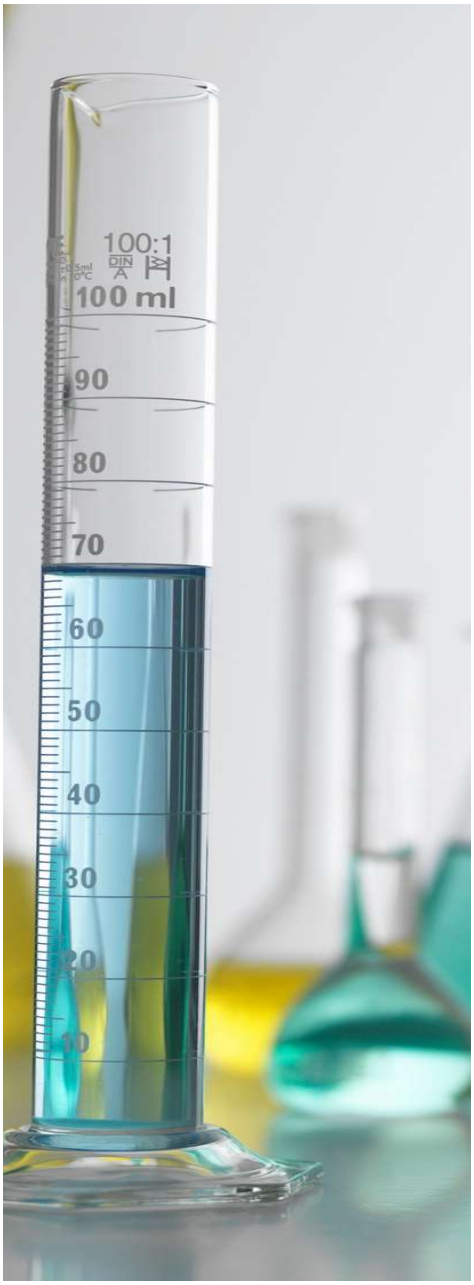
ASSESSMENT OF SKILL REQUIREMENTS OF INDIAN PHARMA INDUSTRY

A study conducted by Department of Pharmaceuticals
Ministry of Chemicals and Fertilizers, Government of India

August,2022



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EXECUTIVE SUMMARY

Assessment Motivation:

Starting from a nascent position in 1960s, Indian pharmaceutical industry has emerged as the pharmacy of the world. The industry has played a key role in driving better health outcomes across the world through its affordable and high-quality generics drugs. Increased accessibility to affordable drugs has helped reduce disease burden in the country by 36 percent between 1990 and 2016 and has also brought down treatment cost for several life-threatening diseases to <5% of its original cost.

The Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers-Government of India has taken an interesting and critical initiative to conduct a study under the Pharmaceutical Promotion and Development Scheme ("PPDS") to identify the underlying factors with respect to the demand-supply mismatch vis-à-vis opportunities for Pharma Diploma, Graduates ,Post Graduates and Doctorate holders in the Indian Pharma Industry which will help in framing the policies, monitoring and corrective measures to create and promote conducive environment for their better absorption in the Indian Pharma industry.

Assessment Approach and Framework

A Short-Term Study with a total duration of 3 months was carried out in India to encapsulate the feedback of the stakeholders like Regulators, Key Opinion Leaders, Representatives of Research based pharmaceutical companies, Educational Institutes, Industry Alumni and the Students perusing their pharmaceutical courses. A non-experimental, Combined/ Mixed, Rapid Assessment Approach on the basis of inputs from above mentioned stakeholders and internal and external reports and articles sources was adopted for the study. The primary data from the stakeholders was collected through the semi-structured interviews and stakeholder specific questionnaire surveys while secondary data collection was done from the reports and articles present on the authentic websites of involved stakeholders.

Activities Performed

Below mentioned activities were performed during the study:

Task	Activities
Desk Research	Literature Search, Pharmaceutical Education Streams, Regulations and policies, Relevant internal and external reports related to manpower placements.
	NIPER, DoP, PCI, Startup India, UGC, AICTE, Skill India, IDMA, Job Portal websites etc
Interviews and Surveys	1. Face to Face In-depth Interviews (IDIs) of the Directors/Deans of 6 NIPERs by the trained Interviewers.
	2. Face to Face and Telephonic In-depth Interviews of 5 NIPER Alumni working with leading pharmaceutical companies by trained Interviewers.
	3. Face to Face In-depth Interviews (IDIs) of one Head of Biotechnology Incubation centre and Ex- DG – Indian Council of Medical Research by trained interviewers.
	3. Online Survey of representatives of 30 Plus Pharmaceutical Companies.
	4. Online Survey of 150 plus students perusing their Pharmaceutical Courses in India
	5. Online Survey of 9 Educational Institutes offering Pharmaceutical Diplomas and Degrees
5 Country Case Studies	Country Specific Desk research on opportunities for Indian Pharmaceutical students in Canada, US, Germany, Australia and China.

Key Findings:

The short-term study entitled ”Assessment of skill requirement of Indian Pharma Industry” conducted during the months of April – June, 2022 resulted in specific findings that have been summarized below:

1. India needs to move up the ladder in pharmaceutical chain from being a global Generic pharmaceutical hub to an Innovation driven Pharmaceutical Product Development country.

2. Built on the strong fundamentals, the Indian Pharmaceuticals industry is evenly poised for the new technology uptake and infrastructure upgradation. The academia however needs to match up the ever-increasing expectations of the industry and revamp their outdated course curriculums without any delay.

3. Collaboration between pharmaceutical industry and academia has been limited and fraught with several challenges thereby impeding industry relevant innovation in academia. Aspects of innovations with translational outcomes in the pharmaceutical sector had been challenging in the past due to the rigors of academic careers, milestones for faculty and institutions, and limitations arising from financial concerns or mistrust of developing partnerships with the industry.

4. According to India Skills report 2021, employability or job readiness level in India has remained stagnant for past three years at 46% with Pharma way beyond the average at 37%. As per the India Skill report 2022, there has been slight improvement in employment and job readiness level in Pharma sector to 44%. However, there is still a long way to go and there is an urgent need for enhanced coordination between the Indian pharmaceutical industry, academia and government to improve the employability of the pharmaceutical students.

5. 40% of the surveyed companies informed that they do not see any pro-active steps taken by the academic institutes to approach them for the campus placements of students. Most of the surveyed companies preferred to hire the students from the nearby pharmaceutical institutes.

6. 57% of the surveyed companies informed that do not offer the paid internships to the students during their coursework. Out of the remaining companies which offered the paid internship to students, 83% companies preferred to hire the same students from same institute whenever the requirements arise.

7. As per the responses received from the surveyed companies, Clinical Research, Pharmaceutics, Pharmaceutical Analysis, Medicinal Chemistry and Pharmacology &Toxicology are currently in major demand in the country.

8. 71% of the companies surveyed are open to recruit the people with life sciences and paramedical degrees for the automated processing profiles in their industry. Out of these, 79% of the companies informed that they recruit the people with non-hard core pharma experience because it saves them manpower cost.

9. 73% of the surveyed companies do not hire the Diploma in Pharmacy candidates for any job profile as they consider them underqualified for offered job profiles.
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10. 66% of the surveyed companies prefer to hire he Masters in Pharmacy candidates as they consider them qualified for the offered profiles by them.

11. 45 % of the surveyed companies believed that the students are somewhat prepared for the campus placement activities. On a scale of 10, the surveyed companies gave an average rating of 5 to 5.7 to the recruited students for the skills associated to Technical Knowledge, Awareness of new technologies, Communication, Aptitude and Creativity and Teamwork and collaboration.

12. The surveyed companies have suggested the below mentioned activities to improve the recruitment processes and pay packages:

- Commitment of students to stay with companies for at least 2 years.
- Technical knowledge and Communication skills needs to be improved.
- More emphasis needs to be given on practical trainings during course by Pharma institutes.
- Exposure of the market needs to be provided to the students
- Industrial training and internship along with language and skill courses should be included.
- Pharma institute should have a function/department for industry collaboration and their performance should be measured based on industrial placements.
- Pharma institutes need to develop warm and cordial relationships and be consistently in touch with industry.

13. Following emerging areas/ technologies have been suggested by the surveyed companies on which the students need have training and develop skill sets:

- Personalized medicine
- CRISPR technology

- CAR-T /Cell line testing technology
- Organoid Spheroid Technology
- Medical intelligence
- Medical Devices
- Biosimilars
- Artificial Intelligence and Machine Learning
- Biotechnology based technologies
- Softwares and Technologies aimed at bridging the gap between drug producers and drug users
- Process Automation & Digitalization for Manufacturing Process improvement
- Organ on a chip
- Invitro organ testing
- Flow Chemistry based technologies

14. As per the inputs provided by the surveyed institutes an average of only 17 % students enrolled for paid industry internships during their coursework. Some of the institutes inform that they do not send the students to industry internships as it hampers their routine research work.

15. 78% of the surveyed institutes get the grants from government bodies to carry out product focused research and development activities and on an average of only 12% projects are sponsored by industry in their institutes.

16. As per the inputs provided by the surveyed institutes on the research output, on an average every institute have published 274 research papers, filed 9 patents and have commercialized one product in last three years.

17. As per the inputs received from surveyed institutes, on an average every institute has a campus placement cell for industry interface and is aligned with 15 companies for campus placements. NIPER Hyderabad has the best placement record with an average annual salary package of INR 8.5 Lakh for students in recent placement.

18. Only 4% of the projects completed by students during their course were industry -sponsored projects

19. 63% of the surveyed students informed that they had less than 5 industry interactions during the course and most of these were online interactions. 65% of the surveyed students had not undergone any trainings to improve their employability in market.

20. 71% of the surveyed students were looking for job and wanted to join the industry rather than going for higher studies. 52 % of the surveyed students were looking for hard core Research and Development jobs. Only 1% of the students want to pursue entrepreneurship. Clinical Trials and Pharmaceutical Consulting were also prominent fields in which students wanted to pursue their careers.

21. Most of the students rated the institute's efforts for placement as average to below average. 64% of the surveyed students were not satisfied with the kind of companies coming for the placement at their institute and informed about the companies they want to work with.

22. Average ranking of the students by industry has been in the range of 5-5.7 for the parameters like Technical Knowledge, Awareness of new technologies, Communication skills, Aptitude and Creativity and Teamwork and collaboration however the average GPA of most of students passing out of the surveyed institutes is more than 8.

23. There was a clear mismatch in the expected salaries of the surveyed students and the pay packages being currently offered by the surveyed companies across all degree levels.

24. One of the NIPERs informed that they need their permanent campus immediate infrastructure upgradation to meet the minimum standards expected from institutes of national repute.

25. The surveyed students wanted the below mentioned the industry-oriented topics to be included in their course curriculum to give them better placement chances:

- Good documentation practice
- Technical topics (Power BI, Tableau)

- Data analytics
- Basic electronics and technical aspects
- Artificial intelligence, Machine learning and Data interpretation
- Fermentation Technology and Few instrumentations techniques
- Medical Devices
- Communication, soft and Presentation skills topics.
- Downstream and Upstream Processing Techniques.
- Hands on training on Analytical Techniques like HPLC and LC-MS needs to be mandatory.

INTRODUCTION

The Indian Pharmaceutical industry is poised for a tremendous growth in this decade. While the COVID-19 pandemic has highlighted the complexity of challenges that lie ahead for the pharmaceutical industry, it has also provided opportunities for growth and innovation. The innovation has been made possible by the agile response of Indian Pharmaceuticals industry and its extraordinary global collaboration. The Indian pharmaceutical industry has grown consistently at a compounded annual growth rate (CAGR) of ~11% in the domestic market and ~ 16% in exports over the last two decades. Keeping the momentum going, the Indian Pharmaceutical industry is expected to grow further and is expected to generate opportunities across various sections of the pharmaceutical industry viz. Innovation and R&D, Healthcare delivery, Manufacturing and Global Supply Chain.

The expected growth pyramid in the coming decade is to be built on foundation of strong academic infrastructure. The projected human resource requirement for pharmaceutical sector stands at around 95 lakhs persons by 2022. (Source: IBEF Pharmaceutical Industry Overview).

Academia provides critical human resource required for innovation and growth. The vital question which now arises is how prepared is Indian educational infrastructure to feed the growth engine of Indian pharmaceutical sector in the coming decade. This fundamental question can only be answered if a thorough analysis of current pharmaceutical educational setup is done against the expected standards and requirements of the industry.

DIAGNOSIS OF INDIAN PHARMACEUTICAL DEGREES

The pharmaceutical education sector is one of the most important sectors in India which offers various levels of professional courses based on the skill sets required in the industry and market. These courses are as following:

- Diploma in pharmacy
- Bachelor in Pharmacy
- Master in Pharmacy (with various technical and management specializations)
- PhD in Pharmacy / Pharm D (with various specializations)

These courses are tailored to meet various skill set requirements of the pharmaceutical sector at various levels and across core and allied pharmaceutical industries. Irrespective of the criterion of diploma or degree, every pharmacy student who passes any of the pharmacy courses mentioned above is a registered pharmacist and has the option of working at or running a pharmacy retail store.

The colleges and institutes affiliated to and approved by Pharmacy Council of India (PCI) can offer the diploma, undergraduate, post-graduate and PhD degrees depending upon their approval status for particular course/s with PCI. The various kinds of skill set levels (in ascending complexity order) and the corresponding courses required for the pharmaceutical industry can be listed as following:

Skill Set Level	Course	Minimum Qualification to get admission	Selection Criteria	Duration	Specializations
Level-1	Diploma in Pharmacy	10+2 with Bioscience stream subjects	Minimum % age of Marks in 10+2	2 Years	None
Level-2	Bachelor in Pharmacy	10+2 with Bioscience stream subjects	Minimum % age of Marks in 10+2	4 Years	None
Level-3	Masters in Pharmacy/ M.S in Pharmacy/ M. Tech/MBA	B. Pharm	Entrance Test GPAT / NIPER JEE and Group Discussions/ Personal Interview etc.	2 Years	Medicinal Chemistry Pharmaceutics Natural Products Pharmacology Toxicology Pharma Management Pharmacy Practice etc.
Level-4	PhD in Pharmacy/. Pharm D	M. Pharm	Entrance Test and Group Discussions/Personal Interview	6 Years	Medicinal Chemistry Pharmaceutics Natural Products Pharmacology Toxicology Pharma Management Pharmacy Practice etc.

As per the latest annual report available on the website of PCI, as on 31/03/2020 there were 3022 approved institutes offering Diploma in Pharma and 1961 institute offering the Bachelor, Master and PhD degrees in pharmacy.

In addition to these, seven institutions of national importance called as National Institutes of Pharmaceutical Education and Research (NIPER) (details mentioned in the table below) have also been established by Government of India under the NIPER Parliament Act 1998 and subsequent NIPER Amendment bill 2021 to promote pharmaceutical research and bring it to small Indian pharmaceutical companies.

SI No	Location	Name of institutions incorporated under this Act institute and the State	Date of establishment of Institution
1	Mohali, Punjab	The National Institute of Pharmaceutical Education and Research Society, Mohali	8th July, 1998
2	Ahmedabad, Gujarat	The National Institute of Pharmaceutical Education and Research, Ahmedabad	6th September, 2007
3	Hajipur, Bihar	The National Institute of Pharmaceutical Education and Research, Hajipur	6th September, 2007
4	Hyderabad, Telangana	The National Institute of Pharmaceutical Education and Research, Telangana	6th September, 2007
5	Kolkata, West Bengal	The National Institute of Pharmaceutical Education and Research, Kolkata	6th September, 2007
6	Guwahati, Assam	The National Institute of Pharmaceutical Education and Research, Guwahati	5th August, 2008
7	Raebareli, Uttar Pradesh	The National Institute of Pharmaceutical Education and Research, Raebareli	26th September, 2008

The main objectives of establishing the NIPERs are as under:-

- Nurture and promote quality and excellence in pharmaceutical education and research:
- Run Master's, Doctoral and post-Doctoral courses and research in pharmaceutical education
- Develop a multi-disciplinary approach in carrying out research and training of pharmaceutical manpower; and
- Act as nucleus for interaction between academic and industry by undertaking sponsored and funded research as well as consultancy projects.

The NIPERs are governed by the respective Institute's Board of Governors of which consist of the following persons, namely:

(a) a chairperson (an eminent academician or scientist or technologist or professional nominated by the Visitor.

(b) the Director of the institute, ex officio.

(c) the Joint Secretary to the Government of India in Department of Pharmaceuticals dealing with the national institutes of pharmaceutical education and research, ex officio.

(d) the Secretary, dealing with medical or technical education in the State Government concerned, ex officio.

(e) the representative of Drug Controller General of India, Ministry of Health and Family Welfare of the Government of India, ex officio.

(f) three eminent pharmaceutical experts, at least one of whom is a woman, having special knowledge or practical experience in education, research and biotechnology, to be nominated by the Council.

(g) two pharmaceutical industrialists to be nominated by the Council.

(h) two professors at the institute, to be nominated by the Senate.

Further a provision has been made to create an Apex Council of NIPERs to deal with the policy and coordination issues of NIPERs. This council consists of a chairperson (the Secretary of Department of Pharmaceuticals), the chairpersons of all of Board of Governors of NIPERS, the directors of all NIPERs, AS & FA Department of Pharmaceuticals and Joint secretary – NIPERs, Department of Pharmaceuticals.

Currently, the NIPERs offer only post graduate and PhD degrees in pharmaceutical research and management related fields. NIPERs carry out a lot of interdisciplinary research and therefore has candidates with backgrounds and qualifications not only from Pharmaceuticals but also in the filed like Chemistry, Life Sciences, Biotechnology, Genetics and Biochemistry who compete at a national level entrance test to qualify for the admissions to respective postgraduate courses. Few NIPERS also offers M. Tech and MBA degrees in pharmaceutical management to cater to the technical and management requirements of pharmaceutical companies.

None of the above-mentioned courses are currently offered in distance-learning or online mode by any college, institute, or university.

CAREER OPPORTUNITIES FOR PHARMA CANDIDATES IN INDIA

BELOW MENTIONED CAREER OPPORTUNITIES ARE AVAILABLE FOR PHARMACY CANDIDATES IN INDIA

Skill Set Level	Course	Potential Career Opportunities for Fresh candidates in market
Level-1	Diploma in Pharmacy	Hospital Pharmacist Retail Store Pharmacist Retail Store Owner
Level-2	Bachelor in Pharmacy	Hospital Pharmacist Retail Store Pharmacist Retail Store Owner API Manufacturing- Executive Formulation Manufacturing-Executive Regulatory Affairs Executive Pharma Sales Representative
Level-3	Masters in Pharmacy/ M.S in Pharmacy/ M. Tech	Hospital Pharmacist Retail Store Pharmacist Pharmacy Retail Store Owner API Manufacturing- Supervisor Formulation Manufacturing- Supervisor Formulation and Development Scientist Regulatory & Scientific Affairs – Executive/Manager Research and Development Associate/Scientist Pharmacovigilance Associate /Manager Pharma Sales Management- Supervisory Role
Level-4	PhD in Pharmacy/ D. Pharm	Clinical Pharmacist Pharmacy Retail Store Owner API Manufacturing- Supervisory Role Formulation Manufacturing- Supervisor Role Formulation and Development Scientist Regulatory & Scientific Affairs – Executive/Manager Research and Development Associate/Scientist Pharmacovigilance Associate /Manager Pharma Sales Management- Supervisory Role

OPPORTUNITIES FOR PHARMA CANDIDATES OUTSIDE INDIA

CANADA

Canada is one of the top pharmaceutical destinations for aspiring pharmaceutical professionals. The healthcare expenditure in Canada is set to increase rapidly to more than 14% of the GDP because of high consumption of pharmaceutical products. As reported by Canadian Pharmacist Association (CPA)there is still a great shortage of pharmacists in Canada which leaves a lot of scope for fresh graduates to secure a job pharmaceutical sector in Canada. According to CPA, as Canadian population is ageing it will have an increased need for drugs and medication to keep the disease prevalence to minimum. Thus, the demand for pharmacists in Canada is rapidly growing with pharmaceutical retail outlets expanding and providing 24-hour services.

Region wise, there is a high demand of pharmacists in certain areas of Canada like Prince Edward Island, Alberta, British Columbia, Ontario, Newfoundland & Labrador, New Brunswick, Nova Scotia, Manitoba, and Saskatchewan.

Some of the prominent players in the Canada pharmaceuticals market include:

- Johnson & Johnson
- AA Pharma
- Pfizer
- Abbvie Corporation
- ACIC Pharmaceuticals
- Bayer
- Merck

Scope of Indian Pharmaceutical Degree Holders in Canada: -

Unlike in India, pharmacists have a much more critical role in the healthcare industry in Canada. Pharmacists are considered ideal for patient counseling and are also given the title of Drug Experts. Depending on the roles they play and the place where they work, the pharmacists are further categorized into Community Pharmacists, Hospital Pharmacist, Industrial Pharmacist or Veterinary Pharmacist. Pharmacy Informatics is another emerging field where pharmacists are responsible for management and optimization of the healthcare system.

Canada's has now overhauled its National Occupation Classification (NOC) system which will see 16 new occupations become eligible for Express Entry thereby creating potential employment opportunities for Indian Pharmacists interested in migrating to Canada. However, the interested candidates need to have completed at least an undergraduate pharma degree in India and also check if their Pharma degree is recognized in Canada, In-addition the candidates need to take a qualifying PEBC exam conducted by after registration at Pharmacist Gateway Canada . In addition to this, English proficiency test like TOEFL also need to be cleared and Provincial requirements of Canada need to be fulfilled to be registered as a pharmacist and practice in Canada.
Indian Pharmaceutical post-graduates and PhD students seeking job in Canada with Canadian Pharmaceutical companies can apply for work visa in Canada through a Canadian employer after receiving a job offer or employment contract.

The Top 10 Pharmaceutical job postings in Canada are:

1) Packaging Operator
2) Import/Export Coordinator
3) Quality Assurance Associate
4) Blending Operators
5) Regulatory affairs Associate
6) Quality Specialist
7) Research Associate
8) Pharmaceutical Sales Representative
9) Manufacturing Technician
10) Pharmaceutical Consultant

Average Salary for various job profiles in Canada are mentioned below:

Clinical Project Manager	146,000 CAD
Clinical Research Associate	135,000 CAD
Clinical Research Manager	225,000 CAD
Manufacturing Engineer	132,000 CAD
Pharmaceutical Regulatory Affairs Specialist	143,000 CAD
Pharmaceutical Research Associate	151,000 CAD
Pharmaceutical Sales Manager	229,000 CAD
Pharmaceutical Sales Representative	109,000 CAD
Pharmaceutical Supply Chain Manager	245,000 CAD
Pharmacy Manager	221,000 CAD

AUSTRALIA

The Australian pharmaceuticals Market was valued at $ million in 2020, and it is expected to reach USD 28,750 million in 2026, witnessing a 2.1% CAGR growth over the forecast period, 2021-2026 (Source: Mordor intelligence). The main factors driving the pharmaceutical industry in Australia are rise of aging population, growing burden of chronic diseases and rising investments in research and development expenditure for novel therapeutics in Australia. The main customer of Australian pharmaceutical industry is the federal government which offers subsidized medicine to the public through the Pharmaceutical Benefits Scheme (PBS). Pharmaceutical exports of Australia amount to $4 billion while it has the world's twelfth largest consumer market. If we take a bird eye view of Australian pharmaceuticals industry, the major domains for potential job opportunities for Indian Pharma Post-graduate and PhD holder here are Biomedical research organizations, Biotechnology firms, Innovator and generic medicine manufacturers, and associated wholesaling and distribution businesses. The Australian pharmaceutical industry usually employs people in laboratories, offices and manufacturing abilities.

A recent survey found that there are 40 Innovator companies (mostly subsidiaries or regional offices of Multi-National Companies), 10 generic companies, 470 small-scale core biotechnology companies and over 20 world-class medical research institutes. Most of the pharmaceutical companies in Australia have shifted their focus towards R&D departments to identify new molecules or leads for treatment of diseases with many of them in final phases of clinical trials. There are many factors which favor the growth of high value research-based jobs in Australian Pharmaceutical Market. These are:

- Strong intellectual property provisions
- Maturing biotechnology sector
- World class medical research institutes

Some of the prominent players in the Australian pharmaceuticals market include:

- Pfizer
- Roche
- Sanofi
- Novartis
- Merck
- Novo Nordisk
- Baxter
- Sun Pharmaceuticals
- Otsuka

Scope of Indian Pharmaceutical Degree Holders in Australia: -
In Australia, pharmacist skill set is listed on Short Term Skilled Occupations List. According to Australian job Outlook in 2021, average income of pharmacists was $96,824. There is a higher demand for pharmacists in regional areas of Australia as compared to metropolitan cities. There is a unique concept of Supercare Pharmacies across various states in Australia to provide additional healthcare services through pharmacies.

These pharmacies are run by both nurses and pharmacists enabling cure for minor illness with no need to Physicians.

In addition to developing new chemical entity development and Biomedical research, another sector where is an urgent demand of pharmaceutical professionals is Community Pharmacy. There are approximately 5,700 community pharmacies in Australia with an average of 440 million individual patient visits a year. Some of the roles which are in demand in community pharmacies are

- Pharmacy Sales Assistant
- Sales Representatives
- Sales Assistant
- Retail Manager
- Retail Supervisor

Average Salary for various job profiles in Australia are mentioned below:

Chemical Process Technician	90,300 AUD
Compliance Specialist	130,000 AUD
Pharmaceutical Regulatory Affairs Assistant	103,000 AUD
Pharmaceutical Research Scientist	174,000 AUD
Pharmaceutical Researcher	168,000 AUD
Pharmaceutical Sales Representative	78,900 AUD
Pharmaceutical Supply Chain Manager	196,000 AUD
Pharmaceutical Team Leader	134,000 AUD
Pharmaceutical Technologist	93,700 AUD

UNITED STATES OF AMERICA

US Pharmaceutical industry is the largest pharmaceuticals market in the world and is expected to be worth US$ 685.45bn by 2023. US is expected to increase its share in Global pharmaceutical market to 43.73% by 2023. There are various factors impacting this high growth: -

- Increase in the ageing population which has risen to 15% of the total
- Increase in the purchasing power of and access to quality healthcare to middle class families
- Incentives to cure rare and specialty diseases
- Innovations in the field biologics, nucleic acid therapeutics, cell therapies and bioelectronics & implantable which has attracted good investments

Scope of Indian Pharmaceutical Degree Holders in US:

There is steady demand for pharmacists in the US with more than 3,20,000 pharmacists working in country. The average monthly wage of a pharmacist stands at $10,460 and varies from $12,250 in Alaska to $8,620 in North Dakota. However, there are various factors influencing this amount which are educational background, location of work, level of experience and type of employer.

The job distribution in the pharmaceutical sector in USA varies by various regions. Mid-Atlantic regions has the highest number of jobs with 33% of the workforce employed in the region and low unemployment rate of 1.3%.

The ten-year job outlook for the pharmacists is not that optimistic in US according to U.S. Bureau of Labor Statistics, 2020. Required job opportunities in the sector are expected to decline by 2.14 % in the time period of 2020-2030. A major reason for this negative growth is increase in the number of pharmaceutical graduates in the country thus leading to supply outstripping the demand. However, there are some selective sectors where demand for pharmaceutical jobs is set to increase. There will be an increased demand of pharmaceutical professionals in non-retail settings such as hospitals and ambulatory care facilities. Alternatively, all retail positions which make up half of all pharmacy jobs in US are expected to decline over next 10 years.
Some of the best paying potential pharmaceutical jobs in the US for Indian Pharma Post Graduate and PhD holders are:

- Research Scientist
- Pharmaceutical Field Sales Representative
- Pharmaceutical Quality Auditor
- Pharmaceutical Project Manager
- Medical Science Liaison
- Biotechnology Consultant
- Pharmacy Manager
- Nuclear Pharmacist

Average Salary for various job profiles in US are mentioned below:

Biotechnologist	129,000 USD
Clinical Data Manager	126,000 USD
Clinical Data Specialist	120,000 USD
Clinical Operations Manager	172,000 USD
Clinical Pharmacist	119,000 USD
Clinical Pharmacy Specialist	148,000 USD
Clinical Programmer	65,800 USD
Nuclear Pharmacist	130,000 USD
Pharmaceutical Quality Auditor	138,000 USD
Pharmaceutical Sales Manager	172,000 USD

GERMANY:

The German Pharmaceuticals market was valued at US$41.4 billion in 2019 and is expected to grow at Compound Annual Growth Rate (CAGR) of 6.0% from 2020 to 2027. The growth is expected to come from increasing patent applications which include novel drug delivery systems, new drugs, and formulations. Increase in exports is also expected to boost the German pharmaceutical industry which is showing a 10% Year on Year (YoY) growth. The major export destinations for German pharmaceutical industry are U.S., Netherlands, and Switzerland. Domestic growth of industry is aided by favorable reimbursement scenario and pricing for pharmaceuticals companies e.g., in Germany, 90% of the population is covered from Statutory Health Insurance (SHI) and the remaining 10.0% is covered by special schemes and private insurance. German pharmaceuticals market is primarily driven by Innovation driven pharmaceutical and biotechnology companies like:

- Boehringer Ingelheim International GmbH
- Bayer AG
- Merck & Co., Inc.
- Fresenius Kabi AG
- STADA Arzneimittel AG
- Pfizer Inc.
- Abbott
- AbbVie Inc.
- Novartis AG

Scope of Indian Pharmaceutical Degree Holders in Germany:
Germany is a globally recognized pharmaceutical market with about 1,20,000 people employed in the sector. Germany has always been instrumental in drug development and is known for high-grade quality products. According to Deutsche Aerzte Finanz, the starting salaries for people with Masters and PhD degrees in the pharmaceutical industry range from €3,500 to €4,000, The salary structure varies depending upon industry and location of the employer. Individual factors affecting monthly income include professional experience and the individual's academic degree, i.e., a doctorate always has financial benefits.

For Indian Pharmaceutical students seeking jobs in Germany a degree in pharmacy along with knowledge of German language at B2 level will support in obtaining a license to work and the possibility of employment. Popular cities for pharmaceutical employment are Hamburg, Stuttgart, Essen, Cologne, Munich, Hanover, Bremen and Berlin.

A doctoral degree in Germany is instrumental in building career in pharmaceuticals sector. It comes with clear entry position benefits, clear salary and a defined career path in the industry. A doctoral degree can help a candidate in advancing his/her carrier in the scientific field. Good grades are helpful to enter the industry and employers tend to check the grades before interviewing the candidates. Some of the major job profiles in demand are mentioned below:

- Manager Quality Assurance
- Manager Process Development Drug Product
- Regulatory Affairs Labeling Manager.
- Clinical Research Manager
- Medical Writer
- Pharmaceutical Marketing Manager
- Drug Product Development Scientist
- Pharmacologist

Average Salary for various Pharma job profiles in Germany:

Biotechnologist	4,750 EUR
Clinical Pharmacy Specialist	5,790 EUR
Clinical Programmer	2,560 EUR
Clinical Research Associate	4,060 EUR
Clinical Research Manager	6,540 EUR
Clinical Study Manager	5,810 EUR
Compliance Specialist	4,870 EUR
GCP Auditor	4,080 EUR
Hospital Pharmacy Technician	3,730 EUR
Pharmaceutical Regulatory Affairs Assistant	3,840 EUR

CHINA:

China's pharmaceutical market has been growing tremendously and is estimated to reach US$300.9 billion by 2025 with prescription medicine making up 86.4% of the market. Chinese pharmaceutical industry is also expected to make 30% share of the Global Market. The overall pharmaceutical market in China can be segmented into generics, OTC, and patented medicines.

Currently, the major focus of Chinese pharmaceutical industry is on generics while R&D investments are lower. This scenario is however expected to change as government continues to incentivize patented drugs and innovation. Thus, it is expected that there will be more R&D investments and enhanced product quality in coming years.

Prominent players in the Chinese Pharmaceutical industry are mentioned below:

- Sinopharm Group
- Shanghai Pharmaceuticals
- Jiangsu Hengrui Medicine
- Guangzhou Baiyunshan Pharmaceutical
- China Meheco
- Huadong Medicine
- Yunnan Baiyao
- Shanghai Fosun Pharmaceutical

Scope of Indian Pharmaceutical Degree Holders in China:

The growth of Chinese pharmaceutical industry has led to demand for pharmaceutical executives. There is an intense demand for executives capable of managing the business, investments and approval processes. Furthermore, there are two areas which have seen a massive increase in demand viz. Marketing and R&D. However, one of the major requirements to get these jobs in China is thorough knowledge of the Chinese language. Some of the major job profiles in demand are:

- Commercial Business Analyst
- Project Manager
- Business Development Manager

- Scientist
- Product Design Lead
- Pharmaceutical Technical Expert
- Pharmaceutical Chemist
- Clinical Programmer
- Pharmaceutical Information Specialist

Average Salary for various job profiles in China are mentioned below:

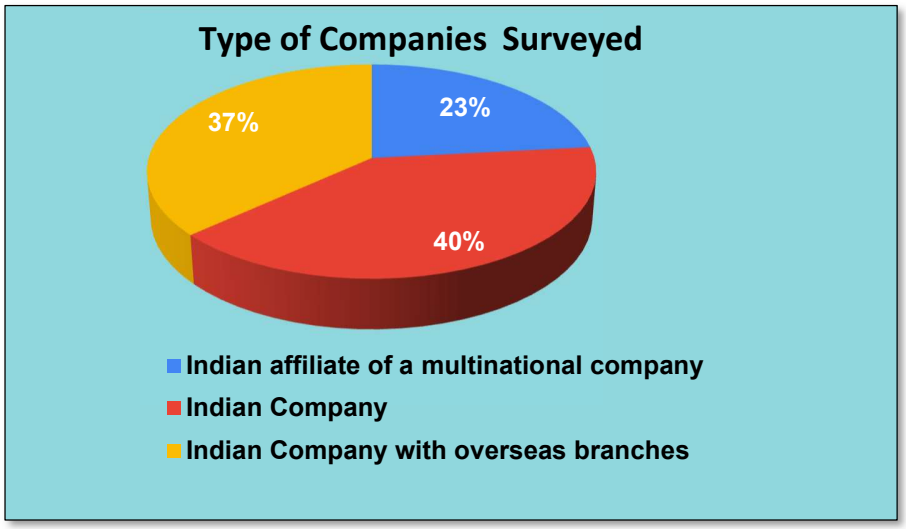
Clinical Data Manager	37,600 CNY
Hospital Pharmacy Technician	28,700 CNY
Medical Representative	24,400 CNY
Pharmaceutical Sales Manager	52,500 CNY
Pharmaceutical Sales Representative	26,000 CNY
Pharmaceutical Supply Chain Manager	56,300 CNY
Pharmaceutical Team Leader	41,200 CNY
Pharmaceutical Technologist	29,400 CNY
Pharmacist	38,800 CNY

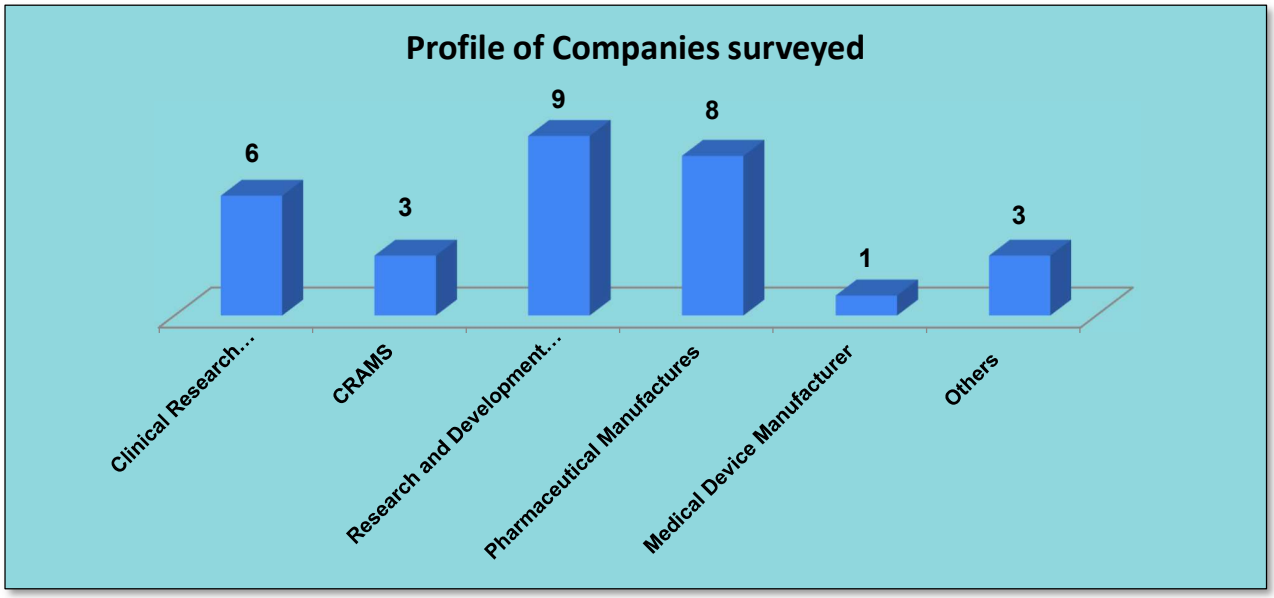
SURVEY DATA

RESULTS & DISCUSSIONS

INDUSTRY PERSPECTIVE:

Number of Companies Evaluated: 30

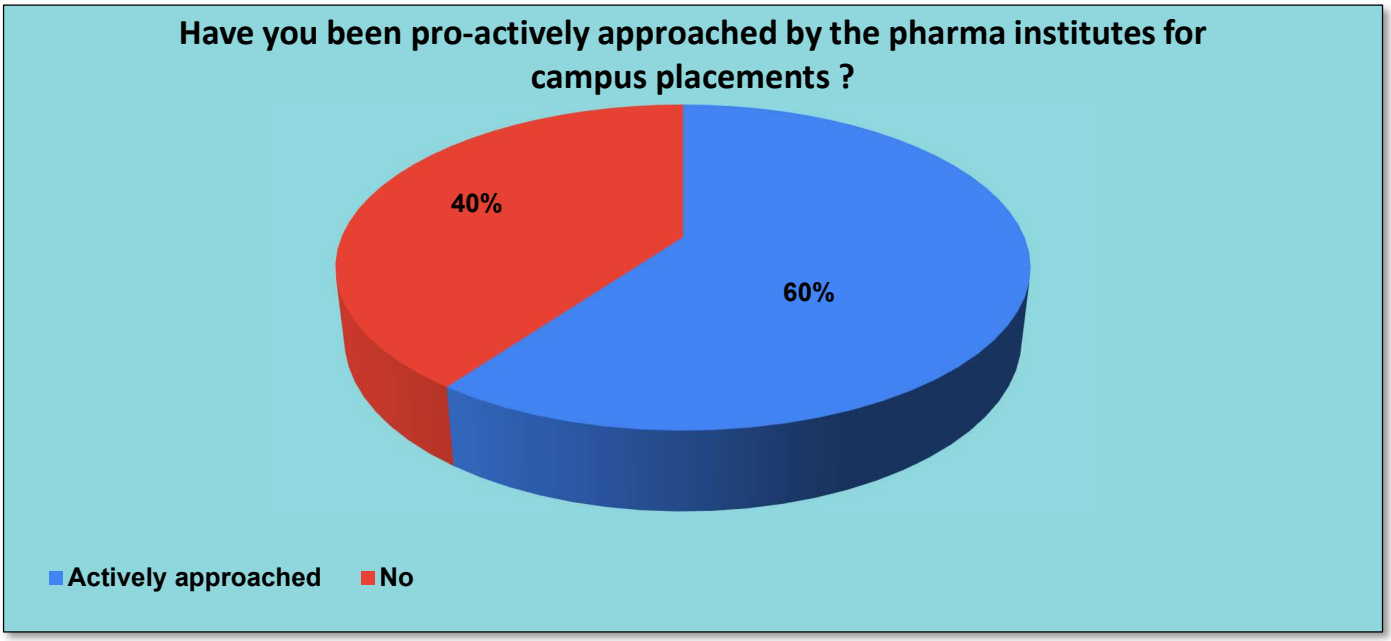




RESPONSES TO THE QUESTIONS AND THEIR INFERENCES:

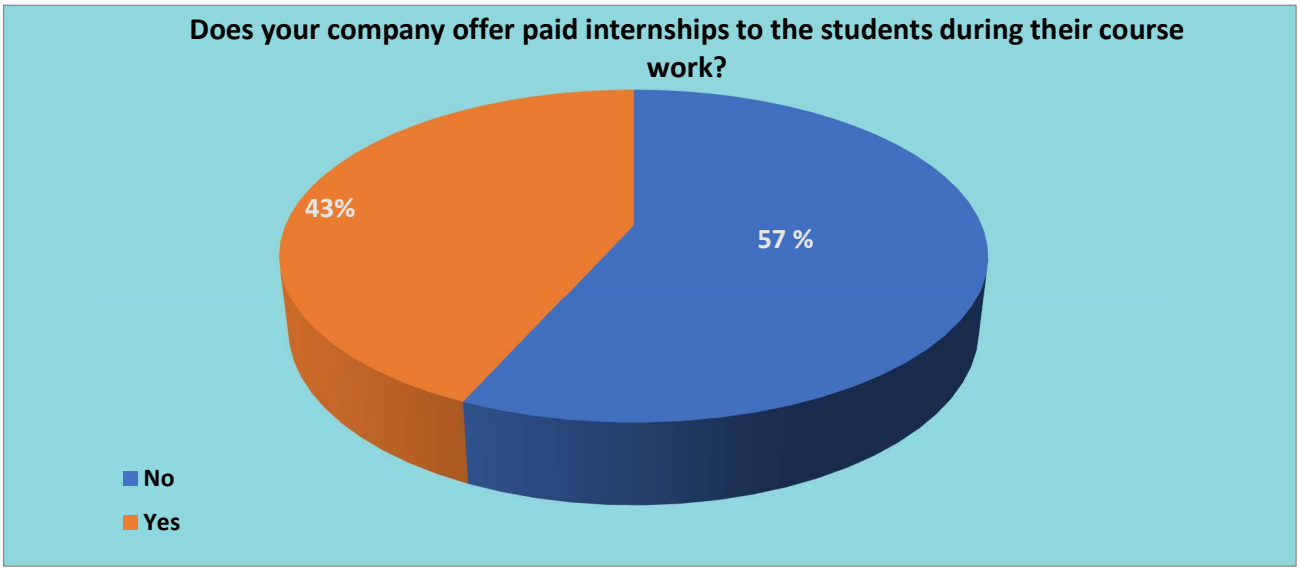
1. Are you pro-actively approached by the pharmaceutical education institutes for campus placements?

Response: 40 % of the surveyed companies do not see any proactive steps taken by the pharma institutes for campus placements.



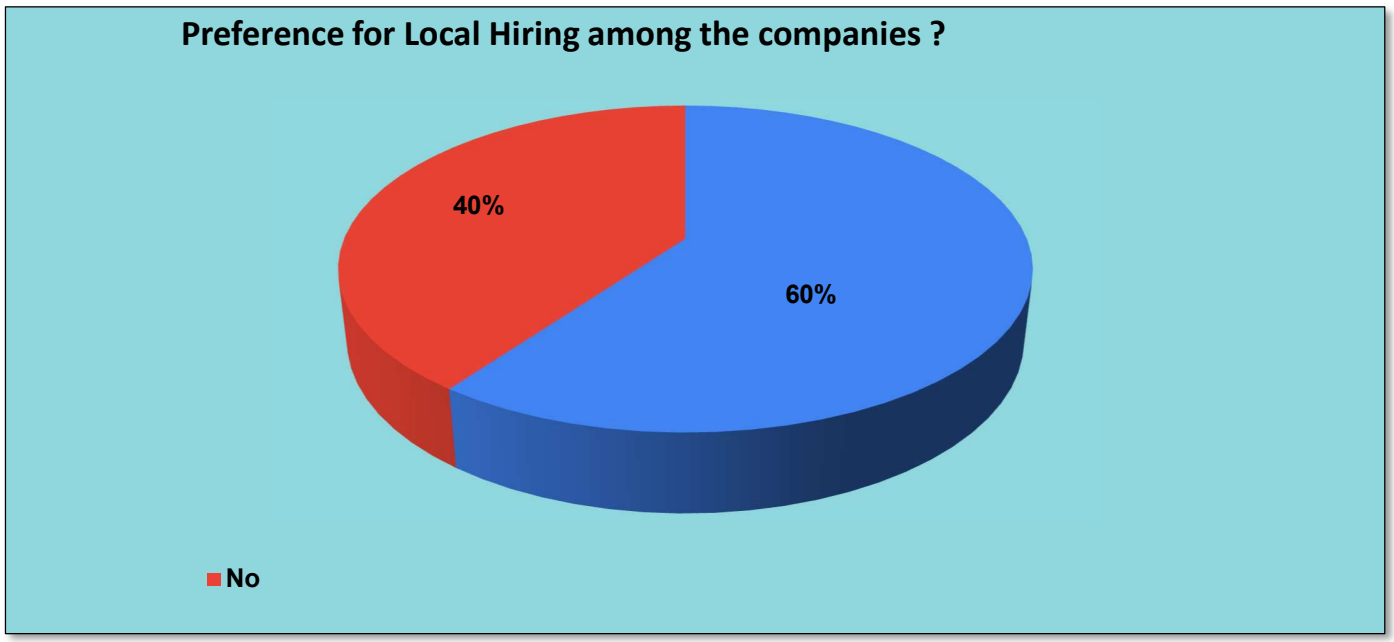
2. Does your company offer paid internships to the students during their coursework?

Response: 57% of the surveyed companies informed that they do not offer paid internship to the students



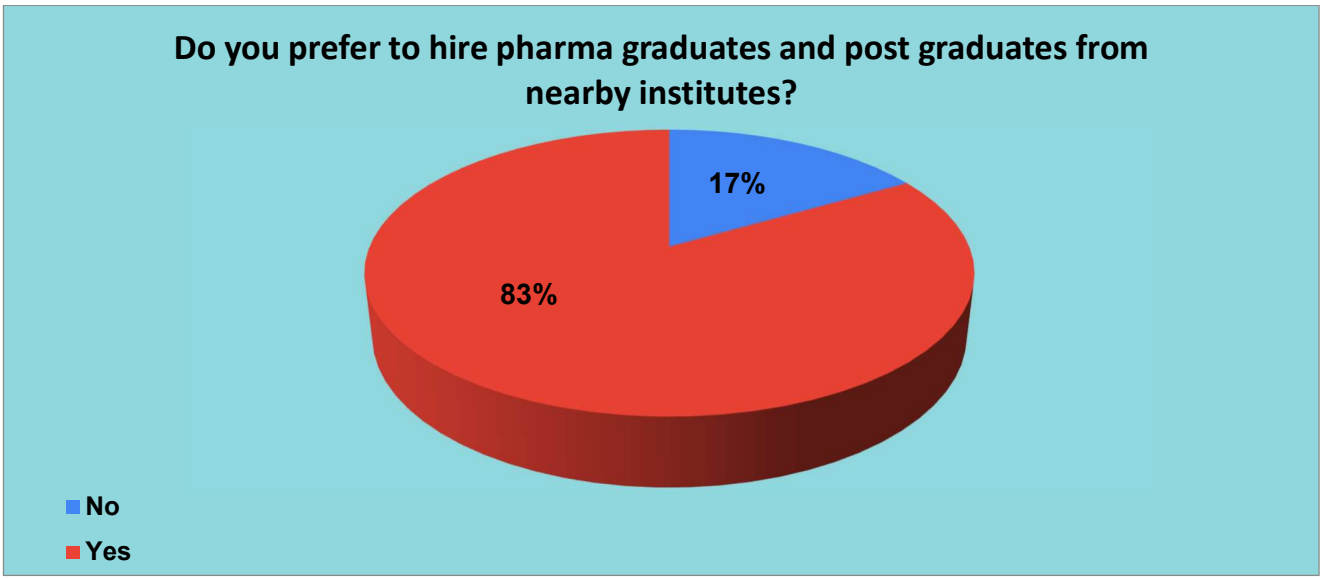
3. If yes; do you prefer to hire from the same institute?

Response: 60 % of the surveyed companies which offered paid internships to students of an institute, preferred to hire from the same institute.



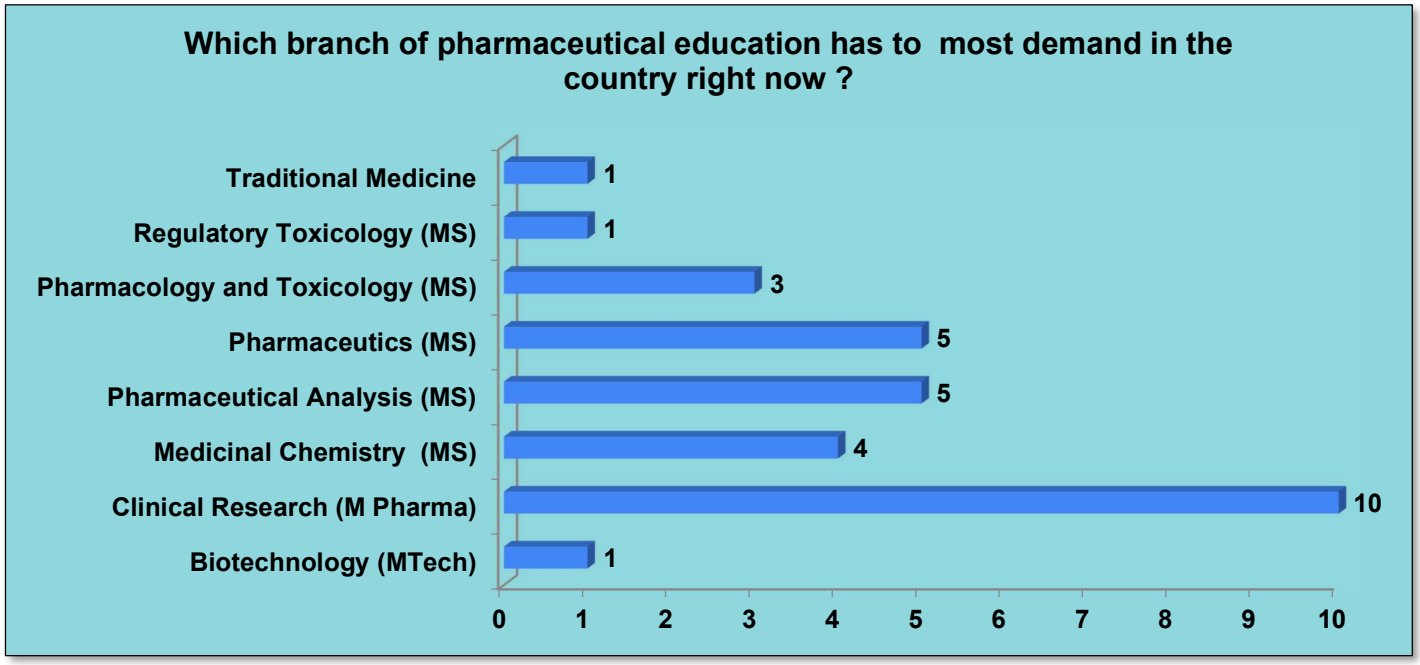
4. Do you prefer to hire pharma graduates and post graduates from nearby institutes?

Response: 83% of the surveyed companies preferred to hire the pharma graduates and post graduates from nearby institutes.



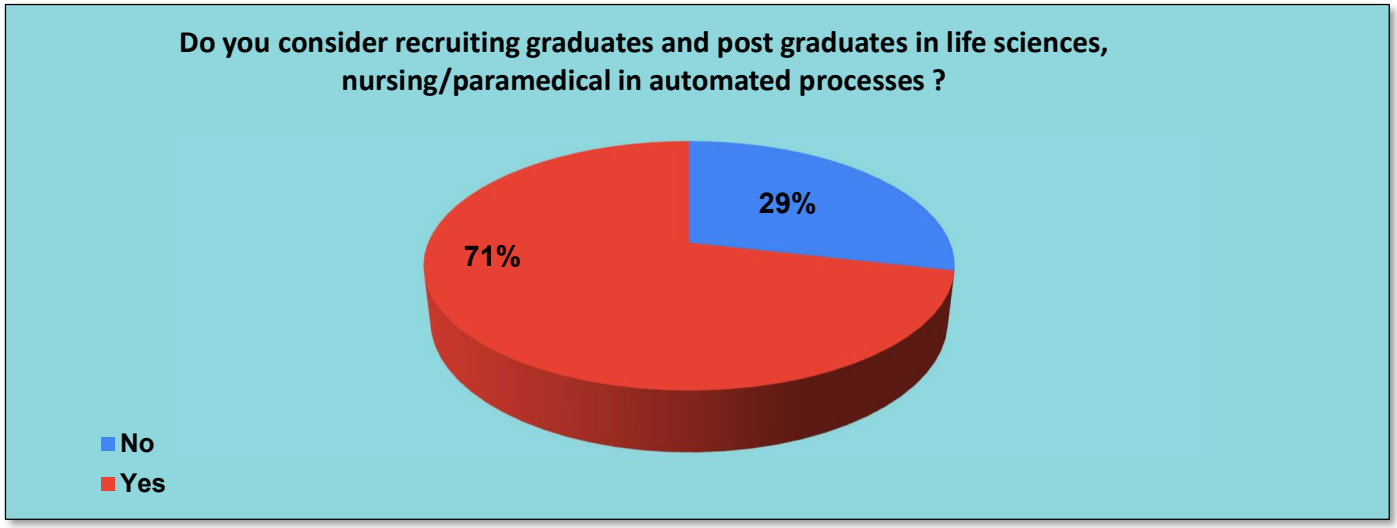
5.. Which branch of pharmaceutical education has the most demand in the country right now?

Response: Clinical Research, Pharmaceutics, Pharmaceutical Analysis, Medicinal Chemistry and Pharmacology &toxicology are currently in major demand in the country.



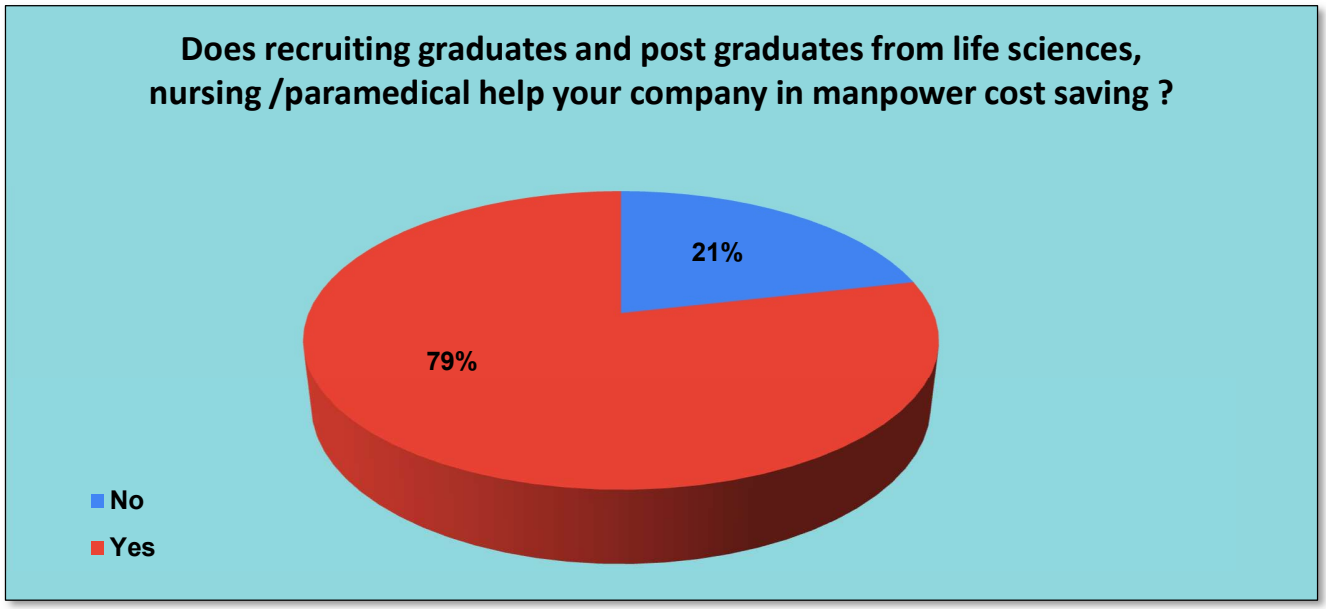
6. Do you consider recruiting graduates and postgraduates in life sciences, nursing and paramedical for the automated processes in your industry?

Response: 71% of the companies surveyed are open to recruit the people with life sciences and paramedical degrees for the automated processing profiles in their industry.



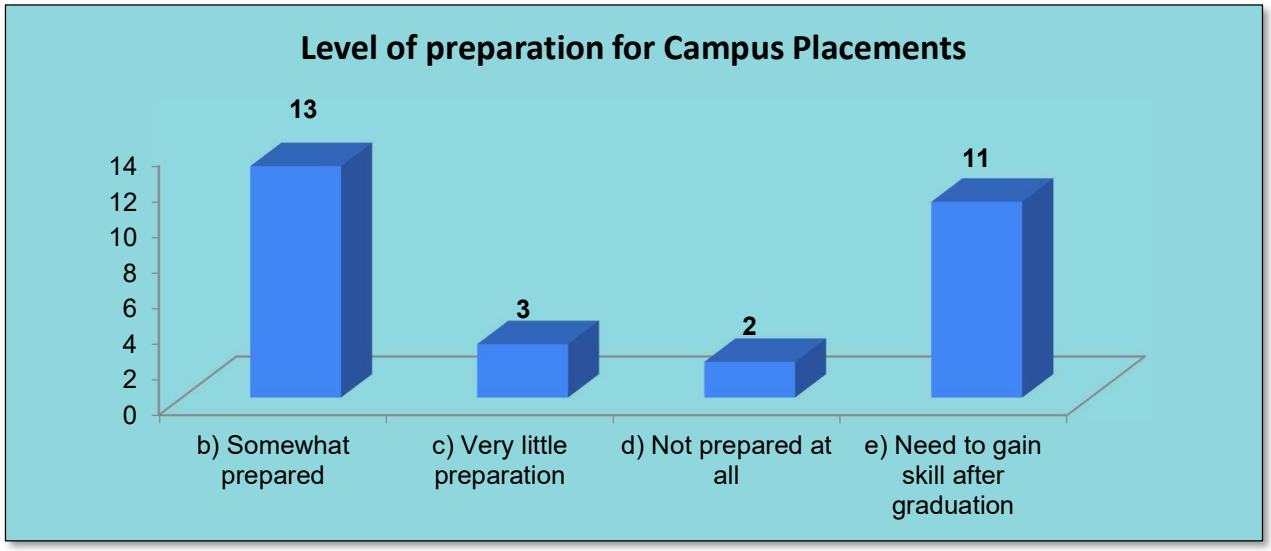
6. Does recruiting graduates and postgraduates from life sciences, nursing and paramedical backgrounds help your company in manpower cost saving?

Response: 79 % of the companies surveyed agreed that recruiting graduates and postgraduates from life sciences, nursing and paramedical backgrounds help their company in manpower cost saving.



7. What is the level of preparation among the students who sit for campus placements activities with your company?

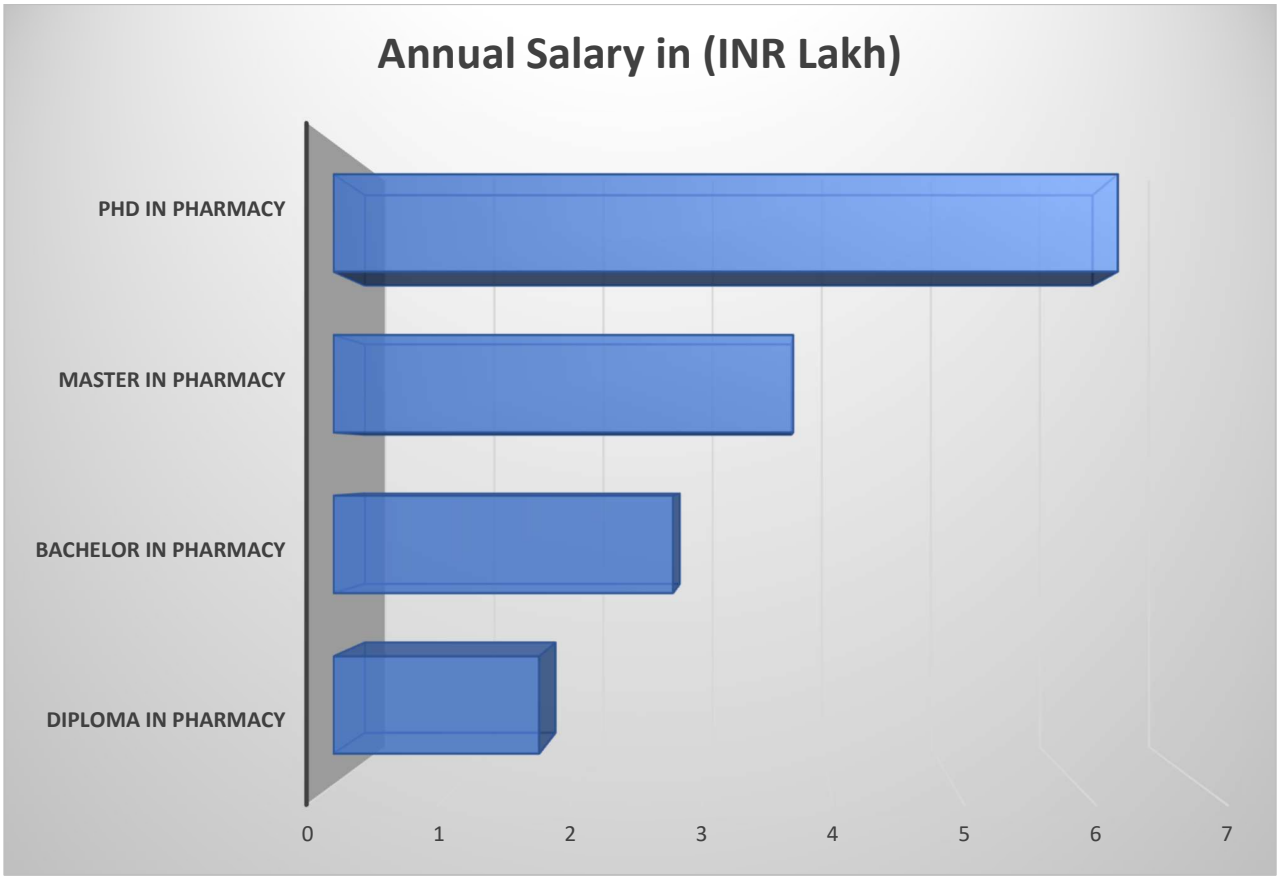
Response: 45 % of the surveyed organisations believed that the students are somewhat prepared for the campus placement activities.



8. What is the average salary offered by your company to fresh pharma candidates completing their diploma, undergraduate degree, post graduate degree or PhD Degree?

Response:

- 73% of the surveyed companies do not hire the Diploma in Pharmacy candidates for any job profile as they consider them underqualified for offered job profiles.
- 46 % of the surveyed companies prefer to hire the Bachelor's in pharmacy candidates as they consider them qualified for the offered job profiles.
- 66% of the surveyed companies prefer to hire he Masters in Pharmacy candidates as they consider them qualified for the offered profiles by them.
- 50 % of the surveyed companies prefer to hire the PhD in Pharmacy candidates as they consider them qualified for the offered profiles by them.

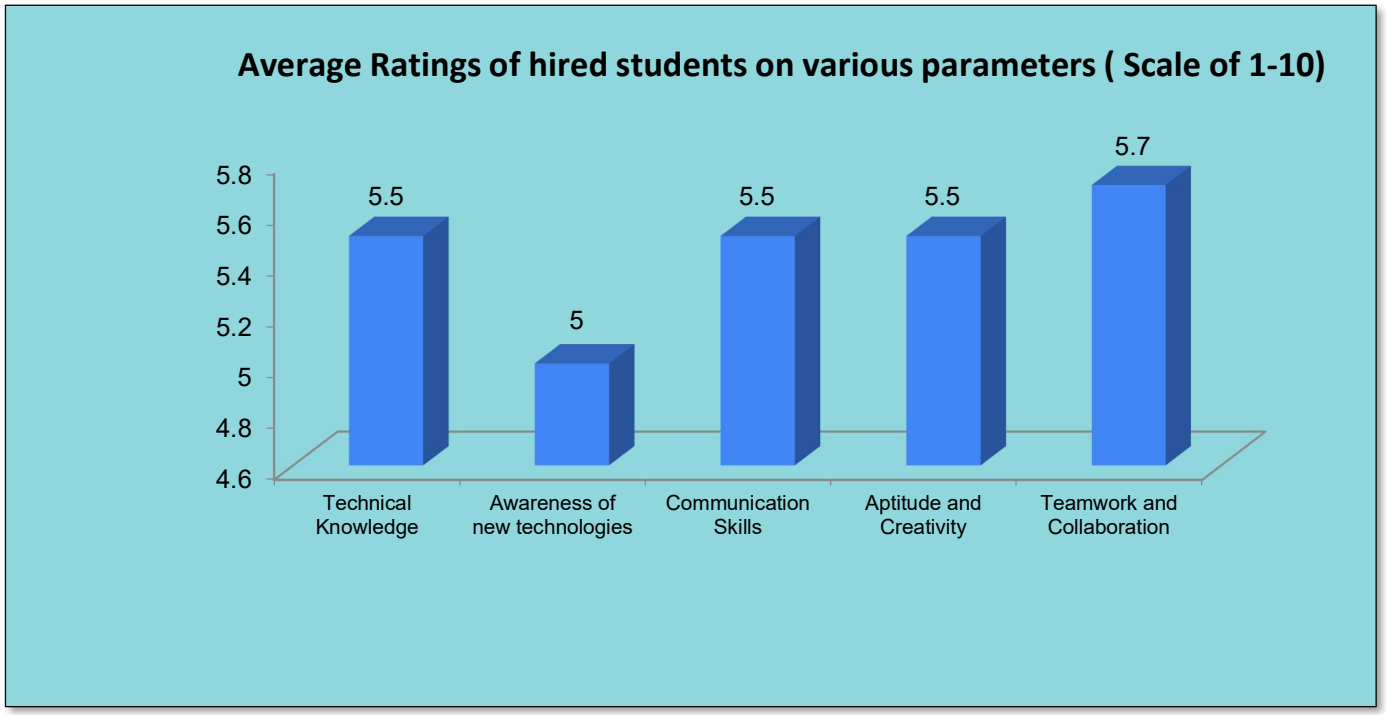


- The average annual salary offered by Surveyed companies to the Diploma in Pharmacy holders is INR 1.66 Lakh
- The average annual salary offered by the surveyed company to B. Pharma Degree holders is INR 2.74 Lakh.
- The average annual salary offered by the surveyed company to M. Pharma Degree holders is INR 3.71 Lakh.
- The average annual salary offered by the surveyed company to PhD Degree holders is INR 6.33 Lakh.

9. Please rate the students hired by your company during last two years on following parameters from 1 to 10

- Technical Knowledge
- Awareness of new technologies
- Communication skills
- Aptitude and Creativity
- Teamwork and collaboration

Response: The average ratings of the hired students for the above-mentioned parameters was in the range of 5-5.7.



10. What is the skill gap that you find while hiring the pharma graduates and post graduates during campus placements? Please list them.

Response: Below skill gaps have been identified by the surveyed companies:

- Lack of Communication Skills, Soft skill and positive attitude.
- Lack of Aptitude, Analytical skills and Creativity.
- Lack in-depth theoretical knowledge even after scoring grade point of >8 in academics.
- Lack of understanding on flow of activities or chronology of events.
- Spoken and written English
- Many functions are being carried out through soft wares and students are not aware of the basics of used software.
- Lack of knowledge on pharmaceutical regulations, latest technologies & instruments and GMP processes etc.

11. What improvement would you like to see in the recruitment process of the pharmaceutical institutes?

Response: The received responses from the surveyed companies have been summarized below:

- Institute should ensure that the student joining the companies should be committed for at least 2 years.
- Technical knowledge and Communication skills needs to be improved.
- More emphasis needs to be given on practical trainings during course by Pharma institutes.
- Exposure of the market needs to be provided to the students
- Industrial training and internship along with language and skill courses should be included.
- Pharma institute should have a function/department for industry collaboration and their performance should be measured based on industrial placements.
- Pharma institutes need to develop warm and cordial relationships and be consistently in touch with industry.

12. In which specific job/profiles are you facing most difficulties when looking for suitable employees with the relevant knowledge and skills?

Response: The received responses from the surveyed companies have been summarized below:

- Bioinstrumentation, Molecular kits and reagents manufacturing profiles
- R & D Profiles
- Production, QA, QC profiles
- Pharmacovigilance, Medical summarization, Medical sorting Medical scribe profiles
- Formulation Development profiles
- Regulatory toxicology profiles

- Pharmacokinetic and pharmacodynamics profiles
- Clinical Trials and Medical Writing profiles
- Marketing and sales profiles
- Statistics and Analytics Profiles
- Regulatory Affairs and Computer System Validation profiles
- Strategy and Advanced R&D profiles
- Analytical Development profiles

13. Which are the futuristic technologies that are going to be most important in your relevant pharma sector?

Response: The received responses from the surveyed companies have been summarized below:

- Personalized medicine
- Medical intelligence
- Artificial Intelligence and Machine Learning
- Biotechnology based technologies
- Softwares and Technologies aimed at bridging the gap between drug producers and drug users
- Process Automation & Digitalization for Manufacturing Process improvement
- Organ on a chip
- Invitro organ testing
- Flow Chemistry based technologies

14. What support can the government provide to bridge the skill gap and create more jobs in the sector?

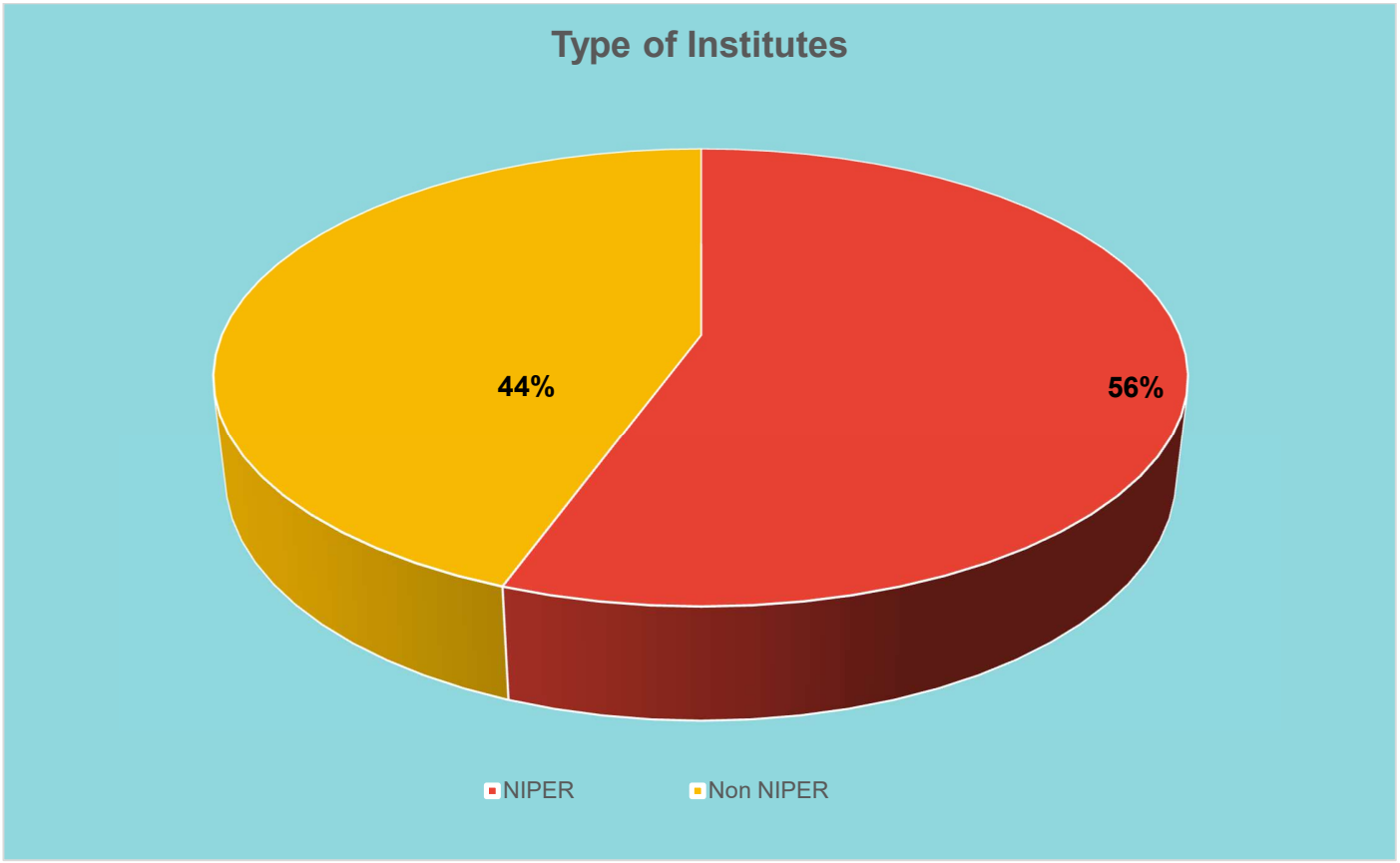
Response: The received responses from the surveyed companies have been summarized below:

- Government is doing its best. Institutions need to be more aligned with the market requirements and upgrade the course curriculums as per to industry requirements and global standards.
- Updating of curriculum should be frequently done in collaboration with industries.
- Government and institutes should work together to understand the industry requirement.
- More practical training needs to be imparted to teachers as well as students.
- Investing and incentivizing the Research and Development can be a positive step in this direction.
- Government should encourage small pharma organizations and provide subsidy or tax rebate to them.
- Government can offer best possible accidental insurance for private working employees in pharmaceutical sector.
- Soft skills training programs can be provided by the government to pharma students at affordable rates.
- More institutions like NIPERs should be established and undergraduate courses should be started by NIPER so that the required skill set development can start from bachelor level itself.
- Government can create a free job portal meant specifically for pharmaceutical students.

INSTITUTIONAL PERSPECTIVE:

Number of Pharma Institutes Evaluated: 9

Profile of the Pharma Institutes evaluated: NIPERs and Non-NIPER institutes



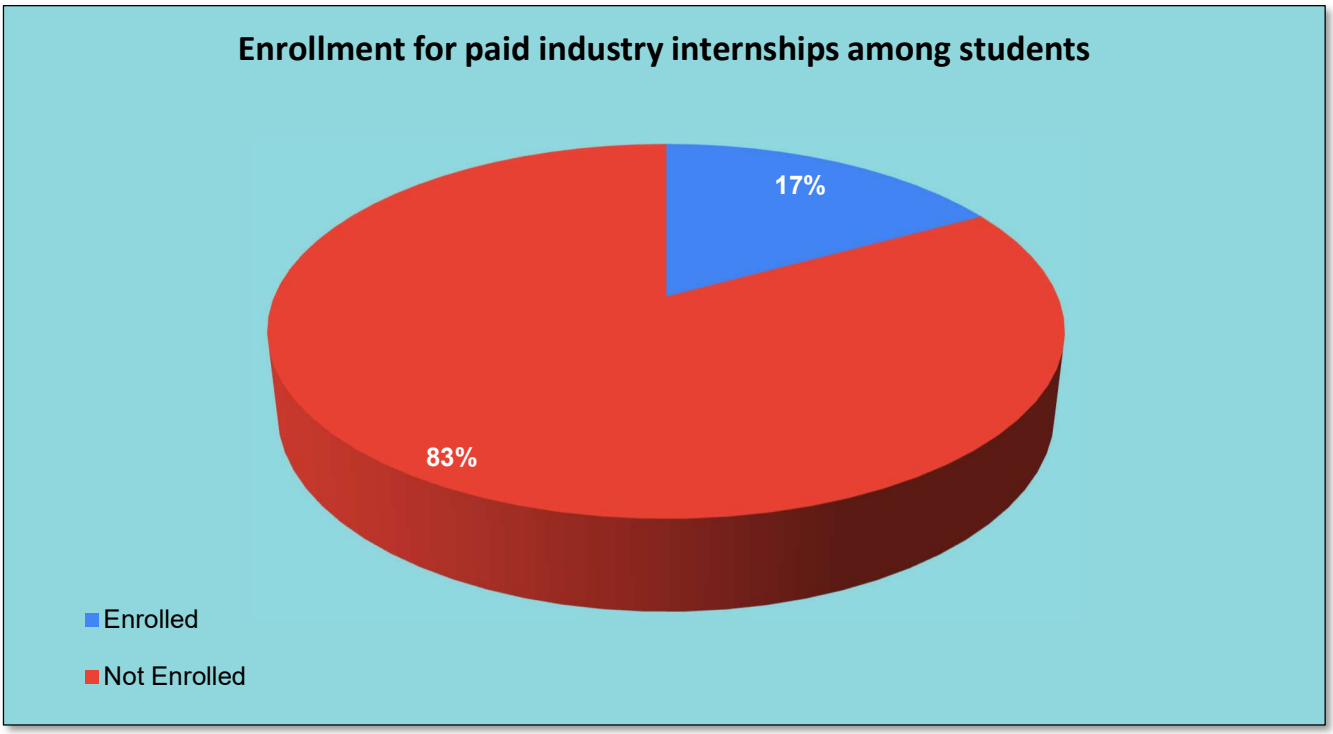
Courses offered by the Evaluated institutes:

1. Diploma in Pharmacy
2. Bachelor in Pharmacy
3. Master in Pharmacy/ M.S (different specializations)/ MTech/ Pharm Tech
4. M.B.A in Pharmaceutical Management
5. PhD in Pharma /Pharm D

RESPONSES TO THE QUESTIONS AND THEIR INFERENCES:

1. What percentage of your students go for paid industry internships during the required coursework?

Response: As per the inputs provided by the surveyed institutes an average of only 17 % students enrolled for paid Industry internship during their course curriculum.



2. What are the other industry exposure activities carried out by your institution every year for the students?

Response: Following industry exposure activities were carried out by the surveyed institutions for students.

- Training on analytical instruments.
- Industrial visits, Industrial projects, Internship programs
- Industry- Academia Interactions,
- Carrying out Industry sponsored projects
- Teaching of students by Guest faculty from Industry
- Collaborative training programs, industry-expert lectures and workshops on newer technologies.
- Industry experts frequently visit the institute and provide lectures on technology & industrial needs.

3. Is there any Faculty Development Program carried out by your institution in association with the industry to equip the faculty with latest technologies, trends, and know-how in the industry? If yes, please share details.

Response: Most of the surveyed institutes informed that Faculty development programs were carried out by them which include arranging regular talks by the eminent personnel from the industry who share the latest trends in the pharmaceutical sector. No external trainings with hands-on experience for Faculty in new technologies were mentioned in responses.

4. What kind of career counselling activities are offered to students by the institution?

Response: Following career counselling activities were offered by the surveyed institutes for the students:

- Mock interview
- Resume writing & Interview techniques
- Soft Skills and Presentation Skills
- Personality Development Programs
- Career Opportunities, soft skills, Presentation Skills

5. On an average, how many industry-interactions are carried out by your institution every year for the students?

Response: On an average 10 industry interactions were carried out by the surveyed institutes per year.

6. What kind of pharmaceutical Companies come for such interactions with students?

Response: Following kind of companies come for such industry interactions:

- Manufacturing and pharma marketing
- Software companies.
- Pharma, Biopharma and R&D based companies.
- Nutraceutical Companies
- Clinical Research Organisations
- Health Economic Outcomes Research organizations
- API Manufacturing companies,
- Generic/Branded Generic Pharmaceutical,
- Innovative Research based Biotech Pharma and Pharmaceutical Service companies.

7. Are there any people with industry- experience included in the faculty of your college?

Response: All of the surveyed institutes informed that they have faculty team members with industry experience.

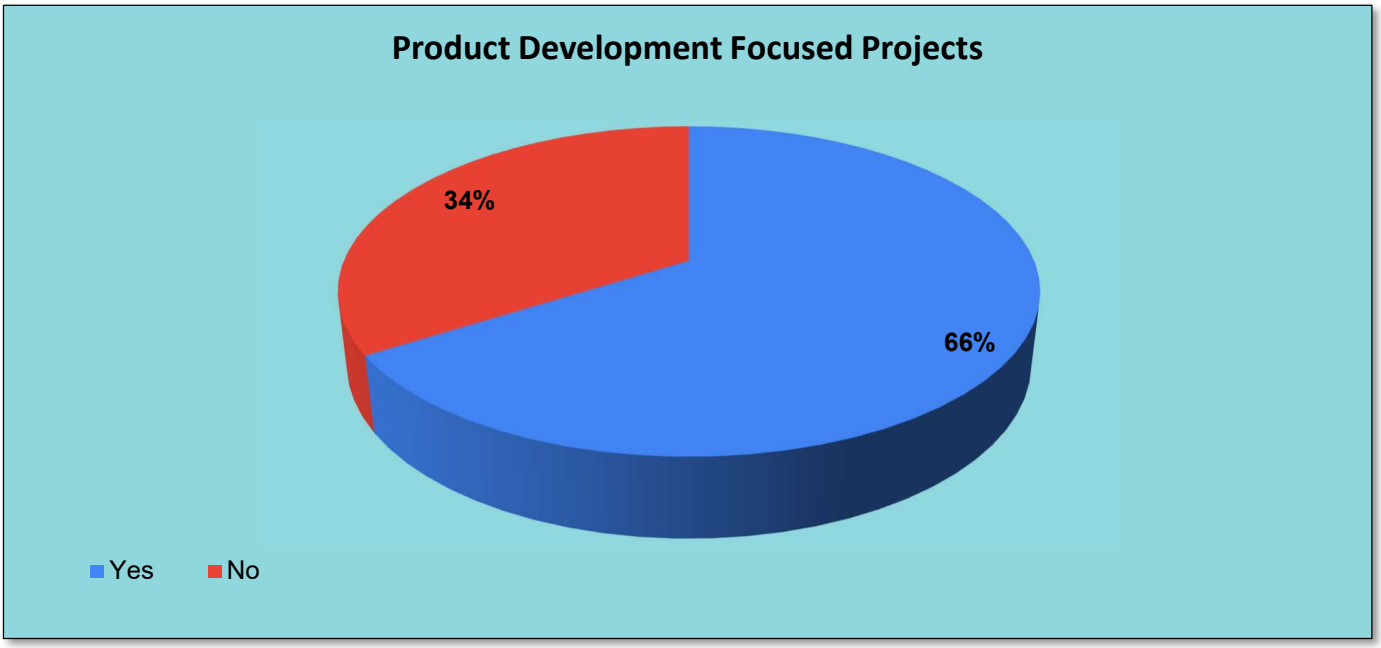
8. What employability skills in addition to technical knowledge does your institute imparts to students for industry placements?

Response: Most of the surveyed institutes informed that in addition to technical skills following employability skills are Imparted to students:

- English Language Proficiency
- IT Skills,
- Communication and soft skills
- Analytical Skills

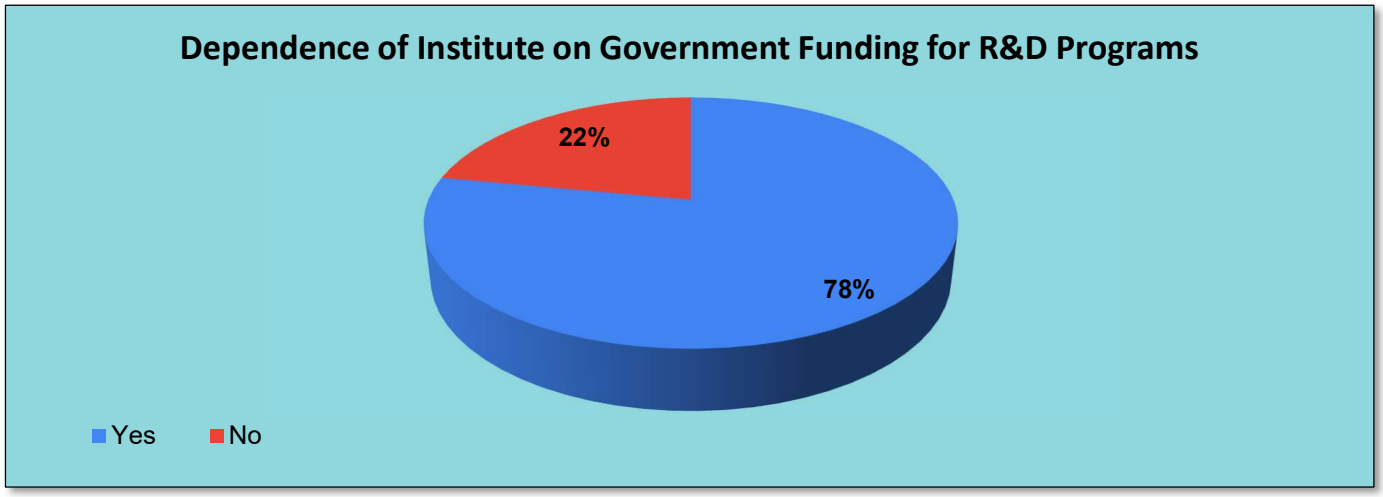
9. Are there any product development focused research and development programs carried out by your institution?

Response: As per the inputs provided by the surveyed institutes, 66% of the institutes carry out product development focused (R&D) programs.



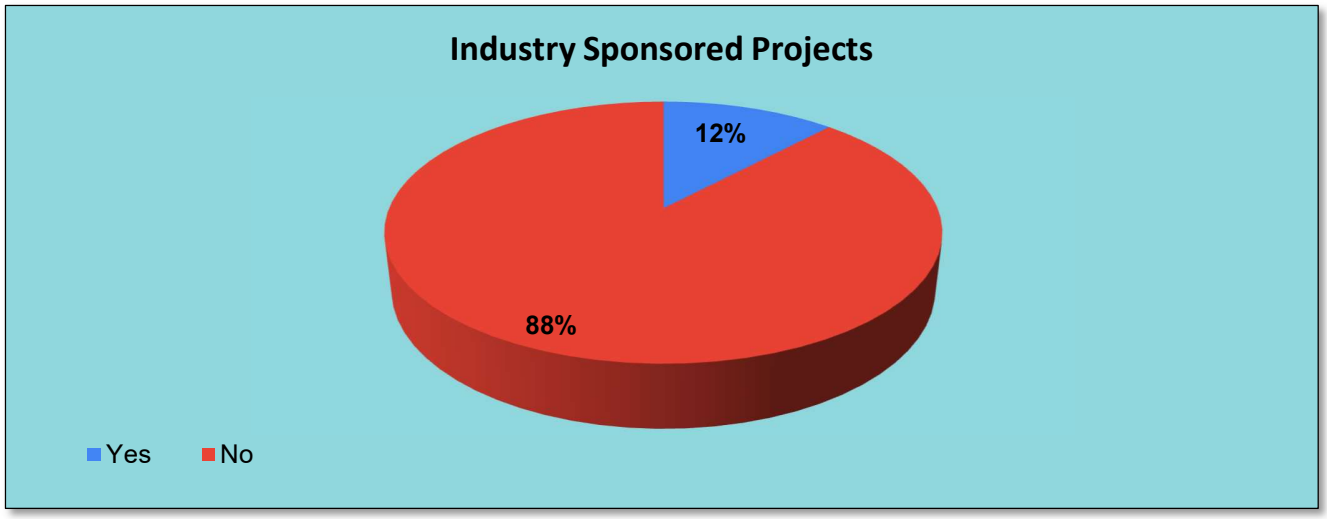
10. Does your institute get the grants from government bodies to carry out product focused research and development activities?

Response: As per the inputs provided by the surveyed institutes, 78% of them get the grants from government bodies to carry out product focused research and development activities.



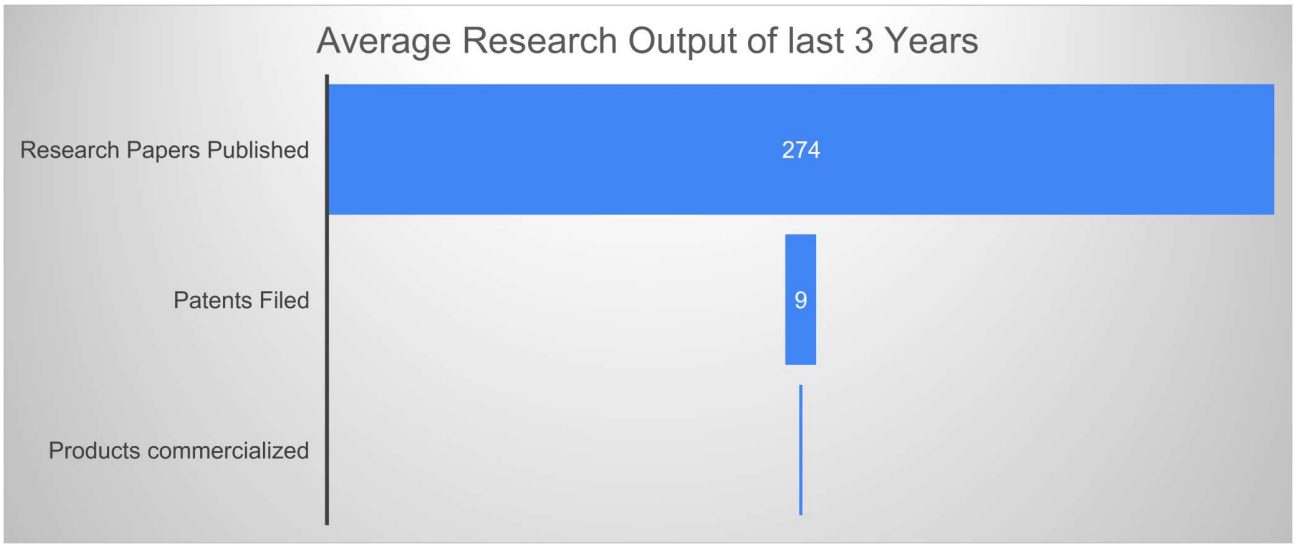
11. What percentage of such product focused R&D programs are sponsored by industry in your institute?

Response: As per the inputs provided by the surveyed institutes, an average of only 12% projects are sponsored by industry in their institutes.



12. Please provide the number of research papers published, patents filed, and the products commercialized by your institute in last 3 years.

Response: As per the inputs provided by the surveyed institutes, on an average every institute have published 274 research papers, filed 9 patents and have commercialized one product in last three years.



13. What kind of major reforms can be brought in the college examination and evaluation system?

Response: The received responses from the surveyed institutes have been summarized below:

- The number of analytical questions should be increased in the examination.
- Rubrics should be used for the assessment.
- Use of ICT Tools in specific areas.
- Continuous evaluation of the students throughout the semester should be done.
- Use of various teaching and learning techniques such as problem-based learning,
- Assignments/Seminars on industry Case studies presentations.
- Lab oriented courses should be included and evaluated.

14. How many companies is your Institute currently aligned with for campus placements?

Response: As per the inputs received from surveyed institutes, on an average every institute is aligned with 15 companies for campus placements.

15. Do you have a student placement committee for industry interface?

Response: All most all of the surveyed institutes had the placement committees for industry interface.

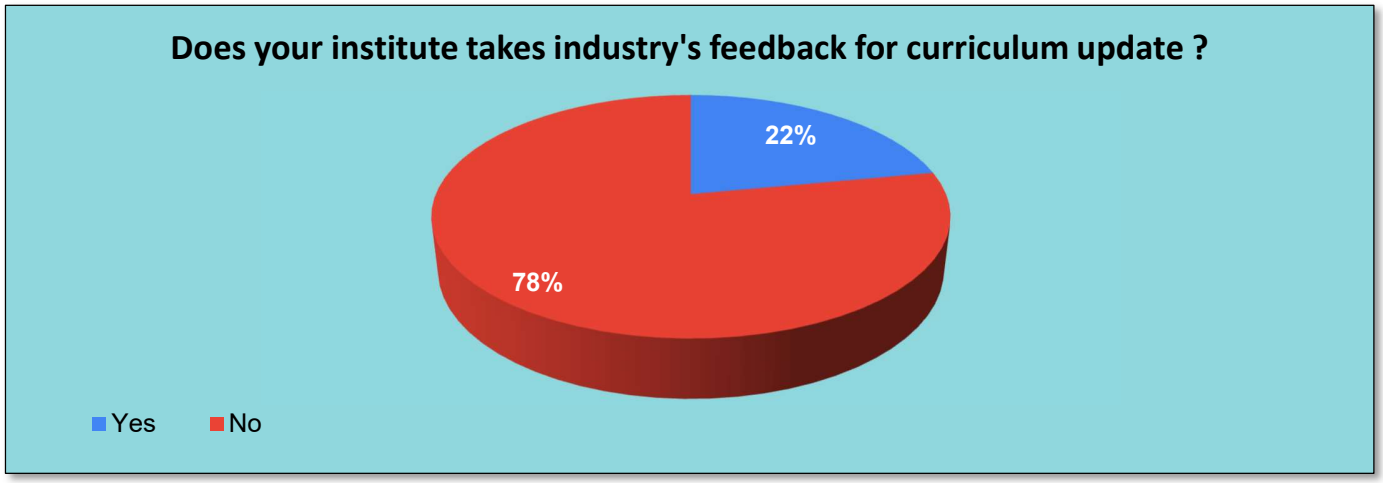
16. What activities does the placement committee undertake to maintain good relations with the industry?

Response: The received responses from the surveyed institutes have been summarized below:

- E-mails and telephonic communication by student coordinators with industries.
- Regular Meetings and Interactions with HR department of pharmaceutical companies.
- Develop a student's detail leaflet and send it to industries.
- Arranging for Industry visits, Expert Lectures and Guest talks with all the suitable industry partners.
- Arranging Industry-Academia collaboration programs conducted on regular basis.

17. Does your institute take feedback from the industry about latest technologies, trends and developments and include them in curriculum?

Response: 78% of the surveyed institutes informed that they take feedback from the industry about latest technologies, trends and developments and include them in curriculum.



18. Are the students of your institutions getting overseas placements to Post Graduate and PhD candidates? If yes, to which specific countries?

Response: 78% of the surveyed institutes informed that their students get overseas placements in countries like US, Canada, UK and other European countries.

19. Does your institute train the students for placements with modules such as mock interviews and practice Group Discussions?

Response: All most all of the surveyed institutes informed that they train the students for placements with modules such as mock interviews and practice Group Discussions

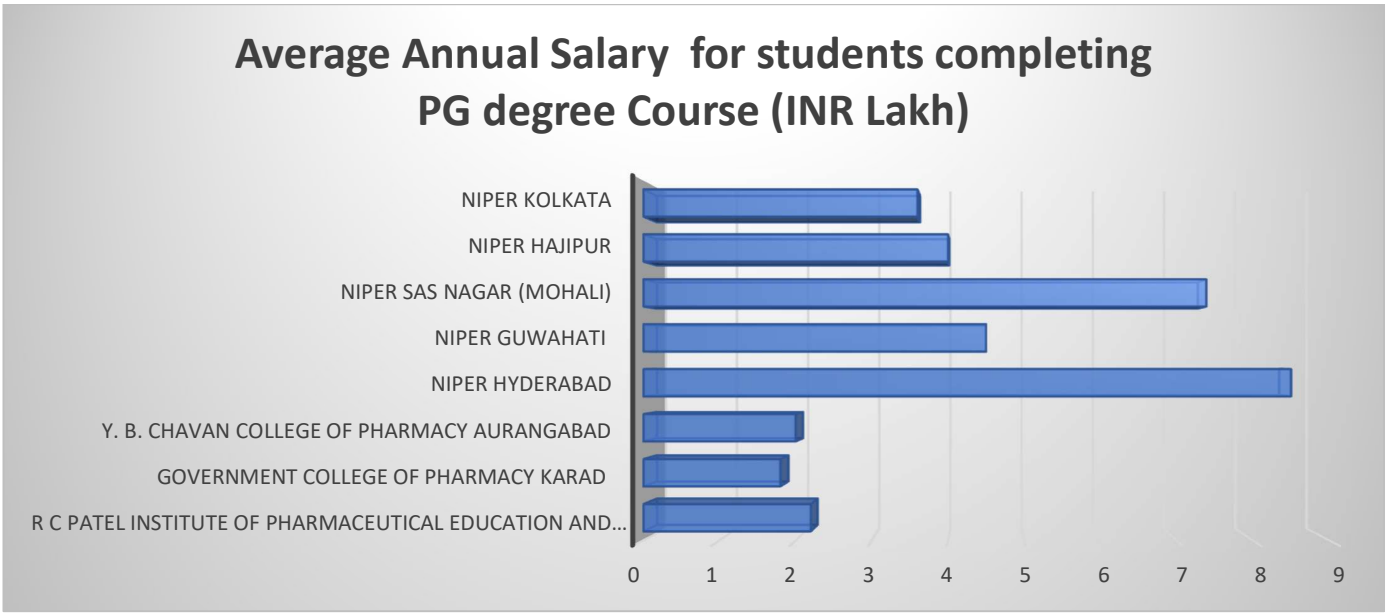
20. What support does your institute require to improve the placement record of the students?

Response: The received responses from the surveyed institutes have been summarized below:

- Mock round, language skills development and more industry connections.
- We are able to achieve 100% placement record for our students for last 3 years. However, we require support from Industry heads to increase offered salaries to the deserving candidates
- Regular Placement Officer, regular students counselling, training and soft skill enhancement etc.
- Support in connecting NIPERs to potential pharma /Biopharma companies

21. What is average salary package offered to your students during the last year college placements for the PG course?

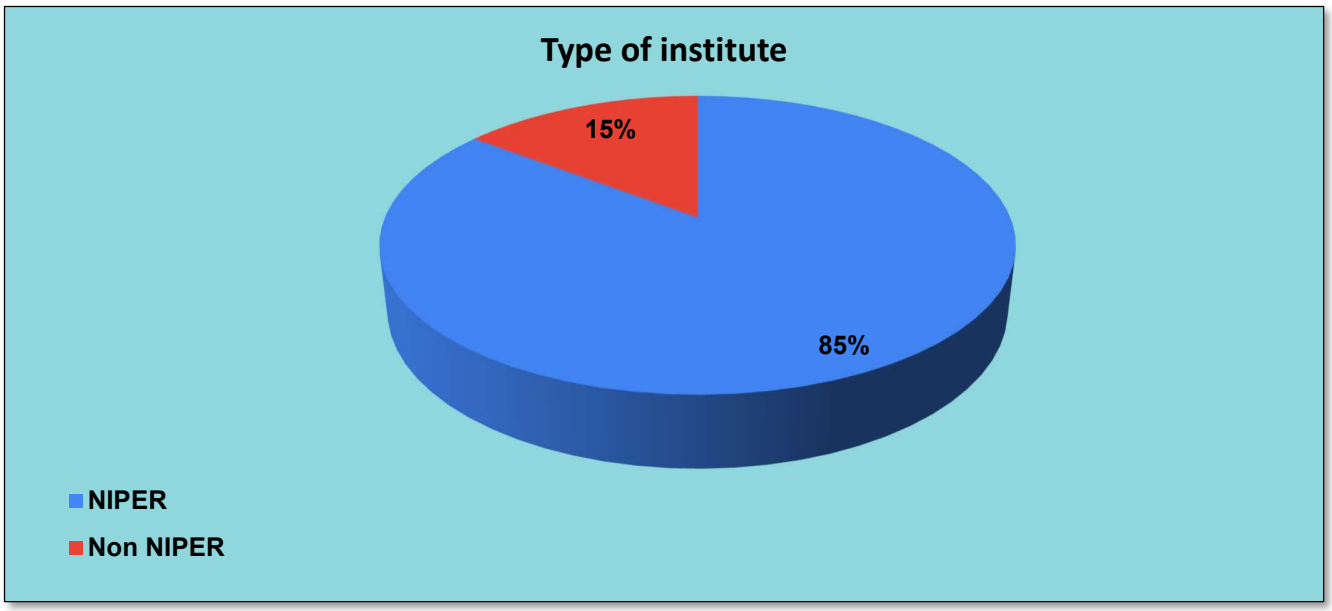
Response: NIPER Mohali had the highest package offer of INR 27.83 Lakh for the recently completed campus placements for the students. Among the NIPERS, the average salary package offered to NIPER Hyderabad was highest *INR 8.5 Lakh during the last year college placements. The other NIPERs which were surveyed had the average salary package in the range of 3.6 Lakh to 7.39 Lakh. The other pharmaceutical institutes which were surveyed had an average salary package of around INR 2 Lakh for fresh PG students through campus placements.



STUDENT PERSPECTIVE:

Number of Students Evaluated: 171

Profile of the students evaluated: Students Perusing Diploma, Post Graduate and PhD Degrees from NIPER and other Pharma institutes.



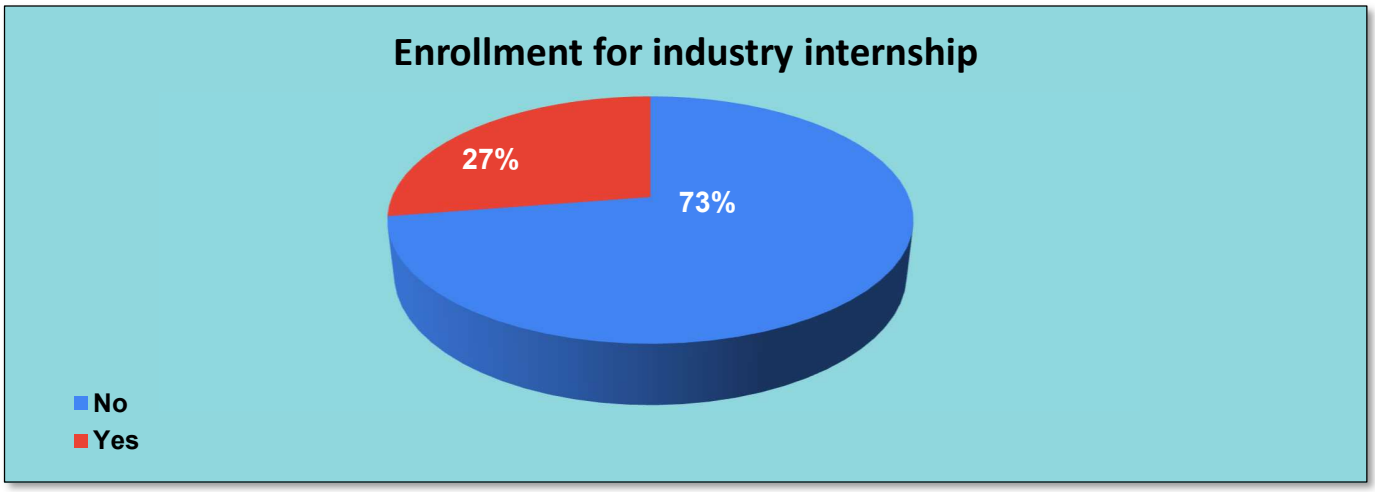
Fields of Specializations Covered during the survey for the PG and PhD students:

- Pharmaceutics
- Pharmacology and Toxicology
- Medicinal Chemistry
- Biotechnology
- Pharmacy Practice
- Natural Products
- Pharmacoinformatics
- Pharmaceutical Analysis
- Pharmaceutical Technology
- Pharmaceutical Management

RESPONSES TO THE QUESTIONS AND THEIR INFERENCES:

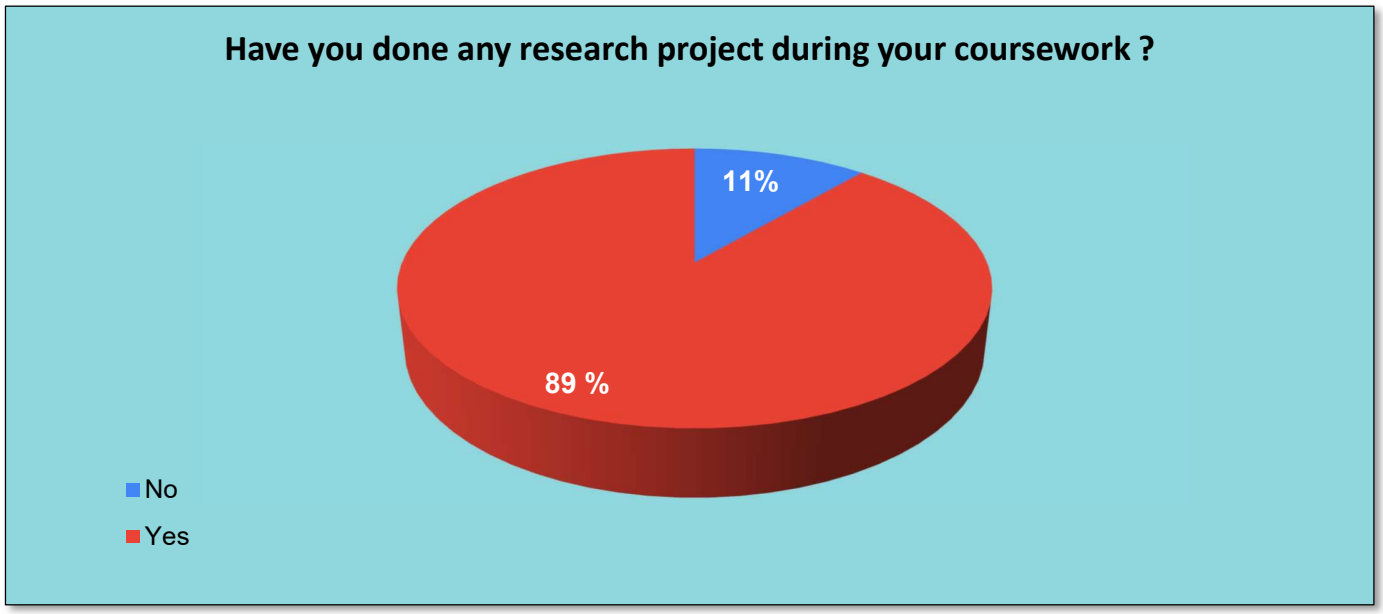
1) Have you enrolled/completed any industry internship of at least for duration of two months during your course in the institute?

Response: 73 % of the surveyed students did not enrol/complete any industry internship of at least for duration of two months during their course at the institute.



2. Have you done any research/technical project during your coursework?

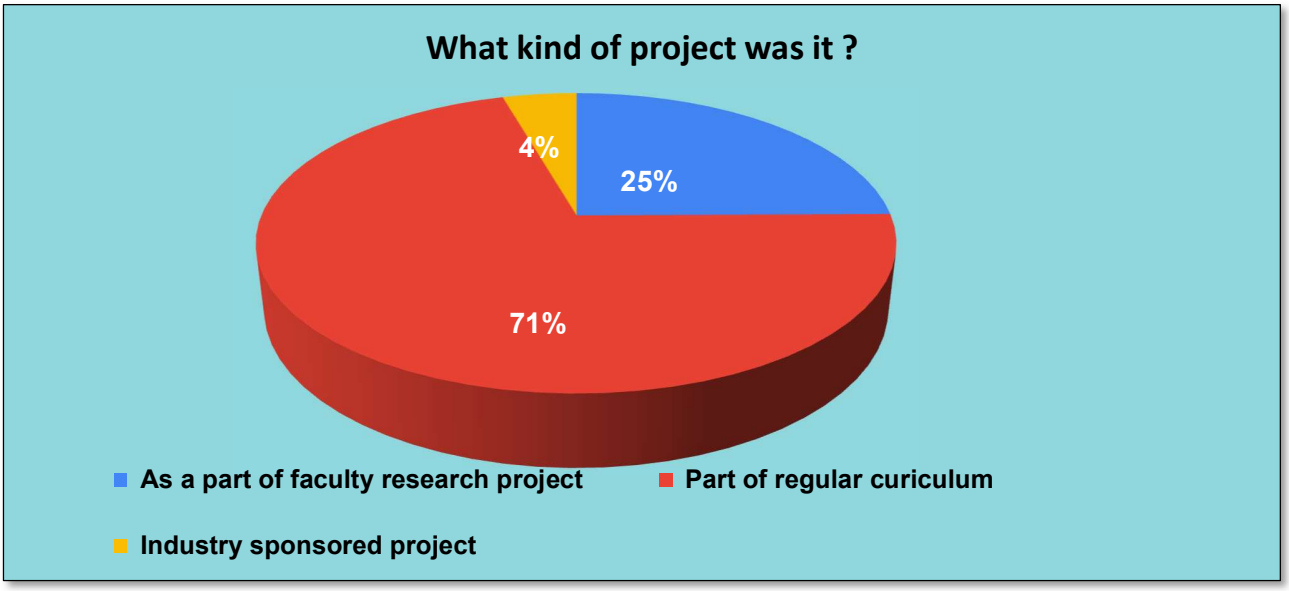
Response: 89 % of the surveyed students did the research or technical project during their coursework.



3. What kind of project was it?

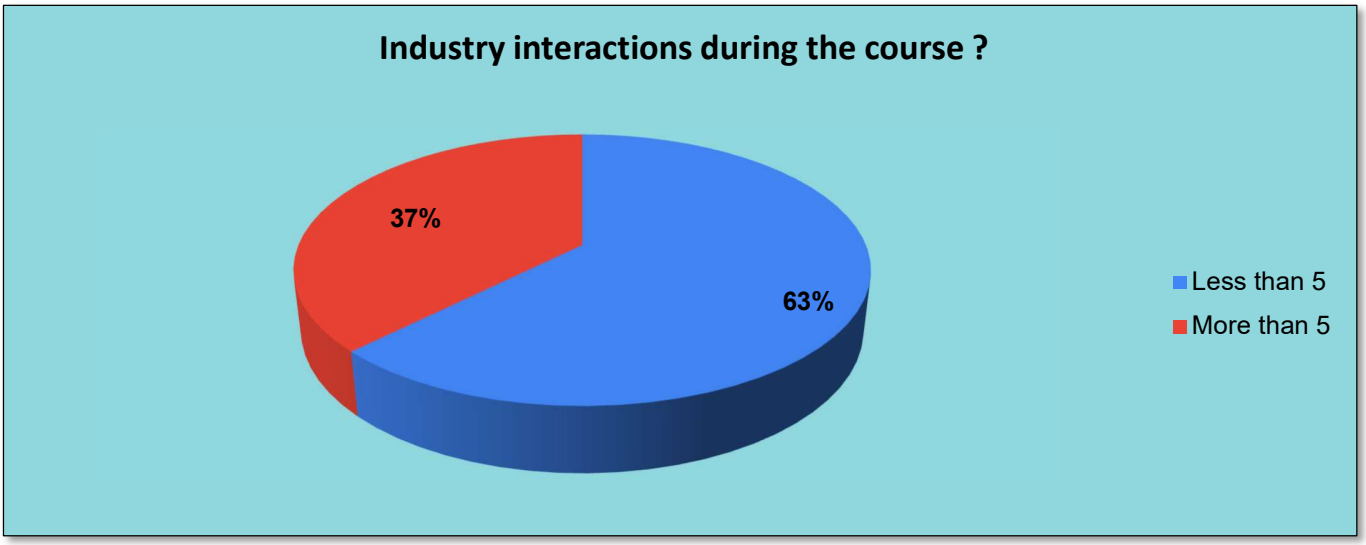
Response: Only 4% of the projects completed by students were industry -sponsored projects.

96% of the projects completed by students were a part of either regular course curriculum or a faculty's research project.



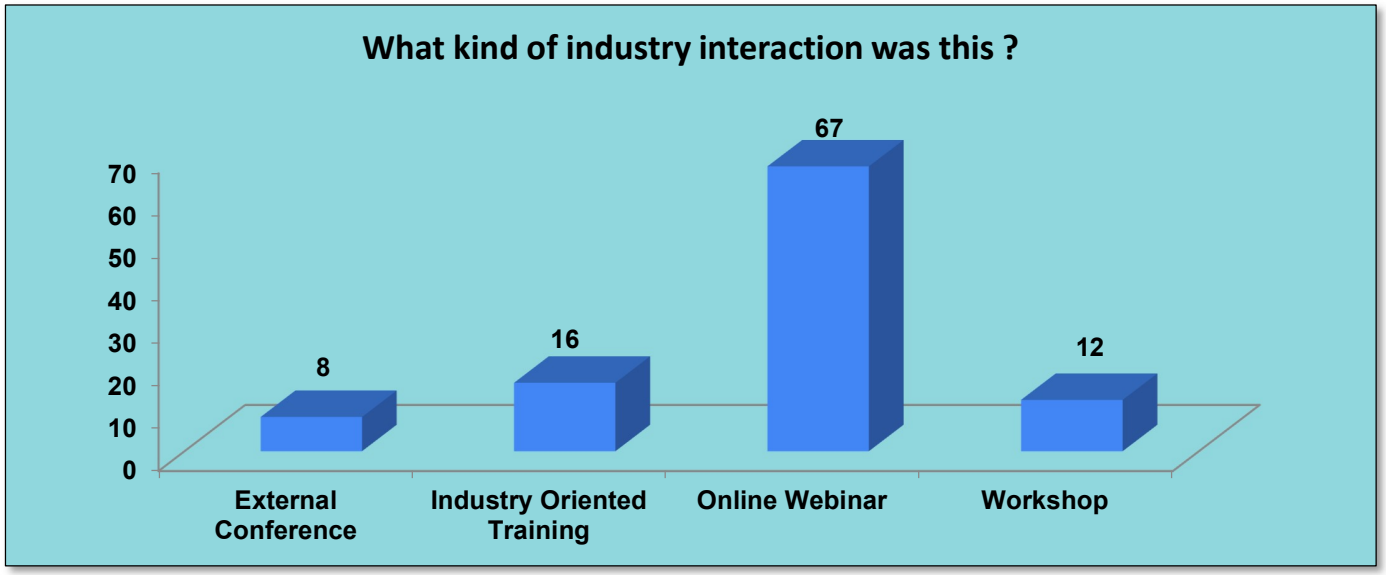
4. Have you had any industry interaction during the course work?

Response: 63% of the surveyed students informed that they had less than 5 industry interactions during the course.



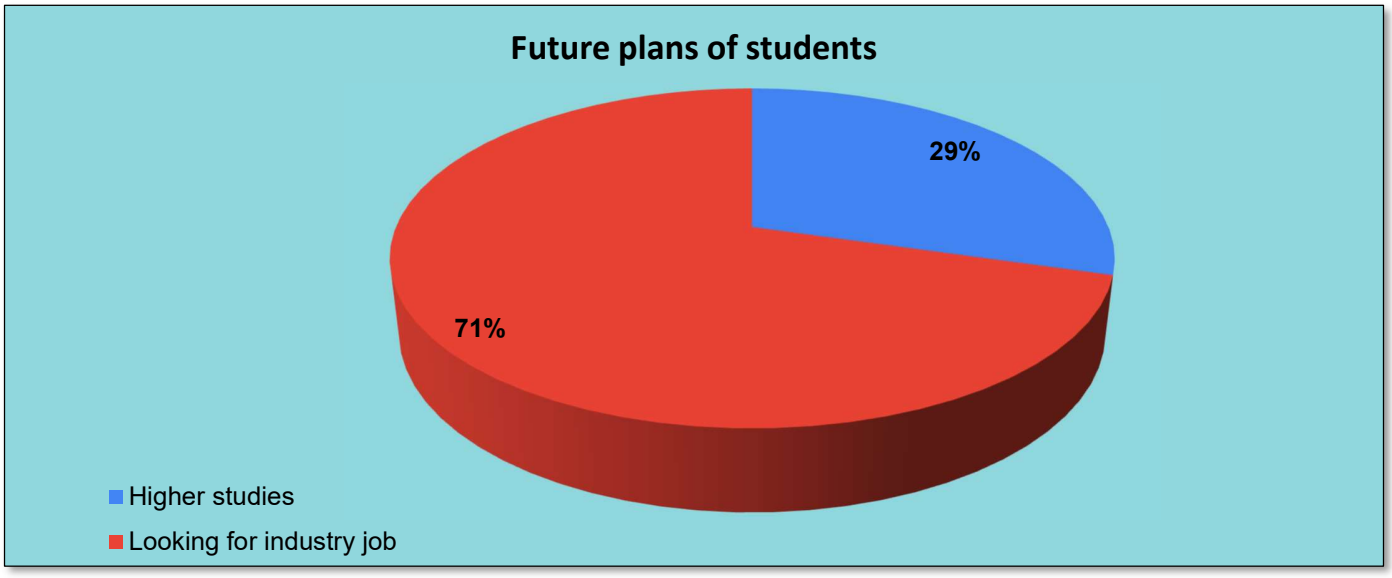
5. What kind of the Industry Interaction was this?

Response: Most of the industry-interactions in which students participated were the online webinars.



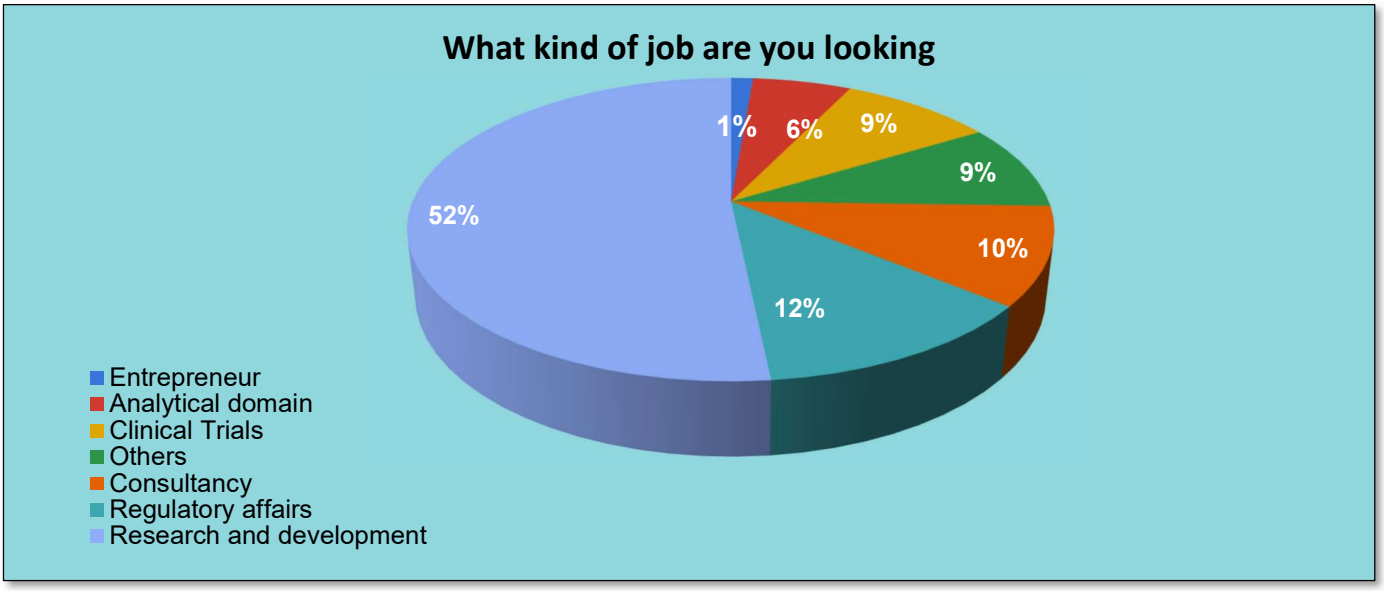
6. Are you looking to get an industry job after the course or want to go for higher studies?

Response: 71% of the surveyed students were looking for job and wanted to join the industry rather than going for higher studies.



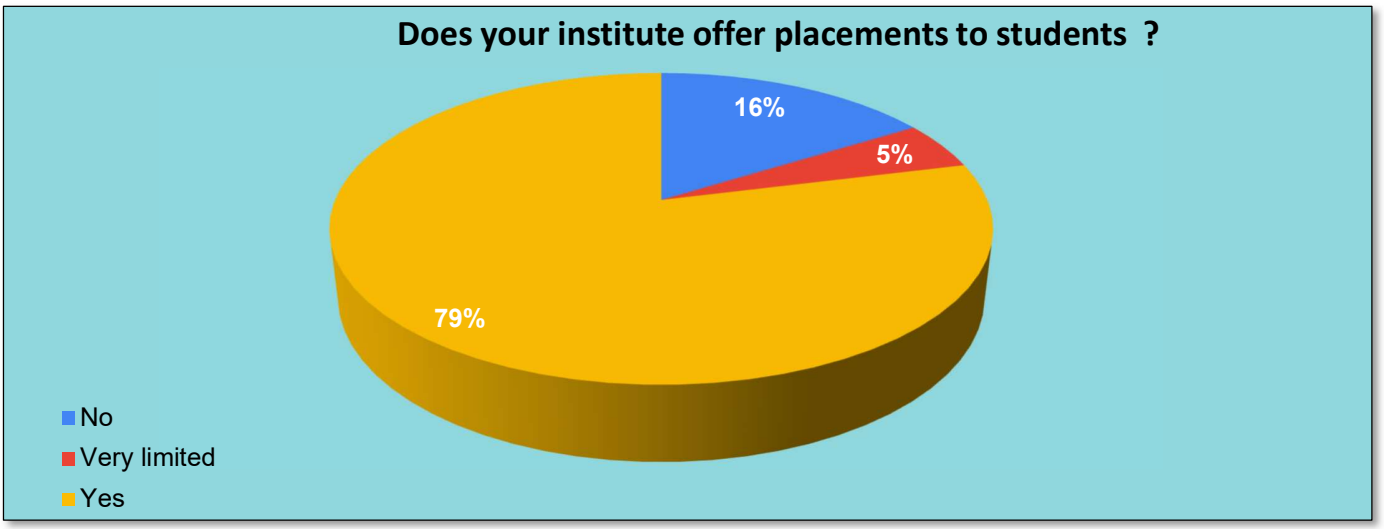
7. What kind of job are you looking for in industry or you wish to join?

Response: 52 % of the surveyed students were looking for hard core Research and Development jobs. Only 1% of the students want to pursue entrepreneurship. Clinical Trials and Pharmaceutical Consulting were also prominent fields in which students wanted to pursue their careers.



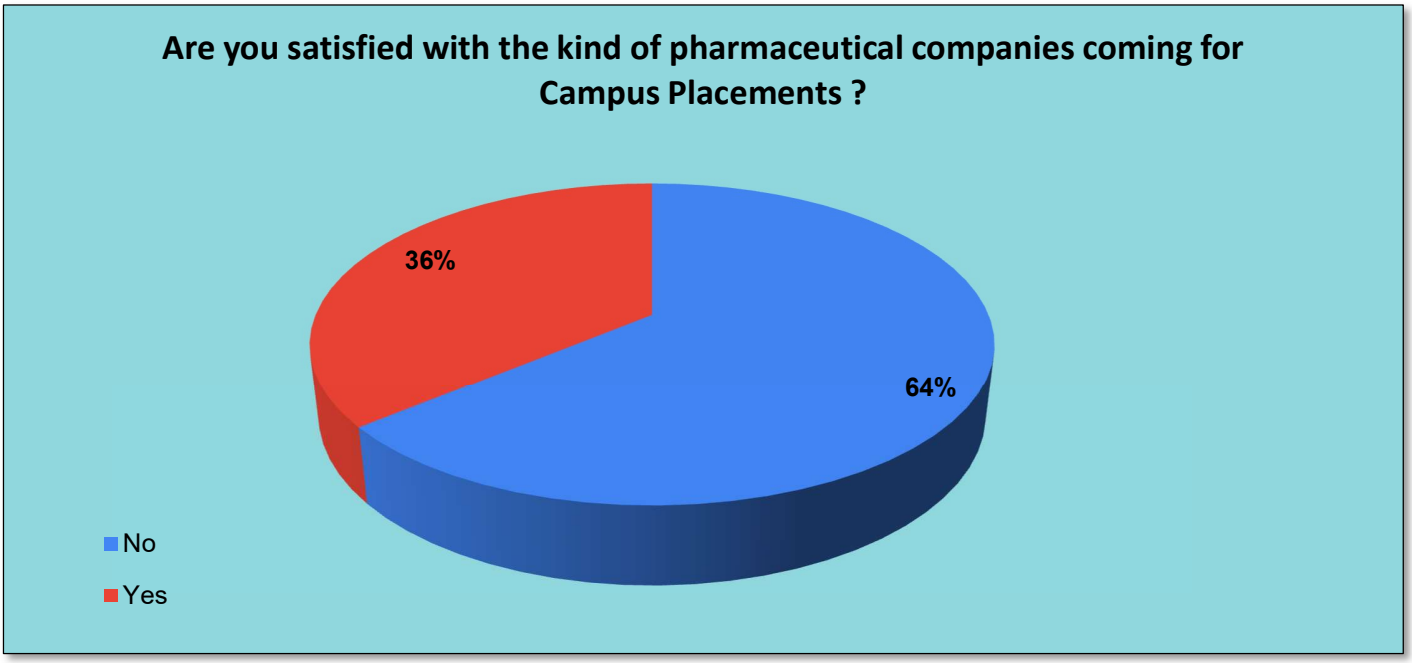
8. Does your college offer placements to students?

Response: 79% of the surveyed students informed that their institute offer placements to the students.



9. Are you satisfied with the companies that come for the campus placements at your institution?

Response: 64% of the surveyed students were not satisfied with the kind of companies coming for the placement at their institute.



10. Would you recommend any particular company to take part in the campus placements?

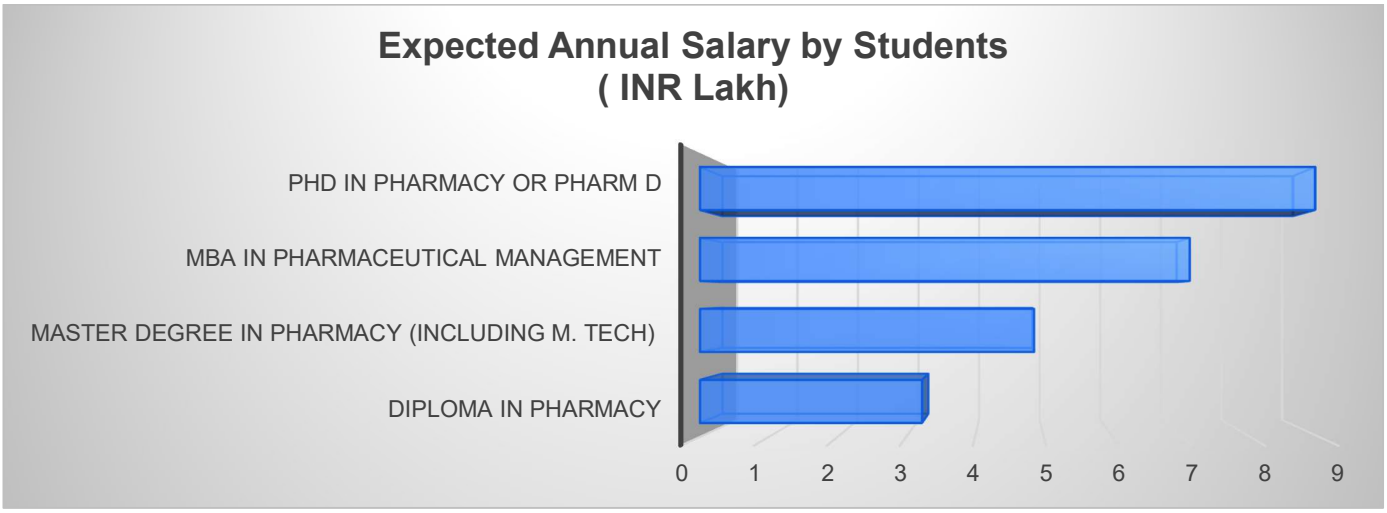
Response: Students wanted the following companies to visit their institutions for campus Placements:

Sun Pharma, Novartis, Labcorp, Dr. Reddy's, Pfizer, Intas, Glenmark, Biocon, Parexel, Baxter, Merck, Roche, Boehringer Ingelheim, AstraZeneca, Takeda, GSK, Eli Lily, AstraZeneca, Glenmark, Cipla, Sai life sciences, Aurigene, Lambda, Biological E, Bharat Biotech, Cognizant, ZS, IQVIA, Serum institute of India, Aurobindo, Hetero, Mylan Lupin, INTAS, Rubicon, Episource, Mankind, Bain& Co., Mc Kinsey& Co, BCG, Sanofi, Johnson & Johnson, Stryker, Danaher, Medtronic, Thermo, BD, Deloitte, Accenture, EY, KPMG, DE shaw, Goldman Sachs, Jubilant Morgan & Stanley, PWC, APCER, Piramal etc.

11. What is your per month salary expectation from the job that you will get from the campus placements?

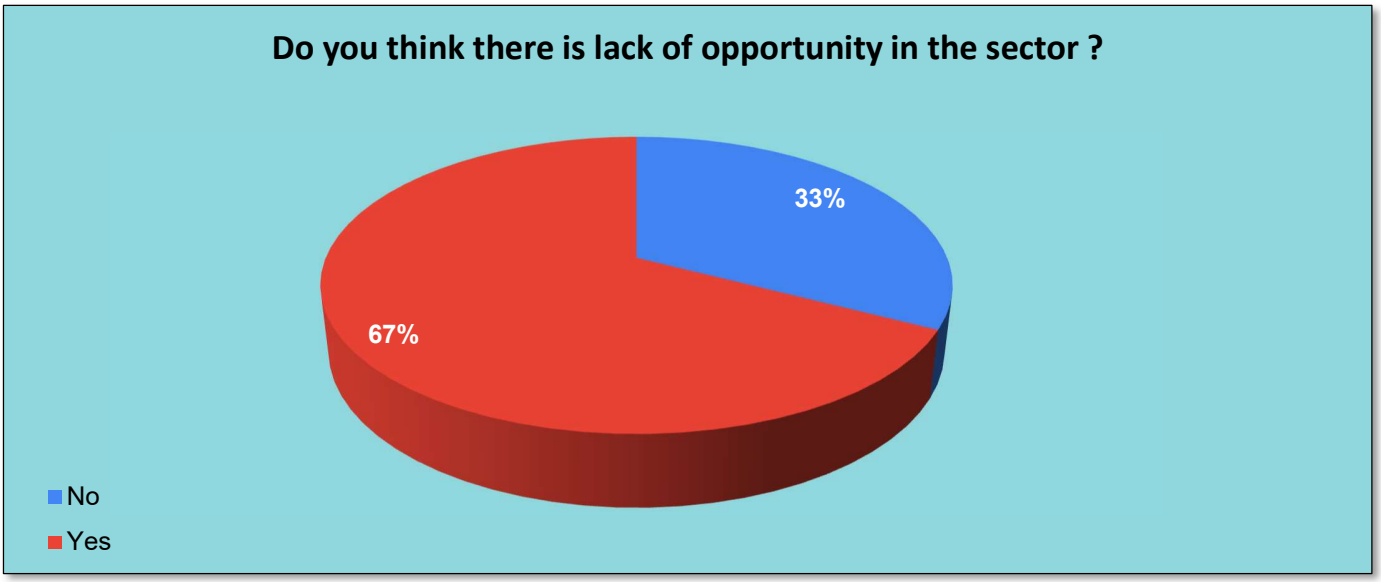
Response: Expected Average Annual Salary Expectations of students are summarized below:

- Diploma in Pharmacy - INR 3.23 Lakh.
- Master's degree in pharmacy (Including M. Tech) - INR 4.86 Lakh.
- MBA in Pharmaceutical Management- INR 7.12 Lakh.
- PhD in Pharmacy or Pharm D- INR 8.94 Lakh.



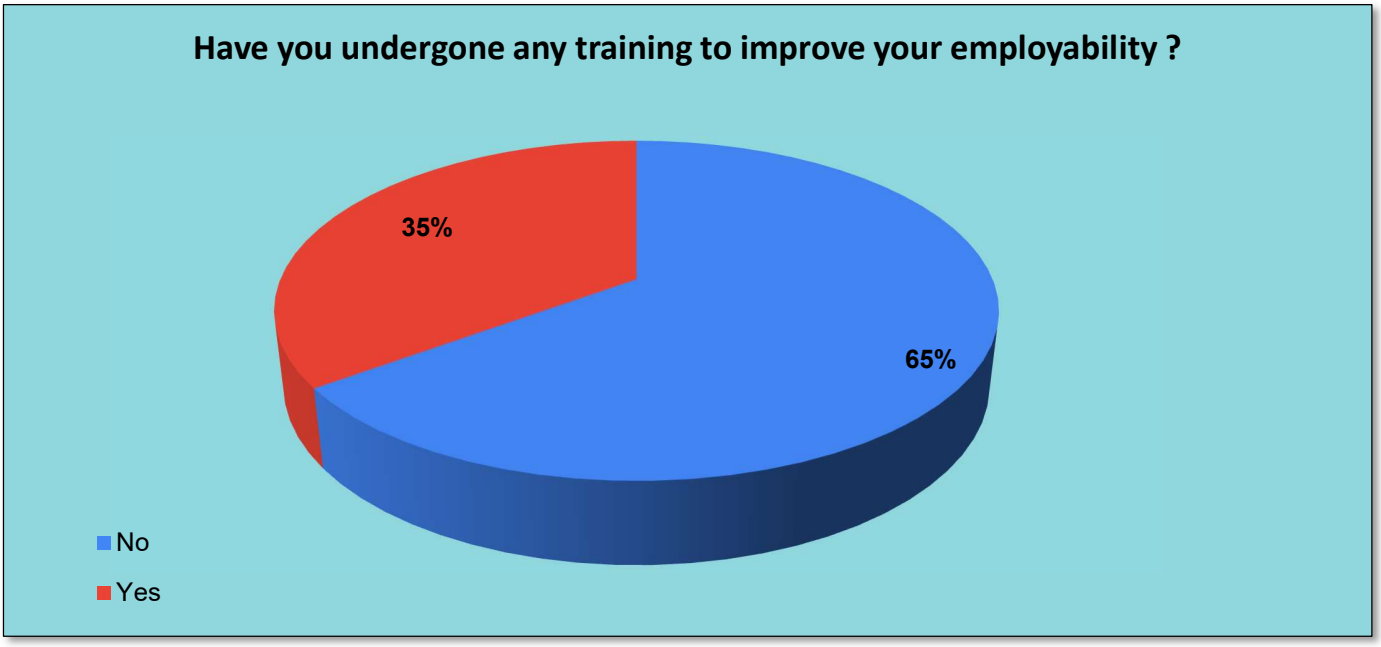
12. Do you think that there is lack of job opportunities in Pharmaceutical Sector?

Response: 67% of surveyed students believed that there is lack of opportunities in sector.



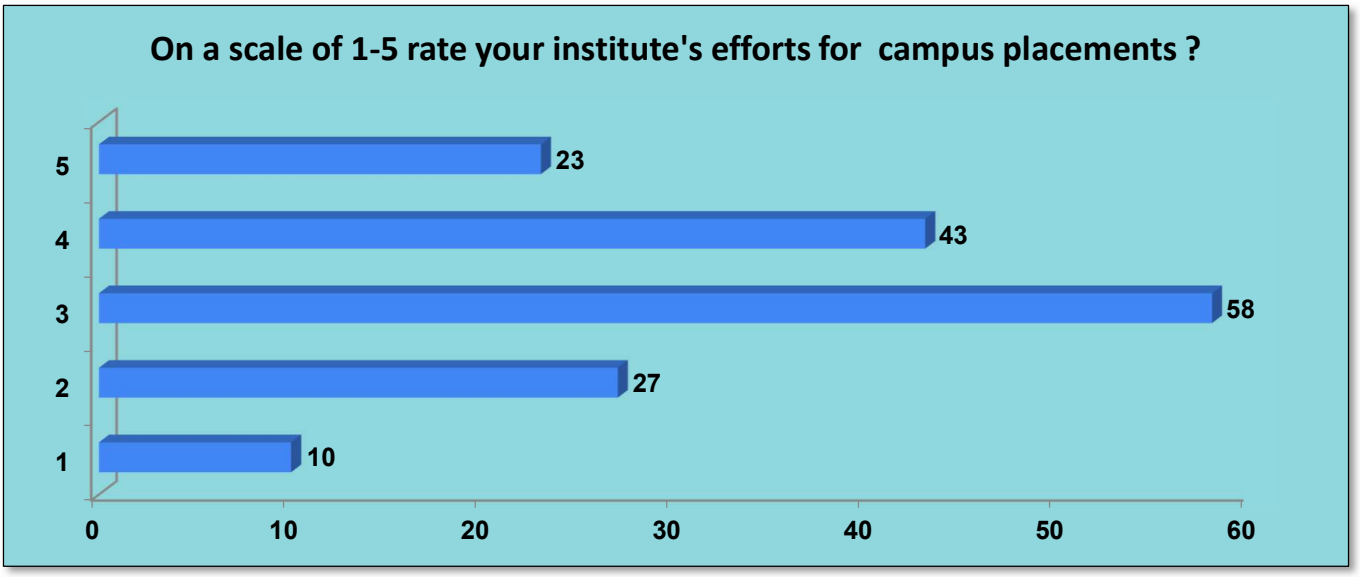
13. Have you undergone any training to improve your employability in the market?

Response: 65% of the surveyed students have not undergone any trainings to improve their employability in market.



14. On a scale of 1-5, rate your institute's efforts in campus placement of students.

Response: Most of the students rated the institute's efforts as average to below average.



15. What are the challenges that you face while searching for the job?

Response: Most of the surveyed students mentioned the below challenges while searching for the job:

- Finding the right company/ profile
- Getting the interview
- Clearing the interview

16. What kind of industry-oriented topics are lacking in your course curriculum?

Response: As per the surveyed students, the industry-oriented topics which are lacking in their course curriculum are summarized below:

- Good documentation practice
- Technical topics (Power BI, Tableau)
- Data analytics
- Basic electronics and technical aspects
- Artificial intelligence, Machine learning and Data interpretation
- Fermentation Technology and Few instrumentations techniques
- Medical Devices
- Communication, soft and Presentation skills topics.
- Downstream and Upstream Processing Techniques,
- Hands on training on Analytical Techniques like HPLC and LC-MS needs to be mandatory.

17. What can be done by your institute to meet the placement expectations of the students?

Response: As per surveyed students, below are expectations from institutions:

- Improvement of employability skills
- Improvement in industry interface activities
- Onboarding of industry faculty
- Removal of obsolete and irrelevant courses

KEY INSIGHTS FROM OPINION LEADERS, INDUSTRY EXPERTS & ALUMNI

- **Dr. Mansukh Mandaviya (Hon'ble Minister of Health and Family Welfare and Chemical and Fertilizers of India):** *Students are very important stakeholders and have vital role in taking the pharmaceutical industry forward. We need to understand their aspirations while developing a roadmap for pharmaceutical sector in India. Industry and academia have to work in sync. We have observed that the industry- academia linkages have not been that strong in recent past. We wish to develop a system that during the last year of their courses, the pharmaceutical students should compulsorily work with the industry. This will give them the required exposure and better placements after their course completion.*
  (Reference: Excerpt from the Talk during the 7th International Conference on Pharmaceutical & Medical Device Sector held between 25th- 27th April,2022)

- **Mr. Pankaj Patel (Chairman-Zydus Life Sciences):** *Indian Pharmaceutical Industry needs to move from volume to value game. The focus needs to be adopting new technologies like CRISPR developing an innovation eco-system around these technologies in India. We have large infrastructure of government supported research laboratories in India including NIPERs. We need to have a mechanism where one centre focuses on one area and develop that capability and make it available for everyone to use at a significantly lower cost in India.*
  (Reference: Excerpt from the Talk during the 7th International Conference on Pharmaceutical & Medical Device Sector held between 25th- 27th April,2022)

- **Mr. Sanjay Murdeshwar (Managing Director- Novartis, India):** *My vision for India-2047 in pharmaceuticals is that India discovers 20% of world's new innovative medicines and manufacture them in India. Discovery and innovation worldwide are done mostly by nimble and small biotech startups. Therefore, we need to have a strong ecosystem which can develop thousands of such successful biotech startups which will be fundamental life blood of innovation.*
  (Reference: Excerpt from the Talk during the 7th International Conference on Pharmaceutical & Medical Device Sector held between 25th- 27th April,2022)

- **Mr. Viranchi Shah (National President – Indian Drug Manufacturer's Association):** *Today; we claim to be world number three in pharmaceuticals but we do not have one academic institute which is among the top 25 institutes. We need to have a good talent pool and need to repurpose our people, retrain them and reskill them in order to achieve our future goals*.
  (Reference: Excerpt from the Talk during the 7th International Conference on Pharmaceutical & Medical Device Sector held between 25th- 27th April,2022)

- **Dr. Montu Patel (President- Pharmacy Council of India):** *There is a huge difference between industry pharmacy and Hospital pharmacy. Right now, there is a single syllabus for both. But now we are planning to differentiate both streams, for community pharmacists and industrial pharmacists. Now, many rules have come for medical devices also but still it is not included in our syllabus. So, we shall also include medical devices in the new syllabus of UG and PG. We shall also include genetics in the syllabus and apart from that pharmacovigilance which is a major part for our profession, will also be included in our syllabus; our work is to report adverse drug reactions to the Government for more research on medicine or to ban if required.*
  (Reference: Excerpt from Interview of Dr. Montu Patel, President of PCI conducted on 3rd May 2022 at Ahmedabad, Gujarat by an online publishing platform Pharmatutor)

- **Dr. Dulal Panda (Director – NIPER, Mohali*): If we want to meet the standards of MIT and Stanford in pharmaceutical research and development, we need to keep on continuously updating our knowledge and skill sets. Quality Pharmaceutical education which is aligned to the industry requirements needs to be imparted to the students.*
  Reference: Excerpt from In-depth Interview of Dr. Dulal Panda conducted by the assessors of Biovantis on 4th May,2022 at Mohali.

- **Dr. V. Ravichandran (Director- NIPER, Kolkata and Hajipur):** *NIPERs should be able to develop the analytical skill set in the students so that they can add value to the employer's enterprise rather than doing the routine jobs. We also need to create a culture of paid internships for our students. We need a system of shortlisting the upcoming technologies used by US and China and should be ready to accept them. NIPERs should not only focus on the employment of the students but also kindle entrepreneurship among them.*
  Excerpt from In-depth Interview of Dr. V. Ravichandran conducted by the assessor of Biovantis on 2nd May,2022 at Kolkata,

- **Dr. Shashi Bala Singh (Director- NIPER, Hyderabad)**: *Industry- Academia collaboration has to be enhanced in all the possible ways and the first few steps need to be taken by academic institutes. Industry is ready to pay, provided we meet their skill set requirements.*
  Excerpt from In-depth Interview of Dr. Shashi Bala Singh conducted by the assessor of Biovantis on 9th May,2022 at Hyderabad

- **Prof. P. Radhakrishnanand (Registrar i/c):** *Academic Institutes need the support for industry contacts to ensure that their research output and the students find a genuine market value.*
  Excerpt from In-depth Interview of Prof. P. Radhakrishnanand conducted by assessor of Biovantis on 10th May,2022 at Guwahati.

- **Dr. V. M. Katoch (Former Secretary, Department of Health Research, Govt of India and Director-General, Indian Council of Medical Research):** *It will be important for the students to not only have adequate knowledge of their key domains but they also need to focus on developing the interdisciplinarity capabilities and think integrative medicine from the beginning. World is rapidly moving in that direction specially for incurable / difficult to treat conditions like cancer, endocrinal problems, rare diseases etc. We expect the students of NIPERs to be original thinking minds. That will make them competent professional whether they serve in industry, teaching or research.*
  Reference: Excerpt from In-depth Interview of Dr. V. M. Katoch conducted by the assessor of Biovantis on 2nd June,2022 at Jaipur

- **Mr. Jitender Tiwary (Alumnus of NIPER Mohali, MBA in Pharmaceutical Management and have corporate experience of 15 plus years with pharmaceutical companies like Torrent and Novartis, India):** *The students coming out of most of pharmaceutical academic institutes have severe gap in the understanding of the processes being followed in the corporate sector. Many times, they have to unlearn few things before learning anything new. The industry has plenty of manpower options these days and therefore the students which meets the maximum skill set requirements (technical or management), get the jobs, irrespective of the brand name of the academic institutes.* **Reference: Excerpt from In-depth Interview of Mr. Jitender Tiwary conducted by the assessor of Biovantis on 9th May,2022 at Hyderabad**

- **Ms. Deepika Wadhwa (Alumnus of Punjab University, Masters in Pharmacy and have corporate experience of 20 plus years with pharmaceutical companies like Ranbaxy and Sun Pharma in Pharmaceutical analytical field):** *The fresh students hired by the companies from some reputed academic institute come with preconceived notions, have preferential expectations and have a tendency to change companies quickly. This is a major concern for companies because they do not want to end up as mere training grounds and career launchpad for fresh students.*
  Reference: Excerpt from In-depth telephonic interview of Ms. Deepika Wadhwa conducted by assessor of Biovantis.

- **Mr. Ravi Bhatia (Alumnus of NIPER Mohali, Masters in Pharmacy and have corporate experience of 15 plus years with pharmaceutical companies like Jubilant, Glenmark and Novartis in Medical & Scientific Writing and Regulatory field):** *When I joined the industry, the first problem that I encountered was spoken and written English. Inspite of being technical capable, I think that my career did not take off the start which I wanted it to. Most of the students who join NIPERs after clearing the entrance exam come from the B. Pharm colleges which do not have any provision for any language skills. This lacuna continues with the students for few years even after joining the industry.*
  Reference: Excerpt from In-depth telephonic interview of Mr. Ravi Bhatia conducted by assessor of Biovantis.

- **Dr. Prashant Pandya (Alumnus of Mumbai University, Master degree in Pharmaceutical Management and PhD and have corporate experience of 20 plus years with pharmaceutical companies like Cadila, Reliance Life Sciences and Viatris in Project Management related to Biomedical Research):** *I wanted to pursue research and be a formulation development scientist after completing my B. Pharm. But since there was hardly any exposure given to us during B Pharma course, I had no option but to choose what was available at that.*
  Reference: Excerpt from In-depth telephonic interview of Dr. Prashant Pandya conducted by assessor of Biovantis

RECOMMENDATIONS

RECOMMEDNATIONS

1. Drug discovery and development has become much more complex science requiring a multi and interdisciplinary approach. Converging concepts of several disciplines such as molecular biology, chemistry, genomics, artificial intelligence and computational biology with pharmaceutical sciences is the need of the hour and has become a necessity for solving real-world problems. NIPERs need to be a flag bearer for this initiative in India.

2. NIPERS have been the institutes of national importance that were established with a vision to bring the pharmaceutical research to small industries in India. This vision needs to be revised in the current context and should include medium to large size, Indian and multinational pharmaceutical industries.

3. To fulfill the new and emerging requirements of pharmaceutical industry, NIPERs need to be the "Anchor Institutes" to develop the high-quality academic talent pool and high-end infrastructure for pursuing long-term research projects on themes of major strategic importance with support of special resources and continous funding. This change in the focus will ensure that the students completing the degrees from NIPERs have better skill sets, more opportunities and better paying job profiles in bigger organisations.

4. Along with the upgradation of NIPERs, the number of seats at PG and PhD level need to be increased. In addition, starting of undergraduate degree programs at NIPERs should be undertaken in a phased manner and should include the subjects and syllabi which meets the industry requirements.

5. Most of the NIPER students get the campus placements but all the people cannot get placed into R&D. The Non- R& D job profile, company profile, pay package and future growth prospects may not that be appealing for the students. This may be due to imbalance in the individual perception and the reality of industry. NIPERs primarily focus on the innovative research driven activities while most of the companies in India are generic pharmaceutical company with a very limited scope of

innovative research and development. This perception gap needs to fill and this initiative has to come from Institute's side.

6. The students pursuing their courses at NIPERs should have mandatory 3 months industry internships of as a part of course curriculum. These internships should be paid in nature and institutes should make all efforts to arrange these internships with industry well in advance. The Department of Pharmaceuticals can also create a separate fund for the paid internships for the deserving students of NIPERs in the beginning if there is lack of response from industry to offer paid internships.

7. In addition, compulsory Job Shadow Programs where the students shadow a host employer for a day should be encouraged. This helps the students in observing the routine work, attending corporate meetings, touring the facility, and gathering department specific information which can further help them decide their interest areas in companies.

8. Department of Pharmaceuticals has been providing incentives to Indian pharmaceutical companies under various schemes. A mandatory requisite to provide paid internships to NIPER students for all such companies before availing incentives can be a proactive step that can add on to efforts of the NIPERs in getting the paid internships for the students.

9. To promote the better absorption of diploma and undergraduate degree holders in industry, regulatory provisions can be made for the Indian Pharmaceutical Industry to employee only the candidates with pharmaceutical or required interdisciplinary research degrees for the basic entry level jobs in pharmaceutical manufacturing.

10. The sponsored projects carried out the NIPERs by students should not include the fundamental research projects but should be more focused on commercially viable products or services that have commercial viability at least in the Indian market. All such projects need to be assessed by a separate expert committee that also has the members from outside NIPERs.

11. There is an autonomous body called as BIRAC" Biotechnology Industry Research Assistance Council" under the aegis of Department of Biotechnology, GoI, which is responsible for providing the funding of various Biotech research projects (including the pharmaceutical/healthcare/medical device projects) after a thorough techno-commercial due diligence. The good practices followed by BIRAC can be incorporated into the systems of DoP to ensure that only the projects with a potential to deliver a commercially viable products or services are provided the government funding in Pharmaceutical Institutes. This will make the students work on the projects, products, technologies and processes that are relevant in the current industry context.

12. There needs to be a setup of strong governance framework to build accountability through strong program management of Research and Development programs and stage gated outcome-based funding based on the
    - New Product Development initiatives by institute.
    - New products developed and commercialized by institute.
    - Student Placement figures of outgoing batch (Average pay package)

    All other parameters like NIRF ranking, Filed Patents and the Research Paper Publications get subsumed in the above three metrics.

13. A separate position of "Placement Officer" needs to be created at every institute. This person should have no other academic or administrative responsibilities and should only be responsible for placement of students. This person should have the industry background and a relevant industry network. He should be expert in industry job mapping and his/her KRAs should be based on end-to-end industrial placements of the students only.

14. The placements cells are already existing in most of the institutes. In addition to the corporate placement activities, these placement cells should also keep the students informed about the government jobs and vacancies in various regulatory and scientific organisations. The placement cell of every NIPER should have an updated list of the potential recruiters and should refer the other NIPERs to recruiters if they are not able to find the suitable candidate/s for a particular profile. A minimum pay package should be informed to the potential recruiter before asking them to visit the institute for campus placements. Also, the recruiters who have withdrawn their job offers to the students in past should be blacklisted and should not be invited again in the institute. The NIPERs can also think on the lines of hiring a professional placement consulting firm on test basis for a year to see if it provides favourable and better results with regards to student's placements.

15. For the Postgraduate and PhD students of NIPERs, the efforts should be made to approach the research-based Innovator Pharmaceutical Companies, Technical Content development, pharmaceutical services-oriented companies and multinational pharmaceutical consulting organisations for student placements. The companies prefer to hire locally and have an inclination towards the students who have already completed their internships with them. This should be considered as an important criterion while approaching the companies for campus hiring. The Indian generic pharmaceutical companies might not be a good option for these candidates because of the limited pay package, very basic job profiles and limited future growth prospects.

16. Irrespective of the size, there is always a limit for a pharmaceutical company to hire the people to do the routine jobs. Many of the functions and operations are automated these days and pharmaceutical companies are open to hire the Graduates and Postgraduates in life sciences and chemistry, paramedical graduates and instrumentation engineers to perform such job functions. This is due to the abundance of such resources in market and their lesser salary expectations. This needs to be considered as a major factor impacting the job opportunities for Pharma candidates in the industry. The NIPER students need to be "Super Brains" with a thorough analytical approach which can add value to the existing systems and processes of pharmaceutical companies rather than just performing routine jobs.

17. The course curriculum of the PG courses of the NIPERs needs be revamped and should include the courses emphasizing on the new biotech based emerging technologies like CRISPR Technology, Latest Fermentation Technologies, CAR-T Technology, Cell Line testing, Nucleic Acid Therapeutics, Organoid Spheroid Technology etc. If needed, new faculty should be hired to teach and train the students on these technologies. In addition, the efforts should be made to make the students aware of Recombinant DNA technology based pharmaceutical products, Biosimilars, Precision Medicine technologies and Molecular assays etc. through continuous industry interactions.

18. Train the Trainer programs can be launched in collaboration with government bodies like Ministry of skill development and Entrepreneurship to train the faculty and bridge the gap in understanding about job requirements in the industry.

19. Academia can also seek the assistance from the reputed innovator pharmaceutical companies in designing the courses meant for specific roles or profiles. Industry input in design of university curriculum needs to increase, along with increase in representation of industry in academia (e.g., as part of board of governors etc.) and vice versa. Additionally, Indian academia's familiarity with latest regulations needs be improved.

20. There is an urgent need to enhance clinical research capabilities in India. Active participation of pharmaceutical students in clinical research can be ensured by integrating clinical research training in their course curriculum. The research training curriculum should cover different dimensions of medical research such as ICH- GCP, Clinical Trial Monitoring, Medical and Scientific Writing, Medical Coding, Pharmacovigilance and Clinical Data Management.

21. To promote interdisciplinary research skills and address the skill shortfalls in the Life Sciences Pharmaceuticals, Biotechnology & Contract Research, the vocational educational institution like Life Sciences Sector Skill Development Council (LSSSDC) needs to be roped in by NIPERs. It can help in

mapping all job specific qualifications and skills in the sector and also help in development of Prospective Vocational Training Organization for these requirements.

22. Most of the skills have a shelf life of 4-5 years. Therefore, students should also be encouraged keep learning by independently enrolling themselves into short courses related to the new technologies related to Artificial Intelligence, Virtual Reality and Data Mining etc. on their own. Most of these courses are online, are free and are carried out by the faculties of IITs and IISC through an online platform of National Programme on Technology Enhanced Learning (NPTEL) of Government of India.

23. A new credit course focused on written and verbal communication skills, language skills, team skills, interview skills, body language and basic etiquettes needs to be designed and included in the syllabi of Technical PG and PhD courses. The course should also include practical demos and mock interviews to build a confidence among the students before they sit for any interview in campus placements. NIPERs can collaborate with some of the management institutes to carry out this course if there is no faculty for the same in the institutes.

24. Alumni referrals and Past experience with the institutes are the two main criteria for any company to come for the campus placement. The institute should be proactively and frequently interacting with the industry to ensure that the students already placed in the companies are meeting the requirements. Institute should also arrange alumni meets/ ceremonies and should felicitate the alumni who have achieved great professional success in their corporate careers. These events should have proper media/ social media coverage. The institutes should actively seek support from such alumni networks of corporates under CSR activities to fund the promising R&D ventures as per the provisions of Section 135 of the Company Act 2013.

25. There should be a process of knowledge sharing through Faculty Exchange Program among NIPERs. This will ensure that the NIPERs work in collaboration with each other rather than in silos. NIPER Mohali can be a torch bearer for this initiative and help the upcoming NIPERs in adopting the best practices. In addition to the NIPERS, the faculty from other reputed pharmaceutical institutes like DIPSAR, Punjab University, Jamia Hamdard, Bombay College of Pharmacy etc. should be approached to give guest lectures on the emerging fields of pharmaceutical sector.

26. Similar mobility programs can be planned between academia and industry wherein faculty from a university can work in corporate environment for some time while people from industry can join in as faculty in the pharmaceutical education institutes.

27. Inter-NIPERs job-transferability of faculty members can also be considered as an option to promote the knowledge sharing and mutual collaboration among NIPERs.

28. The upcoming NIPERs need not to have PG degrees with all specialization. Individual NIPERs can develop and metamorphosize themselves into a sector or technology specific anchor institute offering the best specialization/s as per their core strength/s.

29. NIPER, Hyderabad is one of the newly established institutes but has the best placement records. They should share the best practices being followed by them for the placement activities with the other NIPERs.

30. Pharm D course candidates needs to be more empowered in Indian healthcare scenario. With the dearth of physicians across the country, Pharm D candidates who complete last two years of their course in a complete hospital setup and are well equipped with medicine knowledge and can be considered for disease specific management in health and wellness centers in remote areas. In countries like Canada there are a lot of opportunities for the Pharmacy graduates as community pharmacists. It is important that our undergraduate courses focus on developing competent clinical pharmacists with thorough practical knowledge about the drug and its dosage regime through onsite trainings at hospitals and community health centres .

31. Along with the focus on research and employment, entrepreneurship should also be a part of the vision statement of NIPERs. The feasibility of allowing the students to incorporate pharma-based startups during their course work instead of dissertation should be carried out. The institute should create the provisions like relaxation in attendance for the PG students who want to pursue entrepreneurship during their courses or permitted break of 6 to 12 months for the PhD students to explore pharmaceutical entrepreneurship ventures.

32. Similarly for the faculty members, who want to lead these pharma entrepreneurship ventures, the provisions of sabbatical leave or semester/year break or leave without pay should be made available by the institutes.

33. The Institute need to encourage participation of its personnel in entrepreneurship and enable formation of legal entity in the following manner:
    - Company owned jointly by faculty members, staff, Students and Alumni
    - Company owned by faculty members along with external entrepreneurs
    - Section-8 Company other Society/Non-profit Organization
    - Special Purpose Vehicle (SPV) such as LLP, Society, Trust etc.

34. NIPER Guwahati, which has in-house facilities under the aegis of Atal Incubation Centre can lead this venture. The institutes need to work on similar model and develop necessary infrastructural facilities for innovation and startup activities such as ready to use infrastructure such as office space with amenities, research and testing labs, design studios, technology transfer cell, IPR cell and Promotion cell to make a conducive and encouraging ecosystem for entrepreneurship .In return of the services and facilities, the Institute may take a fixed percentage of (2% to 9.5%) equity in the start-up/spin-off company, based on employee contribution and support provided and use of institute's IP. In addition, a robust policy framework for collaboration and interdisciplinary research on the lines of the policy framework of CSIR and IISc needs to be worked upon for NIPERs as well.

35. The incorporated startups can work from incubation centre and in addition to fund raising activities from DOP, DST, DBT, MHRD, AICTE, TDB, TIFAC, DSIR, CSIR, BIRAC, NSTEDB, NRDC, Startup India, Invest India, MSME etc., these startups can also apply for funds under government 's Start-up India Seed Funds Scheme and look for private investors through the network of incubation centre and collaborating organisations. The operational model and mechanism being followed autonomous institutes like Centre for Cellular and Molecular Platforms (C-CAMP) Bangalore and Regional Centre for Biotechnology, Faridabad can be opted for promoting entrepreneurship among the students and faculty members who want to explore the entrepreneurship ventures.

SOURCES OF SECONDARY RESEARCH

Following documents from Department of Pharmaceutical Research have been referred to:

1. Catalyzing the Pharma & MedTech innovation ecosystem in India
2. Common guidelines on Pharmaceutical Innovation and Entrepreneurship-2022
3. The Gazette Notification for The NIPER (AMENDMENT) ACT, 2022
4. India Skill Sector Report 2021 and 2022.

In addition, the article and reports on the related topics on below mentioned websites have been studied

https://pharmaceuticals.gov.in
https://www.ibef.org/
https://www.investindia.gov.in/
https://www.forbesindia.com/
https://pharmastate.blog/
https://www.biospectrumindia.com/
https://www.statista.com/
https://groww.in/
https://www.researchgate.net/
https://www.ipa-india.org/
https://ficci.in/
https://daxueconsulting.com/
www.mckinsey.com
https://asia.nikkei.com/
www.iqvia.com
www.pharmexcil.com
https://www.mordorintelligence.com/
https://www2.deloitte.com/

https://www.ibisworld.com
canadiangenerics.ca
https://www.fortunebusinessinsights.com/
https://www.globenewswire.com/
https://www.grandviewresearch.com/
https://www.gtai.de/
https://www.pharmiweb.jobs/
https://www.efpia.eu/
http://www.salaryexplorer.com/
https://www.pharmaceutical-technology.com/
https://drug-dev.com/
https://gradaustralia.com.au/
https://www.indeed.com