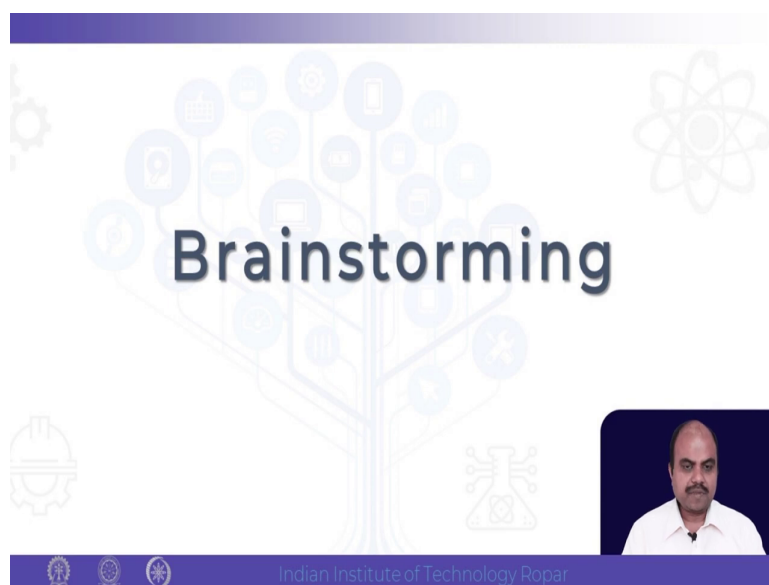


Product Engineering and Design Thinking
Prof. Pranab Kumar Dan
Rajendra Mishra School of Engineering Entrepreneurship
Indian Institute of Technology, Kharagpur

Module - 03
Design Thinking and Concept Development
Lecture - 14
Conceptual Design: Tools and Techniques



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Brainstorming

- Brainstorming is a group creativity technique - to find a solution for a problem by generating a list of ideas.
- The term was popularized by Alex Faickney Osborn in 1953 through the book Applied Imagination.
- Arrange the meeting for a group of the right size and makeup (typically 4-8 people)
- Write the initial topic on a flipboard, whiteboard or other system where everyone can see it. The better defined, and more clearly stated the problem, the better the session tends to be.



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Ok. Brainstorming now brainstorming method we are going to learn as is one of the widely used method in industry. So, in brainstorming it is generally done is a creative technique in which it is used first of all generate a lot of ideas. So, it was initially invented and popularized basically popularized by Osborn in 1953 in his book named as Applied Imagination.

So, typically brainstorming is done in a small group it could be larger also typically generally 4 to 8 people who sat together and generally start generating ideas. So, there is a flipboard, whiteboard, electronic board or maybe just normal board where people are going to one person can actually write it there.

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Brainstorming

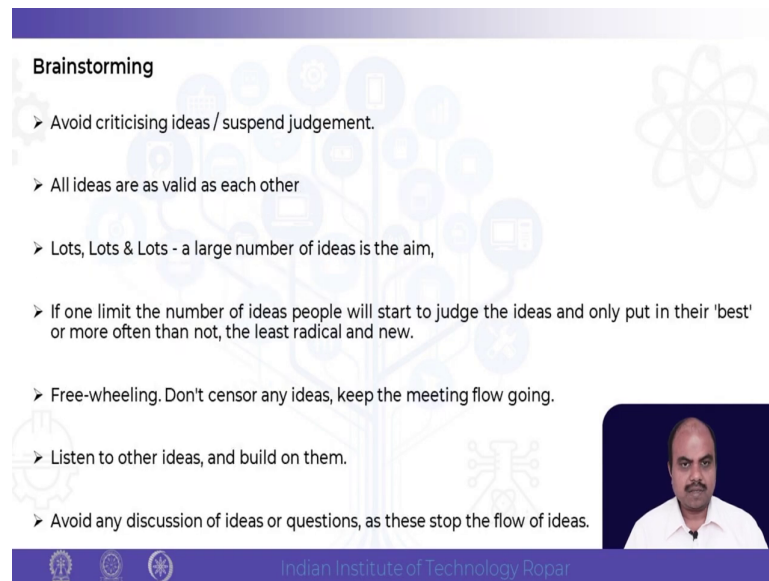
- Make sure that everyone understands the problem or issue
- Have someone facilitating to enforce the rules and write down all the ideas as they occur (the scribe can be a second person)
- Generate ideas - either in an unstructured way (anyone can say an idea at any time) or structure (going round the table, allowing people to pass if they have no new ideas).
- Clarify and conclude the session.

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So, first thing is it is important that everybody understand the problem what exactly the problem is. So, have someone to facilitate and enforce the rules and write down the ideas that is the rules are there in brainstorming that we are going to discuss and it is better that somebody is going to facilitating as somebody is writing.

So, facilitating some it is a two more person is required apart from this group of people generate idea, generate ideas means it is a unstructured either in unstructured way or it is a you know little bit structured way and ultimately be able to clarify and conclude the session.

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Brainstorming

- Avoid criticising ideas / suspend judgement.
- All ideas are as valid as each other
- Lots, Lots & Lots - a large number of ideas is the aim,
- If one limit the number of ideas people will start to judge the ideas and only put in their 'best' or more often than not, the least radical and new.
- Free-wheeling. Don't censor any ideas, keep the meeting flow going.
- Listen to other ideas, and build on them.
- Avoid any discussion of ideas or questions, as these stop the flow of ideas.

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So, here first thing is avoid criticism, avoid criticism means a suspend judgment when somebody is generating ideas the idea brainstorming is when we are going to take the ideas from other and put it in the board. So, we are not going to the assess the assessment or evaluation of the ideas can be done later then all ideas are valid as each other.

So, which means that we are not going to judge the ideas we are going to tell good thing ok this idea is there and we are going to write it down that is it and lots and lots of idea lots and lots of ideas means it has been research has been found that when more than ideas are there more number of ideas the chances are finding out the best solution is much higher than when the less number of ideas there.

So, generating lots of ideas is very important. So, one of the limit of the number of ideas generated will start to judge because we are not trying to find out the best solution we will

have to find out radically new solution different solution. And free wheeling do not censor any other ideas again same thing we are talking, but is very important that we do not censor ideas the meeting is should be flow and generate more and more ideas and listen to each other idea.

So, if somebody is giving you one idea try to listen to it and modify it may be and improve an idea there is self and you can get another idea. So, building each other idea is important then avoid discussion on ideas or questions as they stop the flow which means that we are not going to focus on one idea multiple ideas we are going to focus go to the next idea.

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Brainstorming

- Brainstorming Considerations
- Try having two persons a facilitator and a recorder.
- The recorder should try not to rephrase ideas. If an idea is not clear, ask for a rephrasing that everyone can understand.
- If the idea is too long to record, work with the person to concise rephrasing.
- Keep all ideas visible.
- When ideas overflow to additional flipchart pages, post previous pages around the room so all ideas are still visible to everyone.
- The more ideas the better. Studies have shown that there is a direct relationship between the total number of ideas and the number of beneficial, creative ideas.
- Allow out-of-the-box ideas.
- Build on others ideas

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So, it is better that we have two person as a facilitator and a recorder. So, facilitator is going to ask ok now please generate the ideas ok what are the idea do we have and the recorder is going to record and write it. So, recorder should not to rephrase the ideas means the recorder

is going to idea the aim or the task of the recorder is going to write down. Rephrase is only required if somebody explains to other ideas that somebody the record tells ok this idea do you think this is the right one yeah then otherwise do not rephrase.

Then idea is long to record then we come to rephrase only then keep the idea visible every idea even older ideas whatever like in a 5 minutes 20 minutes 30 minutes we generate the ideas 30 minutes back what ideas has come up before that that we are going to record and keep it in one place it visible it should be visible.

So, when the lot of ideas we can use additional flipcards, flipchart and those things. So, more ideas is better that I have already told that it is very important that we generate lots of ideas and out of the idea ideas are more important. Then build on each other's idea and try to see that more ideas are getting generated.

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Brainstorming: Computer tools

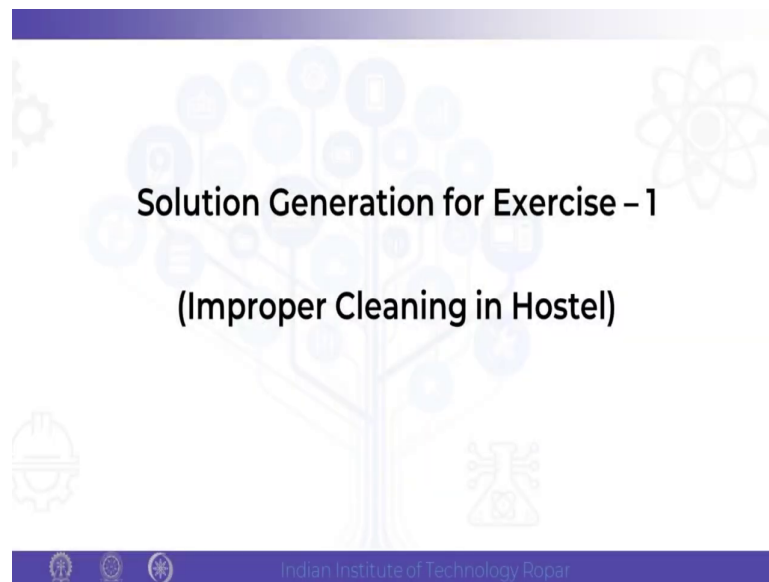
- <https://miro.com/online-brainstorm-tool/>
- <https://www.microsoft.com/en-in/microsoft-365/visio/microsoft-visio-plans-and-pricing-compare-visio-options?tab=tabs-1&activetab=tabs:primary1>
- Google Documents
- Realtime Board
Price: Free
- Bubbl.us
Price: Free for up to three mind maps.
- Freeplane
Price: Free

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There are lot of tools for also brainstorming that micro dot com has having online tool there are also Microsoft brainstorming tool in Visio the Google Docs. Google Docs as you know most of you many of you have use Google Docs there also you can use that there also we can use that tool as a mode of brainstorming then free plan we can use real board real time board we can use bubble dot u s we can use there are.

So, many other techniques other websites are there which are going to give us way to generate this use this brainstorming techniques online.

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So, now, as a for solving the this problem which is the interesting problem there are various methods can be used. So, one of the technique can be brainstorming sanitary trees then gallery methods there is so many techniques are there. So, one of the technique which is widely used in companies especially for solving this kind of problem is brainstorming technique. So, in

brainstorming technique we generally use 4 to 6 people and sit together and understand and generate the solutions.

So, what kind of solutions which you can use? So, in this there are certain rules are there first rule is that avoid criticism avoid criticism means we should not criticize each other idea and we should there are lots of ideas we should generate and then like you know censoring right. Now is the not a good idea because we are not we are not evaluating the idea very wild ideas its good then next is we can build each others idea.

So, somebody is given a little bit of idea you can build on it. So, more ideas are more better as many ideas is possible more ideas are better. So, right now these are the brainstorming method did you understood brainstorming method.

Student: Yes yes sir.

Ok so, let us start the brainstorming method and whatever ideas is coming to your mind please tell and then he is going to write it down.

So, we I think we should maintain the feedback sheet for this problem in which even the timing for the next day can be told by the person whom who whose room has to be clean.

They There is a proper that I means authority should be assigned for the that on the cleaning staff whether it is a that hostel caretaker or the cleaning they are supervisor they should check in each and every each in each and every day or hourly basis that it is quite effective solutions I think.

Ah They can check the owner random basis like not every room, but on random basis the room which they have cleaned and they can also take a feedback of the student.

Yeah he is right.

So, as sir said that a particular feedback form should be maintained. So, what I want to say is that one more data should be collected there that at what time they wake up. Ok So, suppose so, according to the time they wake up to particular like two particular sections of a cleaning staff should be maintained where one particular cleaning staff they will look upon those students whose sleep cycle is very like very different from others like they sleep at 4am and wake up at 11.

So, what happens in this cases like according to me is that like the rooms of these students will also be maintained and it will be good as well and I think that with this solution this problem could be maintained. Apart from this what could be done like the sleep cycle should not be only maintained, but the timing should be freezed one day before like it should be given like at this time my room will be available for cleaning and that can be done accordingly.

So, you mean to say a proper slot system should be.

Yeah.

Available for that and also the students like you are saying about the sleeping cycle. So, the students should also pre-booked the slot if they want to clean at a particular area irrespective to that official hours of the cleaning staff.

I think one mode should be I means provided for each floor and the student should enter their specification that in this timing I am available. So, means if we can divide that 2 I means 2 or 3 slots so, student should fill their slots and get that the cleaning staffs.

Ok.

On their rooms.

[FL] Ok, one more problem that one more solution I would like to give is that since we have discussed one of the problems is that the lack of equipment. So, the authorities should be able to provide the sufficient equipments all the cleaning and chemicals and the equipments used for cleaning and all like a mopping floors we should have floor clothes and all. So, the sufficient amount of equipment should be provided to the cleaning staff also.

Student should have that authority that they should check that whether the chemicals the chemical quality is good or not that because we means we did not rely only on authorities [FL]. So, we have to check I means there should be a one committee that who can check the that quality of I means equipment materials and the chemical which is given to the that cleaning staff.

Ok so, you mean to say active participation for students?

Yeah, active participation is of students it is is required ok.

Ok, so, in addition to what sir said is like we can use a branded chemicals.

(Refer Time: 10:57).

So, in this way.

Yeah.

In this way like there would not be any need to check the quality if we use branded.

Hm.

Quality of the chemicals.

Ok. High quality. (Refer Time: 11:05).

High quality Yes.

And one more thing is like every housekeeping staff tend to work in the morning time, but they should utilize it in the lunch timings and after that or in between any free period. So, that could also be done because if we approach to them in during the lunchtime they are not readily available and they could not be find and we cannot find them actually. So, that should be there the proper contact area should be there where we can contact them. So, that could be that could solve the problem in more easier way.

Yeah, means collage means hostel warden or collage should provide the particular room or space for the cleaning staff. So, if it is if it is if we did not see them that we can approach the that cleaning staff to toward that room that he is available there or she is available there.

So, we you all going to say that there should be a adequate communication channel between the students and the cleaning staff and the authorities.

Yeah, or we can means that authority should provide the particulars that person mobile number. So, we can contact them. That I want to clean my room. So.

Ok ok. So, you what we can perceive is that proper timing time timetable along with the contact details of the cleaning staff should be there. So, that it can be available and we can call them the students can call them and the issue can be more of a flexible and adequate amount of time should be given to the cleaning staff itself. So, that they can come on time and clean the room.

The major cleaning can be done on Saturday Sunday's like the ceiling fans and another other things. So, that students are also available in their rooms. So, that can be done on these days and they are not like busy in their classes.

Ok.

Anybody have new ideas involved?

One more thing I want to add is like the equipments that the cleaning staff is using the student should also have the access for those equipments because sometimes what happens during night time is like they sometimes what happens is they like warm their milk in the kettle and sometimes what happens it spills over the floor. So, in that particular moment if the student has access to the cleaning equipments like the for the mopping purpose. So, like this will also the hygiene condition can be maintained at the personal level.

Yeah.

So, so it is more of a moral responsibility of students also.

Yeah.

To make our hostels and also please.

Yes.

Not only on the cleaning staffs.

No cleaning staffs.

But on the morals of the (Refer Time: 13:47).

Responsibility of individual as individuals also.

Yeah.

Ok.

Ah Currently like a housekeeping staff in our college is given to the private firm, but if we see some government hospitals or another government firms we see that housekeeping staff is present 24 hours. It is available 24 hours like they are given the timing in the shifts like here the security officer and security personnel's are present. So, that can be more helpful that in the evening time they can also clean the washrooms because the time cycle for cleaning is after 24 hours.

So, that creates more like situations more cumbersome it makes more cumbersome situation for them. So, that if they are available in the evening time also or even the night time they can do it their job in a better way.

So, you mean to say that open timings should be there 24s 24 into 7 timing should be there for the cleaning staffs also.

(Refer Time: 14:47) shift.

Shift basis system.

(Refer Time: 14:50).

Ok ok.

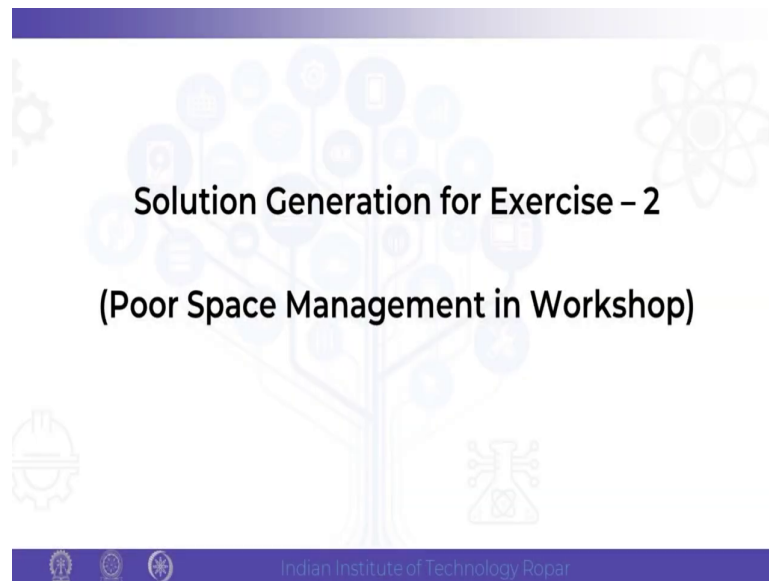
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Solutions

S. No.	Solutions
1	Maintaining feedback
2	Proper authority should be assigned
3	Random inspection
4	Flexibility in cleaning timings
5	One staff for one floor
6	Students should have authority
7	Active participation of students, authority and staff
8	Providing good quality cleaning equipment
9	Major cleaning on weekends
10	Access of equipment to students
11	Shift basis system

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So, yeah guys that like we have discussed we have identified so many problems according to that and we all know that we can also generate solutions for that. So, first and foremost solution what I think is that the planning of the workshop and its construction and the proper placing of the machines should be according to the standards.

The space between the respective machines should be placed accordingly according to all the standards or the regular standards that the standards can be of Indian Standards or because as we know that Indian weather is different from the international one or we can have generalized standards of international standards that we can use for proper. So, sufficient plant layout or workshop layout should be there.

The air ventilation issues is major problem. So, solution for the air ventilation issues that it should be a proper layout of the air ventilation where we can be proper fan or ventilation

issues can be easily we installed in that. During the summer time this is a one major issue that there is a hindrance to the working of the machines and that a lot of cases the heat issue is the main issue.

So, in that particular case if the proper ventilation is there. So, the skilled labors can easily work on all the operations and even the students which are maybe in small number maybe in a large number can easily understand the process. So, in that way it will improve the studying and learning and also the maintenance problem as well. So, in that case its one of the solution to that.

Contribution to space management problem like in our workshop you can see different machines are being placed in different different orders. So, we can do categorization like proper one kind of machine will be placed at one place and sequentially a different machine will be placed at different place. So, in that case like suppose lathe machines are there we will make a compartment and we will place all the lathe machines in a single compartment.

Similarly, for other machines as well equipment we will make compartment wise and then if there is a compartment we know that this much amount of this much number of students are going to work over there. So, only that much number of student along with few staffs will be there in the compartment so, there will be no what you can say no.

Rush (Refer Time: 17:41) crowd will be there.

No crowd will be there like the crowd will be maintained in that compartment only.

Hm.

And in that way we can save lot of space as well as stated in a problem that noise, noise issue we can also cater using this making the compartment or even the common room for common machines like that.

Ok.

Related to the like the space management problem like one of the issues was like the disposal the raw material and the storage of raw material and the storage of the scrap and the byproducts that are formed after machining.

So, timely disposal of the chips and the by other byproducts that are formed after machining that are found or formed after machining should be timely disposed like they should be taken away from the workshop whatever standards they follow it should be like more routine and more regular disposal should be followed. So, that they do not get accumulated in the workshop.

And plus I think there is a need to expand the workshop at least in the sense that store rooms should be for more store rooms should be added to the workshop. So, that this raw materials and the timely that the scraps that are stored for a short period of time they can be taken out of the workshop and stored somewhere else near to the workshop. So, that transportation is not a problem, but it should be like outside the workshop.

Regarding the design and layout of the workshop there must be a proper exit doors, which can verily help for the airflow of the working. So, in that case a ventilation would be a preferred way and also in case any natural disaster as well the people can easily exit to the doors.

And also the if we are making a proper channel of exiting in a door in that case the machines or the characterization machines can be easily be done. So, in that case a proper way out must be provided. So, that the easily moving out of the students or the faculty members or the staff members can be there.

As Gaurav suggested that there should be some a proper utilization of waste proper place for that waste materials. So, there could be a one technical solution for this waste management like we can reuse or reprocess the waste material. So, that we can again use that waste

material itself by processing it or anywhere in that manner we can make our workshop sustainable too that could be a solution for that storage of the waste products.

Ok so, you mean to say that use recycle can indirectly.

Ha.

Effects our space management problem also. Ok. One more issue that can be resolved is like that the sitting area do not has to be distributed over all the workshop it has to be a designated part for there. So, that all the staff members can sit at a particular place only.

Hm.

And like we have seen certain number of chairs are there. So, instead of distributing the chairs overall the shop floor we can have a particular compartment for the sitting persons only and for that as we know if we have a sitting arrangement at a particular area then air conditioning facilities can be provided there only. So, that it could be a more comfortable situation for workers in the rest time also or the staff members in the rest time also.

Apart from this what I feel is that the windows that were not properly seals I think more number of windows, but will be there, but less number of windows in a open space should also be there because that ceiling in proper ceiling of the windows is a major issue if there are more number of windows lying designed according to it.

So, windows should be there, but they should be close to those for example, in casting area. So, proper ventilation we can use a natural convection or natural circulation of air also itself. So, what I think is that windows should be close to those a machines where the need of natural circulation is more.

Yes I do preferably agree with Vikalp we should have a window facility in a workshop the major issue that we are facing is during the summer time we are using table fans. So, during

for the using a table fans the wires has to be installed and one of these case that I have seen with the students working over there even with myself also that I have been about to fall because of the wire tangle issues.

So, in that particular case the proper ventilation and proper design of the airflow and also if we are working on a high rpm machine or high heating machine they can generate fumes and other vapors as well. So, if that proper ventilation is not a good not proper design then the health issues can also arise and it can hamper the working conditions also if we are using any external source of a the heating ventilation issue then that case a working condition also can may hamper. So, that results may vary also in that case.

As we all know workshop consist of very larger or larger or heavy machineries. So, as we already know there are less number of larger or you can say big doors. So, that whenever we are going to play we are installing some new machineries in workshop sometimes what happens that we need to break some side walls. So, that we the newly procured or machines can be inserted inside the workshop and then it can be installed.

So, there should be a solutions that from now onwards we increase the size of door as well as increase the number of doors. So, that the even the cranes can insert can enter inside the workshop and it can easily lift and drop or place the machine in a proper manner.

Otherwise we it needs to do like we used to use some move moving vehicles to carry the machine and in between there is a chances the machine can get damaged. So, proper door or you can say proper gates gating system should be there for effectively placing and installing the machines.

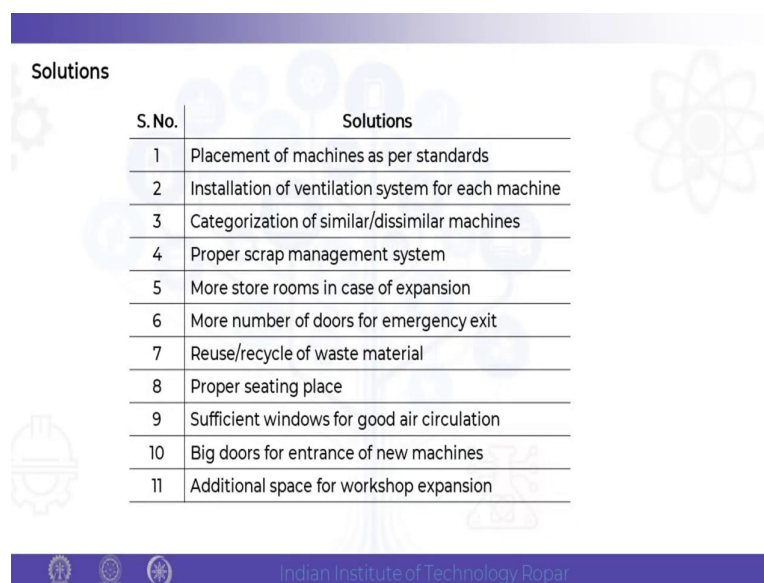
And this solution will also help us in a cost cutting of a facility for the central workshop as well because breaking the walls and again building it again breaking the walls again building it for new machines to come it also hamper the budget of a central workshop as well.

Ok yeah. So, in addition to that we can say that the space the present space is such that we can adjust the existing machines, but there should be a more space. So, that new machines can be

installed with the proper spacing between them in addition with the big doors to be installed there.

So, more space additional space should be always be there for new machines to enter and new machines having a certain new technologies which has to be in built in our workshop. So, that advancement of our workshop can be done regularly ok.

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S.No.	Solutions
1	Placement of machines as per standards
2	Installation of ventilation system for each machine
3	Categorization of similar/dissimilar machines
4	Proper scrap management system
5	More store rooms in case of expansion
6	More number of doors for emergency exit
7	Reuse/recycle of waste material
8	Proper seating place
9	Sufficient windows for good air circulation
10	Big doors for entrance of new machines
11	Additional space for workshop expansion

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