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Invigorating Government Mediated R&D Incentivization of Private Sector in India

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Abstract

In the current century, research and innovations have become a key parameter for nations economic and societal growth. Research and innovations are money intensive programmes. Most developed and innovation based economies like USA, China, Japan, Germany and S. Korea are spending over 2% of GDP in R&D, whereas developing nations like India, contribution in R&D is 0.69% of GDP. Moreover, in the innovation based economies, the share of private sector investments in R&D is more than the public sector. In comparison, the public sector's share of gross R&D expenditure, of developing countries including India is nearly 60-70% and the rest accrued by the private sector. To stimulate the private sector's R&D investments, the Government of India (GoI) has taken substantive steps by floating various incentivization schemes, in the form of direct and indirect tax incentives, patent related incentives and financial support for carrying out R&D. This study discusses the R&D incentivization schemes of the top 10 R&D spending countries of the world including India (6^{th} largest R&D spender). The study has listed two types of R&D incentivization mechanisms available for the private sector, a) R&D tax incentivization and b) R&D financial support mechanisms. The study has come up with few notable suggestions for invigorating government mediated R&D incentivization of the private sector in India. Some of the key suggestions listed in the study are revamping the R&D tax incentives for the industry, introducing financial R&D support schemes especially for MSMEs, introduction of risk guarantee schemes, creation of industry research groups, industry technology hubs and theme based clusters to support industrial R&D.

Key words: Private Sector, R&D, Incentivization, Tax Incentives

Introduction

Research and Development (R&D) has become one of the most essential parameters for determining the economic growth and productivity of a nation. Countries like USA, China, Japan, Germany and S. Korea, spend a substantial amount on R&D thus emerging as the most innovative and technologically advanced nations[1]. Although India has incremented its investment in R&D, its GDP contribution towards R&D is still less than 1%.

India is amongst the fastest growing economies of the world. In order to rub shoulders with developed nations, it has to address the issue of stimulating the private sector investment in R&D, as a million dollars of investment in R&D is required to promote a national innovation ecosystem. No nation can set aside this kind of money for R&D activities, and thus the private sector has to be roped in, as is the practice in developed countries. To stimulate the private sector engagement in the R&D ecosystem, India must review its R&D policy for the private sector and incorporate appropriate global R&D incentives for catching up with the stable economies of the world.

Global Status of R&D Investments

Innovative research practices have become one of the key sources for generation of new processes, products, and technologies that can be explored in national and international markets to bring out mankind's benefit. Substantial investments in R&D activities are required to promote national innovation ecosystem. The R&D processes and the costs associated with R&D varies from country to country and year to year. Global spending on R&D has reached a record high of almost United States Dollar (USD) 2.3 trillion [1]. About 10 countries (US, China, Japan, Germany, S. Korea, France, India, UK, Brazil and Russian Federation) account for 80% of global R&D spending (Figure 1)[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[2]. As per the continental share in world R&D expenditure, Asia with 24 countries is leading in R&D investments (more than 42% of total R&D expenditure) in total followed by Europe (34 countries), North America (12 countries), Russia (5 countries), Middle East (13 countries) and South America (10 countries) (Figure 2) [1]. Asian countries such as China, India, Singapore, South Korea, etc. from past decade has undertaken impactful initiatives to enhance their R&D investments for building self-reliant technological advancements.

The most commonly-used indicators to monitor resources devoted to R&D worldwide are gross domestic expenditure on R&D (GERD) expressed in purchasing power parity (PPP$)

and R&D intensity (percentage of gross domestic product (GDP) devoted to R&D activities)[3]. USA is the top most R&D spender globally with 521. 69 PPP Billion USD as GERD that accounts to be 2.7% of its GDP value [2]. After US, China is the only country that has GERD >400 with R&D intensity of 2.0. Further, as observed in Figure 1, S. Korea has the highest R&D intensity of 4.3% followed by that of Japan (3.4%) and Germany (2.9%) [2]. Most of the developed countries spent more than 2% of their GDP on R&D. In comparison to the world most developed and innovation-based economies, India is lacking far behind in terms of R&D progress. India spends less than 1% of the GDP[4] in the research activities whereas, South Korea and Israel have the largest contribution of GDP (more than 4%) towards research that has led to the emergence of these countries as amongst innovative countries of the world in short span of time [1, 2].

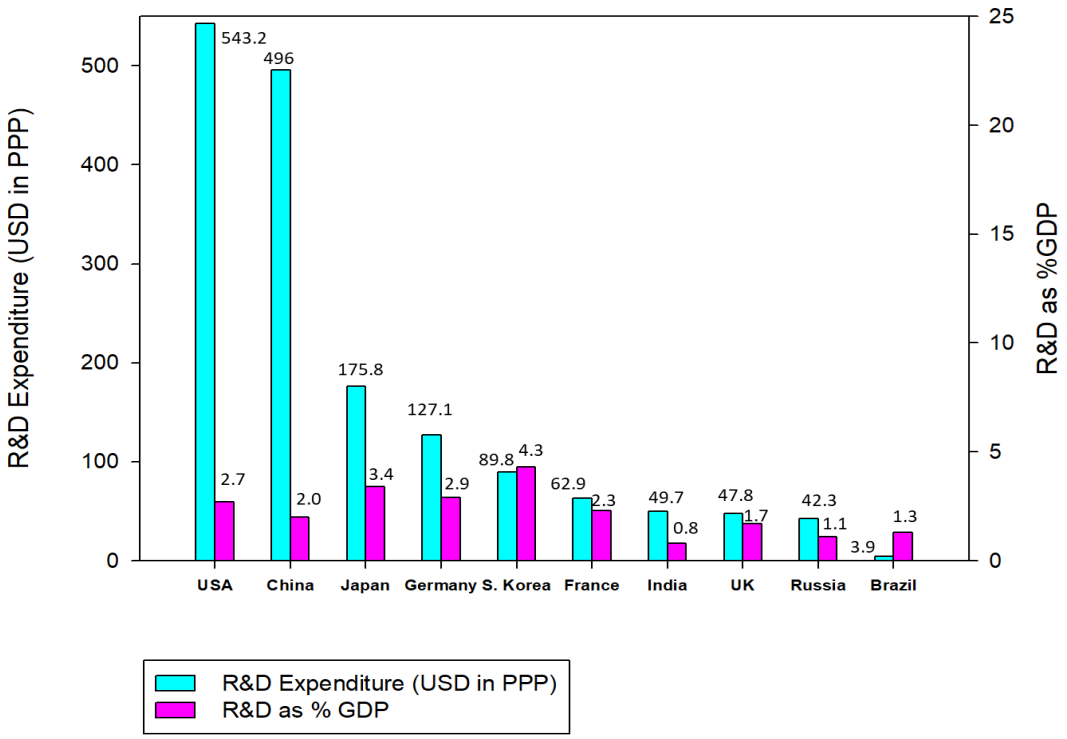

Figure 1: Top 10 Global R&D Spenders

R&D Expenditure of all the countries is for year 2017, except Brazil (2016) and India (2015).

Sources: UNESCO Institute for Statistics, June 2019 [2]

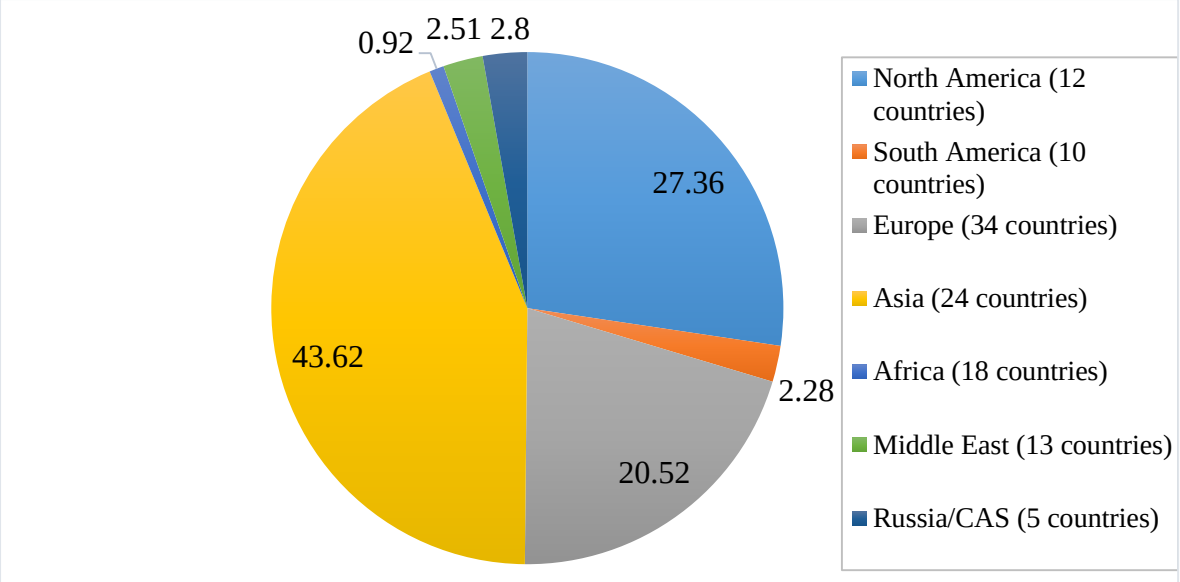

Figure 2: Global R&D Expenditure Share

Source: ABM & IRI, 2018 [1]

In any nation, investments in R&D are incurred by public sector that comprise of government and public enterprises, and private sector that consist of private organizations which are not government controlled. Each country has specified pattern of public and private sectors contribution to the national R&D expenditure. From USA to China, industrial R&D has become the mainstay of a country's research and development efforts. Industry is now generally responsible for two thirds or more of a country's R&D performance. Globally, the sourcing of R&D funds has been split nearly equally by government and industry. Innovation driven countries like USA, China, Japan, Germany, South Korea and France, industry supports R&D at twice the level as government does (Figure 3). Industry is the major influential force behind nation's R&D drive and contributes to the largest share in national R&D investments in countries such as, S. Korea (78.22%), Japan (77.76%), China (77.29%) and USA (71.5%)[2]. In comparison, the pattern of R&D funding in India is totally reverse[4]. One-third of R&D is supported by the private sector and the rest is contributed by the public sector funded R&D investments.

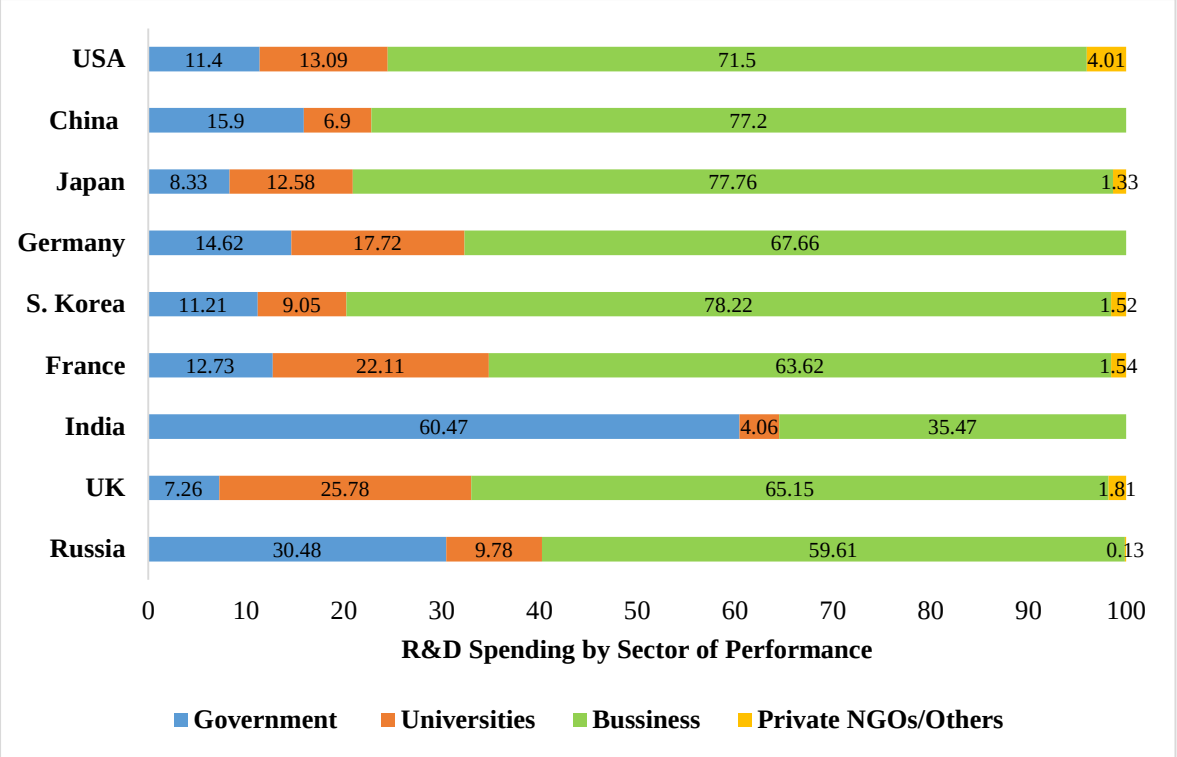

Figure 3: Sector Wise R&D Spending in Top R&D Spending Countries

Source: http://uis.unesco.org/apps/visualisations/research-and-development-spending/; retrieved on 15 Nov. 2019 [2]

India is ranked 6th in terms of global R&D investments with 2.8% share in global R&D investments [1,2]. The Gross expenditure on R&D (GERD) in the country has been consistently increasing over the years (Figure 4). India has witnessed tremendous growth in its national R&D expenditure, showcasing more than 200% increase in its R&D expenditure from 2004-05 (INR 190,428 .9 million) to 2014-15 (INR 722,435.1 million)[4]. As a fraction of GDP, expenditures on R&D has been stagnant between 0.6-0.7% of GDP, over the past two decades [5].

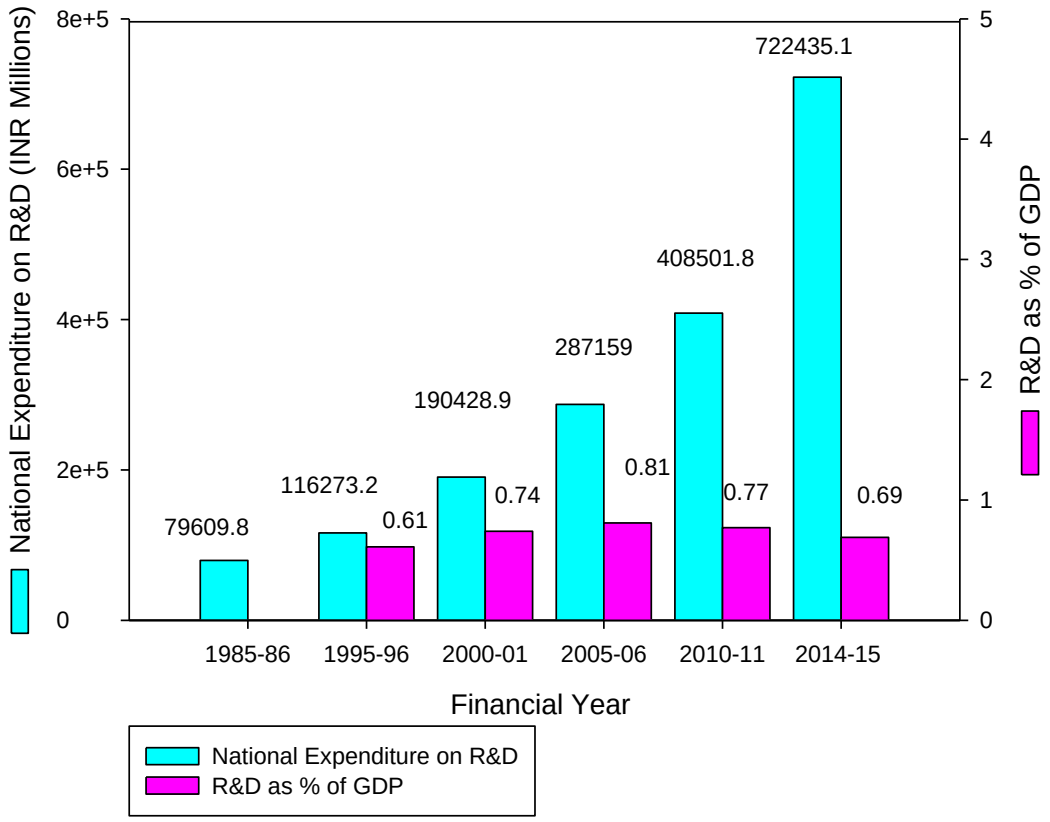

Figure 4: National R&D Expenditure of India from 1985 to 2015

Source: http://www.nstmis-dst.org/newsite/SnT-Indicators2017-18.aspx [4]

Gross Expenditure on R&D is mainly driven by the government sector comprising of central government 45.1%, state governments 7.4%, higher education 3.9% and public sector industries 5.5% with private sector industries contributing 38.1% during 2014-15 [4]. Over the years, India has witnessed increased R&D investments from both the Central government sector as well as the private sector (Figure 6).

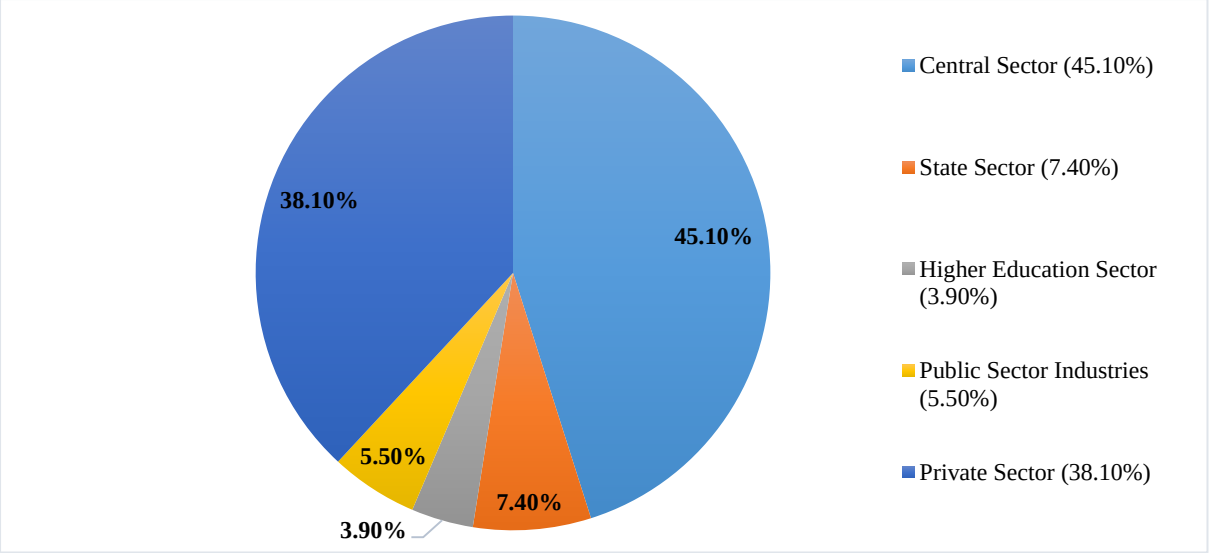

Figure 5: National R&D Expenditure Sector Wise (2014-15)

Source: http://www.nstmis-dst.org/statistics-Glance-2017-18-2.pdf [4]

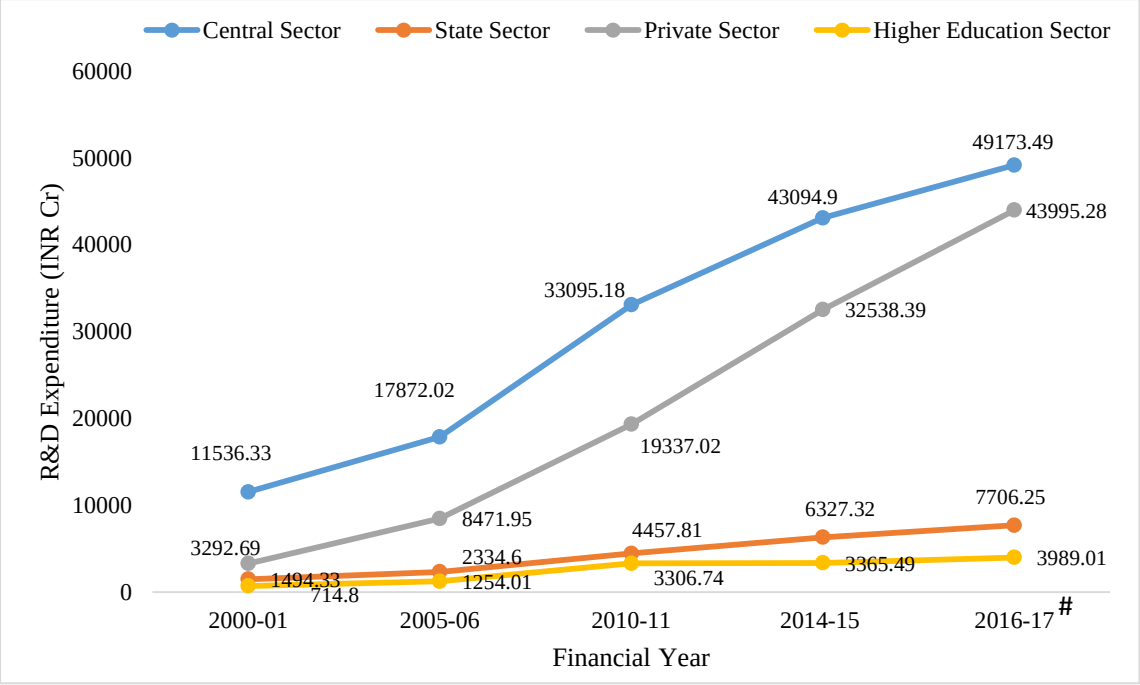

Figure 6: Sector Wise Growth in R&D Investment since 2000 in India

Source: http://www.nstmis-dst.org/statistics-Glance-2017-18-2.pdf [4]

(#For the year 2016-17 estimated values are provided)

Government is continuously seeking private sector participation in R&D as stated in various government released white papers and expert committee reports, including '*Committee Report on Corporate Participation in Higher Education*,' 2012 (Planning Commission,

2012); '*Stimulation of Investment of Private Sector into Research and Development in India*,' 2013 (DST & CII, 2013); '*Sectoral Innovation Council on Industrial R&D*,' 2013 [Department of Scientific and Industrial Research (DSIR), 2013]; 'Report of the Expert Committee on Innovation and Entrepreneurship', 2015 (NITI Aayog, 2015), etc. India has targeted to double its GDP contribution to R&D to 2% by the year 2022. It also aims to target 50% of the global R&D market and double its R&D related exports in next 3 years [5].

A large chunk of the total R&D spent is done by the government and there is a vacuum in private investment. There is an immense opportunity for the private sector to enhance its investments in the R&D sector in India as it provides a very diverse market for investments as compared to other countries. India also provides a diverse talent pool whose full potential is yet to be leveraged. Increased investments in R&D both from the government and private sector will help in retaining this talent in the country. Identifying the need for increased investment in R&D, the government is proactively making policies to make India a leading R&D hub in Asia. The government has also announced numerous progressive initiatives such as 'Make in India', 'Start-up India' and 'Digital India' that would provide a huge impetus to the R&D sector.

Government Mediated R&D Incentivization of Private Sector

R&D related innovations have become integral component of nation's socio-economic development. These innovations are the result of high-end innovative research practices undertaken by the public (government and academia) and private sectors (industry). Globally, the total R&D investments for the year 2019 have been forecasted as 2.3 trillion USD in Purchasing Power Parity (PPP)[1]. By and large, major share of R&D investments is contributed by the private sector globally. In order to stimulate the innovation ecosystem of private sector, primarily industries, national governments worldwide have come up with the R&D incentivization programs specific for the private sector. These countries follow a set pattern of awarding incentives to the private sector engaged in R&D i.e. a) direct funding and b) tax incentives by providing tax relief or allowance on a portion of R&D expenditure (Figure 5).

Worldwide, there are two types of incentives for R&D. The first category is the direct incentive that includes funding industrial R&D and second category includes indirect incentivization by provided tax incentives on R&D expenditure. The share of both direct and indirect incentivization for R&D excelling countries considered in our study is presented in

figure 4. In countries like S. Korea and Japan, significant percentage of GDP (0.19 and 0.14) is subjected to R&D tax incentives, respectively. Whereas, in country like USA, significant percentage of GDP (0.18) is accounted for financially supporting private industries in pursuing their R&D projects[6]. Majorly utilized R&D incentivization falls under tax incentives.

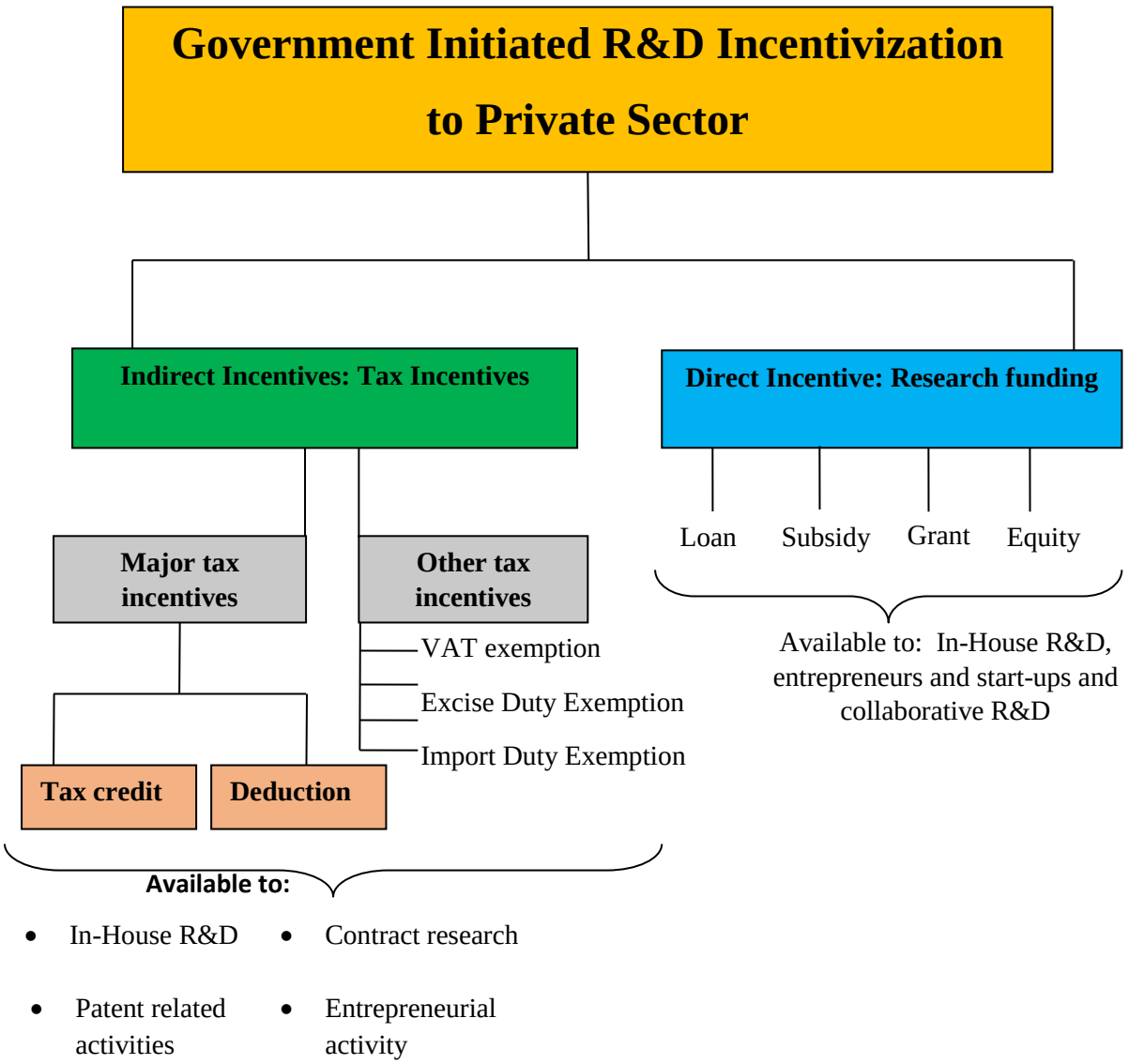

Figure 5: Types of Government Mediated R&D Incentivization of Private Sector (Globally)

Comprehensive account of Government mediated R&D incentives for the private sector as implemented in top 10 R&D spending countries is presented in the tabular form (Table 1 and 2).

Table 1: R&D Incentives Implemented in top 10 R&D Spending Countries of the World (Overview)

S. No.	Country	Funding Support	R&D Tax (combined)	R&D Tax Credit	R&D Tax Deduction	Volume based	Incremental based	Refundable	Carry Forwarded	Preferential Tax Incentives		Patent Box	CAPEX incentives
										SMEs	collaboration		
1.	USA	√	√	√	n.s.	×	√	√ (start-ups)	√	√	×	√	√
2.	China	√	√	n.s.	√	×	×	×	×	×	×	√	×
3.	Japan	√	√	n.s.	n.s.	√	√ (R&D intensity)	×	×	√	√	×	√
4.	Germany	√	×	×	×	×	×	×	×	×	×	×	√
5.	S. Korea	× (limited)	√	√	n.s.	×	√	×	√	√	×	√	√
6.	France	√	√	√	n.s.	√	×	√	√	√	√	√	√
7.	India	× (limited)	√	n.s.	√	√	×	×	√ (only in case of losses)	×	×	√	√
8.	UK	√	√	√	√	√	×	√ (forSMEs)	√	×	×	√	√
9.	Russia	√	√	×	√ (150%)	×	×	×	×	×	×	×	√
10.	Brazil	×	√	×	√ (160-270%)	×	×	×	×	×	×	×	√

Source: OECD 2016 [6]; OECD 2017 [7]; Deloitte Touche Tohmatsu Limited 2018 [8]; EY 2017 [9]; PwC 2017 [10]; n.s: .not specified

Table 2: Types of Incentives availed by Private Sector in top 10 R&D Spending Countries of the World

S. No.	Country	R&D Incentives
1.	USA	**A. R&D Tax Incentives** **i) Federal Research and Experimentation Tax Credit**: The tax credit is calculated on the exceeding amount of the qualified research expenditure in comparison to the base amount. Different forms of tax credit are as follows: ➢ **Traditional Research Tax Credit**: it is calculated as 20% of the amount of qualified research expenditure that exceeds the base amount, which is calculated by considering the data from the time period 1980-84. The traditional tax credits are generally utilized by old and long-standing companies. ➢ **Alternative Simplified Credit**: it accounts to 14% of the 50% increment of the qualified research expenditure in comparison to the average of previous three years of qualified research expenditure that acts as a base amount. ➢ **Computational Adjustments**: a number of computational adjustments can be taken up for reducing the amount of tax to be paid. These tax credits are based on increment in R&D expenditure, non-refundable in nature and can be carried forward (20 years) and backward (1 year). **ii) Targeted Research Tax Credits**: Under this regime, following research credits can be availed: Basic Research-20%; Energy Consortiums-20% and Clinical Testing-50% **iii) Special Preferential Tax Benefits:** Small businesses (annual gross receipts ≤50 million USD for preceding three taxable years) are eligible for utilizing research tax credits to offset the alternative minimum taxes[1]. On the other hand, all other industries can only utilize research tax credits to offset their regular taxes. Small Start-Ups (annual gross receipts < 5 million USD) can use research tax credits to reduce payroll taxes[2] **iv) Tax Deductions**: US system also offers tax deductions of 100% on the R&D expenditure under Section 174 of Internal Revenue Code. The industry can avail both tax deductions and tax credits.
		B. Financial R&D Support

[1] supplement tax imposed by the US Federal government in addition to the baseline income tax based on certain conditions

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

		US Federal Government under National Science Foundation provide financial R&D support to private sector in form of grants, loans, equity along with partnership support via these programmes: ➢ Industry/University Cooperative Research Centres (I/UCRC) Programme ➢ Small Business Innovation Research (SBIR) Programme ➢ Small Business Technology Transfer (STTR) Programme ➢ Engineering Research Centre (ERC) Programme ➢ Public-Private Investment Programme (PPIP)- Legacy Securities and loans are provided *Risk Undertaking Guarantee Scheme:* State Small Credit Initiative (SSBCI): The state provides collateral and accepts burden of repayment to the financial institution
2.	China	**A. R&D Tax Incentives** **i) R&D Tax Super Deduction:** The rates of R&D tax super deduction depend on the status of the industry: ➢ Large companies: 150% R&D super deduction on qualified R&D expenditure ➢ Small and Medium sized companies (SMEs): 150% R&D super deduction on qualified R&D expenditure. **ii) Reduced Enterprise Tax Rate:** the tax rates are reduced to 15% in comparison to enterprise income tax rate of 25% for two types of status owned enterprises: ➢ The High and New Technology Enterprises (HNTE)[3]. These enterprises are also eligible for 150% R&D tax super deduction. ➢ Technology Advanced Service Enterprises (TASEs)[4]. These enterprises are not entitled to R&D tax super deduction. **ii) Tax Incentives for Venture Capitalists and Angel Investors:** tax incentives are provided to build the venture capitalist industry and start-up equity fund by providing deduction of 70% of the investment from the taxable income.
		B. Financial R&D Support Ministry of Science and Technology (MoST), National Natural Science Foundation of China (NSFC), Chinese Academy of Science (CAS) and China Scholarship Council (CSC), etc. are some of the agencies that provide financial R&D support to industries. Financial support is provided in form of grants, loans, equity etc. Major programmes are listed below.

[3] HNTE status is provided to companies where technology plays a pivotal role in a company's business. The technology areas fall in domains electronic information; biological and medical; aviation and space; new materials; high technology services; new energy and energy conservation; resources and the environment; and advanced manufacturing and automation. HNTE status is provided for a period of three years and is subjected to annual review.

[4] TASE status is availed by submitting an application with the Chinese government and the status is reviewed every year.

		➢ National Key Technologies R&D Program ➢ Innovation and Technology Support Programme (ITSP) ➢ The Research Grants Council Collaborative Research Fund ➢ Torch Programme ➢ Seed Funding (Innofund) ➢ Venture Guiding Fund
3.	Japan	**A. R&D Tax Incentives** **i) R&D Tax Credit** ➢ **Tax Credit (volume based):** Japan provides volume based non-refundable tax credits at varied rates: ❖ 17% Tax Credit: SMEs (stated capital ≤100 million JPY[5]) ❖ 6-10% Tax Credit: Large Companies ❖ 30% Tax Credit: Companies that have undertaken special R&D costs as research payments made to university or public research institution. ❖ The tax credit is limited to 'Blue Return Tax Filers'[6] that include both SMEs and larger companies. Unused credits can be carried forwarded and are limited to 25% of the total liability under the corporate tax. ➢ **Additional Incremental Tax Credits**: it is provided as an additional tax credit of 10% when the company's R&D expenditure in the current year exceeds 10% of the average annual sales of 3 previous years. Unused credits can be carried forward. **ii) Disallowance Clause:** Japan has a Disallowance Clause for certain R&D tax incentives for larger companies. R&D tax incentives can be enjoyed by the large companies only if the meet the following criteria: ➢ Increase in annual wage payment in the current year in comparison to the previous year ➢ Domestic capital investment of the company should be more than 10% of the depreciation costs ➢ The clause was introduced to restrict profitably companies from availing R&D tax benefits if they are not investing sufficiently.

[5] 1 Japanese Yen (JPY)=0.009 USD

[6] Blue tax return system in Japan is intended to improve accounting practices of taxpayers and encourage honest self-assessment. Those who maintain proper accounts as required under the blue tax return system are given certain privileges for tax purposes. Basically, there are two types of income tax returns which taxpayers can choose from:
- White Form or Blue Form. A Blue tax return is usually preferable because it offers some extra tax benefits, including special deductions (k-s-accounting.com).

		B. Financial R&D Support Japan Science and Technology Agency mainly executes the financial support programmes for supporting R&D in the country. The major programmes that support private sector R&D are listed below: ➢ Adaptable and Seamless Technology Transfer Programme through Target-Driven R&D (A-STEP Programme) ➢ Programme on Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA) ➢ Support programme of Capital Contribution to Early-Stage companies (SUCCESS) ➢ Center of Innovation (COI) Program ➢ Collaborative Research Based on Industrial Demand *Risk Undertaking Guarantee Scheme:* Japan Bank for International Cooperation Loan Guarantee Scheme: Government organization guarantees and accepts the burden.
4.	Germany	**A. No R&D Tax Incentives**
		B. Financial R&D Support German Research Foundation and German Academic Exchange Service (DAAD) provide final R&D support for pursuing R&D in Germany. The major financial support mechanisms are as follows. **i) Non-Repayable Cash Grants**: Cash grants are provided to industries for R&D projects (usually in collaborative mode) at average grant rate between 35-50%. Higher grant rates are available for SMEs. **ii) Targeted R&D Grants**: German Federal grants are provided for targeted research in the areas of energy efficiency, industrial resource efficiency, digitilization and automation of the production process, civil security, new vehicle technology, health, etc. **ii) Investment Incentives**: These grants are provided for initial investments to be incurred for setting up of new plant for under new activities. Some of the key running programmes under investment incentives are Environment Innovation Program, Highly Efficient Cross-Sectional Technologies and Acquisition of Electric Vehicles and Charging Infrastructure. Major initiatives to support private sector R&D are listed below: ➢ Fraunhofer Society of Germany (Fraunhofer Research Organization) ➢ Zentrales Innovations programme Mittelstand (ZIM; http://www.zim-bmwi.de/zim-overview) - the Central Innovation Programme for SMEs Industrial Collective Research for SMEs
5.	S. Korea	**A. R&D Tax Incentives**

		i) R&D Tax Credit: R&D tax credit is provided in accordance with the type of industry: ➢ SMEs (annual sales revenue 40-150 billion KRW; company assets<500 billion KRW)- A tax credit equal to 25% of current year R&D expenditure, or tax credit≥50% of current year R&D Expenditure exceeding previous average annual R&D expenditure in the past 4 years ➢ Medium company (not qualify as SMEs but has average sales revenue <500 billion KRW for previous three years)- A tax credit equal to 8% of current year R&D expenditure, orTax credit≥40% of current year R&D Expenditure exceeding previous average annual R&D expenditure in the past 4 years. ➢ Large company (average annual sales revenue >500 billion KRW)- A tax credit equal to 25% of current year R&D expenditure, or Tax credit≥25% of current year R&D Expenditure exceeding previous average annual R&D expenditure in the past 4 years. **ii) Enhanced Tax Credit:** ➢ New growth engine industry[7] and industries associated with the original source technology programme (large and medium sized companies) have the benefit of availing enhanced tax credit that equals to 20% + (R&D expenditure/total sales x 3). The total tax credit rate is capped at 30%. ➢ For SMEs in new growth engine industry, enhanced tax credit equals to 30% + (R&D expenditure /total sales x 3) and is capped at 40%. **ii) IP Related Incentives:** Tax credit equal to 5% of the IP purchase price can be availed by large companies on IP purchase from the Korean SME. The Non-utilized tax credit can be carried forward for a period of 5 years. On similar lines, when SMEs purchase IP from any other Korean party, it avails tax credit equal to 10% of IP purchase price. **v) Investment Tax Credit for R&D Equipment:** Tax credit of 1%, 3% and 6% of the investment made on R&D equipment (including cost related to machinery, tools, facilities, testing machines, office machines, etc.) can be utilized by large companies, medium companies and SMEs. Unused credits can be utilized for a period of 5 years. **v) Tax Credit for Investing in Facilities for Commercialization of New Growth Engine Technology:** Investment tax credit is provided to large companies, medium sized companies and SMEs at 5%, 7% and 10% rates, respectively for purchasing facilities/equipments/tools designed to promote commercialization of new growth engine technology. **vi) Tax Incentive for Foreign-Investing Companies:** Foreign companies investing in high technology business in S. Korea

[7] New growth engine industry represent the value added industries evolved from the existing industries by applying technological innovations. These industries fall in three major fields: green technology, high value-added services and high technology convergence industry.

		can avail 5-year corporate tax exemption, property tax, acquisition tax and individual income tax from the first year of a profitable business or from the 5th year of operation if no profits are generated.
		B. Financial R&D Support National Research Foundation, Korea Institute for Advancement of Technology (KIAT)-specifically working for industrial technology, Korea Energy Technology Evaluation and Planning (KETEP) and Small & Medium Business Administration (SMBA) are the specific agencies dealing with promoting industrial R&D in the country. The specific programmes for supporting R&D carried out by private sector are as follows: ➢ Korea Small Business Innovation Research (KOSBIR) Programme ➢ The Industrial Complex Cluster Programme (ICCP) ➢ Creative Research Initiative ➢ Korea Credit Guarantee Fund New Technology Purchasing Assurance
6.	France	**A. R&D Tax Incentives** **i) R&D Tax Credit:** R&D tax credit of 30% is made available to industries on the first 100 million EUR[8] of qualified research expenditure. Once the R&D expenditure crosses the 100 million EUR mark, the tax credit rate is reduced to 5%. The tax credit is volume based and can be carried forward for a period of 3 years. Only newly established companies, young innovative companies and SMEs facing financial issues can apply for immediate refunds related to unutilized credits. **ii) Innovation Tax Credit:** 20% tax credit is made available to SMEs for the development of prototype and pilot model[9] to encourage completion of new product/process development. The innovation tax credit is capped at 400,000 EUR of qualified research expenditure related to prototype/pilot model. **iii) Young Innovative Company (YIC) Incentive:** These incentives are available for new companies which qualify as SME, independent in its functioning, with existence of less than 8 years and investment >15% of their spending on research. The incentives provided are a)100% tax exemption for the first profitable year; b) 50% tax exemption for the second year; c) 7-year tax exemption from various enterprise related taxes[10] and d) Capped exemption on 'Employer Social Security Contributions for R&D Staff Remuneration' for a period of 7 years.

[8] Euro (EUR)=1.1 USD
[9] It includes activities that are not qualified or availed under R&D tax credits. It must be related to development of new and innovative product.
[10] Contribution Foncière des Enterprises (CFE); taxe foncière, Contribution sur la Valeur Ajoutée des Entreprises (CVAE)

		iv) Patent Box Regime: The capital gains incurred from the sale or licensing of IP (patent or patentable technology developed by the company or was acquired at least two years before the sale of IP) is taxed at 17% corporate tax rate. The royalty income generated is also liable to be deducted from the corporate tax.
		B. Financial R&D Support National Research Agency (ANR) and Innovation Agency (OSEO) have the responsibility of financial supporting industrial R&D. The major programmes and initiative to support private sector for R&D are listed below: ➢ Carnot Initiative ➢ Collaborative Research Projects involving Enterprises (PRCE) ➢ SMEs Immediate Repayment Company receiving financial support under R&D grant issued by government is subjected to different tax relief rates (25% tax relief rate for large scale and medium scale companies and 40% for small scale companies)
7.	India	**A. R&D Tax Incentives** **i) Tax Super Deductions:** Tax super deduction of R&D expenditure incurred by the industry is carried out in varied form as described below: ➢ 150% super deduction on in-house R&D expenditure by the company/business *(to be reduced to 100% super deduction 2021 onwards)* ➢ 150% super deduction for specified payments made to approved scientific research associations, approved universities, colleges, or other institutions *(to be reduced to 100% super deduction 2020 onwards)* ➢ 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 ➢ 100 % super deduction is applicable for capital expenditure made for the scientific purpose by the company. The capital expenditure does not include expenditure made on land acquisition ➢ Super deduction of 150% on scientific expenditure made for any contract or sponsor research or any other form of expenditure made to pay: *(to be reduced to 100% super deduction 2020 onwards)* ❖ National Research Laboratory ❖ Indian Institute of Technology (IIT) ❖ University ❖ Specified person for research purpose in an approved scientific programme

		ii) Customs Duty Exemption: on specified types of imported equipment, components and instruments **iii) Central Excise Duty Exemption:** 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 the European Union) **iv) Tax Benefits for Start-ups:** 'Make in India' initiative has implemented tax benefits for start-ups: ➢ 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. ➢ No taxation for capital gains, if invested in notified funds or in notified start-ups **v) 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 is taxed at a concession rate of 10 % (plus the applicable cess and surcharge).
		B. Financial R&D Support The financial R&D support for the private sector is provided by number of funding agencies in India, these are listed below along with the financial assistance programme offered by them: ➢ Technology Development Board (TDB) ✓ Financial Assistance Programme ✓ Seed Support Scheme ✓ Venture Capital Fund ➢ Global Innovation and Technology Alliance (GITA) ✓ Technology Acquisition Fund Programme (TAFP) ✓ Technology Development Fund (TDF) ➢ Science and Engineering Research Board (SERB) ✓ Scheme for Funding Industry Relevant R&D ➢ National Science & Technology Entrepreneurship Development Board (NSTEDB) ✓ National Initiative for Developing and Harnessing Innovations (NIDHI) ➢ Technology Information, Forecasting and Assessment Council (TIFAC; www.tifac.org.in) ✓ TIFAC-SIDBI Technology Innovation Programme ✓ MSME-Technical Upgradation ➢ Other programmes under Department of Science and Technology (DST)

		✓ Drugs and Pharmaceutical Research ✓ Technology Development Program (TDP) ➢ Biotechnology Industry Research Assistance Council (BIRAC) ✓ Small Business Innovation Research Initiative (SBIRI) ✓ Biotechnology Industry Partnership Programme (BIPP) ✓ National Biopharma Mission ✓ Bioincubators Nurturing Entrepreneurship for Scaling Technologies (BioNest) ✓ Biotechnology Ignition Grant (BIG) ✓ Sustainable Entrepreneurship and Enterprise Development (SEED) Fun ✓ Accelerating Entrepreneurs (AcE) Fund ➢ Department of Scientific and Industrial Research (DSIR) ✓ Building Industrial R&D and Common Research Facilities (BIRD-crf) ✓ Patent Acquisition and Collaborative Research and Technology Development (PACE) ✓ Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) ➢ Council of Scientific and Industrial Research (CSIR) ✓ New Millennium Indian Technology Leadership Initiative (NMITLI) ➢ Ministry of Electronics and Information Technology (MeitY) ✓ Multiplier Grant Scheme (MGS) ✓ Technology Incubation and Development of Entrepreneurs (TIDE) ➢ Ministry of Micro, Small & Medium Enterprises (M/oMSME) ✓ A Scheme for promoting Innovation, Rural Industry & Entrepreneurship (ASPIRE) ✓ Science and Technology Scheme ➢ Department for Promotion of Industry and Internal Trade (DPIIT) ✓ Start-up India ✓ Make in India ✓ Invest India ➢ Defence Research and Development Organization (DRDO)

		The DRDO-FICCI Accelerated Technology Assessment and Commercialization (ATAC) Programme
8.	UK	**A. R&D Tax Incentives** **i) R&D Tax Super Deduction:** 230% Volume-based super deductions for qualifying revenue expenditure is available for SMEs (employees<500 or gross revenue<100 million EUR or gross assets<86 million EUR). The resultant benefit under this scheme is capped at 7.5 million EUR per R&D project undertaken. **ii) R&D Expenditure Credit (RDEC):** Large companies can avail 12% of RDEC on R&D expenditure incurred. Companies availing RDEC can also file for an advanced clearance service as a pre-filing agreement for a period of 3 years. **iii) Patent Box Regime:** The profits earned from IP and other innovations are taxed at a reduced corporate tax rate (10%).
		B. Financial R&D Support UK Government provides financial support mainly in form of grants and loans. Some of the new initiatives to support industrial R&D are as follows: ➢ Catapult Programme ➢ Industrial Partnership Award ➢ Stand-alone LINK Scheme In order to boost research activities undertaken by SMEs, the UK government provides cash credits up to 33% of qualified expenditure, when SME is facing a loss situation.
9.	Russia	**A. R&D Tax Incentives** Companies having qualified R&D expenditure can avail 150% super deductions on computed profits tax liability. R&D incentives are made available to the companies even if they fail to deliver new product or process from R&D activities. In case of losses, 50% of operating losses can be attributed to the super deduction for next period.
		B. Financial R&D Support Russian federation provides industrial R&D support through following programmes: ➢ Innovation Enforcement initiative ➢ Innovation Development Strategy of the Russian Federation to 2020 ➢ Promote regional clusters, including special economic zones, techno-parks and innovation and technology centres Technology Platforms Initiative
10.	Brazil	**A. R&D Tax Incentives**

		i) R&D Tax Super deduction: Brazil offers 160% super deduction on qualifying expenditure under R&D head of companies. The Super deduction is enhanced to 170% for a company if it increases the number of researchers by 5% for specific research projects undertaken by the company. Whereas companies dealing with IT and automation activities are eligible for 260% enhanced super deduction on their total R&D expenditure. For these companies also, if the number of researchers in dedicated research projects are increased by 5%, further enhancement of super deduction to 270% can be availed by the company on their total research expenses. **ii) Patent Box**: Brazil offers extra 20% deduction on R&D costs associated with the patent development process for a registered patent.
		B. Financial R&D Support National Council for Industrial Development has several programmes to support industrial R&D in Brazil. Some of the support programmes are listed below: ➢ National Strategy in Science, Technology and Innovation (ENCTI) ➢ HABITARE ➢ Implementation of Innovation Law (2001) Scheme ➢ Juro Zero Programme ➢ Programme for Support of Research in Enterprise **Brazilian Support Services for Small Enterprises**

Source: OECD 2016 [6]; OECD 2017 [7]; Deloitte Touche Tohmatsu Limited 2018 [8]; EY 2017 [9]; PwC 2017 [10]

Discussion

The economic prosperity of any nation depends on the prevailing R&D ecosystem in the country. Most of the developed and innovation based countries of the world have a strong R&D ecosystem attributed to more than 2% GDP contribution to the R&D. In addition, the private sector is the major contributor to the national R&D investments. Whereas, in India scenario the GDP contribution to R&D is unsatisfactory with the present value of 0.69 % of GDP for R&D. One reason for this low GDP contribution to R&D can be low participation of the private sector in national R&D investments. Therefore, there is an urgent need to revamp the present government mediated R&D incentivization of the private sector in India to stimulate their participation and investments in R&D. The present study aims to collate the government mediated R&D incentivization practiced in top R&D spending countries to come up with special types of incentives that can be introduced in India to stimulate the private sector's R&D.

The government mediated incentives are implemented via R&D tax incentivization and financial R&D support mechanisms. R&D tax incentives have become the most accepted incentivization mechanism for stimulating the private sector's contribution to R&D. USA being the top R&D spender globally has a strong private sector's R&D incentivization mechanism. It offers a tax credit on the R&D investment both on the volume of the R&D investment made and the increment reported in the total R&D expenditure. USA also offers target based incentives to promote targeted research in the country. Similarly, China is the second largest R&D spender has also developed mechanisms for stimulating private sector contribution to R&D. China specifically motivates high and new technology enterprises by giving them extra tax benefits as compared to other general industries. Most of these developed countries such as USA, China, Japan, S. Korea and UK have segmented R&D tax incentives as per the scale of the industry. The small and medium sized companies are liable for additional tax incentives in comparison to the larger companies. Such enhanced R&D tax incentives motivate the small and medium sized companies to come forward and invest in R&D activities. France has introduced special tax incentives for young innovative companies to boost small and newly formed innovative companies in the country. Additionally, a country such as Japan offers increased tax incentives for Industry-Academia collaborated research project carried out by the industries. This becomes one of the mechanisms to support the Public Private Partnership (PPP) for R&D in the country. In order to promote the commercialization of the patent developed, most countries like USA, S. Korea and Japan

have employed a patent box regime that provides additional tax rebates on the royalty income earned on the patents.

These countries have also established strong financial R&D support mechanisms for the private sector. Governments of these countries have various programmes that directly support R&D carried out by the private sector. Germany is one such country that implements a strong portfolio of R&D financial support programmes both for public and private sectors and offers no R&D tax incentivization. Germany sponsors R&D through various national R&D funding programmes and European Union Funding programmes. Germany has undertaken an initiative of establishing Fraunhofer institutes that carry out extensive research work in different domains in collaboration with industry or for industry through contract research work. Similarly, UK has instituted various Catapult Centres all over UK that financially supports the private sector R&D and carries out the collaborative research work in association with industries. Governments across the globe has also introduced specific programmes for financially supporting R&D by the private sector. Programmes such as SBIR and STTR by US Federal government; KOSBIR by S. Korea; Torch Programme and Innovation and Technology Support Programme of China; A-STEP programme of Japan and others.

In India, sound R&D tax incentivization has been executed from past 5 decades. R&D tax super deduction over R&D expenditure is provided under Income Tax Act 1961. The clause for utilization of R&D tax incentives by the private sector in India require government pre-approval of the R&D unit through Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India. nearly 1900 of the industries are recognized by DSIR, which is only a small fraction of a total number of industries existing in India. Moreover, in India there are no separate tax incentives for small scale industries and large scale industries. Additionally, the scope of R&D expenditure as qualified R&D expenditure on which tax incentives can be availed is limited and mostly excludes items related to computers, alcohol, plant and machinery, R&D infrastructure, etc.

On the other hand, government mediated financial support mechanisms especially for the private sector is quite limited in India. Few government agencies such as TDB, BIRAC, DST, DSIR, MeitY have financial R&D support mechanism exclusively for the industries to carry out their R&D projects. TDB through its financial assistance programmes directly provide Most of the programmes of other ministerial bodies support projects carried out under PPP

mode, where industry partners with academia or research institute, where most of the times, funding is provided to the public sector and an equal contribution is desired by the private sector.

The present study has come out with few recommendations to invigorate the private sector R&D incentivization of the private sector in India. These are categorically listed in the following table.

Recommendations for Stimulating Private Sector Engagements in R&D in India	
Revamping Indian R&D Tax Incentivization Landscape	➢ Restoring R&D tax super deduction on R&D expenditure to 200% (which is reduced to 100% March 2020 onwards). ➢ Introducing scale specific tax incentives for small, medium and large scale industries in India as practiced in USA, UK, S. Korea and Japan. ➢ Introducing target based tax incentives for industries working in domains of high technological areas of national priority as practiced in USA and China. ➢ Introducing tax incentives on incremental R&D that will address special incentives to the industries which show enhancement in their R&D expenditure in subsequent years. ➢ Bring awareness about DSIR scheme of 'Recognition of Industrial R&D' to avail tax incentives on R&D expenditure.
Introducing Sector Specific R&D Financial Support Schemes	➢ Special R&D support schemes for MSMEs in India. These programmes can be introduced on lines of SBIR, STTR of USA; Central Innovation Programme of Germany and KOSBIR of S. Korea. In India limited number of programmes are available for MSMEs, a few of them are ASPIRE by M/oMSME; SBIRI by BIRAC; TDP by DST and others. The outreach of these programmes can be increased and such programmes need to be introduced in other ministries having R&D set up. ➢ Introducing scheme of 'Innovation Vouchers' as practiced in many countries such as UK, Ireland etc. These innovation vouchers can be used by industries which are financially starved to carry out individual R&D. These vouchers can also address collaborative

	research where industry can use innovation vouchers to pursue collaborative/contractual/sponsored research with academic/research institute. ➢ Government can also introduce risk guarantee schemes for the industries that will cover the research costs associated with the failure of R&D project. Such kind of schemes will be motivate MSMEs and other smaller young companies to invest in R&D.
Creation of Industry Research Development Group	Creation of industry clusters or groups that presents the industry requirements, expectations from government, dialogue interactions with public sector etc. Such IRDG are quite prominent in Ireland, specific domain wise IRDG clusters are formulated in Ireland and they play crucial role in tax incentivization and government support programmes initiated specifically for Industries by Ireland government.
Creation of Innovation and Technology Hubs for MSMEs	The government agencies in association with M/oMSME can establish innovation and technology hubs especially for MSMEs in select research or academic institutes. These hubs can be established in regions that possess MSMEs clusters. These hubs can offer research facilities, mentorship support, IP and legal support, financial support etc. to MSMEs for their research ideas/projects. These hubs can be institutes in PPP mode.
Creation of Theme Based Centres	On lines of UK's Catapult Centres and Germany's Fraunhofer Centres, theme based centres/institutes can be created in India to support theme based domain specific institutes that will cater to both public as well as private sector for R&D either in collaborative mode or research consultancy/contract/sponsorship mode. These clusters can be managed by industries and government representatives and address industrial requirements from time to time.

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