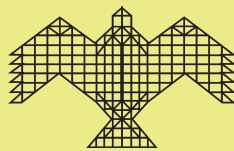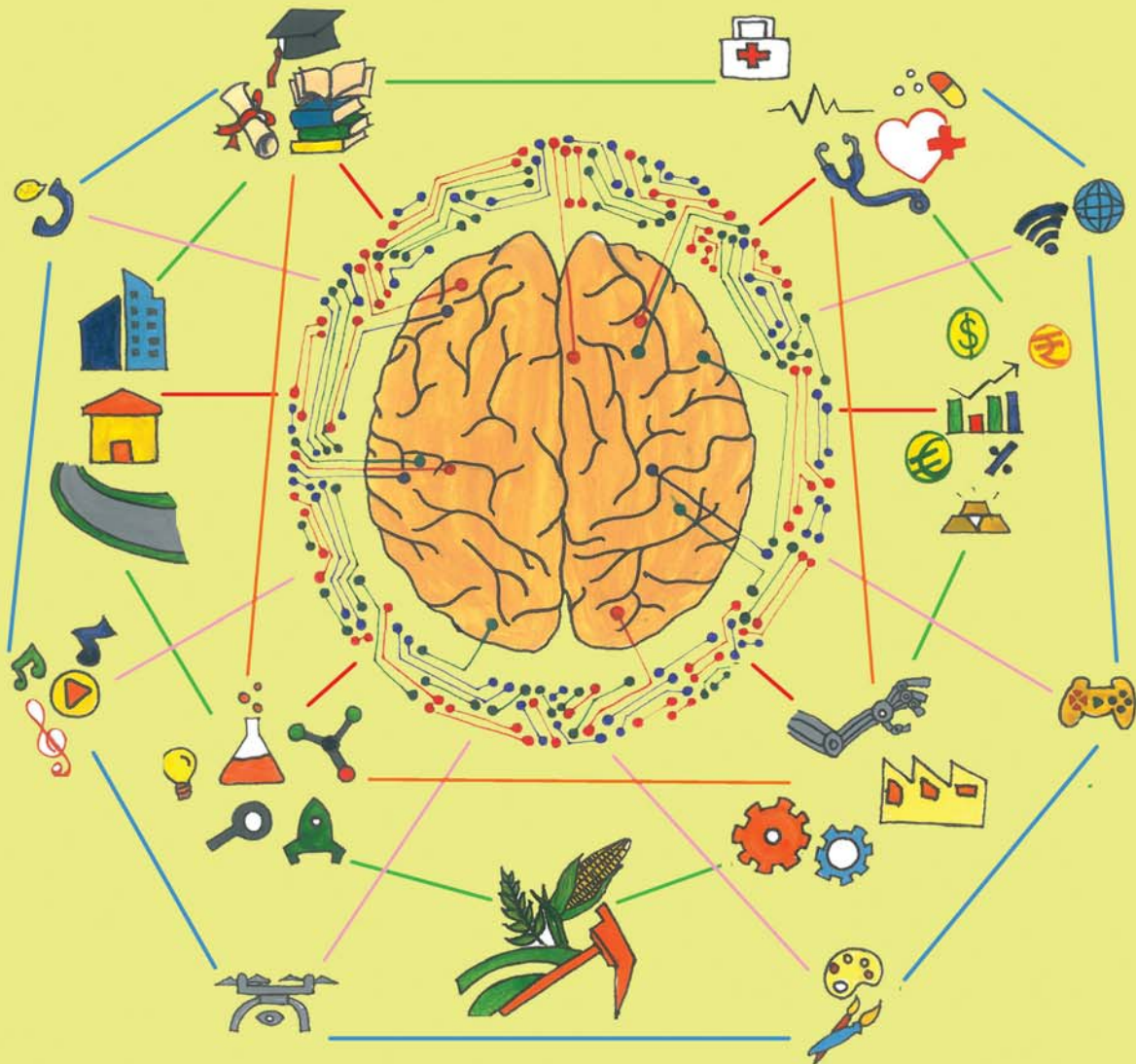M. Sai Baba
V.V. Binoy
Tanvi Vasan
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Artificial Intelligence (AI) and India:
Promise, Perception and Preparedness

National Institute of Advanced Studies
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Artificial Intelligence (AI) and India:

Promise, Perception and Preparedness

Artificial Intelligence is finding applications across the disciplines impacting human life. It is anticipated to realise its potential in major domains such as healthcare, agriculture, communication, automation along with being a part of our lives as smart technology that we carry around. The prospect of AI in the field of entertainment, music, art and video games also opens a wide space for creativity to evolve with technology beyond human capability. With all the apprehensions about AI, it would not necessarily replace but be used as an extra super suit to reach new heights and next big step for human race. The image reflects some of these thoughts.

Cover page drawn by Sneha Yadla

ACKNOWLEDGEMENTS

SUMMARY

Artificial Intelligence (AI) is identified as one of the emerging technologies which would have bearing on the lives of the people and society in the coming years. As part of a project titled *"Managing Public Perceptions and Public Acceptances of Public Risks Associated with New and Emerging Technologies Through Science and Technology Communications"* funded by the National Council for Science and Technology Communication (NCSTC), Department of Science and Technology, Government of India, National Institute of Advanced Studies (NIAS) Bangalore, has conducted an online survey to know various dimensions of the perceptions on AI by the Common man of India. The summary of the survey is given below followed by the report.

Will AI change the way people live and work in the near future?
Largely optimistic about impact of AI with 76% saying that AI will "positively" change the way we live and work.

Transport and finance would be experiencing AI induced changes in the coming five years, while agriculture, education, healthcare, defence and administration may take more time

Is AI a risky technology? If so what are the threats?
Despite the predominant belief that AI would have a positive impact on life and work, there was no clear judgement on whether it is a risky technology. The primary concern about AI was security, loss of privacy and loss of jobs. Loss of human control over the AI machines and replacement of humans by machines have also been of concern.

Cutting across all demographic categories, it was felt that AI would widen the gap between the rich and poor.

AI, Job loss and New avenues
Majority of the participants believed that AI will eliminate more jobs than it creates.

One in three respondents (34%) felt that their job will be occupied by the AI agents within 10 years. Medical professionals, academicians and researchers (PhD) were more optimistic and didn't expect an invasion of AI into their profession, but those who do management related jobs and run business believed that their job is at risk.

Need to Learn New Skills?

The respondents were unanimous (more than 80%), in spite of the demographic group they belongs to, about the need for acquiring new skills to adapt with the changing environment.

The responsibility of re-skilling the employee was attributed to the employer (51%), government (20%) and the individuals himself/ herself (20%).

Very few people disagreed with the statement that in India existing education system does not prepare the youth for occupying AI based jobs. Youth will have to acquire both soft and hard skills as well as training in 'coding and programming for adapting with the changing environment.

Can India Develop Cutting-edge AI technologies?

Majority of Indians (66%) were convinced that their nation is capable of competing in the global playfield of AI development. However, only 36 % believed that India possesses the human resource capable of it.

Indians are in favour of the government enhancing financial investment in the AI, but only 46% agreed with tax exemptions for this sector.

Awareness and adoption of the AI

Scientific journals and magazines got maximum vote (64%) as the depended medium for updating information on the AI. This interesting observation could be result of the domination of post-graduates and PhD holders in the respondent population.

Newspapers continued as an important medium (57%), in the current flood of various social media platforms. Only 24% opted WhatsApp as the channel for the information on AI.

People in India consider lack of awareness, shortage of the experience and dearth of trust in the AI (68%) as the major hindrance for the adoption.

In the opinion of Indians, developing trustworthy and safe AI, enhancing dialogue between public and AI industry, enhancing familiarity with AI technology and launching more education and awareness programmes are essential to boost the acceptance and popularisation of AI technology.

Respondents also expected more government intervention to address public concerns and establishment of an independent agency to ensure transparent and responsible AI.

AI and Responsibility

Indians attributed responsibility of the security of personal data collected by the AI systems as follows; the company which collects and store such information (48 %), developer of the technology

(28%), government (16%) and the individuals (7%).

In an accident involving human and AI machine majority (64%) considered the company that made the machine as responsible.

AI in day to day life
Amongst the people participated in the present study 39% were comfortable to hand over the tasks such as making appointments, answering calls, handling purchase etc. to an AI agent. Women showed more apprehension over men on AI handing these activities.

Elderly people (above 60 years; 59%) and government employees (53%) were more happy in AI doing such tasks.

Indians preferred the support of AI based personal assistants for online retail (70%) and travel (69%), but not in healthcare and education. They were not hesitant to have conversation with AI agents and this trend was consistent across various demographics studied.

It was only 34% felt that there do exists gender a bias in naming the AI agents. Youngsters (below 20 years) and those who have an educational qualification till 12th grade believed in the existence of such discrimination.

INTRODUCTION

"Technology, through automation and artificial intelligence, is definitely one of the most disruptive sources"

Alain Dehaze

Autonomous robots living with humans would no longer be a feature of science fiction stories or films; developments happening in the field of Artificial Intelligence (AI) are empowering machines to process huge amount of data in a short period of time as well as to learn from experience. AI means "*computers, robots or other technology that can accomplish tasks humans can do, as well as learn and complete tasks that humans may not be able to do*" (Northeastern University and Gallup, 2018). AI based machines are acquiring more and more cognitive capacities one thought to be unique to human beings and its superiority in number crunching, image recognition, language processing etc. makes its presence visible in the natural language processing, decision support systems, diagnosis of diseases, navigation and a host of other areas which has direct influence on the life of the people (Ghosh, 2018). The success in achieving compactness and high-speed computation in the devices today is a boon and catalyst to AI technology (Srivastava, 2018). Predictive search on browsers, email spam filters, predictive typing on mobile phones, and news suggestions on social networks, all these use AI in the background and several of the users not being aware of the same. However, differing from other technological revolutions humanity had seen in the past the disruptiveness of the AI technology is expected to be reflected on all facets of the human life and failing to adapt with it could lead to disasters. Many experts even warn that development and popularisation of AI based technology has to be done carefully since predicting the behaviour of the machines that have achieved the human level of autonomy and self-awareness is impossible. However if used judiciously AI could be a good friend to humanity and can help us in achieving goals which are not possible only with the capacities humans currently possess. For instance, AI based tools have started helping physicians to detect many diseases at very early stage itself which is not possible using conventional tools and techniques. It is envisaged that due to the advancements being realized, AI would revolutionise the fields of health care, education, transportation, commerce etc. It is expected that research in machine learning, speech recognition, natural language processing, and computer vision will further enhance the computational power and application of AI in the coming years.

The waves of AI revolution spreading all over the world have not left Indian subcontinent uninfluenced. Even the people on the lower strata of social pyramid are getting benefit of software with integrated AI, such as navigation and communication tools and the dependency on these devises, which   are expected to grow in the coming years. Many experts believe that application and popularisation of AI based technologies can help our nation to reduce the urban-rural divide and inequality prevalent

in the vital areas such as health, education etc. In the existing scenario, the cost of education in India is increasingly becoming high, and providing quality education continues to be a challenge, especially to rural population. Development of AI integrated teaching aids and making it available to the children from rural and marginalised areas of our nation could help millions to achieve their dreams.

In villages of our country, there is a need for improved health care. The availability of medical personnel in the rural regions of India is one fourth of that in the urban regions (World Bank, 2017). Through AI intervention in health care, there can be a huge improvement in providing health care for large rural population. The availability of doctors and nurses in India is less than the WHO guidelines (NITI Aayog, 2018) and applications like MOLLY, a virtual nurse; Watson from IBM for oncologists etc. can be helpful in obtaining better health care in remote areas of the nation. Approximately, the high expenditure in healthcare brings about 63 million people to poverty every year and AI based tools are expected to increase the affordability of healthcare services in the future thereby contributing to avoiding such slide.

For a country like India, with diverse population in terms of socio-economic backgrounds, it is important to focus on any growing technology that would help in the inclusive development. Indian government is also aware of the impact this emerging technology could bring on its population and had launched many plans to prepare the people to reap benefits as well as for avoiding the science-society conflict. Programmes such as 'Digital India' and 'Skill India', initiated by the Government of India aim for the development of new skills amongst the youth and helping them to cope with the demands of AI technologies. In February 2018, Ministry of Information Technology has set up four committees on AI for: Citizen Centric Services; Data Platforms; Skilling, Reskilling, Research and Development; Legal Regulatory and Cybersecurity (Economic Times, 2018). NITI Aayog (2018) has identified Agriculture, Transportation, Infrastructure, Education and Healthcare as the five sectors that can benefit from AI and has also established a Centre of Research Excellence (CORE) for pursuing advanced research in AI.

Although high technology products and services are no longer the luxury of the rich in this nation, implementation of AI related technologies should be conducted carefully, since its several possible implications could disturb the stability of India's socio-economic base. Many experts fear that introduction of autonomous and self-learning machines in industry and service sectors could make thousands jobless. Even with the possibility of AI creating newer employment opportunities, there is no guarantee that the numbers will balance out. Finding financial and human resources for reskilling a large employee base and managing transition is a challenge for both employer and employee. Furthermore, percentage of citizens who may fail to adapt to new skills and the measures to be taken to help them, continues to be an unanswered question. At the same time, it is impractical for India not to adopt the emerging AI technology in the current era of globalization (Srivastava, 2018).

Appearance and popularisation of AI based technologies in the market and its intervention into the day to day life of common man is raising many concerns. Currently, consumer centric AI innovations are emerging largely in the private sector and people all over the world are alarmed of one's personal data being collected and exploited by unknown agencies for vested interests. Similarly, many companies are testing autonomous machines such as self-driving cars and drones. The day is not far when these autonomous machines would play an integral role in dynamics of Indian society. However, there is no clarity yet on the legal and ethical aspects of undesirable actions or harm from autonomous AI agents, even though several other nations are actively involved in developing the regulations for futuristic AI applications like driverless cars (Ghosh, 2017). Is there a possibility of growing AI technology making the human intelligence obsolete and replacing the creator in the coming years? Currently, this question resonates repeatedly not only in the debates of philosophers or but in the minds of educated non-specialists also. However no universal answers for this vital question have come out yet and the experts and academicians are continuing in two equally strong but opposing groups keeping the common man confused.

To have a smooth implementation of AI technologies in India and avoid a science-society conflict, it is important to understand the mindset of the members of various strata of the society. It is essential to come out with effective strategies for making people aware of the benefits of the emerging technologies and eliminate fears by documenting (i) the nature of the knowledge people keep on various AI technologies, (ii) their attitude and expectation from such technologies and (iii) the origin of fear and risk attribute on them (Bagla and Binoy, 2017). Furthermore, this is essential for the government to put in place the laws and regulations without causing friction in the society, before AI applications starts impacting the society (Ghosh, 2017). The educational institutions are also benefited from research focusing on the perceptions of Indians on AI; designing of effective and inclusive education programmes for preparing the growing generation to cope with changing work atmospheres. Also, it would be an easy venture if the beliefs of the receiving end are clear to the developer. Although such studies focusing the populations of Europe and America are quickly growing, it is still in its fancy in India. However we cannot wait for a long period to generate this database, as the influence of this disruptive technology is expected to be intertwined with newer developments in of various sectors of industry and people of the country in general. A neglect could catalyse AI- society conflict ending up in people's protest and hindrance in the economic growth of our nation. As part of a project titled *"Managing Public Perceptions and Public Acceptances of Public Risks Associated with New and Emerging Technologies Through Science and Technology Communications"* funded by the National Council for Science and Technology Communication (NCSTC)*,* Department of Science and Technology, Government of India, National Institute of Advanced Studies (NIAS) Bangalore, has conducted an online survey to know various dimensions of the perceptions on AI by the common man of India. The methodology adopted and the results of the survey are given below.

METHODOLOGY

A questionnaire was developed on Google Forms (Appendix 1) to understand various dimensions of the beliefs of the general public on AI intelligence and its integration with the Indian society. There were 26 questions in total: 6 were devoted for understanding the demographic characteristics of the participants and the remaining 20 were related to AI and its impact. Of the 6 demography-related questions, 4 were mandatory and, 5 AI based questions were of the '*Tick all that apply*' category and the remaining 15 were Multiple Choice Questions (MCQ). The header of the questionnaire was a request to participate in the survey and share it with the interested parties. The survey covered topics ranging from the source of information about AI to its expected impact on: education, agriculture, defence, finance etc. Factors influencing trust and adoption of AI, role of government in terms of the regulation of AI machines, mitigation of mishaps etc. were also formed the themes of the questions. The position of the questions on various topics were randomised in order to avoid the bias induced by the sequential effect on the answers.

The link to the questionnaire was posted on various social media platforms such as Facebook, Google Plus, WhatsApp, Twitter and LinkedIn, with a request to share. The link to the survey form was also shared with nongovernmental organizations actively involved in science popularisation and communication via email with a request to distribute amongst their members.

The survey was well received by the people and the response of 1299 participants obtained during a period of 27th May to 10th June 2018, which were considered for analysis. Residents from 27 different states of India took part in the current study and shared their views. However, there was a domination of the respondents from the southern states, Karnataka (32%), Kerala (18%) and Tamil Nadu (17%). Urban dwellers encompassed (65% from cities and 20 % from towns) major share of the people cooperated with the study, but the good representation of the rural population 15%, was also noticed. The respondents were divided into subgroups based on age, gender, educational qualifications and occupation to get an elucidated picture of views of various demographics of the society on AI.

RESULTS

AGE AND GENDER

Young Indians (21- 40 years) outnumbered the other age categories and comprised 74% of the total respondents. Age class of 40 to 60 years (16%) was the next large group and 3% senior citizens (who had crossed the age of 60 years) and 6 % teenagers also participated in this survey (Fig. 1). Gender wise segregation revealed that only 34 % of the total respondents were females. The transgender, gender queers and those who are not interested in disclosing their sex combined, were 1% (Fig.2).
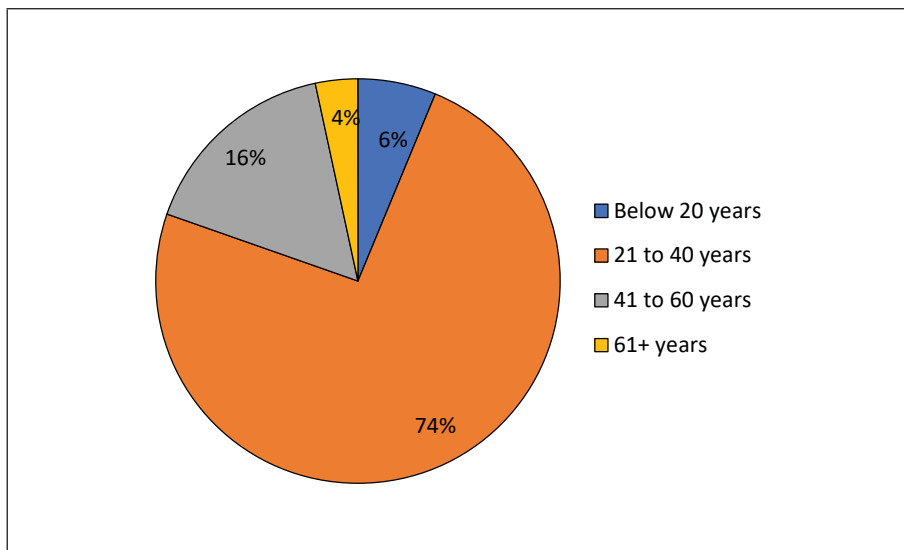
Fig. 1 Age distribution of the participants (Q 1)
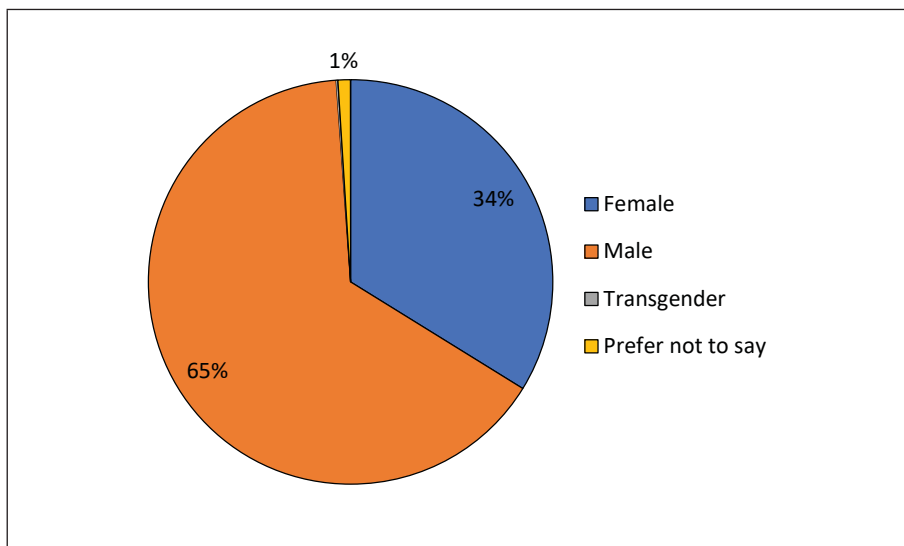
Fig. 2 Gender of the participants (Q 2)

EDUCATION AND OCCUPATION

The respondents were divided into four major categories based on their educational qualification: *up to 12th Grade, Graduates, Postgraduates* and *PhD*. The categories '*Graduates*' and '*Postgraduates*' were further divided into three sub-categories based on their specialisation; science and technology formed the first two groups and the third category 'non - science and technology' was an aggregation of those who have studied management, arts and humanities. Amongst the graduates 19% had technology background, 12% were specialised in science and 6% studied non-science subjects (Fig. 3). Meanwhile, 21% postgraduates had learned sciences, 13 % technology and 11% non-science subjects. All participants with PhD were added to one group and not considering their specialisation and this category formed 14% of the total participants. Participants with an educational qualification, below 12th grade, comprised 4% of the total respondents.
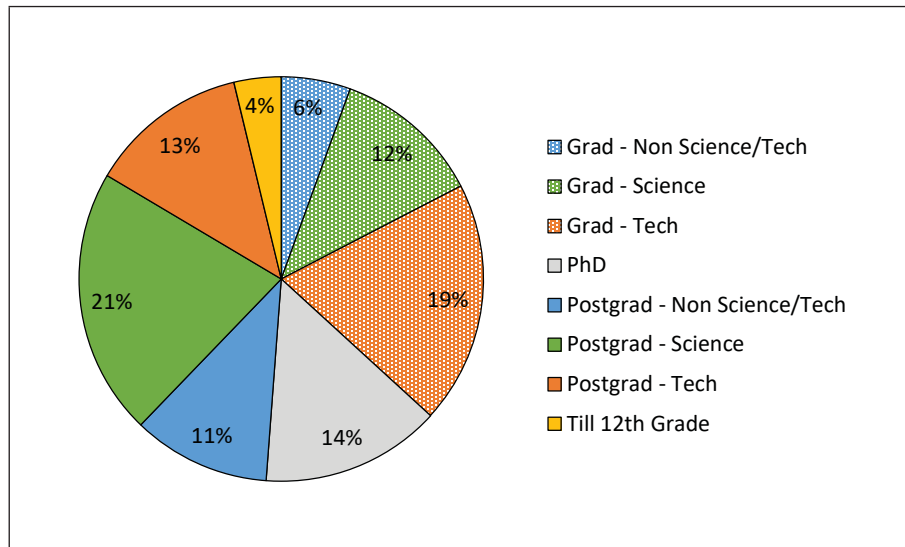

Fig. 3 Educational qualification of the participants (Q 3)

Although the column '*Occupation*' was not kept mandatory 80% of respondents filled it. Those who were not interested in disclosing their job were added to the category '*Undisclosed*'. Out of those respondents who indicated their profession as 'academicians' (23%) - the cluster consisting of scientists, teachers, researchers and post-doctoral fellows - were the dominant respondent group. Government employees (4%), medical professionals (2%), people working in various private sectors such as business (4%), engineering (9%), management (7%) and students (26%) also participated (Fig. 4). All other professions were put under one category '*Others*' since none of them crossed 0.5% of the total respondents.
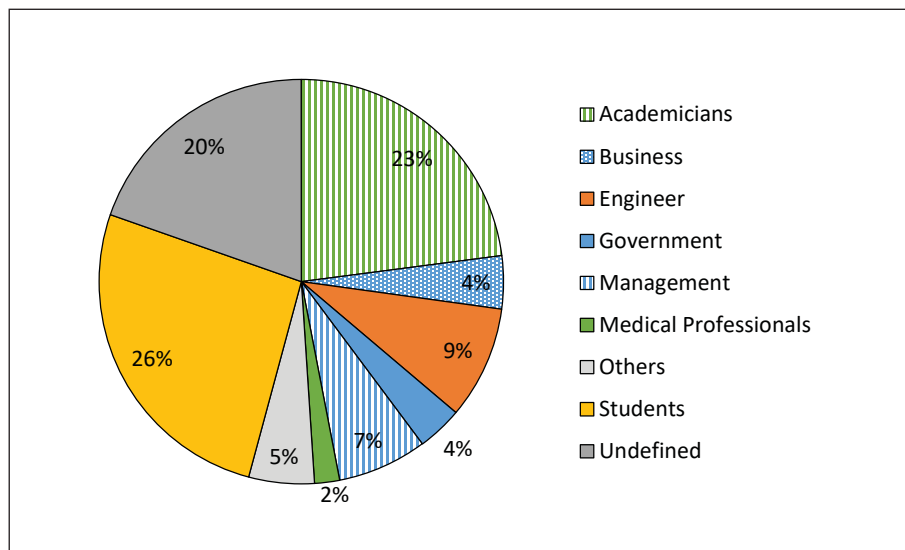
Fig. 4 Occupations of the participants (Q4)

Will AI change the way people live and work in the near future?

Our result revealed that Indians are largely optimistic about the impact of AI, with 76% of the respondents believing that AI will "positively" change the way they live and work in the coming 10 years (Fig. 5). Neither gender nor educational qualifications were found to be influencing this belief significantly. A similar result was obtained when the data was segregated and compared based on the age of the participants. An interesting response came from medical professionals, 35% of them confessed that they "Don't know", whether AI is going to bring any positive or negative influence in the coming 10 years.

A poll conducted by Gallop (2018) amongst the Americans also revealed that more than 75% of participants trust that AI will fundamentally change the lifestyle of the people by helping them to solve the complex problems faced by the humanity in the coming decade. The result obtained by a study, which focused only a cross-section of the Indian society - people working in the business sectors - was also not different (Ghosh, 2018) and more than 70% of the participants resonated with their American counterparts.
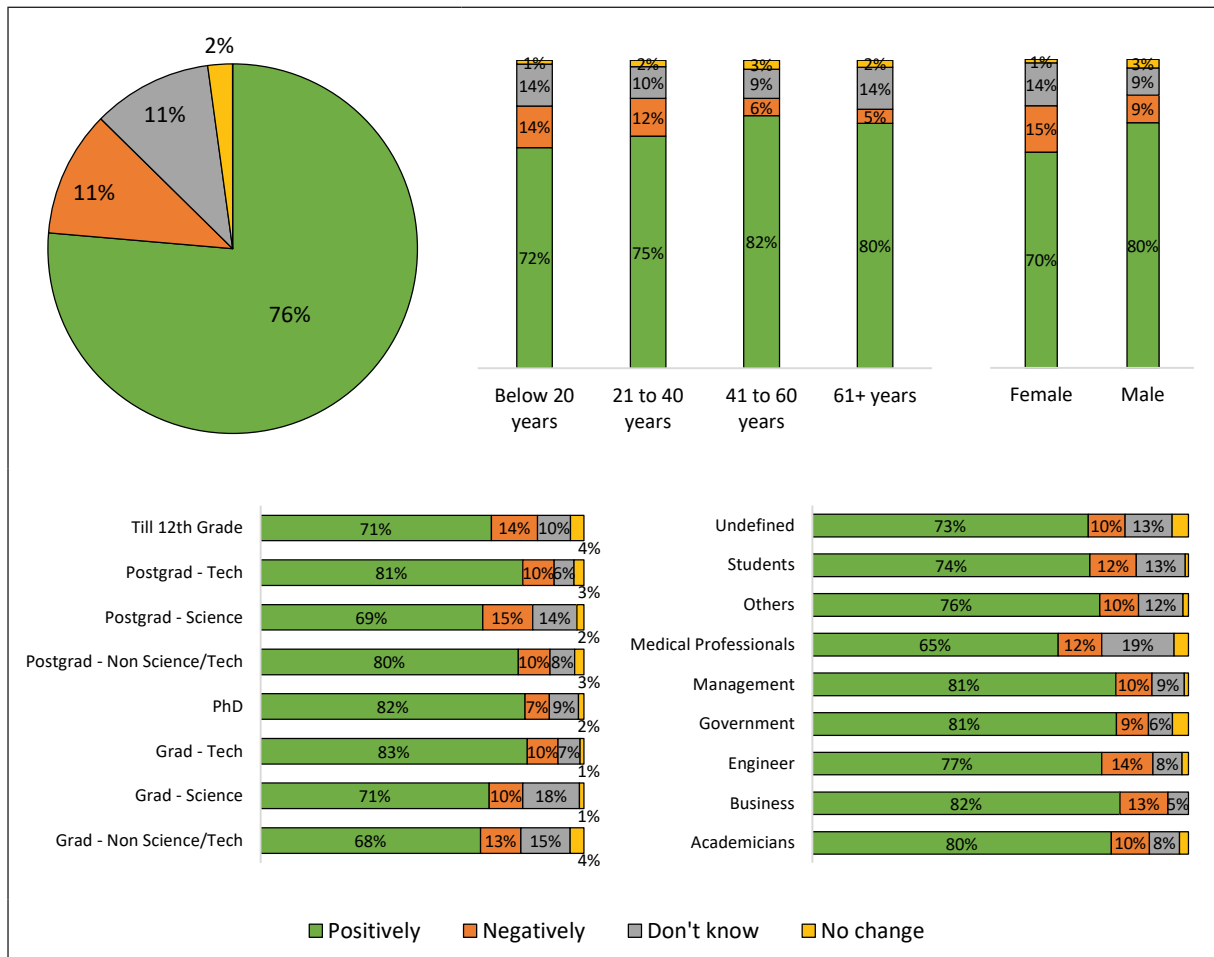
Fig.5 *AI will change the way people live and work in the next 10 years (Q 7)*

Which sectors would be impacted by AI and When?

It is an undisputed fact that influence of AI is becoming conspicuous in various realm of the human life. All over the world scientists are involved in active research to bring AI integrated autonomous machines in the sectors such as agriculture, health care, administration, defence, finance, transport etc. Around 60% of the Indians believed that AI is going to make significant impact on these sectors within 10 years. Interestingly a good share of people participated in the current survey were expecting an extensive modification of the transport (40%) and finance (40%) by AI within five years. Nevertheless, such a change in agriculture (42%), education (40%), healthcare (41%), defence (37%) and administration (35%) was anticipated after 5 to 10 years only (Fig. 6).
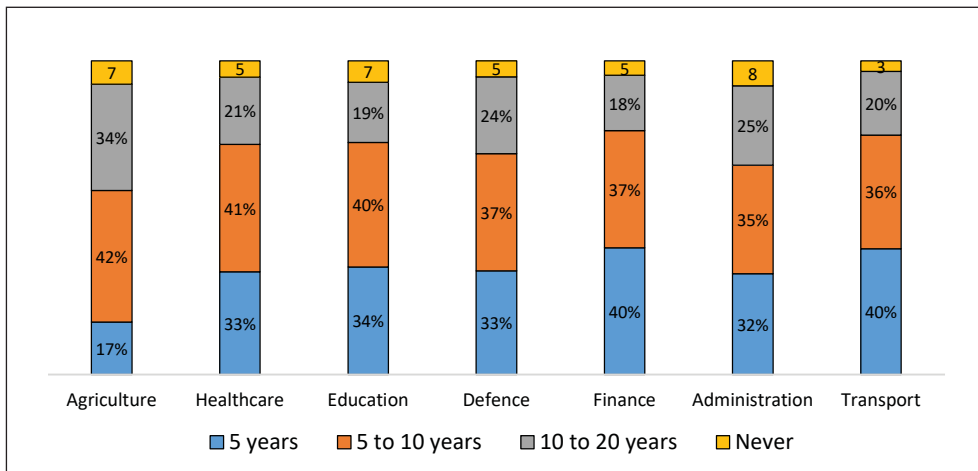
Fig.6 Do you think AI can significantly impact these sectors? If Yes, when? (Q 12)

Although, understanding whether public prefers AI machines doing the jobs in these areas is essential for a friction free implementation of such technologies, till date very few studies explored this question in India. We got a mixed response: Indians preferred finance and defence being handled by the AI machines (Fig. 7) while there was an overwhelming preference to humans over AI in education (83%) and healthcare (75%). This result points to the fact that people prefer 'human factors' in the teaching-learning environments and situations demanding medical care. In this context it should be remembered that healthcare and education are the two major areas attracting financial investment for developing AI based autonomy. However, no stark bias towards either AI or human doing jobs in agriculture (57%), finance (59%), defence (57%) and administration (60%) was noted.
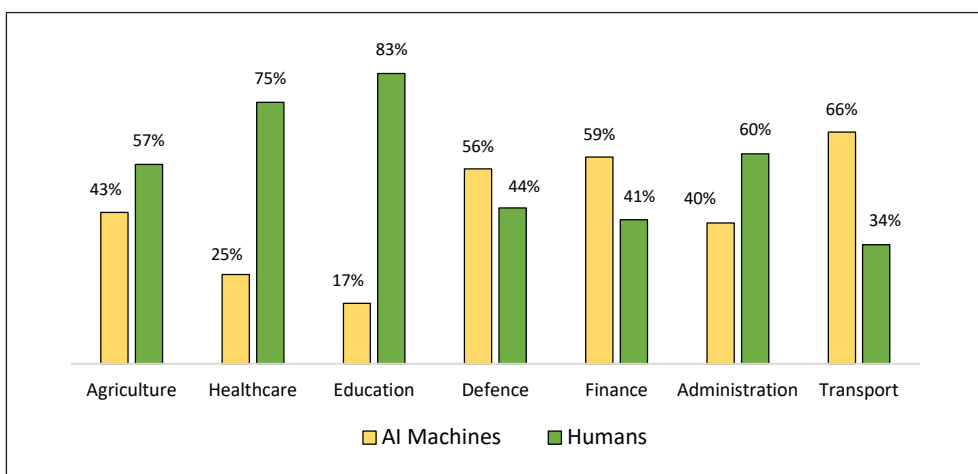

Fig.7 Who would you prefer to do these jobs? (Q 9)

Is AI a risky technology?

The risk from AI technology is a hot topic of debate all over the world and scientists, industrialists and policy makers are equivocal on the negative side of this quickly emerging technology. When asked whether they consider AI as a risky technology, around one third of the total respondents either "strongly agreed" or "agreed" (36%). At the same time an almost equal proportion (31%) of the participants disagreed with this statement and 32% hadn't a clear opinion. Although, no influence of the gender, education or occupation was observed on this pattern of response, age wise comparison revealed that people above 40 years were more optimistic about AI (Fig. 8). Tracing out the reason behind this chasm in the belief on the risk from AI kept by the elder and younger generation of the nation is highly important to avoid the disagreements while implementing the new AI based technologies in India.
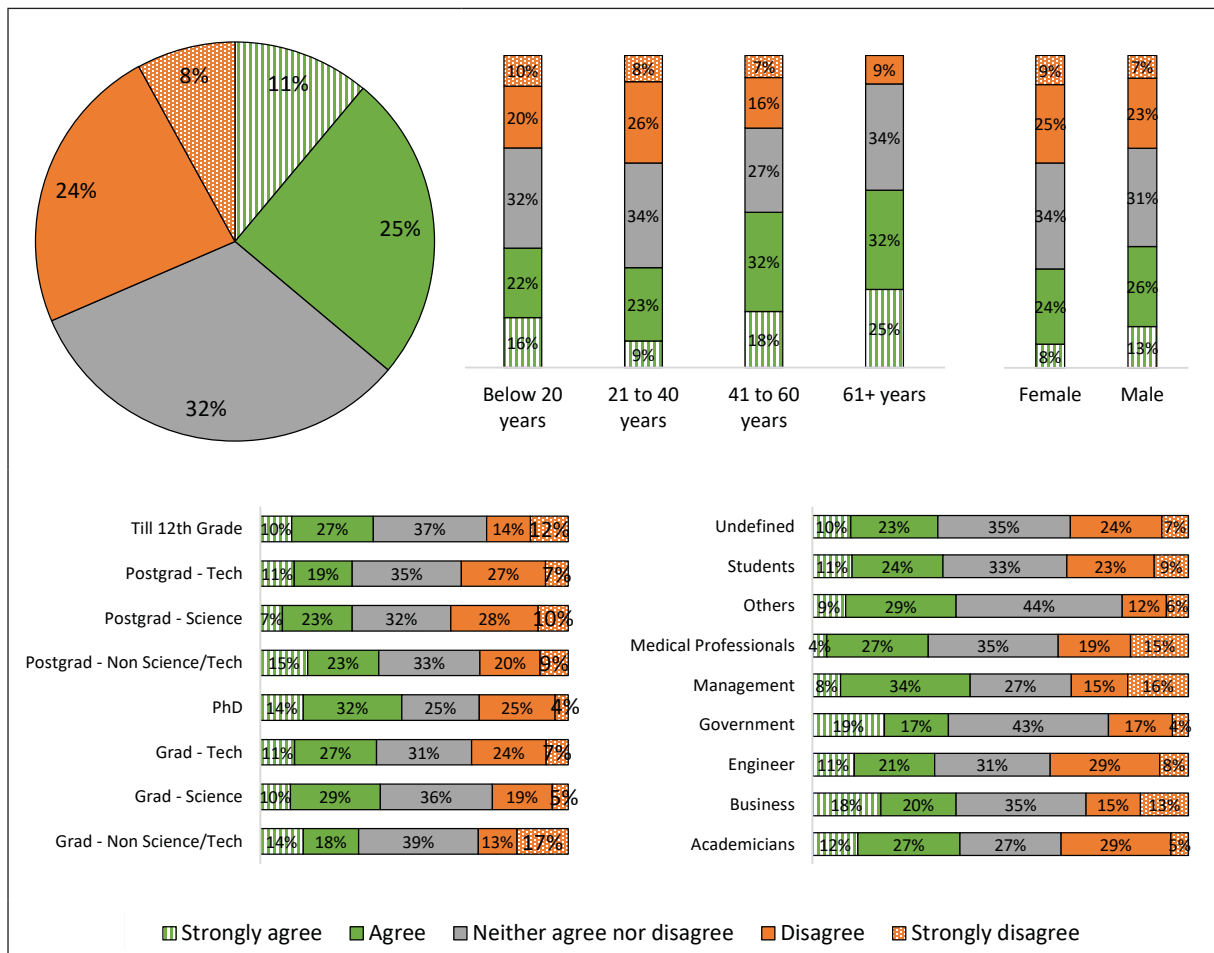

Fig. 8 AI is NOT a risky technology (Q 11)

Out of the five different kinds of threats expected from AI, given in the questionnaire, security issues got maximum vote (68%). Indians are also concerned about the job loss (60%), loss of human control over the AI machines (58%) and replacement of humanity by autonomous machines (57%) (Fig. 9).
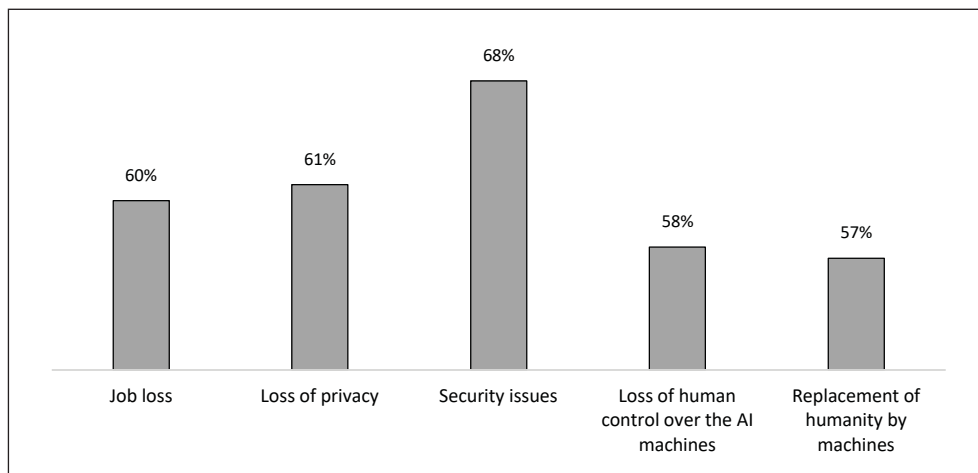
Fig. 9 The major risks from AI (Q 13)

Another threat anticipated with the adoption of AI technology by the society is the widening of the gap between the rich and poor. For instance, more than 60 % of Americans believed that AI could make rich people richer and poor more vulnerable economically (Northeastern University and Gallup 2018). Interestingly Indians were not different from their American counterparts and believed that AI would enhance inequality in the society. Approximately one in two Indians who took part in the current study felt that AI would increase economic disparity in the society. Further analysis revealed that approximately 40% of the participants from the management background, non-science graduates and having education up to 12th standard kept their answer neutral (neither agreed nor disagreed) to this question. No noticeable variation was observed when the data was analysed after segregating based on the age, sex, profession and education, but only less than 10% from management profession differed with the notion that AI would increase economic divide, in comparison in other groups of occupation (average 17%; Fig. 10).
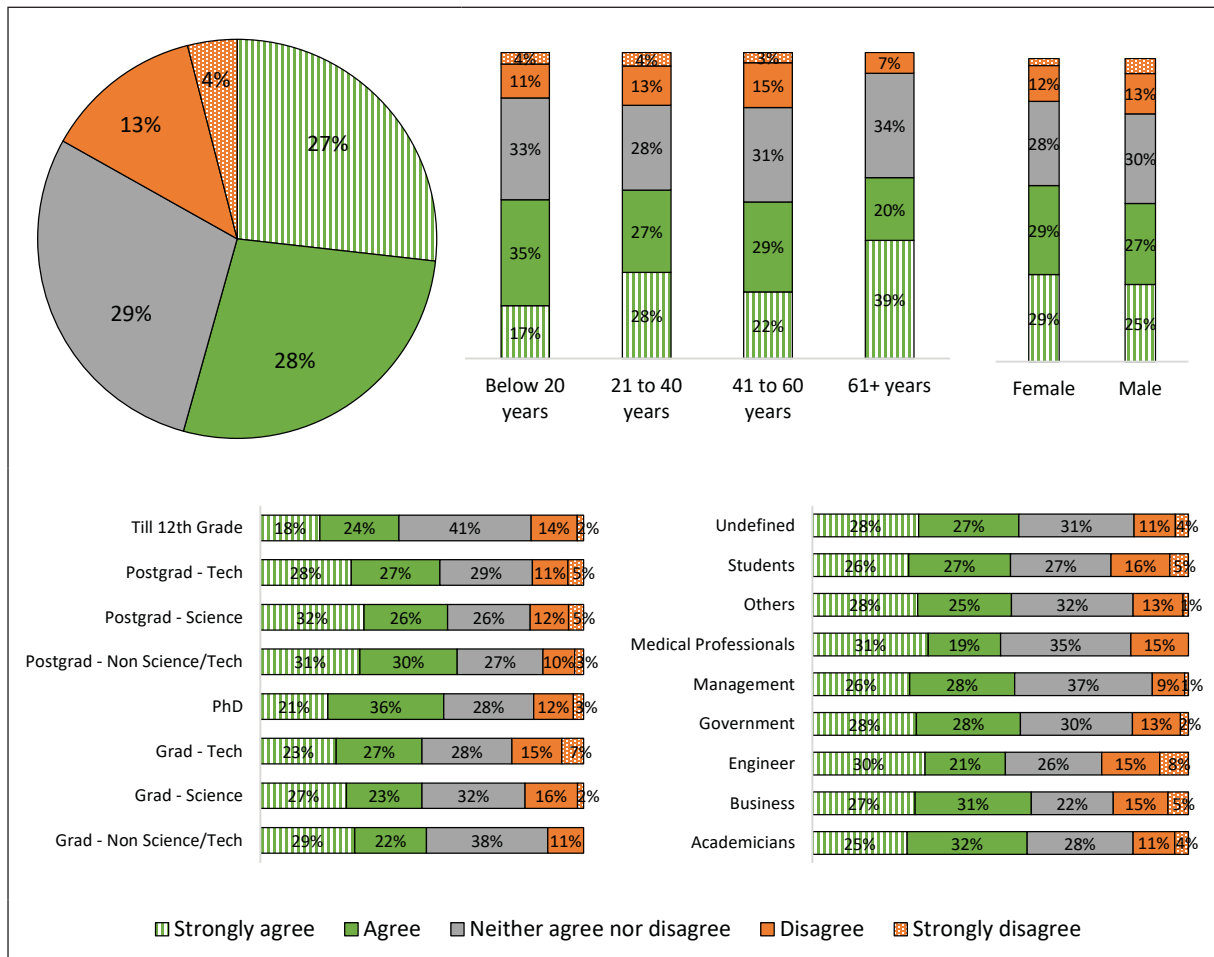
Fig. 10 AI will widen the gap between Rich and Poor (Q 16 D)

AI: Job Loss and New Avenues

In many contexts AI and automation is considered as the synonym for mass termination of job opportunities. According to a study conducted by Frey et al. (2013) 47% of all traditional jobs in US are under the risk of being replaced by the AI machines. By contrast the belief, AI will generate new kinds of jobs and people will not be left unemployed, though sometimes they may have to update their skills, is also prevalent amongst the academicians and general public. According to majority of the respondents (28% strongly agreed and 39% agreed) AI will eliminate more jobs than it creates. The age group who was more concerned about this important issue was below 20 years (81%; Fig. 11). Amongst male participants 15% believed that AI will bring more job opportunities, but only 7% females kept such a notion. There were few differences in the perceptions on job security across other demographics studied.
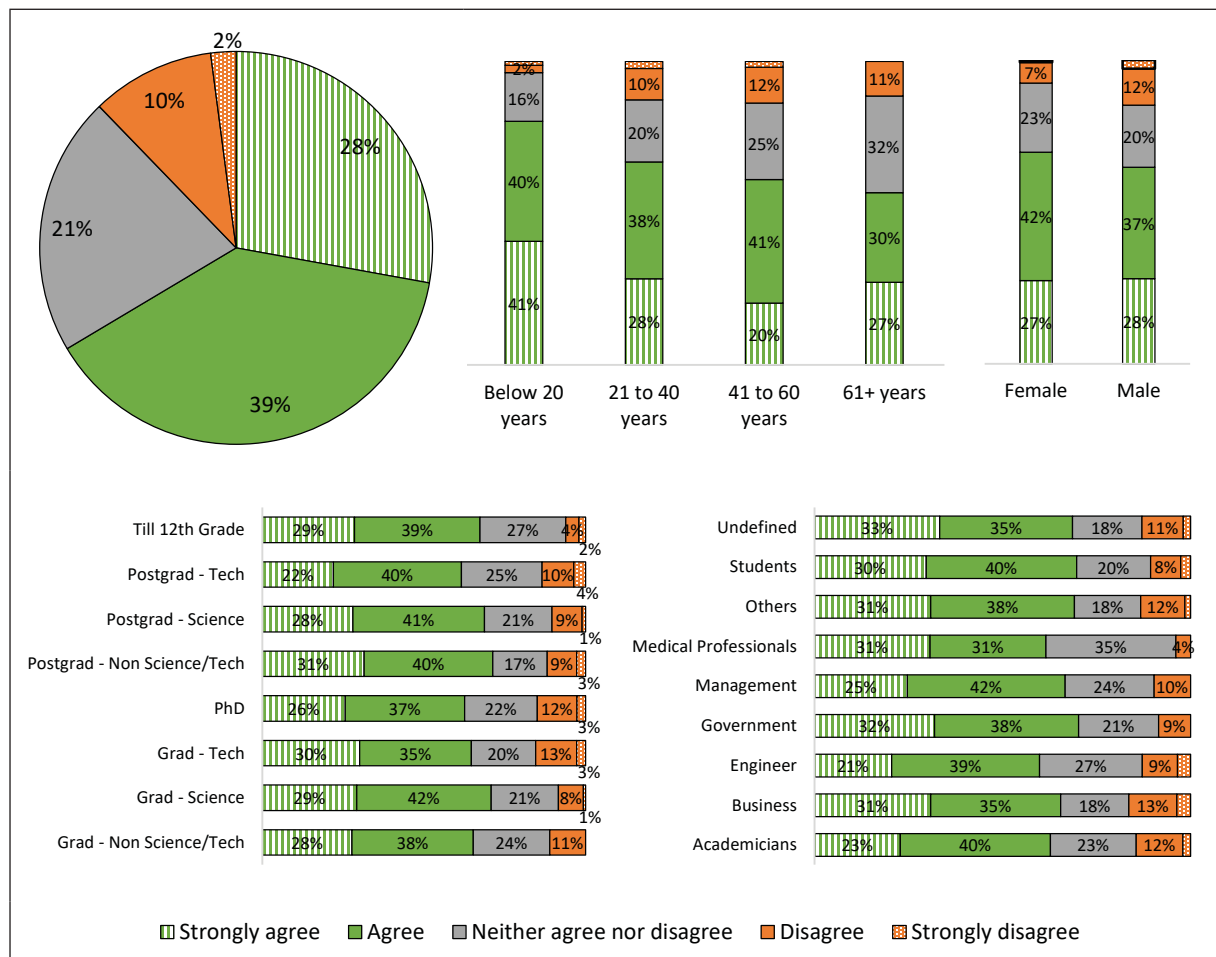
Fig. 11 AI will eliminate more jobs than it creates (Q 16a).

We got a mixed response to the question, whether the respondent feared that his/her job is facing a threat from AI. One in three participants (34%) felt that their job will be occupied by the AI agents within 10 years, meanwhile 37% were confident that the occupation in which they are involved would never be lost to AI. Amid different professionals, those who are from the field of medicine, academics and research (PhD) were more optimistic and didn't expect an invasion of AI into their profession. Unexpectedly those who are in management (45%) related jobs and run businesses (54%) believed that their job is at risk (Fig. 12).
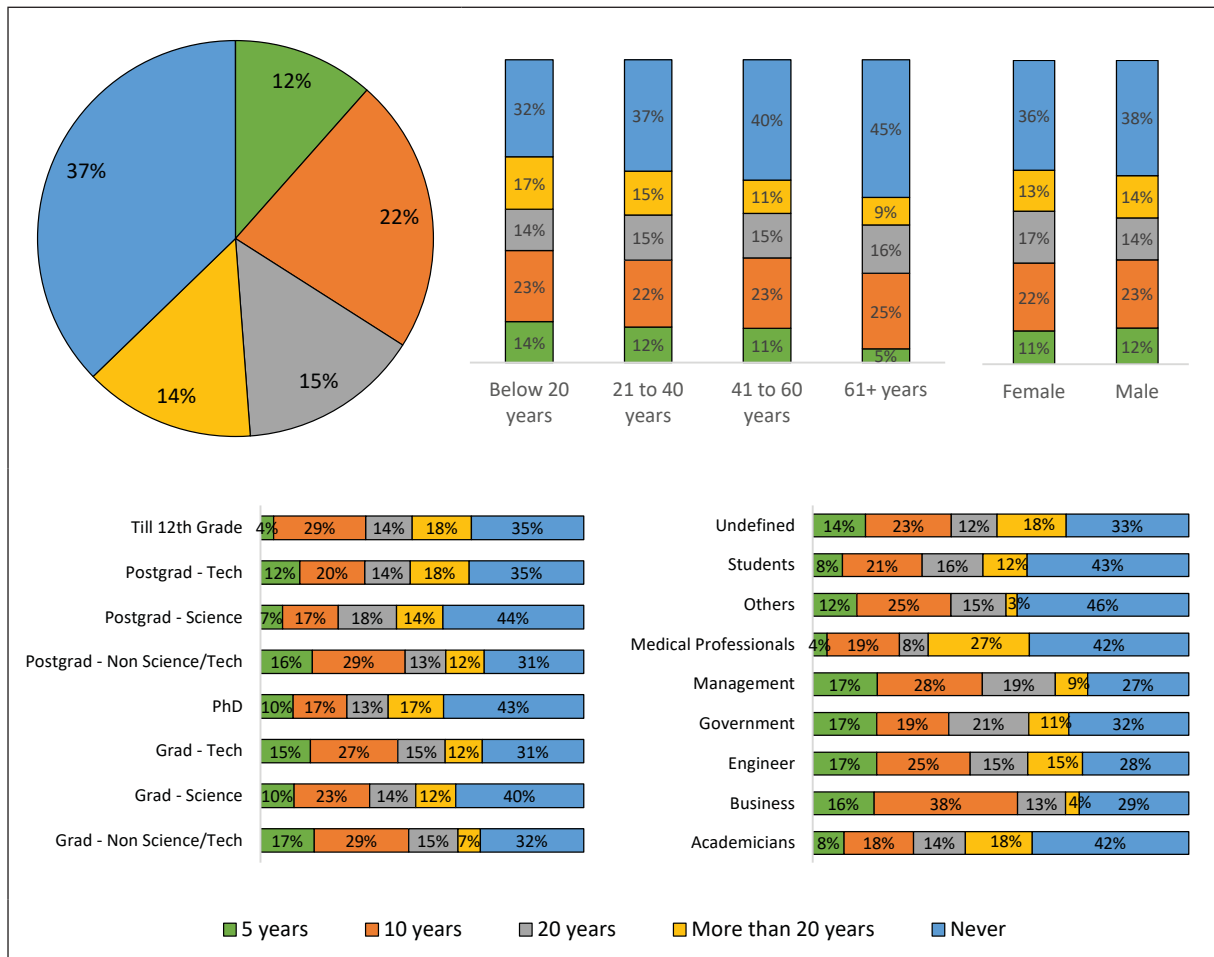
Fig. 12 My profession will be replaced by AI tech within (Q 19)

The respondents were unanimous (more than 80%), in spite of the demographic group they belong to, about the need for acquiring new skills to adapt with the changing environment. Only 3% kept the notion that one would not have to gather new sets of skills to work in an AI integrated work environments (Fig. 13).
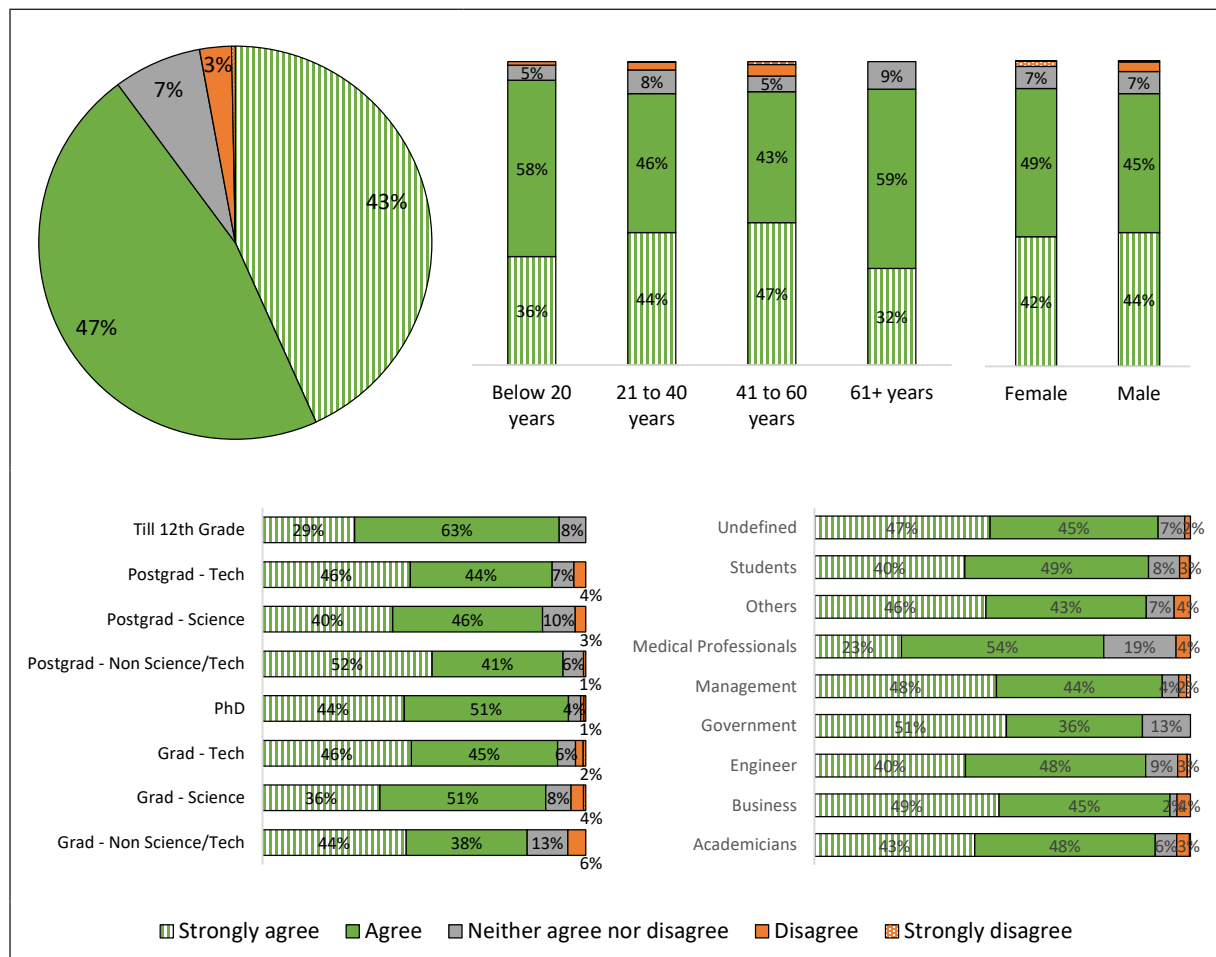
Fig. 13 One will have to acquire new skills to adapt with AI based jobs (Q 16b)

This strong belief of Indians that they will have to learn new skills to work in an AI enabled ecosystem is a hint to the policy makers and the higher education institutions to contemplate and come out with policies and courses to make the workforce our nation ready to face the phase shift. Differing from the Americans who suggested that the responsibility of preparing employees to cope with the demands of AI workplace lies with the Federal Government (Northeastern University and Gallup 2018), only 20% of Indians kept such an opinion. In the present survey, the respondents 51% of them believed that the employer should make sure that the skills of employee is updated and for 25% it is the duty of the individual to be up to date. In India though state governments also play key role in providing education and skill development training very few people (4%) attributed such a responsibility to this institution of governance. With regards to the demographic group 'occupation', government employees (62%) and academicians (59%) felt that the obligation

lies with the employer. In the opinion of age group below 20 years both central government (35%) and employer (40%) share the responsibility while other age groups as well as the non-science post graduates (57%) and PhD holders (61%) attributed greater responsibility to the employer (57%). Here also no noted variation was observed in the response of males and females.
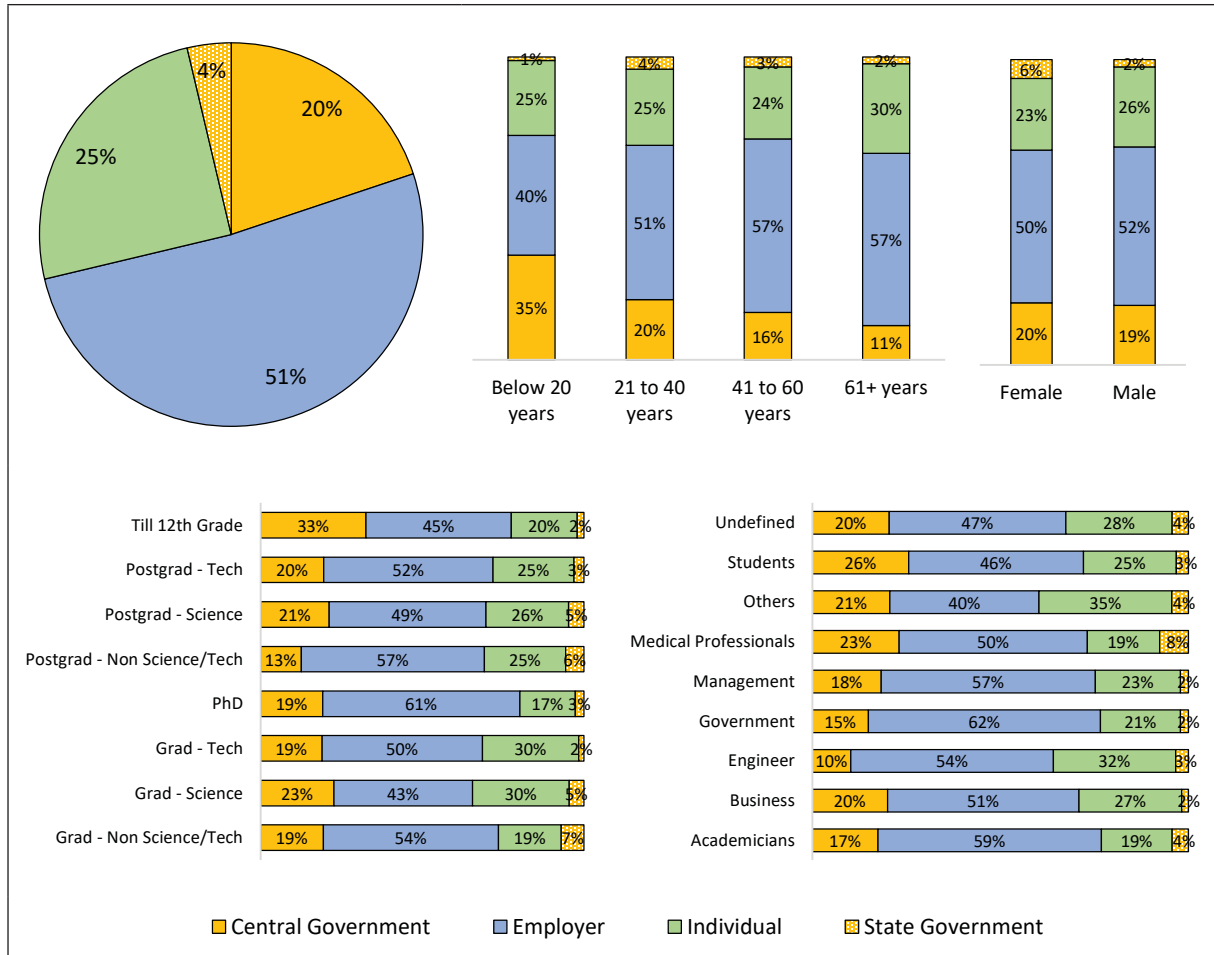

Fig. 14 Preparing employees to adapt with new AI tech in the workplace is the responsibility of the

There was a very feeble disagreement with the statement that 'in India existing education system does not prepare the youth for occupying AI based jobs' and 44% strongly agreed and 37% agree with it (Fig. 15). This opinion was consistent across different demographical groups focused.
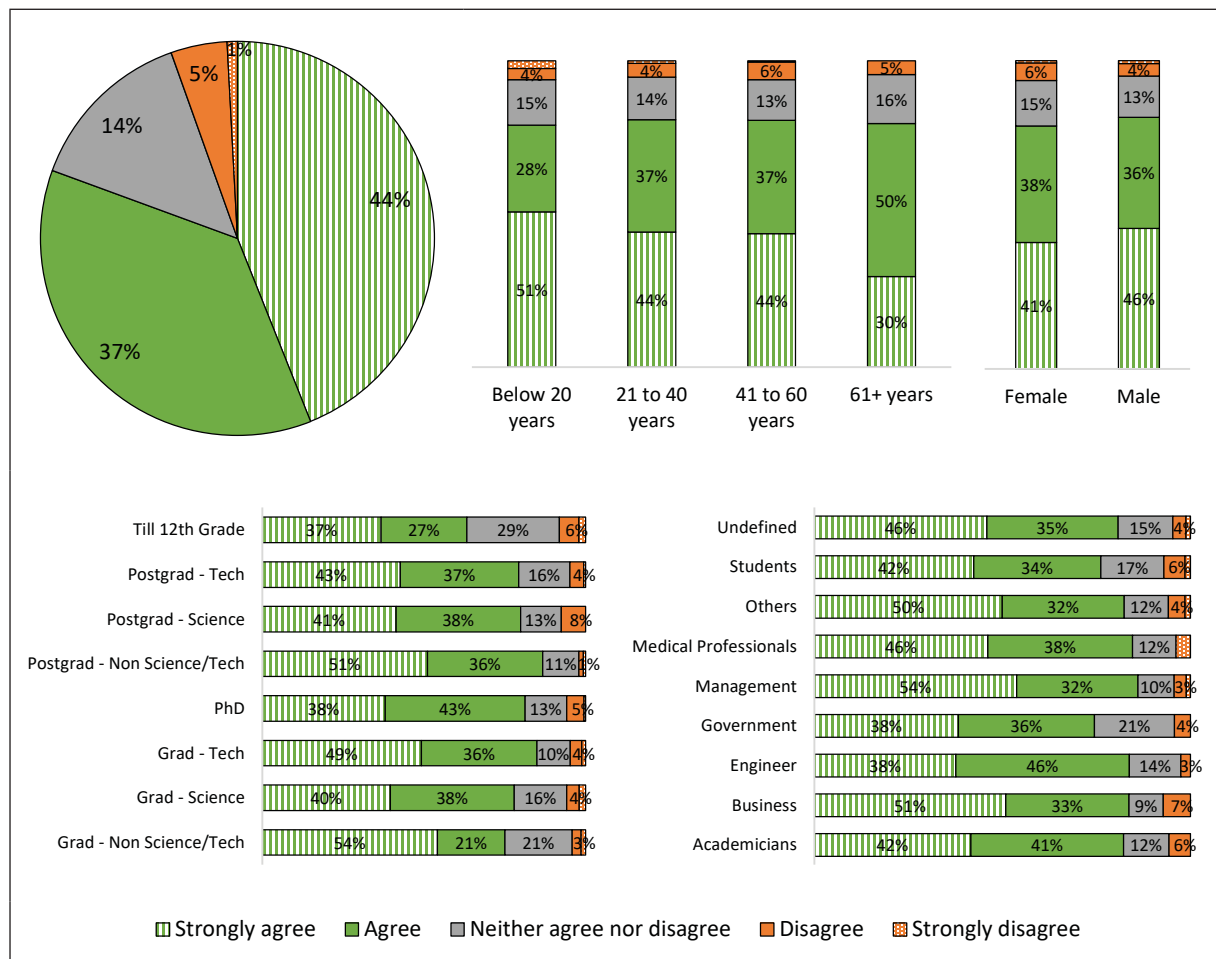
Fig. 15 Indian education system is not preparing youth for AI based jobs (16 C)

Respondents strongly believed that, in order to adapt with the changing job requirements brought in by the AI revolution, youth would have to acquire soft skills (66%) such as arts, communication etc. as well as mathematics and science (hard skills 68%). Moreover 70% opined that, in order to empower the young generation providing training in 'coding and programming' is also essential (Fig. 16)
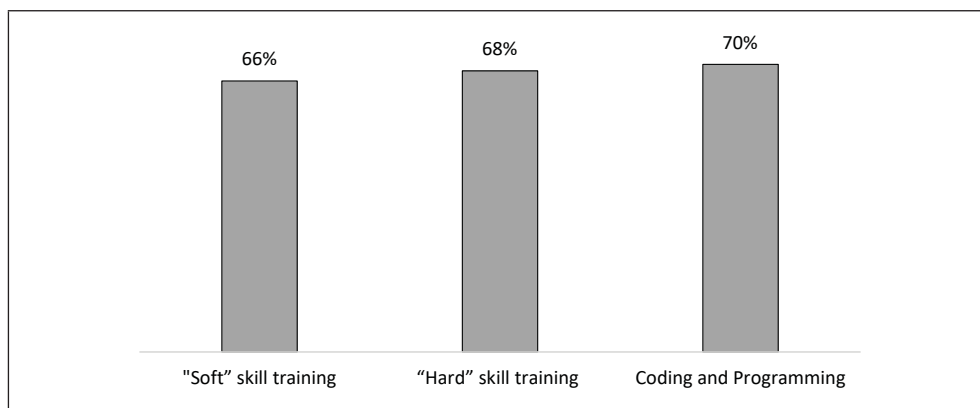

Fig. 16 The youth could be empowered to adapt with the forthcoming AI revolution by providing training in (Q 18)

Can India Develop Cutting-edge AI technologies?

Majority of Indians (68%) are convinced that their nation is capable of competing in the global playfield of AI development (Fig. 17). With regards to the age groups, degree of agreeability with this statement was stronger amongst the participants elder than 40 years. There was no distinction noticeable with educational qualifications but engineers, business persons, and managers were more confident about the capacity of the nation (more than 75%) than medical professionals (58%).
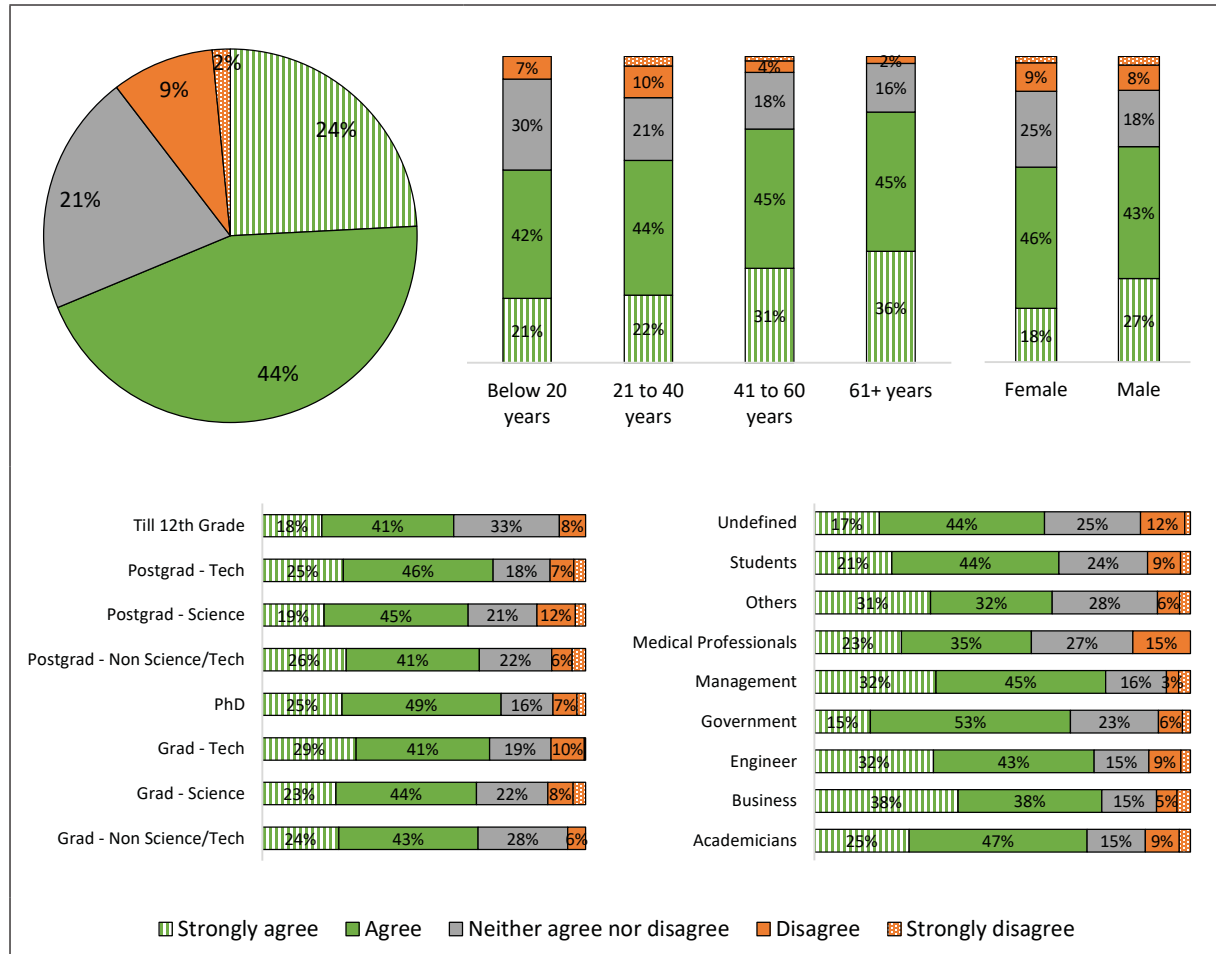

Fig. 17 *India can compete with AI development globally (Q 23a)*

Even though a strong faith in the competence of their nation to come out with the state of the art AI technology was conspicuous, only 36 % of the respondents believed that India possesses the human resource capable of it. A good share of the academicians and engineers (42% in both groups Fig. 18) were in agreement with the statement - *'India doesn't have the human resource to develop cutting edge AI tech'*. Majority of the participants present on the lower strata of the category education (less than 12th standard; 40%), and medical professionals (42%) were neutral in their response (neither agreed nor disagreed).
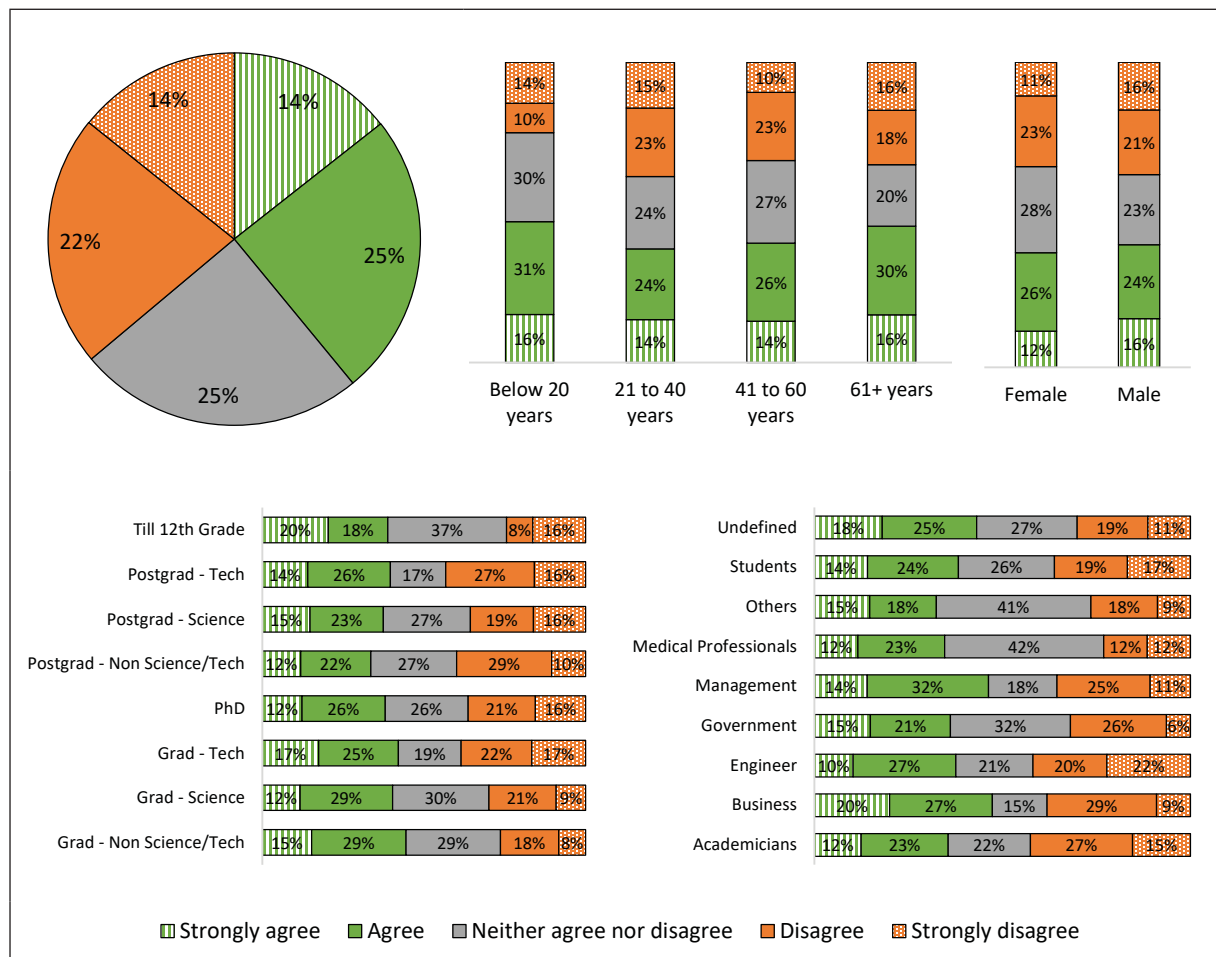
Fig. 18 India doesn't have the human resource to develop cutting edge AI tech (Q 16 E)

Indians are in favour of the government enhancing financial investment in the AI sector; an aggregate of 77 % (29% strongly agreed and 48% agreed) of the total respondents preferred an increment in the financial intervention from the government to boost the development of AI technologies. This trend was found consistent across the focal demographical categories (Fig. 19).
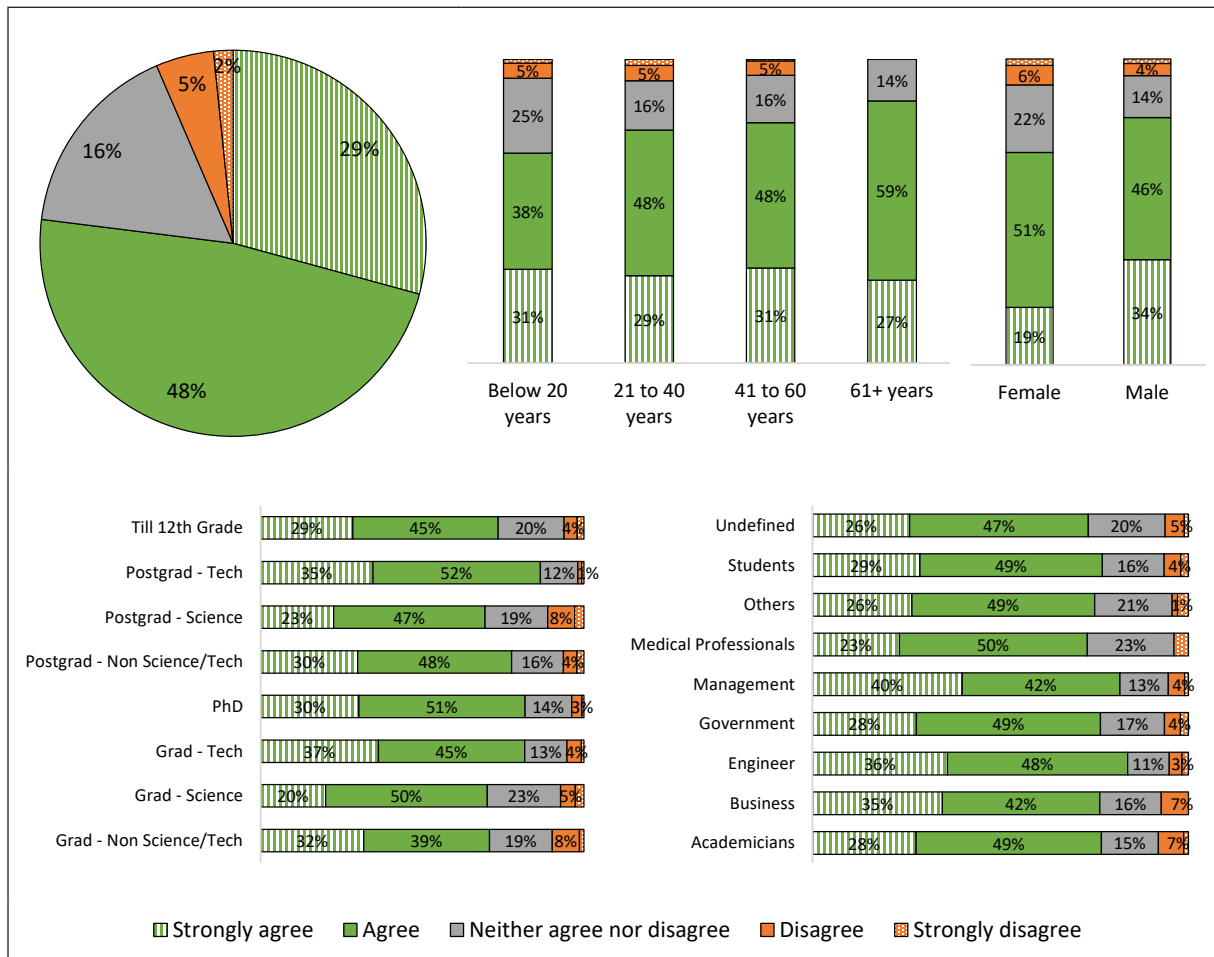
Fig. 19 Indian government should enhance financial investment for AI development (Q 23b)

Although a positive attitude toward the government spending more money for the promotion of AI sector was observed, answer was equivocal to the question whether AI developers and start-ups should be provided any tax breaks? Only 46% of the participants agreed with tax exemptions and 34% were neutral in their opinion. Age group above 61 years stood out with 62% supporting, while the categories post graduates (science), academicians and medical professional had lesser number of members supporting this idea (Fig. 20).
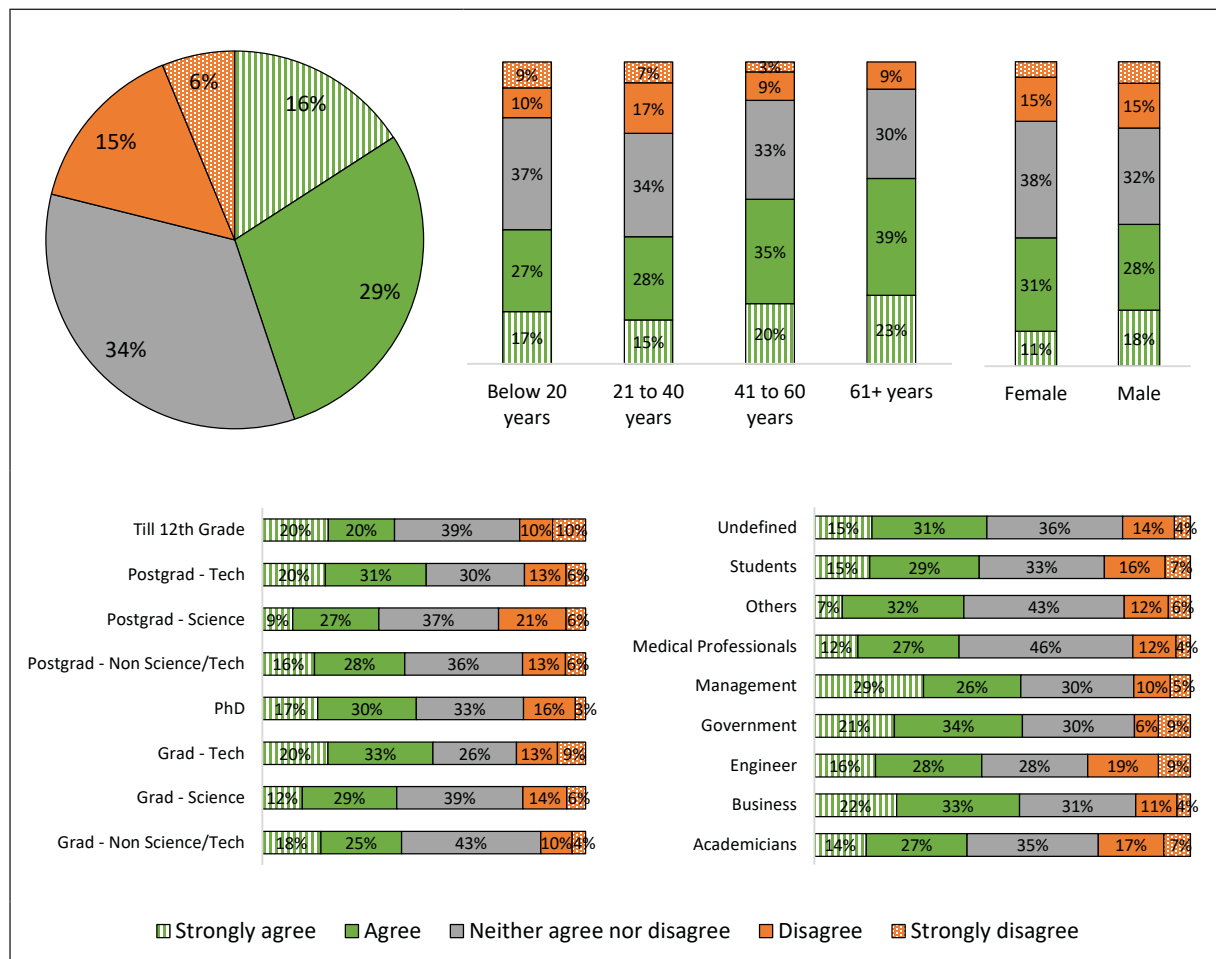
Fig. 20 Tax break for AI developers (Q 23C)

Awareness and adoption of AI

In order to develop effective awareness programme on any topics it is indispensable to understand the sources of information on which the public is relying on. As per the result of current study scientific journals and magazines got maximum vote (64%; Fig. 21) as the depended medium for updating information on the AI. This interesting observation could be result of the domination of post-graduates and PhD holders in the respondent population. Newspapers continued as an important medium (57%), in the current flood of various social media platforms. 41% disclosed that they are getting information from their family members and friends. Amongst various social media channels YouTube (49%) was the leader, followed by Facebook (37%). Even though WhatsApp has evolved as a major medium of communication in India, only 24% were using this channel for the information on AI.
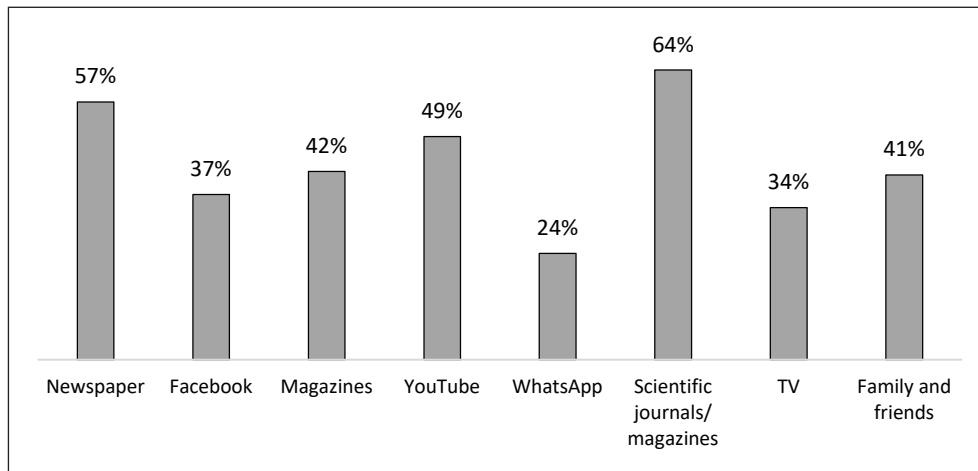
Fig. 21 Your source of information regarding AI tech is (Q 14)

Participants had a pretty good knowledge of AI being utilised in various Information Technology (IT) based services. All the five technologies utilising AI at various levels, given as the possibilities were recognised by the majority (Fig. 22). For instance 83% knew that tools of AI are integrated in 'virtual assistants' and other applications they use in day to day life, such as 'predictive search' mechanisms (80%), email spam filters' (66%) etc.
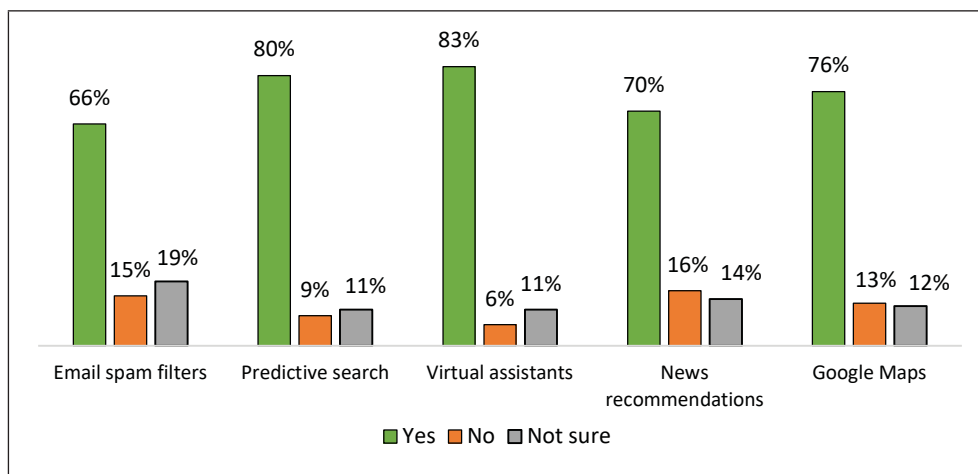

Fig. 22 Do these commonly used technologies use AI? Q 8

Although both traditional and modern media is actively involved in publicising the developments happening in the field of AI, people in India considers lack of awareness (74%) and experience with the AI based technology (75%; Fig. 23) as the major hindrance for the adoption. Lack of trust in the AI based machines (68%) and unavailability of government regulations (44%) were also chosen

by a good share of the population as reasons behind the hesitation to embrace AI. The respondents believed that media is doing their duty to promote AI and only 29% disagreed with this notion.
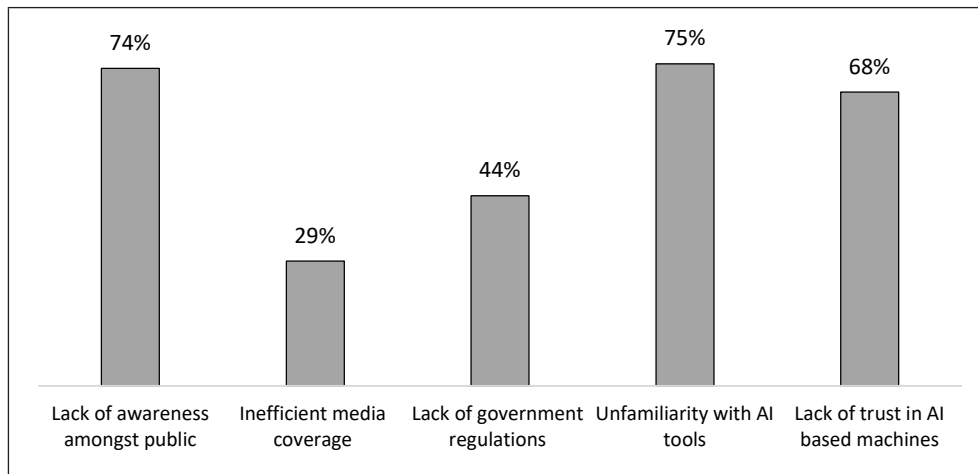

Fig. 23 Adoption of AI tech by people is hindered by (Q 15)

If the industry and policy makers aim to boost the acceptance and popularisation of AI technology, in the opinion of Indians, it is essential to come out with trustworthy and safe AI (91%; Fig. 24) and enhancing the effective dialogue with public (86%; Fig. 25). They resonated their answer for the question *'which factor blocks the adoption? (Q 15)'* and confirmed that enhancing familiarity with AI tech (89%; Fig. 26) is the key to increase in the acceptance. An overwhelming number of respondents felt (53% strongly agreed and 39% agreed; Fig. 27) that India should launch more education and awareness programmes on AI. These opinions were unwavering through age, gender and education and occupation.
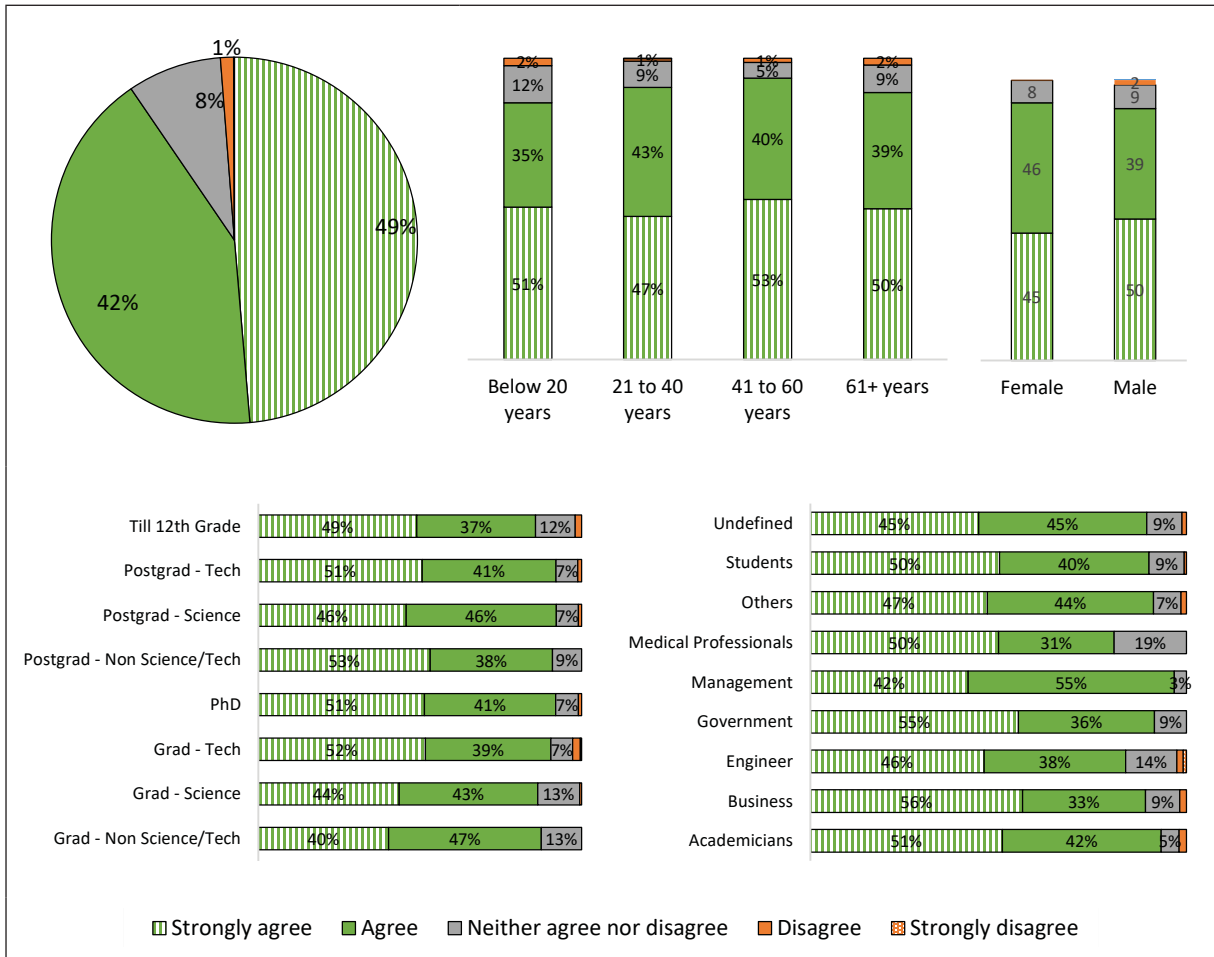
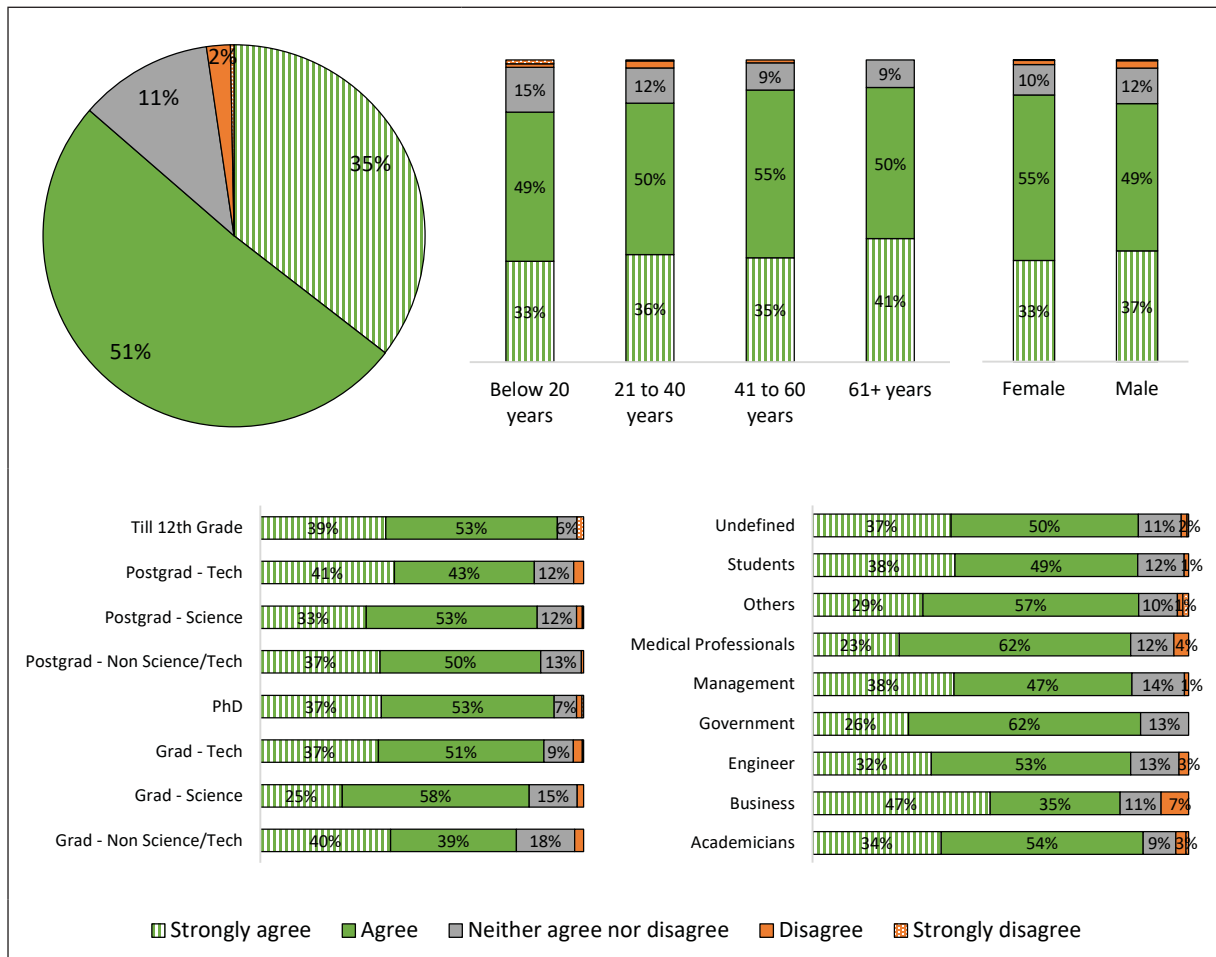*Fig. 24   Developing Trustworthy and safe AI tech (Q 20a)*

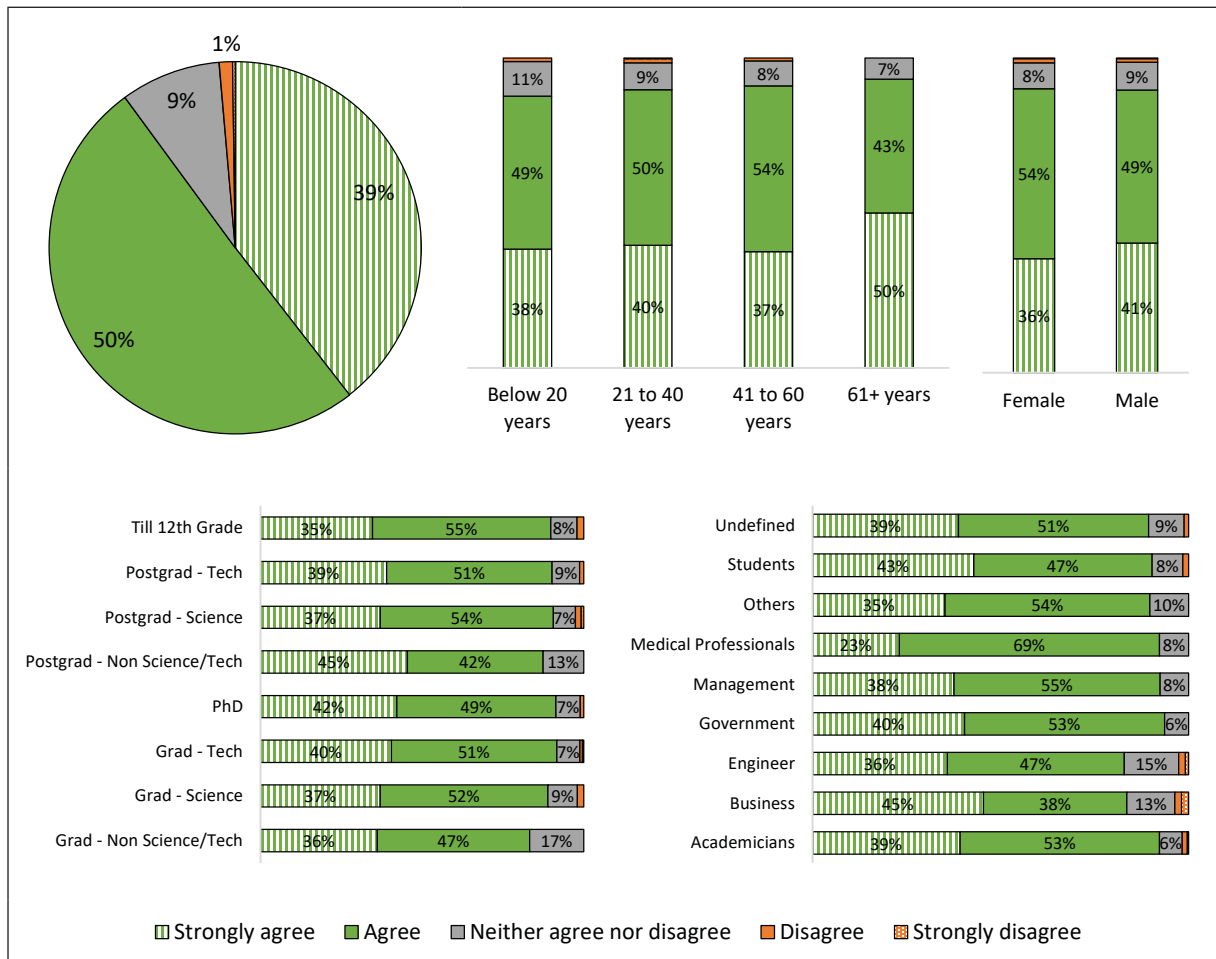*Fig. 25 Effective interaction between AI industry and public (Q 20c)*

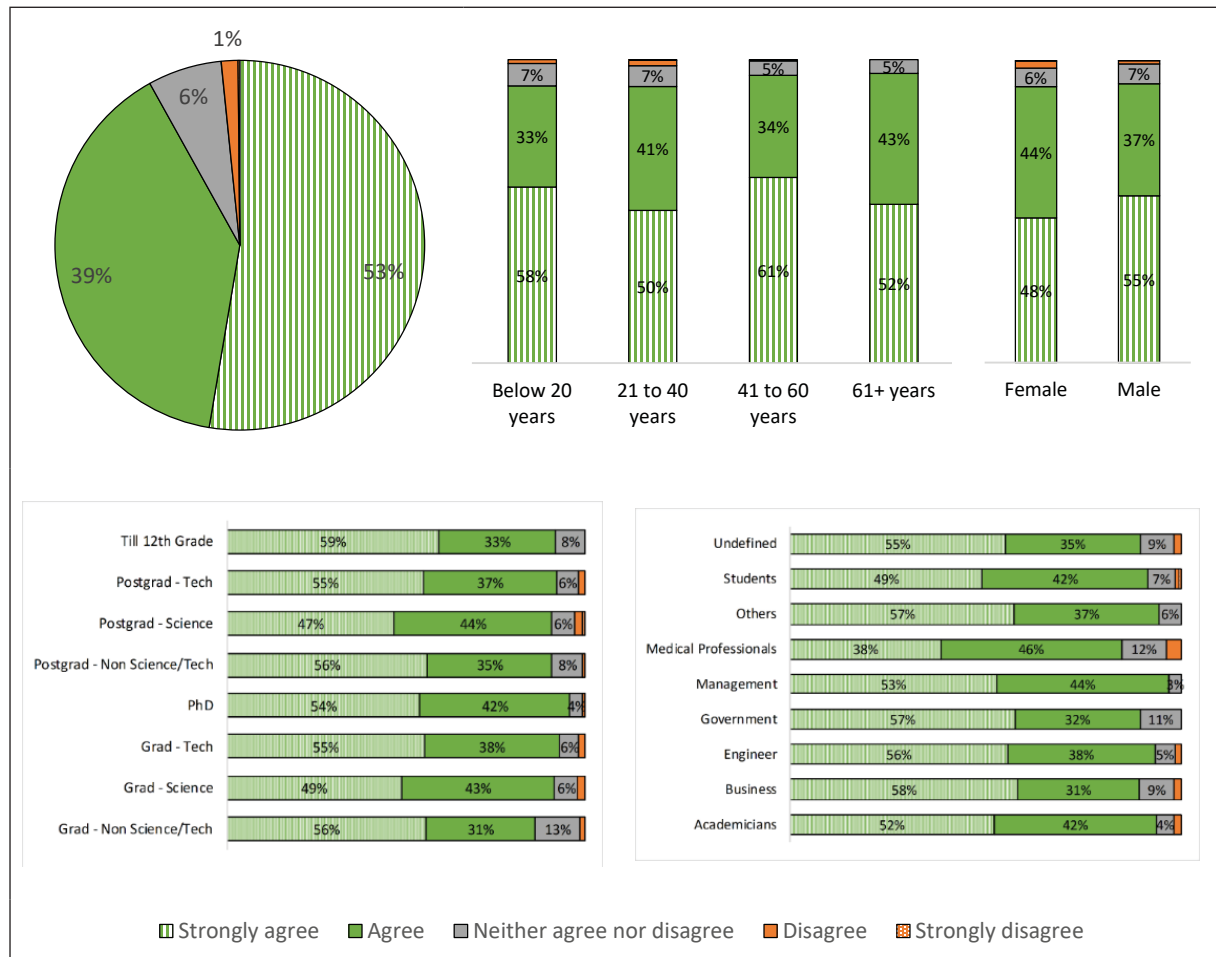*Fig. 26 Making public familiar with AI (Q 20b)*

Fig. 27 India needs more education and awareness programmes on AI (Q 23 E)

Respondents also expected more government intervention to address public concerns (76%; Fig. 28) arising from this novel technology to make them confident to embrace it. Indians were keen to establish an independent agency to ensure transparent and responsible AI technology and only 5% of the respondents disagreed with this suggestion (Fig. 29). Similar result was obtained across the demographical categories, age, gender and educational qualifications. However, only one out of the two medical professionals agreed with having such an institution to observe the AI and stood apart from the other occupation classes.
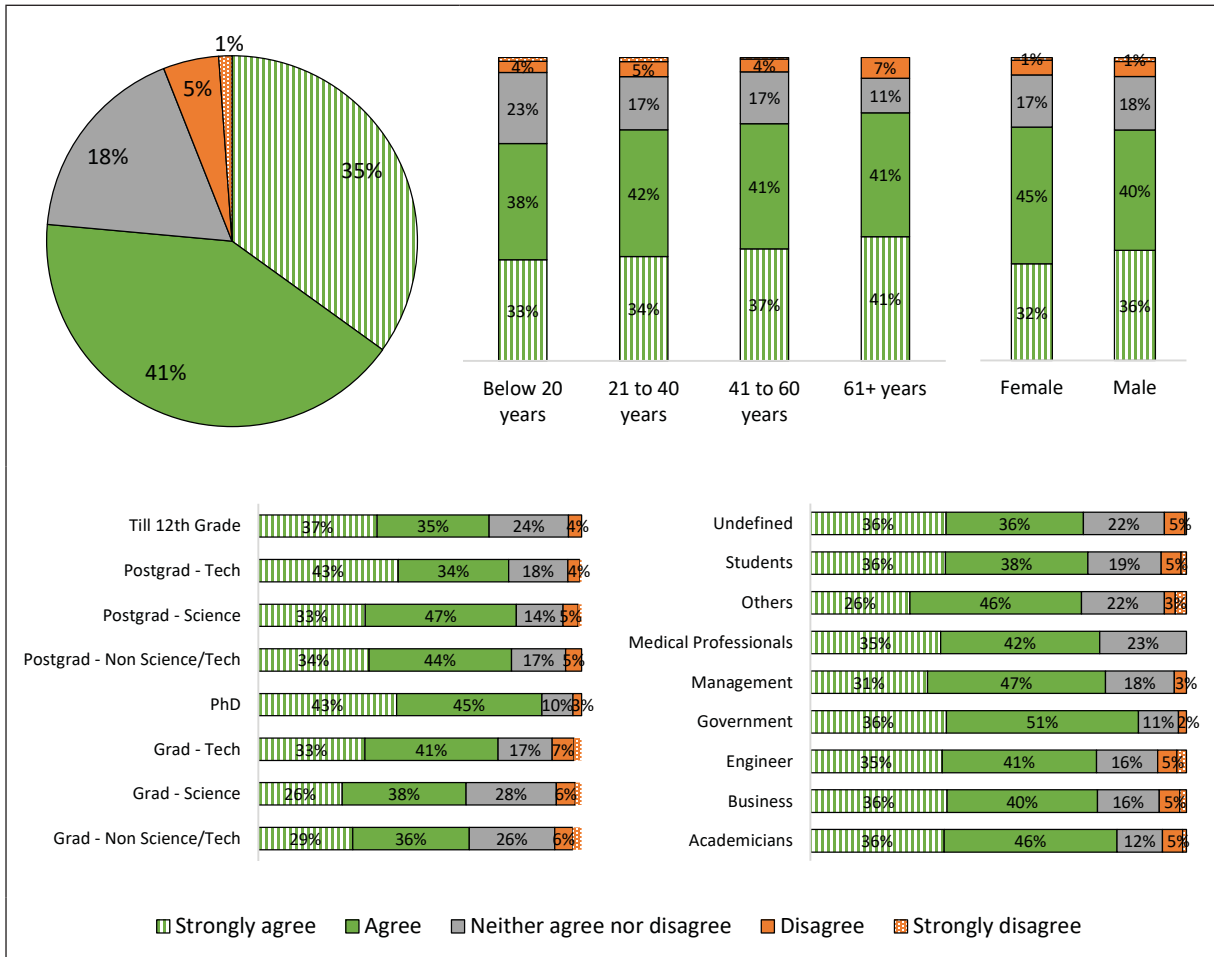
Fig. 28 Government intervention to manage and address public concerns (Q 20d)
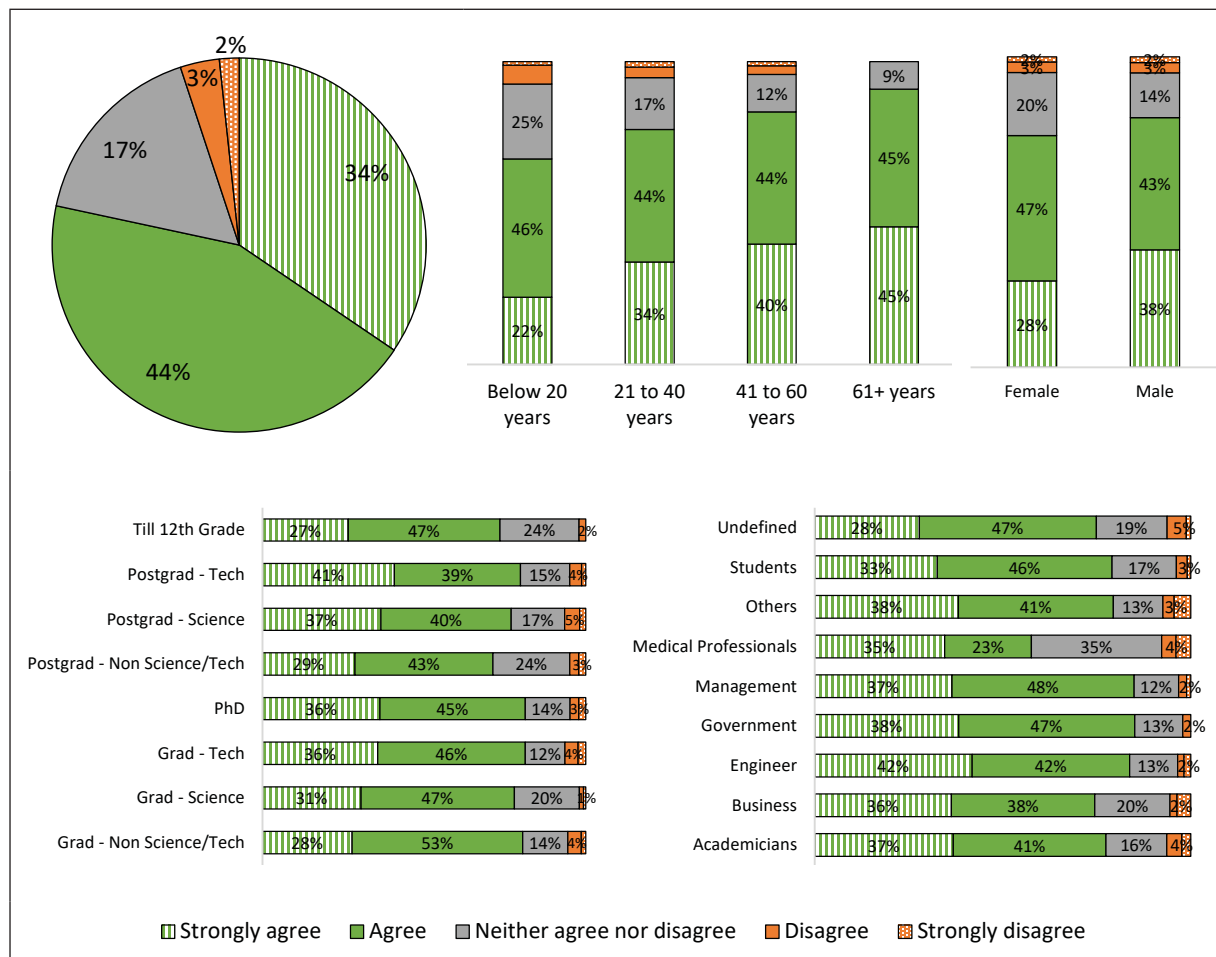
Fig. 29 An independent agency to ensure transparent and 'responsible' AI tech (Q 23d)

In order to elucidate the picture of trusting and accepting AI by Indians, a couple of queries on the two topics being debated all over the world - security of the personal data collected by the AI systems and machines with autonomy – were also added to the questionnaire. The answer to the question, who is responsible for the *'security and protection of private information collected by AI machines'*? (Fig. 30) 48% Indians answered that it is the duty of the company which collects and store such information. People also voted for the developer of the technology (28%) and the government (16%) for taking care of this task. It was only 7% suggested that user/consumer of the technology is responsible for the security and protection of the information. One out of the two people participated in the current study put this responsibility on the company who collects and stores the data, across different the age groups. However 43% of the respondents below 20 years felt that it is the obligation of the company who developed the technology and medical professionals (38%) resonated this opinion. Interestingly very few (15%) government employees supported this idea, and preferred the the responsibility to lie with the company handling the data. Interestingly there were respondents who suggested that "no one is responsible" for the security of the private

data collected by AI (less than 3%); they were from the demographics students, graduates (both science and technology), engineers, government employees.
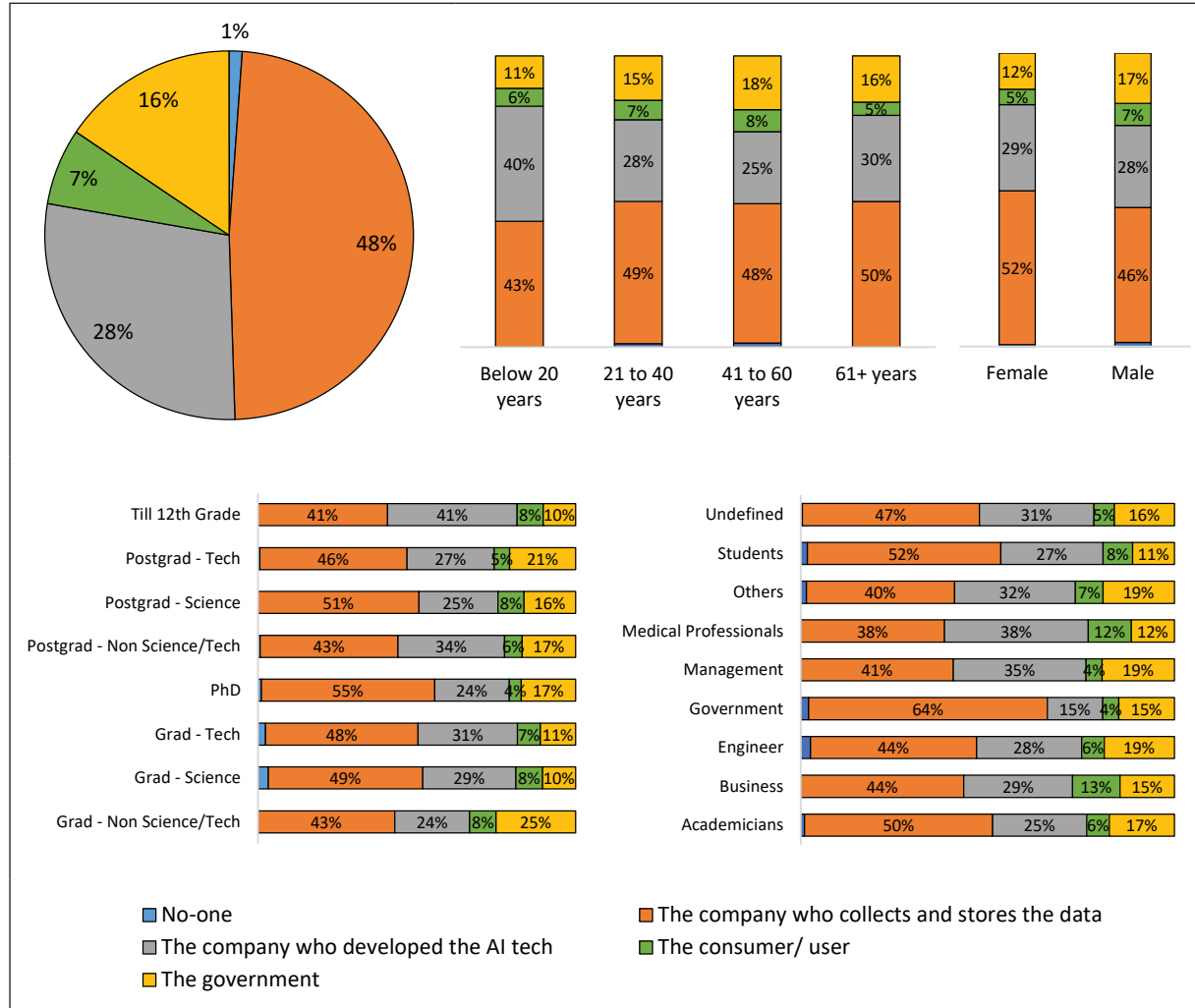

Fig. 30 Security and protection of private information collected by AI machines is the responsibility of (Q 22)

Autonomous machines are expected to hit the market very soon and India is not going to be an exception. In response to the query who holds the responsibility in an accident involving human and AI machine majority of the Indians (64%) pointed towards the company that made the machine. Some respondents believed that human involved (13%), machine (8%) and government (4%) also could be blamed for such an accident. Noticeably 10% of the participants felt that responsibility of such incidents cannot be put specifically on any one. Although the notion of responsibility of accidents to be borne by the company made the machine remained the same across the gender

and other demographics there was a good representation of the people attributing the blame on AI machine (19%) in the age group below 20 years. Differing from other demographic categories very few people above 60 years (2%), PhD holders (4%) and management professionals (6%) supported the idea 'no one is responsible for such mishaps' (Fig. 31).
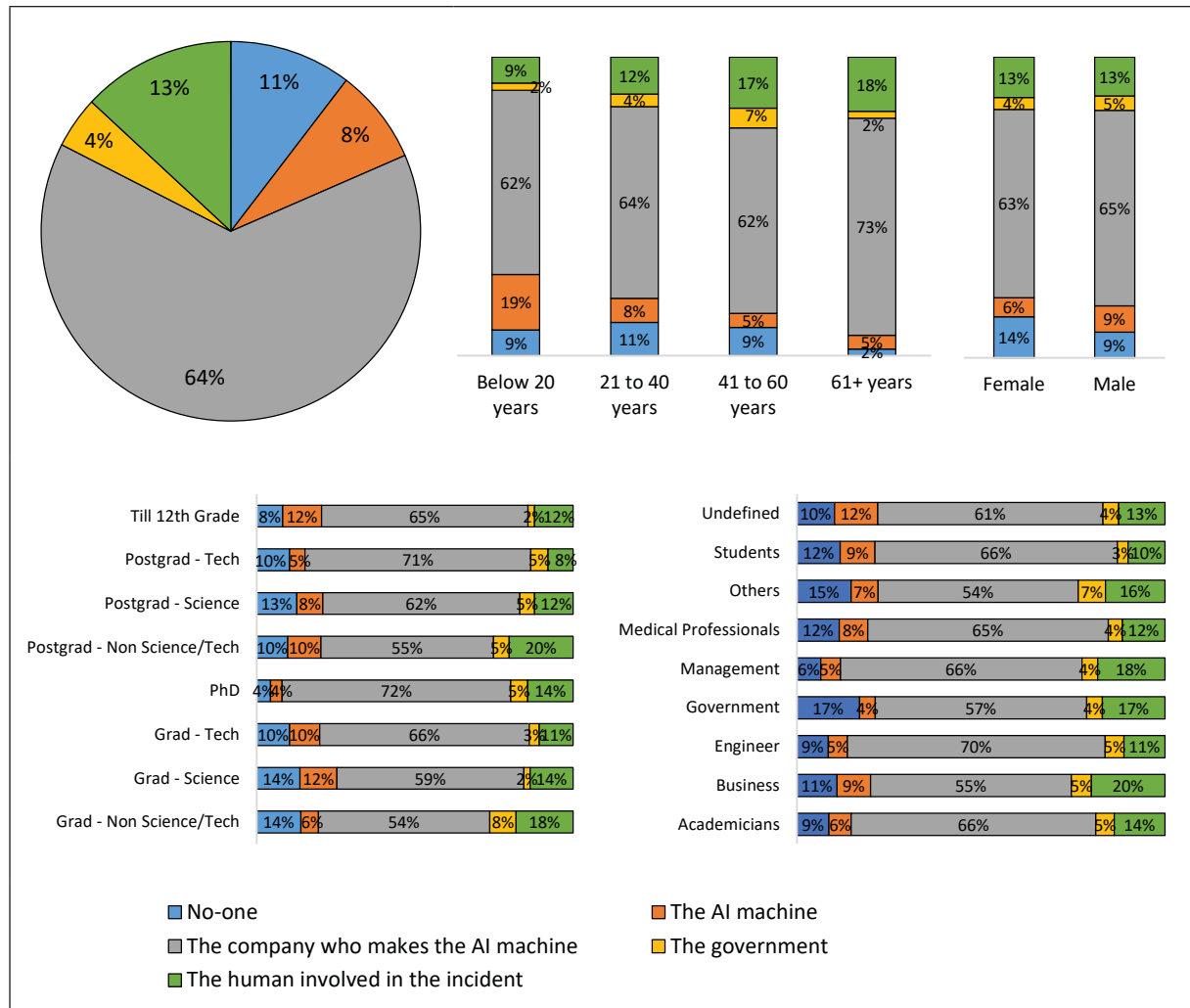

Fig. 31 In event of an accident caused by an AI machine, who is responsible? (Q 21)

AI in day to day life

Fourth industrial revolution and AI based autonomous machines supporting human beings in various realms of life is not far away. Having knowledge of whether Indians are comfortable with AI intervening their day to day activities, and the situations they resist the presence of such machines

could be useful for industry and policy makers to prioritise their goals and educational institutions to come out with training programmes making people fit for adapting with the AI integration. Amongst the people participated in the present study, 39% were comfortable to hand over the tasks such as making appointments, answering calls, handling purchase etc. to an AI agent. Women showed more apprehension over men on AI handing these activities. Respondents over the age of 61years (59%; Fig. 32) were happier in AI doing such tasks, while postgraduate in science, graduates (non-science and tech) and education category till 12 grade were divided almost equally into the comfortable, uncomfortable and neutral groups and were with lesser number of members supporting the AI doing their routine jobs. Amongst various occupation categories medical professionals were the most uncomfortable (38%), whereas 53% of government employees responded positively.
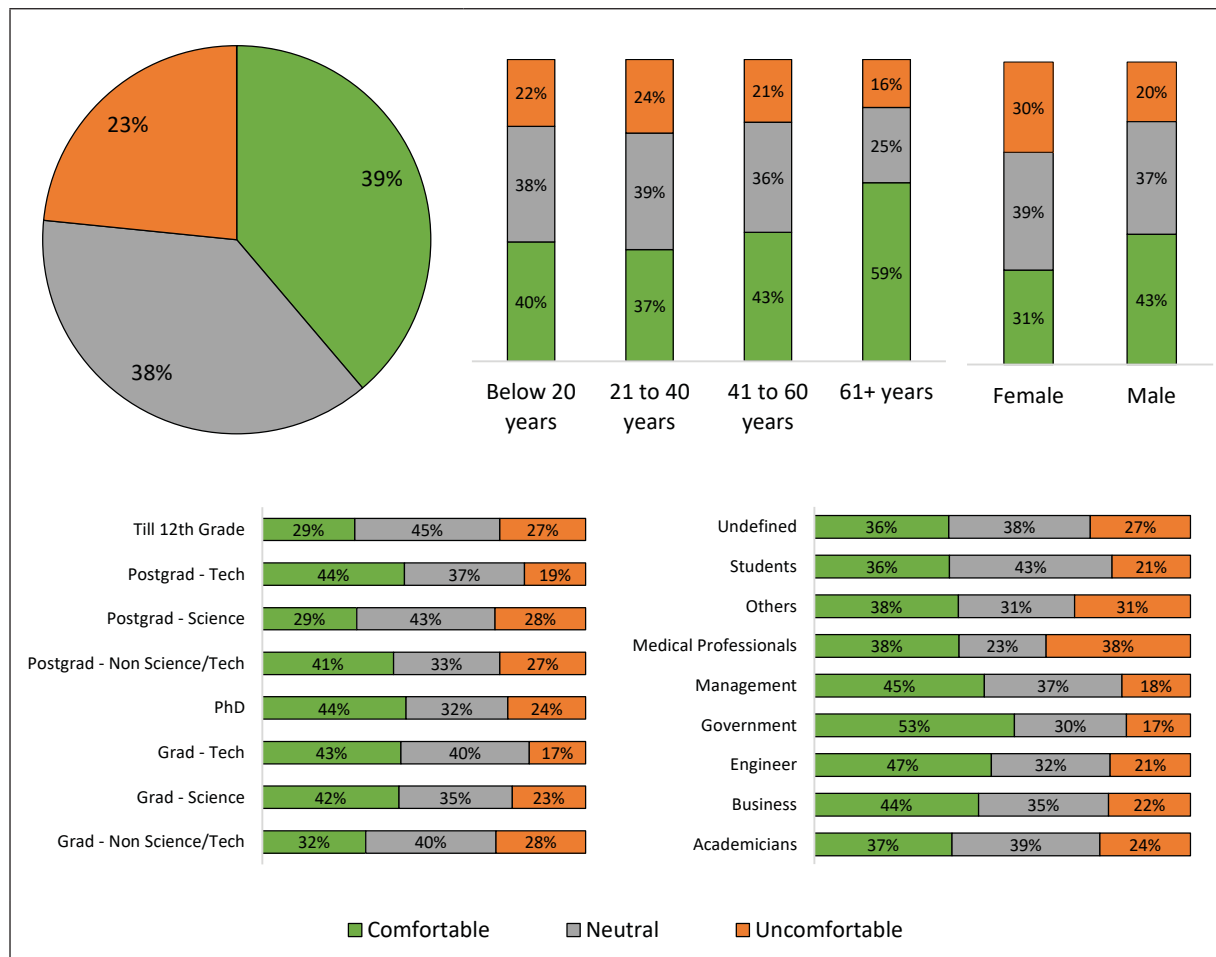

Fig. 32 How would you feel about an AI Agent handling your daily activities (such as making appointments, answering calls, handling your purchases, etc.)? Q 24

Indians preferred the support of AI based personal assistants for online retail (70%) and travel (69%). Even though the healthcare and education are projected as the areas expecting more AI integration and attracts the attention of the developers, our results show that people are not much in favour of AI personal assistants (38% and 34% respectively; Fig. 33) in these sectors.
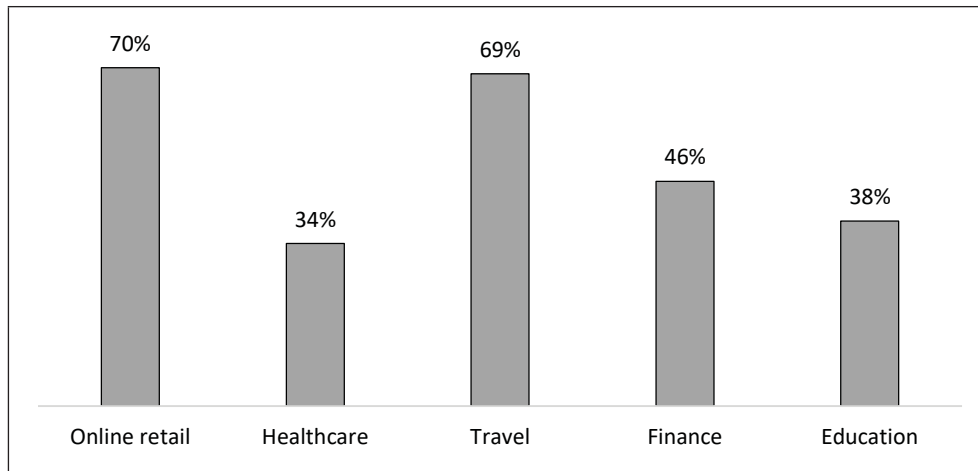

Fig. 33 I would opt for an AI based personal assistant for (Q12)

Respondents were asked, would they continue the conversation after knowing that it is an AI agent on the other side. This question is relevant since the new conversation agents such as Google Assistant which holds the potential to initiate and maintain conversation with near human accuracy is expected to have more popularity in coming years. Indians (67%) were not hesitant to have conversation with AI agents and this trend was consistent across various demographics studied (Fig. 34).
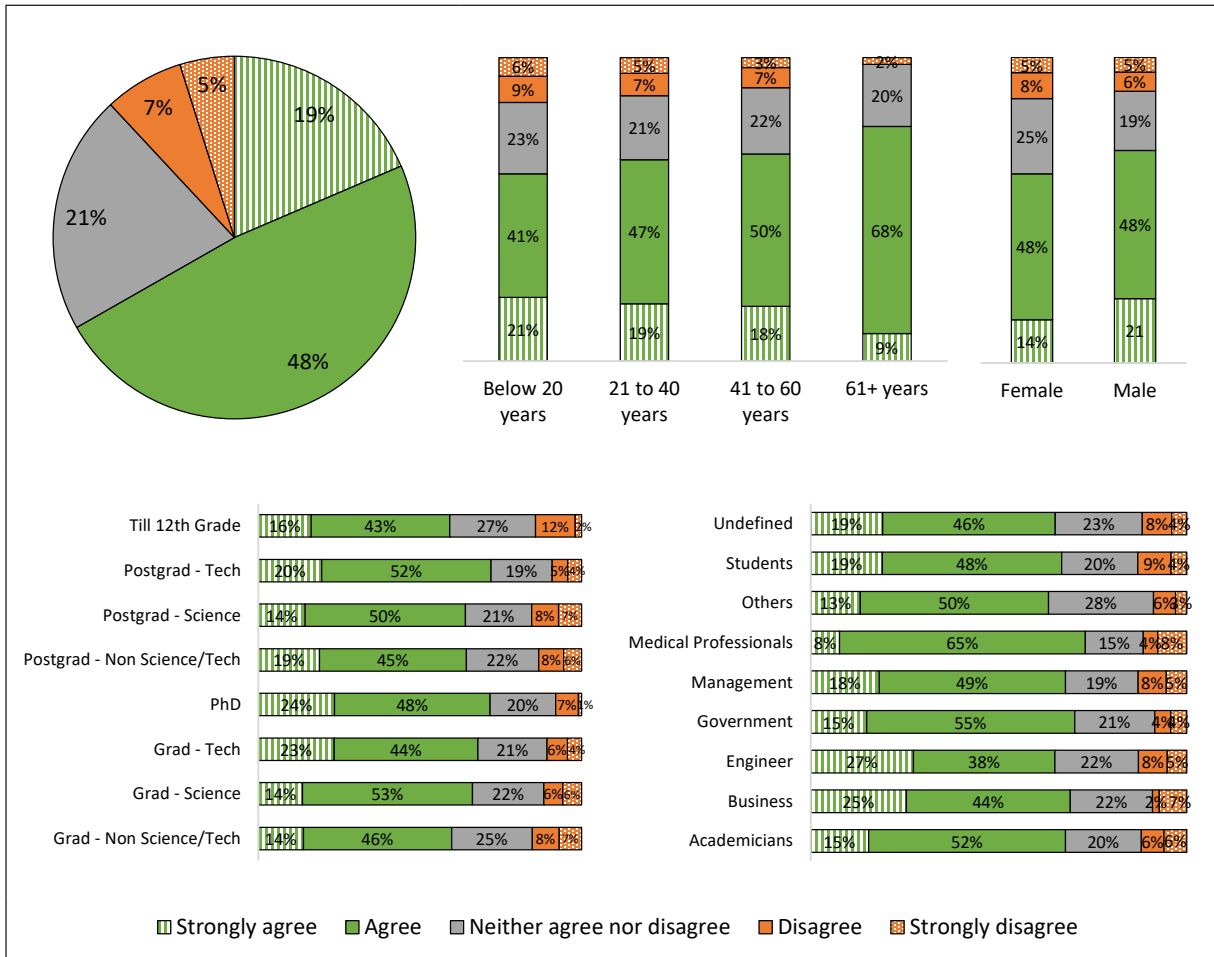
Fig. 34 You will continue if you KNEW you were having a conversation with an AI based agent (Q 26)

Virtual assistants developed by different companies are famous in the names given to them. Some of them hold a feminine name while others are masculine in nature. Gender neutral names are also not rare. Siri (Apple), Alexa (Amazon) Echo (Google) are a few to name. Although 42% of the respondents noticed no bias, 34% felt that there exists gender difference in naming the AI agents. Youngsters (below 20 years; Fig. 35) and those who have an educational qualification till 12ᵗʰ grade believed in the existence of such discrimination. The medical professionals and government employees stood out in the demographic category, occupation; the former had only 4% and the latter 13% of members believing in the gender bias while giving names to the AI personal assistants, which was noticeably lesser than other groups. Interestingly one out of the two medical professionals participated in the present study 54% were not sure whether there is any bias in naming AI agents.
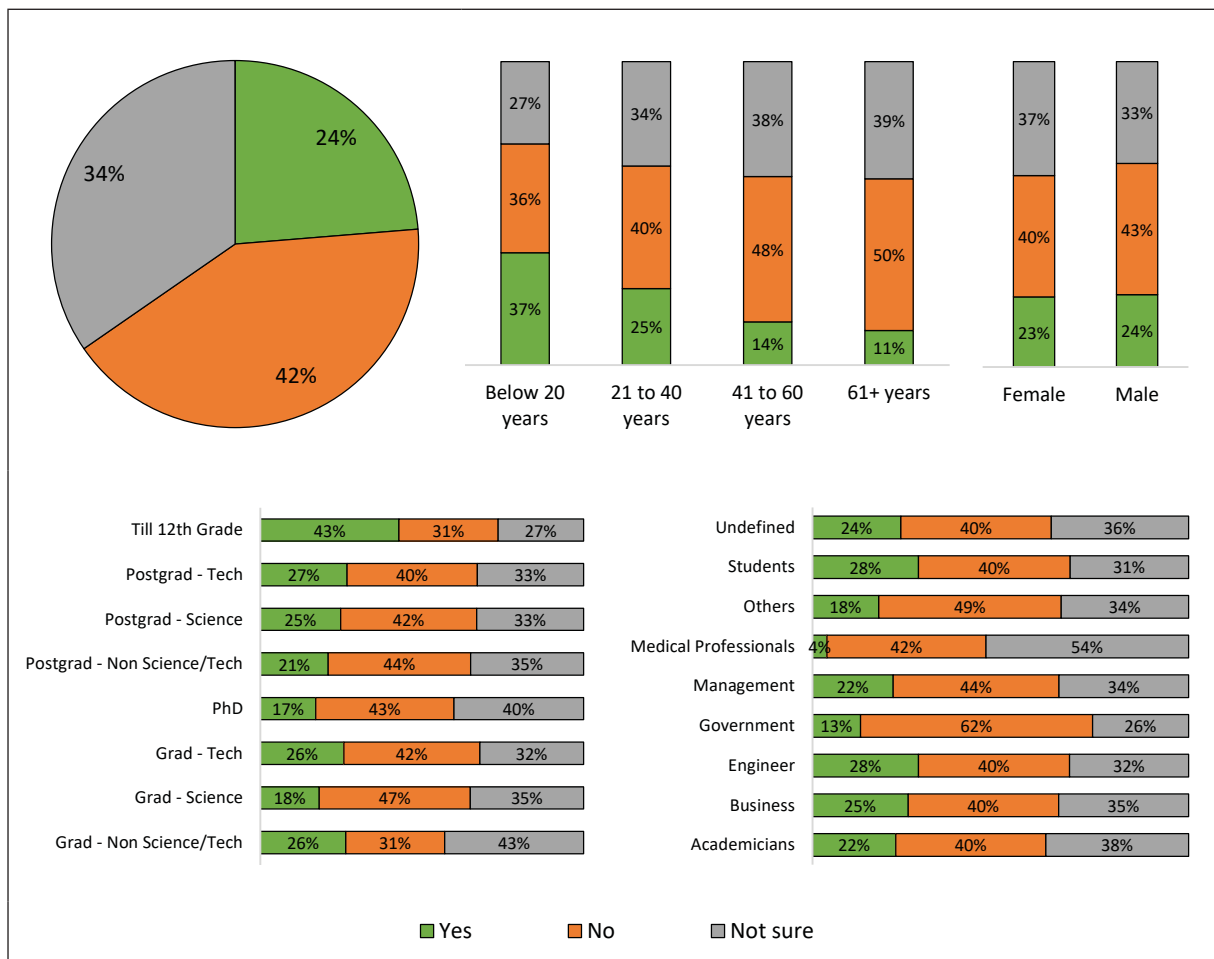
Fig. 35 Is there a gender bias in naming an AI based personal assistants? (Q 25)

Conclusion

Artificial Intelligence (AI) is a quickly emerging disruptive technology which is expected to influence humanity in an unprecedented way. Its friction free integration into the society requires the convergence of the expertise of scientists, social scientist, industrialists and policy makers and a clear understanding of the mindset of the consumers of this technology, the general public. The present study provides insights into the perception and preparedness of people from various strata of the Indian society to accept this novel and emerging technology. However, it is undisputed that India is a 'cultural mosaic' where people vary in their expectations, acceptance and values, attributed to any interventions from the side of the science and technology. Hence, it is expected that in the near future more studies focusing various socio-economical and cultural groups in India and elaborating their perceptions and attitude towards various AI based devices, will be taken up and would work as the pointer for the industry and policy makers to catalyse the conflict free incorporation of this vital technology into the Indian society.

Further reading

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APPENDIX 1

Artificial Intelligence (AI): A Survey on Public Perception

Artificial Intelligence (AI) based technologies are making strides and have started to influence various aspects of human life. Artificial intelligence can be defined as a "set of computer science techniques that enable systems to perform tasks normally requiring human intelligence and empower computers to learn and adapt independently."

As part of a project titled "Managing Public Perception and Public Acceptance of Public Risks Associated with New and Emerging Technologies through Science and Technology Communication", National Institute of Advanced Studies (NIAS) Bangalore, is involved in research to understand the perception of AI by people from various sections of Indian society. This project is funded by the National Council for Science Technology Communication (NCSTC), Department of Science and Technology, Government of India.

This survey is aimed to know your view on different dimensions of AI technologies. Filling of the questionnaire may take approximately 7 to 10 minutes. The information collected would be kept confidential and would be used only for research purposes. No financial compensation would be given for taking part in the survey.

If you need further information about this study you could contact Dr Sai Baba (msaibaba@nias.res.in) or Dr V.V Binoy (vvbinoy@nias.res.in), faculties of NIAS coordinating this research.

We greatly appreciate your time.
Thank you very much.

* Required

1. **Age:** *
   Mark only one oval.

   ◯ Below 20 years
   ◯ 21 to 40 years
   ◯ 41 to 60 years
   ◯ 61+ years

2. **Gender:** *
   Mark only one oval.

   ◯ Female
   ◯ Male
   ◯ Transgender
   ◯ Prefer not to say
   ◯ Other: _____

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3. **Educational Qualifications:** *
Mark only one oval.

- ( ) 10th Grade
- ( ) 12th Grade
- ( ) B.Sc
- ( ) B.Tech/ B.E/ B.Arch
- ( ) B.A
- ( ) M.Sc
- ( ) M.Tech/ M.E/ M.Arch
- ( ) M.A
- ( ) PhD
- ( ) Other:_____

4. **Occupation**

_____

5. **State**

_____

6. **From:** *
Mark only one oval.

- ( ) Rural
- ( ) Town
- ( ) City

7. **AI will change the way people live and work in the next 10 years.** *
Mark only one oval.

- ( ) Positively
- ( ) Negatively
- ( ) No change
- ( ) Don't know

8. **Do these commonly used technologies use AI?** *
Mark only one oval per row.

	Yes	No	Not sure
Email spam filters	( )	( )	( )
Predictive search	( )	( )	( )
Virtual assistants (Siri, Alexa, Duo etc.)	( )	( )	( )
News recommendation on Facebook	( )	( )	( )
Google Maps for real-time traffic information	( )	( )	( )

9. **Who would you prefer to do these jobs:** *

Mark only one oval per row.

	Humans	AI Machines
Agriculture	◯	◯
Healthcare	◯	◯
Education	◯	◯
Defence	◯	◯
Finance	◯	◯
Administration	◯	◯
Transport	◯	◯

10. **Do you think AI can significantly impact these sectors? If Yes, when?** *

Mark only one oval per row.

	Less than 5 years	5 to 10 years	10 to 20 years	Never
Agriculture	◯	◯	◯	◯
Healthcare	◯	◯	◯	◯
Education	◯	◯	◯	◯
Defence	◯	◯	◯	◯
Finance	◯	◯	◯	◯
Administration	◯	◯	◯	◯
Transport	◯	◯	◯	◯

11. **AI is NOT a risky technology** *

Mark only one oval.

◯ Strongly agree

◯ Agree

◯ Neither agree nor disagree

◯ Disagree

◯ Strongly disagree

12. **I would opt for an AI based personal assistant for: (Tick all that apply)** *

Check all that apply.

☐ Online retail

☐ Healthcare

☐ Travel

☐ Finance

☐ Education

13. **The major risks from AI are: (Tick all that apply)** *

Check all that apply.

☐ Job loss

☐ Loss of privacy

☐ Security issues

☐ Loss of human control over the AI machines

☐ Replacement of humanity by machines

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14. **Your source of information regarding AI tech is: (Tick all that apply)** *
Check all that apply.

- [ ] Newspaper
- [ ] Facebook
- [ ] Magazines
- [ ] YouTube
- [ ] WhatsApp
- [ ] Scientific journals/ magazines
- [ ] TV
- [ ] Family and friends

15. **Adoption of AI tech by people is hindered by: (Tick all that apply)** *
Check all that apply.

- [ ] Lack of awareness amongst public
- [ ] Inefficient media coverage
- [ ] Lack of government regulations
- [ ] Unfamiliarity with AI tools
- [ ] Lack of trust in AI based machines

16. **How does AI impact job security in India?** *
Mark only one oval per row.

		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
a	AI will eliminate more jobs than it creates.	◯	◯	◯	◯	◯
b	One will have to acquire new skills to adapt with AI based jobs	◯	◯	◯	◯	◯
c	Indian education system is not preparing youth for AI based jobs.	◯	◯	◯	◯	◯
d	AI will widen the gap between Rich and Poor.	◯	◯	◯	◯	◯
e	India doesn't have the human resource to develop cutting edge AI tech	◯	◯	◯	◯	◯

17. **Preparing employees to adapt with new AI tech in the workplace is the responsibility of the: (Choose one)** *
Mark only one oval.

- ◯ Employer
- ◯ Central Government
- ◯ State Government
- ◯ Individual

18. **The youth could be empowered to adapt with the forthcoming AI revolution by providing training in (Tick all that apply)** *

Check all that apply.

☐ "Soft" skill training (Communication, Arts, Critical thinking, etc.)

☐ "Hard" skill training (Math, Science, Data Analysis)

☐ Coding and Programming

19. **My profession will be replaced by AI tech within:** *

Mark only one oval.

◯ 5 years

◯ 10 years

◯ 20 years

◯ More than 20 years

◯ Never

20. **Public acceptance of AI could be enhanced by:** *

Mark only one oval per row.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
a Developing Trustworthy and safe AI tech	◯	◯	◯	◯	◯
b Making public familiar with AI tech	◯	◯	◯	◯	◯
c Effective interaction between AI industry and public	◯	◯	◯	◯	◯
d Govt intervention to manage and address public concerns	◯	◯	◯	◯	◯

21. **In event of an accident caused by an AI machine, who is responsible? (Choose one)** *

Mark only one oval.

◯ The AI machine

◯ The human involved in the incident

◯ The company who makes the AI machine

◯ No-one

◯ The government

22. **Security and protection of private information collected by AI machines is the responsibility of: (Choose one)** *

Mark only one oval.

◯ The company who developed the AI tech

◯ The consumer/ user

◯ The government

◯ The company who collects and stores the data

◯ No-one

23. In your opinion: *
Mark only one oval per row.

		Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
a	India can compete with AI development globally	◯	◯	◯	◯	◯
b	Indian government should enhance financial investment for AI development	◯	◯	◯	◯	◯
c	Tax break for AI developers	◯	◯	◯	◯	◯
d	An independent agency to ensure transparent and 'responsible' AI tech	◯	◯	◯	◯	◯
e	India needs more education and awareness programmes on AI	◯	◯	◯	◯	◯

24. How would you feel about an AI Agent handling your daily activities (such as making appointments, answering calls, handling your purchases, etc.)? *
Mark only one oval.

◯ Comfortable

◯ Neutral

◯ Uncomfortable

25. Is there a gender bias in naming an AI based personal assistants? *
Mark only one oval.

◯ Yes

◯ No

◯ Not sure

26. You will continue if you KNEW you were having a conversation with an AI based agent. *
Mark only one oval.

◯ Strongly agree

◯ Agree

◯ Neither agree nor disagree

◯ Disagree

◯ Strongly disagree

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1. **Document No. and Date:** NIAS/NSE/U/RR/070/2019

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6. **Authors(s):** M. Sai Baba, V.V. Binoy, Tanvi Vasan and H.J. Subhash

7. **Originating School:** Natural Science and Engineering

8. **Programme:** None

9. **Collaboration:** None

10. **Sponsoring Agency:** National Council for Science and Technology Communication (NCSTC), Department of Science and Technology

11. **Abstract:**
AI is identified as one of the emerging technologies which would have bearing on the lives of the people and society in the coming years. As part of a project "Managing Public Perceptions and Public Acceptances of Public Risks Associated with New and Emerging Technologies through Science and Technology Communications" funded by the NCSTC, DST, NIAS, has conducted an online survey to know various dimensions of the perceptions on AI and the results are reported in this report.

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13. **Security Classification:** Unrestricted

14. **ISBN:** None