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A Comprehensive Study on Private Sector's R&D Incentivization Landscape in USA and India: Lessons Drawn for India

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Abstract: Research and Development (R&D) is one of the most essential attributes of national socio-economic growth. The United States of America (USA) is the global powerhouse and the world's largest R&D spender with 581.6 Billion USD in PPP global R&D investments. Although, India is the 6th largest R&D spender of the world and annually invests nearly 68 Billion USD in PPP investment in R&D which is nearly 80% less than that of the US. The US invests 2.8% of its GDP for R&D and India contributes only 0.69%. The unsatisfactory positioning of India in R&D parameters can be attributed to less than 50% participation of the private sector in the national R&D ecosystem in contrast to the US where private sectors contribute more than 70% of the total federal R&D investments. In order to enhance R&D investments in India, the private sector needs to be incentivized for stimulating its engagements in R&D. US executes strong financial support under its common programmes SBIR and STTR executed by each federal agency and creation of a Small Business Administration assemblage for business R&D. The Federal government also practices one of the most generous tax incentives on R&D expenditure incurred by the private sector across the globe. India has limited financial support provided by TDB and few ministerial departments and agencies such as DSIR and BIRAC. Moreover, India has radically truncated its tax incentivization scheme of 200% super deduction to 100% super deduction on private sector' R&D expenditure. In the present study, a notable suggestion for enhancing private sector engagements in R&D has been drawn from the US system. The major recommendations include the introduction of target-based research credits, tax incentives on increased R&D expenditure to benefit all types of industries, creation of common industry R&D support programmes in each ministerial set up on lines of SBIR and STTR and enhancing the scope of eligibility of Industries and R&D expenditure as qualifying to avail government R&D incentives in India.

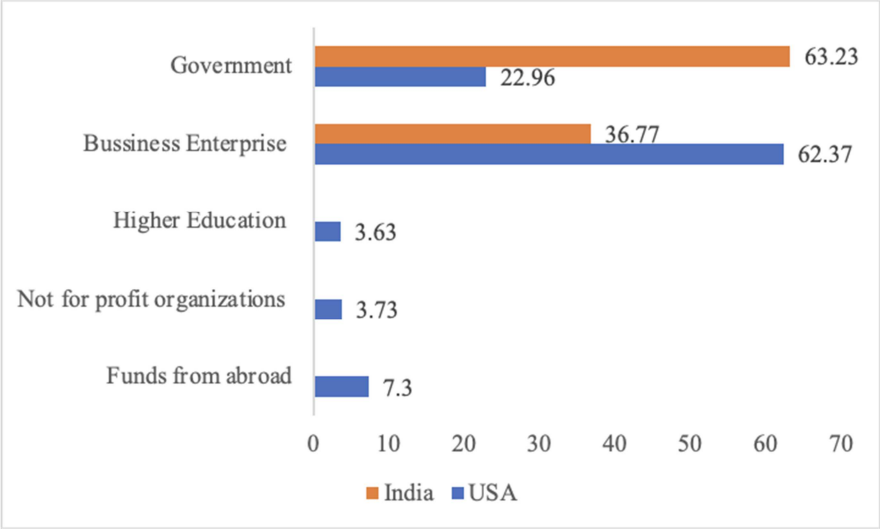
Keywords: R&D, Financial Support, Tax Credits, Tax Super Deduction, Incentivization, USA, India

1. Introduction

It is widely acknowledged that Research and Development (R&D) leads to development of new products and technologies that significantly contribute to the socio-economic growth of the country. Global spending on R&D has reached a record high of almost 1.7 trillion USD [1]. About 10 countries in total account for 80% of global R&D spending [1]. As part of the Sustainable Development Goals (SDGs), countries have pledged to substantially increase public and private R&D spending as well as the number of researchers by 2030 [1]. The US is the scientifically and technologically most advanced nation of the world. For more than 50 years, the US has dominated the world's R&D spending [2]. The US spends more than any other single country and contributes nearly 27% share in the world's R&D spending for the last 5 years [2].

As per the financial data collected by UNESCO, the US invested 581.6 Billion USD in PPP in the year 2018) [3]. On the other hand, India is the 6th largest R&D spender with 68.2 Billion USD in PPP R&D investment for the year 2018 [3] and is the only developing nation to compete with other

developed nations in terms of R&D spending. In spite of India amongst the top 10 nations of the world in global R&D spending, its performance on global innovation parameters with 48th global ranking on Global Innovation Index for 2020 is not that convincing.



Source: [3]

Figure 1. *Percentage Contribution in National R&D System in US and India (2018).*

The US spends nearly 2.8% of its GDP for R&D and India spends only 0.69% of its GDP for R&D (UNESCO Institute of Statistics, 2020). In the US, the private sector is the major R&D spender and performer (>60% contribution in national R&D system) whereas, in India, the government is the largest R&D spender and performer and the private sector contribute only 30-40% in national R&D ecosystem. The comparative sector wise monetary contribution in overall R&D investments in the US and India is presented in Figure 1. On comparing US and India on R&D and innovation parameters, US is performing exceptionally well leading in most of the innovation attributes in comparison to India (Table 1). The strength of the US comes from its performance in pillars like financial system, business sophistication, and innovation capabilities. These sub-indices reflect a strong factor of production and a vibrant innovation ecosystem in the US. This is reflected in the outstanding positioning of the US on parameters such as business environment, company spending on R&D, growth of innovative companies, financing of SMEs and other factors as presented in Table 1, where India needs to work upon. Government-mediated incentives for the private sector's R&D is one of the most effective ways in stimulating the private sector to come forward in the national R&D ecosystem. Government incentives are applicable as:

a. Direct Support: by providing financial assistance to the R&D projects carried out by the industrial firms.
b. Indirect Support: in form of tax incentives to reduce the tax burden on the industrial firms associated with the R&D activities.

In the present study, an attempt is made to review the system of government-mediated R&D incentivization for private sector's R&D in US and India and relevant lessons have been drawn for stimulating private sector's R&D in India.

Table 1. *Global Rankings of US and India Based on R&D, Innovation and Business Related Indicators.*

S. No	Indicators	Global Rank of USA	Global Rank of India
1	Global Competitiveness Index[a]	1	58
2	Global Innovation Index[b]	3	48
3	Research and Development Spending[c]	1	7
4	Gross Expenditure on R&D,% GDP[b]	9	57
5	GERD Performed by Business,% of GDP[b]	8	52
6	GERD Financed by Business,% of GDP[b]	11	48
7	Research Talent,% in Business Enterprise[b]	6	38
8	Overall R&D Standing[b]	2	35
9	Publications[d]	1	9
10	Citable Documents H-Index[b]	1	21
11	Intellectual Property Rights[e]	1	59
12	Capacity for Innovation[a]	2	
13	Global R&D Companies, avg. expends. top 3, mn $US[b]	1	16

S. No	Indicators	Global Rank of USA	Global Rank of India
14	Business Environment	3	106
15	Company Spending on R&D[a]	2	
16	Ease of Getting Credit[b]	4	23
17	Domestic Credit to Private Sector,% of GDP[b]	2	70
18	Microfinance Gross Loans,% of GDP[b]	n/a	25
19	Financing of SMEs[a]	1	16
20	Venture Capital Availability	1	13
21	Growth of Innovative Companies	2	26

Source: [a][4]; [b][5]; [c][1]; [d][6]; [e][7]

2. Government Mediated R&D Incentivization of Private Sector

2.1. USA

The US Federal government is commendably contributing 2.8% of its GDP for its national R&D activities. The private sector is the major funder and performer of R&D and the government has played a crucial role in this by supporting the industry by means of financial support and tax benefits on R&D as discussed below.

2.1.1. Financial Support

The US Federal government implements a number of financial assistance programmes for research in the country. The US Federal government provides one of the largest volumes of direct funding support for business R&D followed by Russia, China, S. Korea and France amongst the OECD countries [8]. Two major agencies Office of Science and Technology Policy (OSTP; https://www.whitehouse.gov/ostp/) and Office of Management and Budget (OMB; https://www.whitehouse.gov/omb/) under Executive Office of the President (EOP) play a crucial role in strategizing R&D activities in the country and decide over R&D budget of the federal government. Both OSTP and OMB play a remarkable role in designing US's science policy and budgeting process on a yearly basis in terms of funds allocated to each agency and further how these funds need to be spent. Under this government is implementing programmes like Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) program in various federal agencies for supporting business R&D. Additionally, the US Federal government has established 'Small Business Administration (SBA; https://www.sba.gov/)' that specifically provides financial support for the development of small businesses in the US. The major R&D financial supporting programmes of US federal agencies are listed in Table 2.

Table 2. *Financial Support Programmes of US Federal Government.*

S. No.	Funding Agency	Funding Programme for Industry
1	National programme (applicable for each funding agency)	*a.* Small Business Innovation Research (SBIR) *b.* Small Business Technology Transfer (STTR) program
2	National Science Foundation	*a.* Business and Industrial R&D scheme *b.* Industry-University Cooperative Research Centers Program (IUCRC) *c.* Partnerships for Innovation: Accelerating Innovation Research - Research Alliance (PFI: AIR-RA) *d.* Partnerships for Innovation: Accelerating Innovation Research - Technology Transfer (PFI: AIR-TT)
3	National Institute of Health	*a.* Partnerships for Innovation: Building Innovation Capacity (PFI: BIC) *b.* NIH Centers for Accelerated Innovations (NIH/NCAI)
4	Small Business Administration https://www.sba.gov/about-sba	*a.* Grants *b.* Loans *c.* Financial guarantees as surety bonds *d.* Contracts *e.* Investment capital as equity bonds

2.1.2. Tax Incentivization

The system of research tax credits was a temporary provision in the US federal government and each year it was renewed subjected to numerous conditions at the Senate and Congress level. In the year 2015 (under 26 US Code 41-credit for increasing research activities[1]), it was accorded a permanent status by signing of law on the provision of the research tax credit to the corporates. With the permanent status to the research tax credits, the US Federal government has taken an impactful move to incentivize the private sector to invest in R&D. The US system executes the tax incentives for R&D in the form of research tax credits[2] referred as 'Federal Research and Experimentation Tax Credit'. All

[1] Section 41 of the Internal Revenue Code (IRC) of the US Federal government implements the provision of providing research-related tax credits to corporates that leads to reduced tax rates on their income. Most of the states follow the research tax credit scheme at variable rates.

[2] Tax credits are the system of providing special credit rates that apply directly to the total tax that is owned by the taxpayer and reduce the tax to be paid by the value of tax credits. These tax credits can either be refundable or non-refundable.

types of industries in the US can avail tax credits on research expenditure that is qualified as per rules and regulations specified by the US Federal government. The qualified research expenditures (QRE) include expenditure made on paying the wages of the labor of in-house research units of the industry, expenditure made on supplies to be used for research activities, creation of innovative software for self-use, construction of pilot plant and part of contractual research as specified in Table 3. The Federal government excludes any form of expenditure associated with capital and overhead fields.

Table 3. *Contractual Research Expenditure (CRE) as QRE.*

S. No.	Percentage of CRE Considered as QRE	Attributes of Contractual Research
1	65	Amount paid by the industry to any person for carrying out qualified research
2	75	Amount paid by the industry to research consortia for carrying out qualified research
3	100	Amount paid by the industry to small businesses/federal laboratories/higher education institute for carrying out qualified research

Source: [9-11]

The main attributes of Federal tax credit system are as follows:

a. It is a non-refundable tax credit system (with a few exceptional states of the US that offer refundable tax credits[3]).
b. It is based on the increment exhibited by industry on its R&D expenditure year to year. The tax credit is calculated on the exceeding amount of the qualified research expenditure in comparison to the base amount[4].
c. Unused tax credits can be carried forward for a period of 20 years and can be carried back for an only one-year period.
d. The taxpayers can check for their tax credit on R&D investment by provision of pre-filing agreements. This also helps in resolving issues related to tax credits between government and industries. Due to the involved time and effort constraints, this practice is rarely practiced.
e. There is provision of special preferential tax benefits for small businesses and start-ups (annual gross receipts ≤ 50 million USD for preceding three taxable years) to use tax credits for offsetting their alternative minimum taxes[5].
f. Small start-ups which have annual gross receipts less than 5 million USD can use research tax credits to reduce payroll taxes[6].

Types of Research Tax Credits

There are different forms of tax credits the industry can opt for its R&D investment. Types of research tax credits as practiced in the US are as follows [10, 11].

a. *Targeted Research Tax Credits*: is the most widely used system of tax credits that can be explored by industries pursuing targeted research. Different credit rates are offered for different target groups of research (Table 4).
b. *Traditional Research Tax Credit*: is calculated as 20% of the amount of QRE that exceeds the base amount. The base amount is calculated by considering the data from the 1980-84 time period. The traditional tax credits are generally utilized by old and long-standing companies.
c. *Alternative Simplified Credit*: amounts to 14% of the 50% increment of the QRE in comparison to the average of previous three years' QRE that acts as a base amount. In the past few years, alternative simplified tax credits are utilized by most of the industries due to its ease in the calculation of the tax credits in comparison to the traditional research tax credit system. In the case of no qualified research expenditure in any of three previous years, then the industry can utilize 6% of the tax credit on its total tax to be paid.
d. *Computational Adjustments*: can be taken up for reducing the amount of tax to be paid where traditional and alternative tax credits are not applied.

In addition to tax credits, the US Federal government also offers 100% tax deductions on the R&D expenditure under section 174 of Internal Revenue Code. Industry can avail both tax deductions and tax credits and generally tax credits are dominated in the US system. Additionally, the US Federal government offers specific tax benefits in terms of capital expenditure, energy sustainability and employment generation that have played a substantial role in overall development of the private sector in the US. Some of them are New Market Tax Credit, Domestic Production Deduction, Work Opportunity Tax Credit, Solar Power Investment Tax Credit, Wind Production Tax Credit and many others which have contributed to the overall development of the private sector.

[3] Refundable tax credits work when the tax credit amount is more than the total tax owned by the taxpayer and the additional tax credit amount is refunded to the taxpayer. On the other hand, in case of the non-refundable tax credit, the extra tax credit amount is not refunded back, it can only be used to maximally reduce the amount of tax to be paid till zero.

[4] The base amount signifies the amount of the qualified research expenditure which is expected to occur. It is calculated on basis of taking average expenditure in previous years or taking the fixed base value of certain reference period subjected to sales and inflation.

[5] The alternative minimum tax is the supplement tax imposed by the US Federal government in addition to the baseline income tax based on certain conditions. Small businesses which have are eligible for utilizing research tax credits to offset the alternative minimum taxes which are applied on them whereas other industries can only utilize research tax credits to offset the regular tax.

[6] Payroll taxes are taxes imposed on employer and employees based on the salaries paid by the employer to its employees.

Table 4. *Targeted Research Based Tax Credits.*

S. No.	Domain	Tax Credit	Brief Details
1	Basic Research	20%	20% research tax credit is provided to basic research that includes the R&D expenditure made by industry on funding research activities undertaken by research organizations and universities with no commercial objective
2	Energy Consortiums	20%	20% research tax credits are applied on the payments and other expenditure incurred on energy consortiums
3	Clinical Testing	50%	50% research tax credits are applicable on the expenditure made on clinical research associated with the orphan drugs which have remain commercially undeveloped

2.2. India

The Government of India (GoI) has a promising outlook towards R&D and has taken the substantial initiative to support R&D activities in the country as listed below.

2.2.1. Financial Support

The major programmes implemented in India to support industry's R&D fall under Technology Development Board (TDB), Department of Scientific and Industrial Research (DSIR), Ministry of Electronics and Information Technology (MeitY), and Biotechnology Industry Research Assistance Council (BIRAC). Other ministerial departments and agencies have R&D funding programmes which provide R&D grants to either individual researchers, HEIs and research laboratories, or for industry-academia collaboration research projects and limited grants are received by the industry for its core R&D. The major financial support from the GoI to the industries pursuing R&D are listed in Table 5.

Table 5. *Government Mediated Financial Support Programme for R&D Projects of Private Sector.*

S. No.	Government Ministry/Department/agency	Financial Assistance Programme
1	Technology Development Board (TDB; http://tdb.gov.in/)	TDB Board provides financial assistance in form of *a.* Loan @5% for the 50% of the project cost *b.* Equity for 25% of the project cost *c.* Grants for national importance R&D project *d.* TDB National Award for financial assistance
2	Department of Scientific and Industrial Research (DSIR; http://www.dsir.gov.in/)	*a.* Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) *b.* Patent Acquisition and Collaborative Research and Technology Development (PACE[a]) *c.* Technology Development and Demonstration Programme (TDDP)
3	Biotechnology Industry Research Assistance Council (BIRAC; http://www.birac.nic.in/)	*a.* Sustainable Entrepreneurship and Enterprise Development (SEED) Fund *b.* Biotechnology Ignition Grant (BIG) *c.* Small Business Innovation Research Initiative (SBIRI) *d.* Biotechnology Industry Partnership Programme (BIPP)
4	Ministry of Electronics and Information Technology (MeitY; https://meity.gov.in/)	Modified Special Incentive Package Scheme (M-SIPS[b])
5	Ministry of Micro, Small and Medium Sized Enterprises (MoMSME; https://msme.gov.in/)	*a.* A Scheme for promoting Innovation, Rural Industry & Entrepreneurship (ASPIRE) *b.* Credit Linked Capital Subsidy for Technology Upgradation (CLCSS[c])
6	Global Innovation and Technology Alliance (GITA; www. gita.org.in)	*a.* Bilateral and multilateral programmes *b.* Technology Acquisition Fund Programme *c.* Technology Development Fund
7	Technology Information, Forecasting and Assessment Council (TIFAC; www.tifac.org.in)	Revolving Technology Innovation Fund [under TIFAC-Small Industries Development of Bank of India (SIDBI) Programme]
8	Council of Scientific and Industrial Research (CSIR; www.csirhrdg.res.in)	New Millennium Indian Technology Leadership Initiative (NMITLI)
9	Indian Council of Agricultural Research (ICAR; www.icar.org.in)	*a.* National Agriculture Innovation Fund *b.* National Agriculture Science Fund
10	Department of Pharmaceuticals (http://pharmaceuticals.gov.in/)	*a.* Cluster Development Programme for Pharma Sector (CDP-PS) *b.* India Pharma Awards *c.* Scheme for Development of Pharmaceutical Industry
11	Department for Promotion of Industry and Internal Trade (DPIIT; http://dipp.nic.in)	*a.* Industry Promotion Scheme *b.* Invest India[d]
12	Ministry of New and Renewable Energy (MNRE; http://mnre.gov.in/)	Research, Design & Development (RD&D)
13	Indian Space Research Organization (ISRO; www.isro.gov.in)	Sponsored Research (RESPOND)
14	Indian Council of Medical Research (ICMR; www.icmr.nic.in	Grant-in-aid (GIA) Scheme for Inter -Sectoral Convergence & Coordination for Promotion and Guidance on Health Research

Notes: [a] Loan is provided to industries for 50% of the project cost; [b] provides 20% capital subsidy to the electronic manufacturing units located in special economic zones in India; [c]15% capital subsidy for technology upgradation by MSMEs; [d] joint venture company (not-for-profit company) of DPIIT, FICCI and various state governments with shareholding of 45%, 51% and 4% respectively. It holds the responsibility of facilitating investments in R&D in India (http://www.investindia.gov.in/).

2.2.2. Tax Incentivization

The GoI introduced tax super deduction due to the R&D investment in the year 1981 under Section 35 of the Income Tax Act 1961. Since then, the extent of tax benefits in terms of the percentage of super deduction has varied widely. The pre-approval from DSIR is essential for availing the tax benefits for R&D investments. Major financial assistance from the government to industry for qualified R&D project also requires DSIR approval. Hence, DSIR is the specialized government department for recognizing the industrial R&D and accreditation of R&D units of industries making them eligible for fiscal benefits on industries' R&D investments. The tax benefits practiced in India are listed in Table 6. The GoI has issued the list of items (11th Schedule of Income Tax Act 1961) that do not fall under qualified R&D that includes alcoholic formulations, tobacco and its related products, cosmetics, confectionary items, gramophones, office machines and many other daily routine items thereby restricting the scope of R&D to be carried out by the private sector.

Table 6. *R&D Related Tax Benefits for the Private Sector's R&D Investment.*

S. No.	Tax Benefits	Reference
1	150% Super deduction on in-house R&D expenditure by the company/business	Section 35 of Income Tax Act 1961 [Subsection (2AB)]
2	150% super deduction for specified payments made to approved scientific research associations, approved universities, colleges, or other institutions	Section 35 of Income Tax Act 1961 [Subsection 1 clause (ii)]
3	100% Super deduction for specific payments made to a scientific research company/research association/university/college/other institution for the purpose of scientific and statistical research	Section 35 of Income Tax Act 1961 [Subsection 1 clause (iia)]
4	100% would be applicable for capital expenditure made for scientific purpose by the company. The capital expenditure will not include expenditure made on land acquisition	Section 35 of Income Tax Act 1961 (Subsection 2)
5	Super deduction of 150% on scientific expenditure made for any contract or sponsor research or any other form of expenditure made to pay: *a.* National Research Laboratory *b.* Indian Institute of Technology (IIT) *c.* University *d.* Specified person for research purpose in approved scientific programme	Section 35 of Income Tax Act 1961 [Subsection (2AA)]
6	Customs Duty Exemption on specified types of imported equipment, components and instruments	Indirect taxes, Income Tax Act 1961
7	3-year central excise duty waiver on specific goods developed by the Indian owned company that is patented at least in two countries (India, US, Japan and any one country from European Union)	Indirect taxes, Income Tax Act 1961
8	'Make in India' initiative has implemented tax benefits for start-ups: *a.* The start-up companies set up during the period starting 1st April 2016 to 31st March 2019 can avail 100% deduction in their profits for a period of 3 years. *b.* No taxation for capital gains, if invested in a notified funds or in notified start-ups	Finance Bill 2016
9	Patent Box Regime: is valid only for the patents which are developed and registered in India. The royalty income earned (gross revenue income) from these patents will be taxed at concession rate of 10% (plus the applicable cess and surcharge).	Section 115BBF (introduced in 2016 Finance Bill)

The US and India have developed a robust system of private sector's R&D incentivization. The comparison between the R&D incentivization practiced in the US and India is presented in Table 7.

Table 7. *Comparative Analysis of Government Mediated Incentives for Private Sector's Engagements in R&D in US and India.*

Attributes	US	India
Financial Support	*a.* Strong *b.* Over 900 Financial support Programmes *c.* Offers grants, loans, equity, contracts and surety bond *d.* Available to all types of industries	*e.* Limited *f.* TDB offers major financial support in form of Loans, Grants and equity to industry for R&D *g.* Mostly applicable to DSIR recognized industries
Tax support	*a.* Tax credit *b.* Tax super deduction	*a.* Tax deduction *b.* Tax exemption *c.* Patent box regime
Basis of tax incentives	Increment in R&D Investments	Volume of R&D investments
Refundable/non refundable of tax incentives	*a.* Non refundable tax incentive *b.* Can be carried forwarded for 20 years *c.* Can be carried back for 1 year	*a.* Non refundable tax incentive *b.* Can be carried forwarded for 8 years only in loss situations *c.* Cannot be carried back
Industry eligibility	All types of industries	Only DSIR recognized industries (need to fulfil the specified criteria)
Qualified Research Expenditure	*a.* Wages of labour in In-house R&D unit *b.* Supplies for performing R&D *c.* Contractual R&D expenditure *d.* Development of innovative software for internal use in the industry *e.* Creation of pilot plant of R&D process *f.* Cost of obtaining patents	*a.* Wages of labour in In-house R&D unit *b.* Supplies and utilities for performing R&D *c.* Clinical drug trial related expenditure only when the drug trial is pre-approved by the concerned regulatory authority in India and patent application is filed for the drug for which clinical testing is carried out.
Non-qualified research	*a.* Land, building and depreciable assets like equipment	*a.* Land and building cost

Attributes	US	India
expenditure	*b.* Overhead costs *c.* Licensing fees *d.* Leasing charges	*b.* Depreciation cost *c.* Overhead costs *d.* Administrative costs *e.* Allocated expenditure
IP requirements	The IP related to the R&D has no restrictions it can be applied anywhere or can be from any part of the world on which US based industry can avail tax credits	The IP related to the R&D has no restrictions it can be applied anywhere or can be from any part of the world on which industry can avail tax credits only if industry owns the patent
Jurisdiction	There is no specific jurisdiction required for the industry to avail tax benefits	Jurisdiction applies on availing paten box benefits as benefits are only available for the innovators who are Indian and license their patents to Indian company
Administrative requirements	No government pre approval required for availing the tax benefits	Government pre-approval required for availing the government incentive Recognition and renewal requirements from the DSIR

3. Lessons for India to Stimulate Private Sector's R&D Investments

3.1. A Robust System of Financially Supporting Private Sector's R&D

In both the US and in India, the system of providing financial assistance in form of grants, loans and equity to the private sector for R&D projects is carried out. In the US there are over 900 different programmes of the US federal government that aim to support the private sector's R&D financially [10-13] but in India, there are limited programmes from TDB, DSIR, MeitY and BIRAC which directly support private Sector R&D. Following suggestions are proposed for strengthening the financial support system for industry in India:

a. A fixed percentage of funds (1-2%) in all the government ministries should be allotted to support the private sector's R&D.
b. It is necessary to introduce a financial guarantee scheme on the lines of the US's State Small Business Credit Initiative; to provide the guarantee in order to secure the huge amount of money invested by industry in R&D.
c. Indian universities and national research laboratories are credited with a sound research environment. Therefore, GoI should take impactful steps to link industry to universities and national research laboratories via schemes such as I/UCRC, PFI, PPIP as practiced in the US.
d. In the year 2012, the Department of Biotechnology (DBT) created BIRAC to support the biotech industry. The major flagship programmes like SBIRI and BIPP were modelled on the US Federal programmes SBIR and STTR programme. BIRAC has led to the generation of 820 start-ups, supported 653 companies for their R&D that has led to commercialization of nearly 146 products and technology with the generation of more than 200 intellectual properties [14]. It is highly recommended to initiate such councils in domains such as electronics and information technology, agriculture, space technology, energy and many more.
e. Further improvement in BIRAC can be prompted by introducing a number of industry-academia research partnership schemes.

3.2. Establishment of the National Council for the Assistance of Small Businesses

The US has a dedicated agency 'Small Business Administration (https://www.sba.gov/)' for promoting the growth of entrepreneurs and small business. Similarly, India has a dedicated Ministry for promoting small and medium-sized enterprises and entrepreneurs through MoMSMEs and Ministry of Skill Development and Entrepreneurship (https://www.msde.gov.in/). On the lines of SBA, MoMSME can perceive financial assistance programmes in form of loans, grants, equity, guarantees etc. for small businesses, damaged business houses and women-owned businesses in order to expand their businesses.

3.3. Increasing the Scope of Qualified R&D Expenditure

In India, a part of R&D expenditure is qualified for government mediated incentives, hence it is suggested that the scope of qualified R&D expenditure should be expanded by modifying 11th Schedule of negative products. The key suggestions are as:

a. Certain products ranging from cosmetics to electronic products are continuously evolving in their standards in accordance with the consumer's budget and quality expectation by implementing R&D activities. These products may be qualified for the R&D incentive scheme.
b. Cover up costs incurred for translating R&D work involving test designing, standardization, and clinical trials should be considered as QRE.
c. Simplifying the eligibility status of the companies to avail R&D incentives.
d. Wide awareness of the DSIR scheme of 'Recognition of Industrial R&D' should be carried out to attract industries to invest in R&D.

3.4. Creation of tax Benefit System Based on R&D Increments

In India, the tax incentives are provided on the total amount of R&D expenditure incurred by the industry, while in the US tax incentives are provided on the increment in the R&D investment. Increment based tax support is more complex to design but is cost-effective for the government as

tax incentives are provided to those industries which are performing well and have justifiable R&D investments [16]. As India is one of the fastest growing economies of the world, there is a need to modulate its taxation policy to support the industries which are performing well on the parameters of R&D and innovation, therefore it is recommended that GoI may adopt hybrid of both volume and increment based tax incentivization of private sector for R&D expenditure. The hybrid system can be imposed as per the scale of industries, type of industry, the magnitude of R&D undertaken and the year since the R&D activity was first initiated in the industry.

3.5. Introduction of Targeted Research-Based Incentives

The US's targeted research credits specifically promote basic research and clinical research to promote the development of orphan drugs. On similar lines, Indian tax incentives can be targeted to promote specific research in the field of pharmaceuticals and life science to address the national challenge in the field of health and agriculture. To further strengthen the pharmaceutical industry in India, special incentives for clinical research and including cost incurred on clinical research as the qualified research expenditure will act as a great boost for the pharmaceutical industry [17].

3.6. Restoration of Tax Super Deduction on R&D Expenditure to 200%

The scheme of tax incentives on R&D expenditure is not a permanent scheme in India. Since the introduction of tax incentives for R&D expenditure, the percentage super deduction on the R&D expenditure incurred by the companies has been decreased or increased as per the government analysis and industrial policy framework with each year's union budget presented by the Ministry of Finance (Table 8).

Table 8. *Evolution of the R&D Tax Incentivization Scheme in India.*

S. No.	Union Budget	Evolving R&D tax incentives (as per section 35 2AB of IT Act 1961)
1	1981-82	Introduction of 100% of super deduction on R&D expenditure
2	1999-2000	Extension of 125% of super deduction on R&D expenditure up to 2005
3	2000-01	Super deduction on R&D expenditure was increased to 150%
4	2010-11	Super deduction on R&D expenditure was increased to 200% up to 2016-17
5	2016-17	Super deduction on R&D expenditure was decreased to 150% from 2017 financial year up to 2020 financial year and further will be decreased to 100% super deduction on R&D expenditure 2020 financial years onwards

The union budget of 2016-17 radically reduced the tax incentives to 150% super deduction on R&D investments from the start of the financial year 2017 up to the end of the financial year 2020. It is further decreased to 100% super deduction financial year 2020 onwards. The decreased rates of tax super deduction on R&D investments can lead to underinvestment in R&D by industries mainly which fall under the medium scale and small scale enterprises. This can create an imbalance in R&D required and incurred as per social desirable optimum level [11]. Therefore, there is strong urge from the industries to restore to 200% tax super deduction on the R&D Investment as per Section 35 (2AB) of Income Tax Act 1961 [16].

4. Conclusion

India being the fastest growing economy of the world, has to improve and enhance its R&D ecosystem for technology led socio-economic growth of the country. The public sector is the major source of R&D in the country [18]. In order to enhance India in technological advancements the private sector needs to come in forefront of R&D investments [15]. This can be achieved by stimulating private sector engagements in the innovation ecosystem of the country as observed in the most developed and technological advanced nation of the world. The study has come out with relevant suggestions as drawn from reviewing the US system of private sector incentivization for R&D. The highlighting points are as a) creation of robust financial supporting system for private sectors R&D projects; b) creation of national council for small businesses; c) enhancing the scope of research performed in India that comes under realm of eligible industries and qualified research expenditure; d) creation of increment in R&D investments based and target research area based tax incentivization and e) restoration of 200% super deduction rates for calculating taxable amount as a tax benefits to industries investing in R&D.

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References

[1] UNESCO Institute of Statistics. Retrieved from http://uis.unesco.org/apps/visualisations/research-and-development-spending/

[2] Advantage Business Media and Industrial Research Institute (2017). "2017 Global R&D funding forecast. Industry Research Institute". Retrieved from http://digital.rdmag.com/researchanddevelopment/2017_global_r_d_funding_forecast?pg=1#pg1

[3] UNESCO Institute of Statistics (2020). Global Investments in R&D. Fact Sheet No. 59. Retrieved from http://uis.unesco.org/sites/default/files/documents/fs59-global-investments-rd-2020-en.pdf.

[4] The Global Competitiveness Index (GCI) Report (2018-19).

[5] The Global Innovation Index (GII) Report (2020).

[6] http://www.scimagojr.com/countryrank.php

[7] IPRI Report (2017). Retrieved from http://www.internationalpropertyrightsindex.org

[8] OECD (2015). "OECD-NESTI data collection on tax incentive support for R&D expenditures". Retrieved from https://www.oecd.org/sti/oecd-nesti-data-collection-on-tax-incentive-support-for-rdexpenditures.pdf

[9] OECD (2016). "Compendium of R&D tax incentive schemes: OECD countries and selected economies". Retrieved from https://www.oecd.org/sti/rd-tax-incentives-compendium.pdf

[10] Deloitte Touche Tohmatsu Limited (2017). "2017 Survey of global investment and innovation incentives". Retrieved from https://www2.deloitte.com/us/en/pages/tax/articles/global-survey-ofinvestment-and-innovation-incentives.html

[11] Mani, S. & Nabar, J. (2016). "Is the government justified in reducing R&D tax incentives". Economic and Political Weekly, 1 (30), 22-25.

[12] PwC (2017). "Global R&D incentives group". Retrieved from https://www.pwc.com/gx/en/tax/pdf/pwc-global-r-and-d-brochure-april-2017.pdf.

[13] PwC (2017). "2017 global innovation 1000 study". Retrieved from https://www.strategyand.pwc.com /innovation 1000 19.

[14] Biotechnology Industry Research Assistance Council (BIRAC) Brochure 2020.

[15] Department of Science and Technology and Confederation of Indian Industry (2013). "Stimulation of investment of private sector into research & development in India". Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.694.4211&rep=rep1&type=pdf

[16] Department of Science and Technology (2020). "Draft 5th National Science, Technology, and Innovation Policy for public consultation". Retrieved from https://dst.gov.in/draft-5th-national-science-technology-and-innovation-policy-public-consultation.

[17] Global Data (2020). "New incentives and tax benefits can boost R&D ecosystem for new drug development in India, says GlobalData". Retrieved from https://www.globaldata.com/new-incentives-and-benefits-can-boost-rd-ecosystem-for-new-drug-development-in-india-says-globaldata/

[18] Department of Science and Technology (2020). "Research and Development Statistics 2019-20". Retrieved from https://dst.gov.in/sites/default/files/Research%20and%20Development%20Statistics%202019-20_0.pdf