Nurturing Engineering Talent in the Aerospace and Defence Sector

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1.0 Outlook of India's Aerospace &DefenceSector

The Indian aerospace industry has become one of the fastest growing aerospace markets in the world, primarily due to the increase in defence spending and a growing commercial aviation market. The rapid growth of this industry has attracted major global aerospace companies to India and has boosted the confidence of domestic aerospace players to increase and deepen their operations.

India's defence industry which has seen a steady growth in recent years, seems poised for even better days. Growth in domestic demand looks promising and the Government has a clear vision for an indigenous defence industry. The defence companies across the globe are increasingly looking at India as a lucrative sourcing hub, in order to remain globally competitive. India has a tremendous potential for exporting engineering services and component manufacturing capacity in these sectors.

With the Government of India now encouraging indigenous development in the Aerospace & Defence (A&D) sector in a big way through its "Make in India" initiative, huge investments are expected in the A&D sector in the areas of manufacturing. India is rapidly building capabilities to emerge as a preferred destination for manufacturing of aerospace components. India’s real and sustainable advantage lies in demonstrating our expertise in the entire process, beginning right from the initial design to final manufacture. The industry is surely poised for an exponential growth in the coming years.

The A&D sector in India is now being looked at as the sunrise sector and it has the potential to generate a large number of engineering jobs in the years to come. One of the major challenges ahead for the Aerospace and Defence (A&D) organizations is: how to effectively the manage this engineering talent. Organizations are in need of science, technology and engineering talent to cater to the future growth. They require engineers with highly specialized skill sets to cater to their niche requirements. Attracting and retaining critical talent is increasingly viewed as a top strategic issue by the senior management and human resources executives in this sector.

Addressing these challenges requires a comprehensive transformation, the requirement of which stems from the challenges that the A&D industries face due to the mismatch between their requirements and the skills with which the aspiring engineers join these organizations. There is a need for a radical change in the present style of pedagogy being employed in many of the engineering institutes. On the other hand, there is an equally important need for a change in the working style of A&D industries to overcome their existing workforce challenges. Hence, there are efforts and steps required from either side, from the industries and the institutes, so as to better align the engineering workforce with the industry requirements.

2.0 An Engineer's Mind and Aspirations

An engineer's mind is highly inquisitive. Engineers have the tendency to question the actual physics behind any process. Young engineers, who are fresh pass-outs from the institutes, are high on

inquisitiveness and creativity quotient. They are fascinated to see how the machines are being designed and built to achieve magnificent goals and how modern technology influences our day-to-day life. Young engineers enjoy taking up challenges. They are driven by the desire to apply the lessons they have learnt in the classroom to the outside world. Engineers today are expeced to think out of the box, examine and analyze things critically and come up with solutions and improvements which would have been considered unattainable even a decade ago.

However, when it comes to choosing organizations where they would aspire to work, we normally come across one category of engineers who are driven more towards what we may call an AC-PC (office room with an AC and a PC) kind of work culture. They do not seem inclined to take up the rigorous work at site or in shop-floor. But there will always be young engineers who get excited by things where they see a purpose, get motivated by a formidable challenge and work which would give them a sense of pride and great professional satisfaction. Working for projects like the "*First indigenous nuclear submarine built in India*" or "*First Indian PSLV to travel on lunar mission*" get them excited more than anything else.

It is indeed very heartening to see the recent trends, which indicate that the present generation of engineers are more drawn towards organizations which provide them with opportunities to work on grass-root innovations, big challenges or social sector applications where they get to implement their ideas through the high-end technology or digital platforms.

3.0 Need for a Radical Change in Engineering Pedagogy

At engineering colleges we are taught how things work, but as practising engineers we have to understand how things can fail as well. Bringing reliability to a product is nothing but to understand the underlying failure mechanisms and generate methodologies to mitigate the failures. Engineering curricula must, therefore, be able to bring such practical orientation into academics and offer budding engineers a true "feel" of the reality outside the classroom.

To be successful as an engineer in this age, one needs to have the technical competence and excellence which comes from a combination of a sound theoretical knowledge imparted through classroom teaching and applied knowledge which comes from industrial exposure and industry-oriented training. It is a good sign that some engineering institutes are introducing "practice schools" for final-year engineers, in place of traditional academic projects.

The purpose of engineering education is to develop the candidate's abilities of analysis, design, application and engineering judgement, while deepening the understanding of engineering fundamentals. The pedagogy currently followed in many universities has following shortfalls:

- Many engineering students find some courses including design courses difficult to grasp or understand in totality, primarily because most of the instructors lack the necessary practical experience to relate fundamentals to practice and to give a real-life orientation to learning. This hampers the student's ability to handle practical problems.

- Many educational institutes lack of the requisite computer hardware and the latest engineering software tools presently used in the industry. This makes the students feel "alienated" when they come out in the industry and are required to use such tools in a big way.

- Some universities cannot set up laboratories because of the shortage of funding and the lack of specialized teaching staff. These factors also attribute to incomplete understanding of engineering fundamentals.

- In traditional teaching methods, students study fundamentals according to predefined steps to acquire certain results and to prepare for examinations based on a well-defined pattern. The teaching methodology rarely encourage independent thinking or application-based learing. This makes it difficult to nurture innovation and creativity.

Therefore, it is necessary to reform the current teaching methods by focusing more on application of learning, out-of-box thinking together with innovative and entrepreneurial outlook. Wherever possible budding engineers nedd to be encouraged to develop a holistic view. For instance, engineers need to realize how the scientific principles derived from basic research, as depicted in Figure 1, attribute to developing the technology and know-how through applied research and how such know-how translates into tangible products and processes. It is imperative for young engineers to implement this value-chain in practice so as to make a visible impact in their professional career.

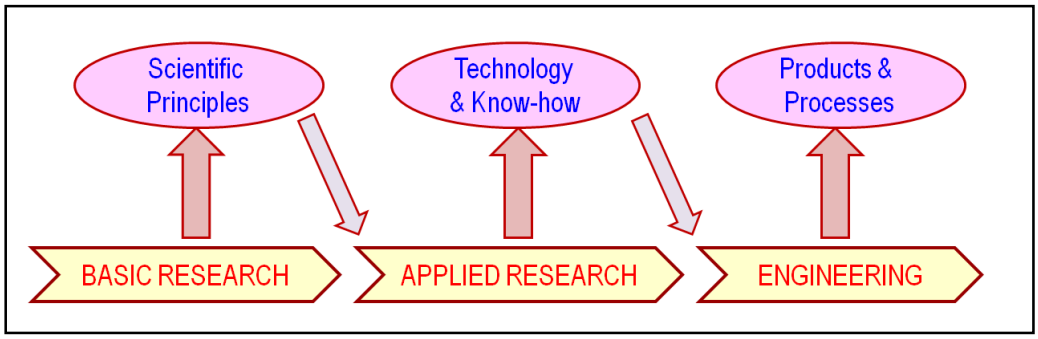

Figure 1: Clarity on Interdependence to be offered by Engineering Education

4.0 Industry Requirements *vs* Output from Academia

Engineering excellence has always been the critical capability for aerospace and defence. The nature of the work assigned to our engineers is constantly evolving with changing requirements and with varying magnitudes of complexity. It calls for a multi-disciplinary approach and additional soft skills which is not what our engineers are normally trained for. It calls for speed and continuity to execute complex projects associated with these A&D programs, which have longer life cycles and tend to drag indefinitely at times. Today, be it any industry including A&D, only fraction of the workforce is completely trained and qualified to carry out the work that they do. Employers have to invest considerable time, effort and money to make the fresh engineers "job-ready" and readily "billable". We need to face the reality that majority of the graduating engineers today are not directly "employable" and both Industry and Academia need to collaborate effectively to bridge the gap beteen Industry requirements and the output coming out from academic institutes. The *National Knowledge Functional Hub* (NKFH) initiative - a collaborative framework between Industry and Academia with a national footprint - launched by the Federation of Indian Chambers of Commerce & Industry (FICCI), is actively addressing this critical issue.

5.0 Managing the Engineering Workforce

The A&D industries, like any other sector, face several typical challenges when it comes to managing the engineering workforce. These include:

- Having the required number of engineers on board
- Developing the engineering capabilities needed for future competitiveness
- Attracting and retaining the engineering talent

5.1 Having the required number of engineer on boards

Given the growth anticipated inthe A&D industry and with changing demographics (specifically, with a large number of existing senior staff approaching retirement), there is a concern about

sustaining the core engineering talent. Though the optimal number of engineers the companies should have is not static, they need to ensure a relatively steady intake of engineers looking at the series of long lead A&D programs in pipeline. As one program ends, a new one begins. As a result, a sufficient base will have to be maintained to absorb the engineering capability and the new engineers will have sufficient time to "cut their teeth" before they get fully engaged with live projects.

5.2 Developing the engineering capabilities needed for future competitiveness

The landscape in A&D is evolving, which has significant implications for the industry's engineering needs. Some of the biggest development programs are now moving into production and other programs are likely to follow, which call for enhanced design and manufacturing skills. There is a tremendous emphasis being laid on necessary skill and capability development, which is one of the driving factors behind "Make in India" initiative.

5.3 Attracting and retaining talent

A&D industry's twin challenges of sustaining a mature engineering workforce and meeting intense competition for younger talent from other industries are well known. A common situation in A&D engineering departments today is a shortage of early and mid-career talent to compliment the experienced engineers.

Looking at the prevailing situation, the imperatives for the A&D sector should be to recruit more creatively, create a well-designed career track for top talent and implement a formal knowledge transfer mechanism from experienced to young engineers, particularly tacit knowledge and experiential learning.

6.0 Towards Better Industry-Academia Alignment

As already mentioned, the engineering institutions and universities produce graduates with basic academic qualification as per prevalent curriculum, but their skills and capabilities often do not meet the current industry requirements. Key shortcomings appear to be the inability to relate class-room learning to practical situations, adopt innovative ideas to face unfamiliar problems and display required "soft skills", specially the people management abilities. Some of the obvious expectations from young engineers are that they should be creative and able to work well in teams, communicate effectively, define problems, consider alternatives, come up with innovative solutions and appreciate the uncertainties of "real world" environment, where not everything is well-defined or well-understood.

Industry and Academia need to collaborate to ensure that fresh engineers are equipped with the necessary technical capabilities as well as "soft skills". Both the entities can play a key role in helping the future engineers with active support in the following areas:

*6.1 Improving the "**Soft Skills**"*

To address the need for students to acquire soft skills, some engineering institutes have already associated with the industry and consultants to understand the factors associated with soft skill development. The idea is to create a teaching environment that fosters holistic development of students by making them work in teams, do hands-on projects in institute as well as industry and actively engage with professional societies.

*6.2 Maintaining the"**Right Balance**"*

Today's engineering students face the challenges of a demanding curriculum, long study hours and a heavy course load. These are particularly daunting for first-year students, most of whom are also required to adapt to the challenge of being away from home for the first time and being responsible

for more than just their academics. All this can lead to poor academic performance and stress-induced problems, requiring professional counselling.

One successful model for helping students not only cope but also thrive forward is by maintaining the right balance between the "course load and pressure of exam performance" on one hand and the opportunity of "Learning and Application" on the other hand. This can enable the students to face their academic challenges in a proactive and relaxed way and also inculcate "learning by doing" habit right from the beginning of their professional life.

*6.3 Introducing "**Real World**" Engineering*

For most engineering students, understanding theoretical concepts and applying these to practical situations with the right context is critical to their success in the classroom and eventually in the workplace. Industry and Academia can join hand in developing a curriculum that allows engineering minds to relate the theories to pracice and appreciate the challenges and uncertainty in real-life applications.

*6.4 Encouraging "**Internships**" and "**Industry Projects**"*

It is encouraging to see that most of the leading academic institutes today are emphasizing the need for student interships and industry-based projects as a mandaotory part of their curriculum, with assigned credit points. This can be a key enablers for young engineers to appreciate their classroom learning better and to understand how the industry functions and what it takes to succeed as a practising engineer. A spin-off benefit from such initiative is that faculty members also get better tuned to the industry realities and get an opportunity to enrich their teaching and research work to make these better aligned with industry requirements. This in turn benefits the students in the long run.

7.0 Skill Development and Innovation

Skill Development is being viewed today as a necessity at the national level in order to transform the "Make in India" dream into reality. While this applies to all industry sectors and all the professions, the need is even more acute for the skill-building of our engineering talent in A&D sector. The movement is essentially a collaborative, multi-dimentional engagement process with many stakeholders, as shown in Figure 2.

Industries need to facilitate the creation of a well-defined set of "Occupational Standards" for the engineering profession, together with appropriate innovation ecosystem. The Academia, on the other hand, needs to ensure that the identified skill sets are being adequately covered in engineering curriculum. Enhancing the efficiency at all levels of operation and sharing of knowledge across stakeholders will be the key to success.

Figure 2: Making 'MAKE IN INDIA' a Reality

Going beyond Skill Development, institutionalizing an "Innovation Culture" will involve additional considerations, as shown in Figure 3. If it is our aspiration to see future engineering talent in Aerospace & Defence sectors as the drivers of innovation and entrepreneurship, then the enabling process should necessarily start in the classroom itself.

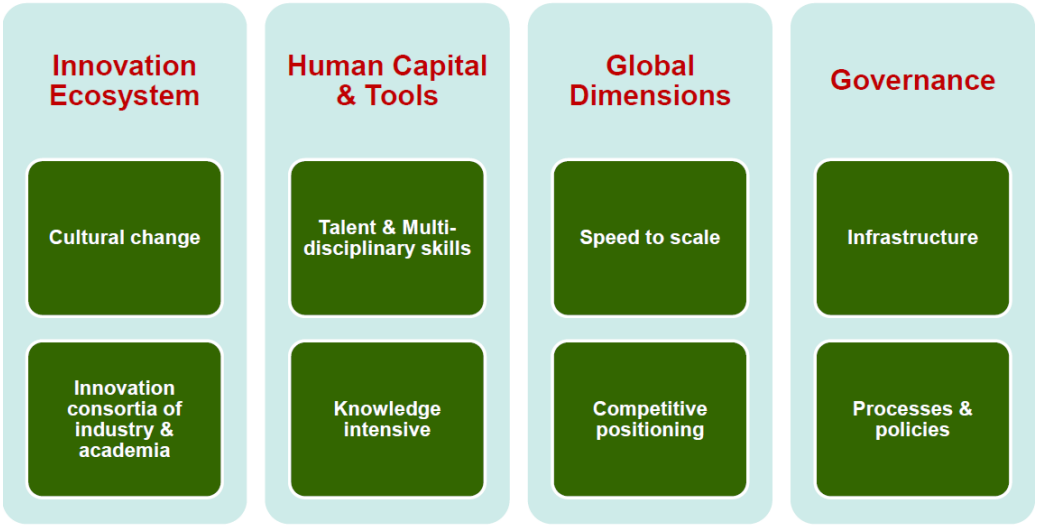

Figure 3: Innovation Pillars

8.0 Conclusion

Going forward the A&D sector is poised for a steady growth, driven by the indigenous development and manufacturing aimed by the "Make in India" campaign. Managing the engineering talent to take up the speed and scale required to keep up to the targeted growth in the sector is going to be the most crucial factor. Recognizing the issues and implementing necessary changes to better align the engineering pedagogy with the external industrial needs is of paramount importance. It is equally important to overcome institutional inertia and enable sustainable improvement in processes dealing with teaching, training and nurturing young engineering talent. Industries in the A&D domain must create a better value proposition for talent and instil a culture of performance management. Organizations that effectively pursue and maintain such transformation will be able to create a competitive advantage with respect to the engineering talent they possess. We in India have the potential of harnessing the best engineerning minds in the world, but it will require a quantum shift in our mindset towards engineering education and a committed and sustainable effort among all stakeholders.