence-production.pdf
[57] Vivan Sharan, Raghav Priyadarshi, Chiraag Samaddar, FISME and Koan Advisory (2015), Challenges of Indian MSME participation in the Defence Sector, http://fisme.org.in/msme-defence/documents/The-Challenges-of-Indian-MSMEs-in-the-Defence-Sector_11062015.pdf
[58] Air Marshal Dhiraj Kukreja, Indian Defence Review (2015), MSMEs in Defence Production: A Neglected Sector, http://www.indiandefencereview.com/news/msmes-in-defence-production-a-neglected-sector/
[59] Tarun Khanna, Government of India, NITI Aayog - CIT&I Division (2015), Report of the Expert Committee on Innovation and Entrepreneurship, http://niti.gov.in/writereaddata/files/new_initiatives/report-of-the-expert-committee.pdf
[60] KPMG, Confederation of Indian Industries (2015), The new wave Indian MSME - An action agenda for growth, https://assets.kpmg.com/content/dam/kpmg/pdf/2016/03/The-new-wave-Indian-MSME.pdf
[61] Manohar Parikkar, Press Information Bureau (2015), Make in India - Defence Sector, A Special Feature on Republic Day 2015, http://pib.nic.in/newsite/mbErel.aspx?relid=114990
[62] MITCON Consultancy & Engineering Services Ltd, National Institute for Micro, Small & Medium Enterprises (2015), Case Studies of Self-Employment / Wage Employment under the scheme "Assistance to Training Institutions", http://www.nimsme.org/ranzo/uploads/articles/case%20study-25_1035.pdf
[63] D.A.Mohan, DAC International, Nasscom, IESA (2015), Accelerating localization of Defence Equipment Design, Development & Procurement through Cooperative Efforts of Indian industry – A Joint Services Framework document outline for defence electronics, http://dacintl.com/defenceelctronicsindcomplex.pdf
[64] CII, KPMG, iNDEXTb, Govt. of Gujarat (2015), Vibrant Gujarat: Emerging base for indigenization of the Indian defence industry defence offset sector profile, https://vibrantgujarat.com/writereaddata/images/pdf/Gujarat-Emerging-Base.pdf
[65] S&P, Indo American Chamber of Commerce, and Rajani, Singhania & Partners Advocates & Solicitors (2015), Make in India: An overview of Defence Manufacturing in India, https://www.gita.org.in/Attachments/Reports/Make-in-India-Defence-Manufacturing-in-India.pdf
[66] Aditi Nigam, The Hindu Business Line (2014), Time to lift MSMEs from 'garage-type' operations in defence, http://www.thehindubusinessline.com/news/time-to-lift-msmes-from-garagetype-operations-in-defence/article6627477.ece
[67] Business Standard (2014), Indian MSMEs battle out for Rs 18,000cr defence pie, http://www.business-

standard.com/article/printer-friendly-version?article_id=114120700384_1

[68] P. Anagha (2014), Electronics For You - Aerospace and Defence Industries - Offering Further Opportunities, https://www.mistralsolutions.com/wp-content/uploads/2014/08/ EFY_Aug14.pdf

[69] Prof C Rakesh (2014), MSR Univ of Applied Sc., Bangalore, PEST Analysis for MSME Sustainability: Statistics and Challenges of MSME Sector, http://www.msruas.ac.in/pdf_files/Publications/MCJournals/Sept2014/5.pdf

[70] Arindam Bhattacharya, Arun Bruce, Anirban Mukherjee (2014), CII and Boston Consulting Group - CII 13th Manufacturing Summit 2014 - The Boston Consulting Group. Make in India: Turning Vision into Reality, http://www.manufacturingchampions.in/Document/ NewsLetter/CII-BCG%20Report%20on%20Make%20In%20India%20-%2013th%20Manufacturing%20Summit%202014.pdf

[71] K. Prabhakaran, M. Chandrasekhar Reddy (2014), National Institute for Micro, Small and Medium Enterprises Hyderabad and Boopathi Educational & Social Trust Tamilnadu - Case Studies of successful entrepreneurs trained under ATI scheme of Ministry of MSME, Government of India, http://www.nimsme.org/ranzo/uploads/articles/ BEST%20success%20stories_1029.pdf

[72] Bikramdeep Singh (2013), Defence Indigenisation - Made in India, by India, for India by Centre for Land Warfare Studies (CLAWS), New Delhi, http://www.claws.in/images/ journals_doc/16092657_BikramdeepSingh.pdf

[73] House of Lords U.K. - Authority of the House of Lords (2013), Roads to Success: SME Exports Report by House of lords, Select Committee on Small and Medium Sized Enterprises, https://publications.parliament.uk/pa/ld201213/ldselect/ldsmall/131/131.pdf

[74] Jyoti P Gadia, Resurgent India Limited (2013), MSME Funding - Opportunities & Challenges, http://resurgentindia.com/wp-content/uploads/research/MSME/ MSME%20Funding%20-%20Opportunities%20and%20challenges.pdf

[75] Apex Cluster Development Services Pvt. Ltd; New Delhi (2013), A Compendium of Key MSME Support Schemes by Micro, Small and Medium Umbrella Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, New Delhi, http://www.clikindia.co.in/Downloads/Scheme%20Compendium_2013.pdf

[76] Melissa Looney (2013), Helping SME's access funding - International Survey Report by CFA Institute, https://www.cfainstitute.org/Survey/smes_poll_survey_report_28_jan.pdf

[77] PWC (2013), Route to the Indian market: Opportunities for UK manufacturing SMEs by UK - India Business Council, https://www.pwc.co.uk/assets/pdf/ukibc-sme-report.pdf

[78] Karanpreet Kaur, Maj Gen Dhruv C Katoch, Avantika Lal (2013), Defence Acquisitions and Offsets - The Road Ahead by Centre for Land Warfare Studies, New Delhi and Knowledge World, KW Publishers Pvt Ltd, New Delhi, http://www.claws.in/images/publication_pdf/ 457520731_MP4218-11-13.pdf

[79] Planning Commission - India (2012), The National Manufacturing Plan. Strategies for Accelerating Growth of Manufacturing in India in the 12th Five Year Plan and Beyond, http://planningcommission.gov.in/aboutus/committee/strgrp12/str_manu0304.pdf

[80] Col KV Kuber (2012), Potential for MSMEs in Defence Sector, by National Small Industries Corporation (NSIC), http://www.cii.in/uploads//11_K%20V%20Kuber_104.pdf

[81] National Small Industries Corporation (2012), Potential for MSMEs in defence sector, http://iesaonline.org/downloads/SES_2012_NSIC_Ravi_Kumar.pdf

[82] S. Prahalathan, Renuka Vijay (2012), Strategic Development of MSMEs - Comparison of Policy Framework and Institutional Support Systems in India and Select Countries by Export-Import Bank of India Occasional Paper No.153, https://www.eximbankindia.in/Assets/ Dynamic/PDF/Publication-

Resources/ResearchPapers/Hindi/19file.pdf

[83] Arindam Bhattacharya, Navneet Vasishth (2012), Creating a Vibrant Domestic Defence Manufacturing Sector by Confederation of Indian Industry (CII) and The Boston Consulting Group (BCG), http://image-src.bcg.com/Creating-Vibrant-Domestic-Defense-Manufacturing-Mar-2012-India_tcm21-28848.pdf

[84] Secretary MSME and Chairman, Working Group on MSME Growth (2012), Report of working group on MSME Growth for 12th 5 year Plan - A Govt of India Publication, http://msme.gov.in/sites/default/files/Report_working_group_5yearplan-2012-17_0.pdf

[85] Working Group of Min of MSME (2012), Report of Sub-Group on Flow of Private Sector Investments for MSME Sector by Govt of India, Min of MSME, http://planningcommission.gov.in/aboutus/committee/wg_sub_pvtsec_MSME.pdf

[86] Shodhganga (2012), Literature review on MSMEs and study methodology, http://shodhganga.inflibnet.ac.in/bitstream/10603/30611/9/09_chapter%202.pdf

[87] MSME Working Group Study Report (2012), Recommendations of the MSME Working Group for 12th Plan period by Govt of India-Ministry of Micro, Small & Medium Enterprises, http://msme.gov.in/sites/default/files/Report_working_group_5yearplan-2012-17_0.pdf

[88] Grant Thornton, FICCI (2011), Vision 2020 - Implications for MSMEs, http://ficci.in/spdocument/20143/Grant-Thornton-FICCI%20MSME.pdf

[89] Principal Secretary, Govt of India (2010), Report of Prime Minister's Task Force lead by Principal Secretary on MSMEs, http://indarun.gov.in/htm/msme/PmTaskForceMSME.pdf

[90] Ernst & Young Pvt. Ltd., CII (2009), Enhancing role of SMEs in Indian defence industry, http://www.cii.in/webcms/Upload/Enhancing%20role%20of%20SMEs%20in%20Indian%20defence%20industry1.pdf

[91] Marie Oscarsson, Stellan Sundh (2008), Failure or success of African SME's - A study on UWAZI cooperation in Zanzibar, Tanzania by Gotland University, Sweden, http://www.diva-portal.org/smash/get/diva2:294146/FULLTEXT01.pdf

[92] Placid Rodriguez (2007), Report of the Working Group on Science & Technology for SMEs for the eleventh five year plan (2007-2012), http://www.dst.gov.in/sites/default/files/rep-subsme.pdf

[93] Asia Eco-Design Electronics (2007), AEDE Country Report on the Indian Electronics Sector by ELCINA - Electronic Industries Association of India, with European Commission, and The Centre for Sustainable Design (UK), http://www.cfsd.org.uk/Indian_AEDE_Report.pdf