

# Assignment-3

Presented by :

Akarsh Gupta (2021307)

Aditya Jain (2021305)

Shivam Gupta

# Mission Statement: Ergonomic chair

## Product Description

"Enhance productivity with our ergonomic chair, boasting backrest, lumbar support, and strain-free seating for prolonged comfort"

## Key Business Goals

- Product to be introduced in one year.
- Establish a 70% customer satisfaction rate within the first six months.

## Primary Market

## Corporate Offices

## Secondary Market

Retail shops  
Administrative offices like in schools

## Assumptions

- Proper adjustment of height of chair.
- Proper posture is maintained by the employee.

## Stakeholders

- Employees
- Retailers
- Manufacturers

# Gathering stakeholder's statements

## Stakeholder statements

"I have my back tilted and discomfort during prolonged sitting."

"I often feel discomfort and strain in my shoulders and arms while sitting at a stretch"

"I'm constantly struggling to coordinate comfortably with my chair and desks "

"I experience strain and discomfort in my thighs after sitting for a while"

## Stakeholder Problems

User finds his back **bent** during prolonged sitting creating discomfort.

User feel pain in his **shoulders and arms** while working.

Users experience difficulty in working due to a **mismatch in the height** of chair and desk

User's find it difficult to sit on chairs for longer time due to **inadequate cushioning**

## Stakeholder Requirements

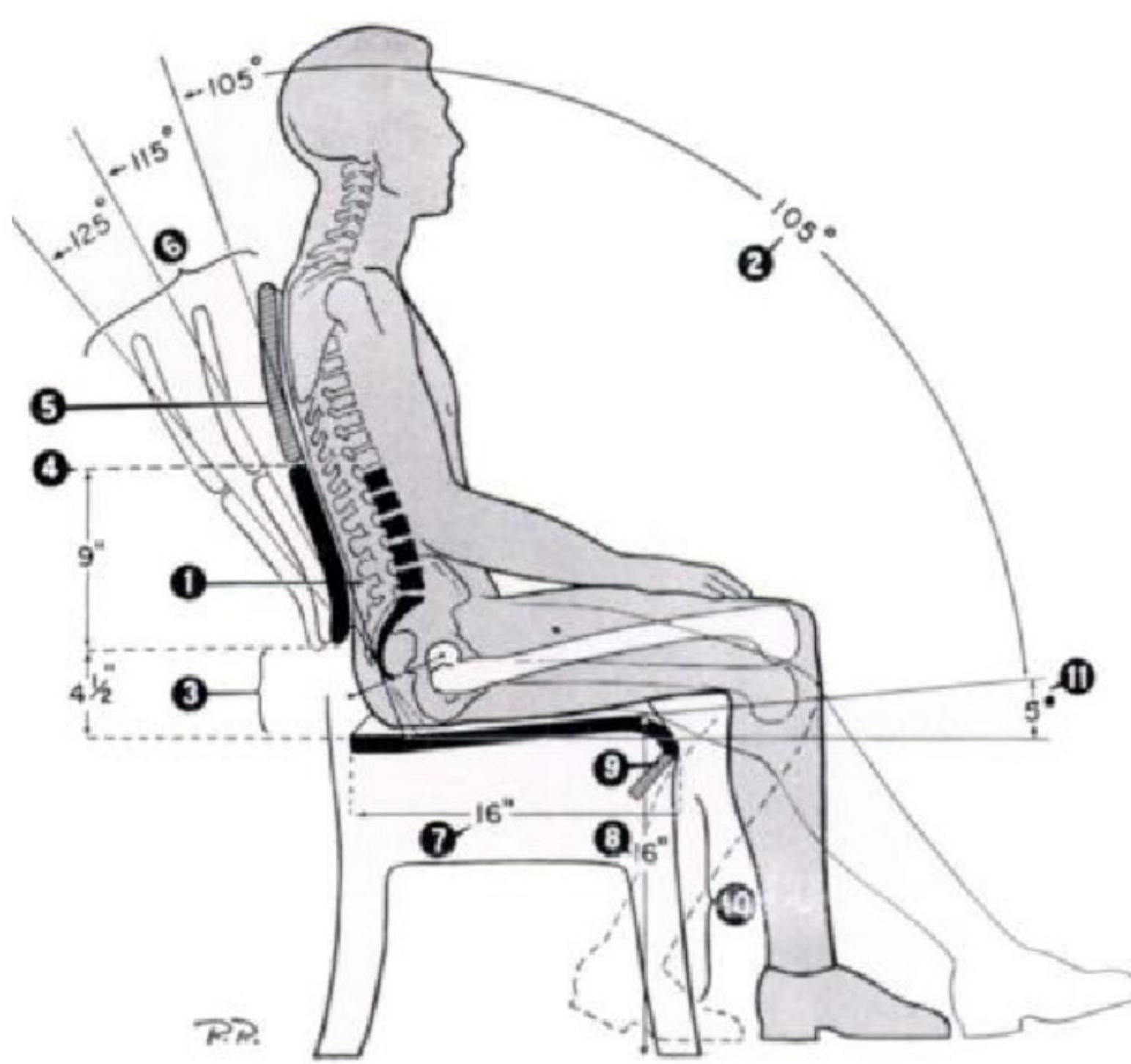
**Inclination angle of the chair need to be adjusted to correct degree.**

**The chair's armrest height and width need to adjusted.**

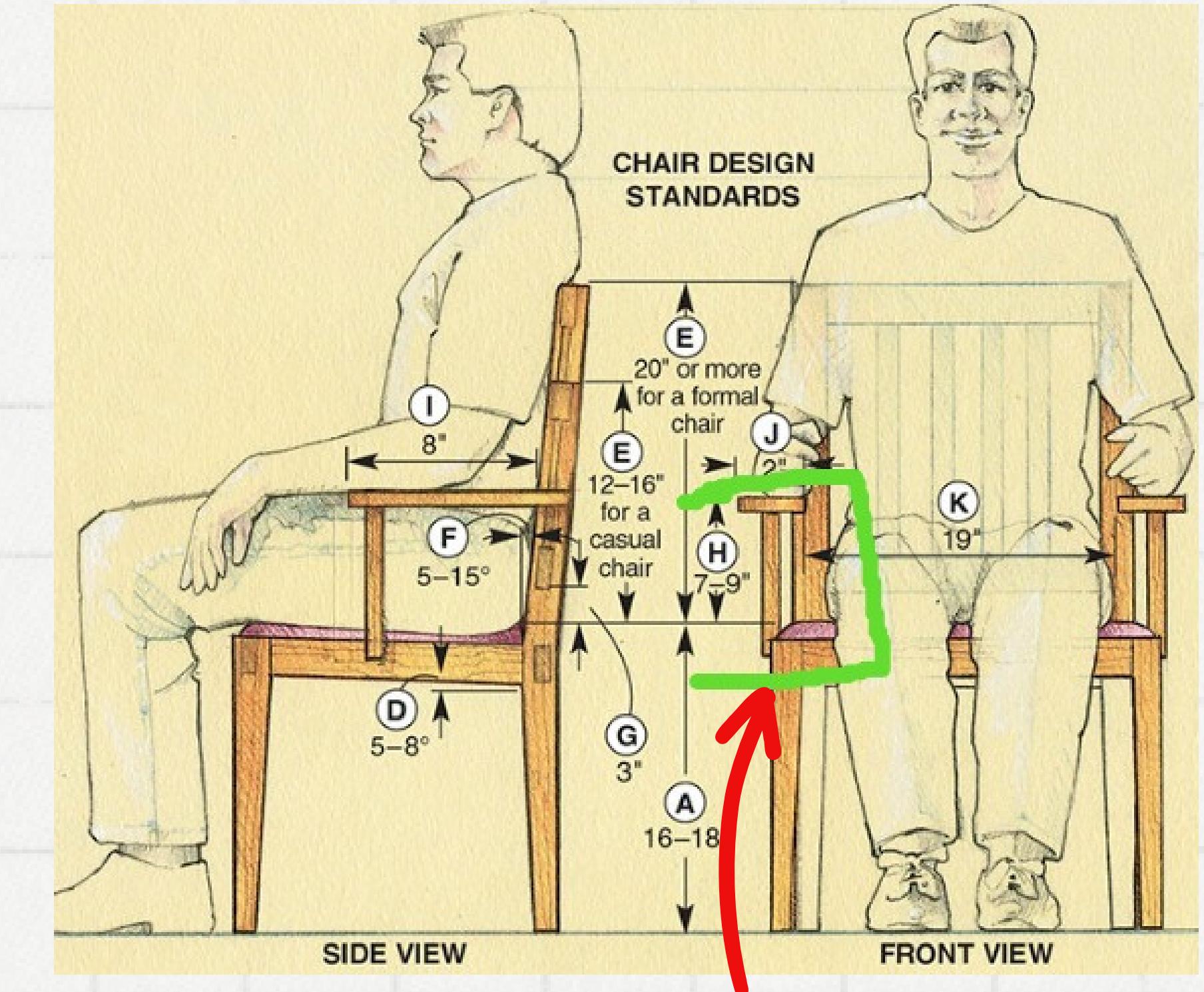
**Height of chair needs to be adjusted properly.**

**Sufficient padding must be added to the chair's seat.**

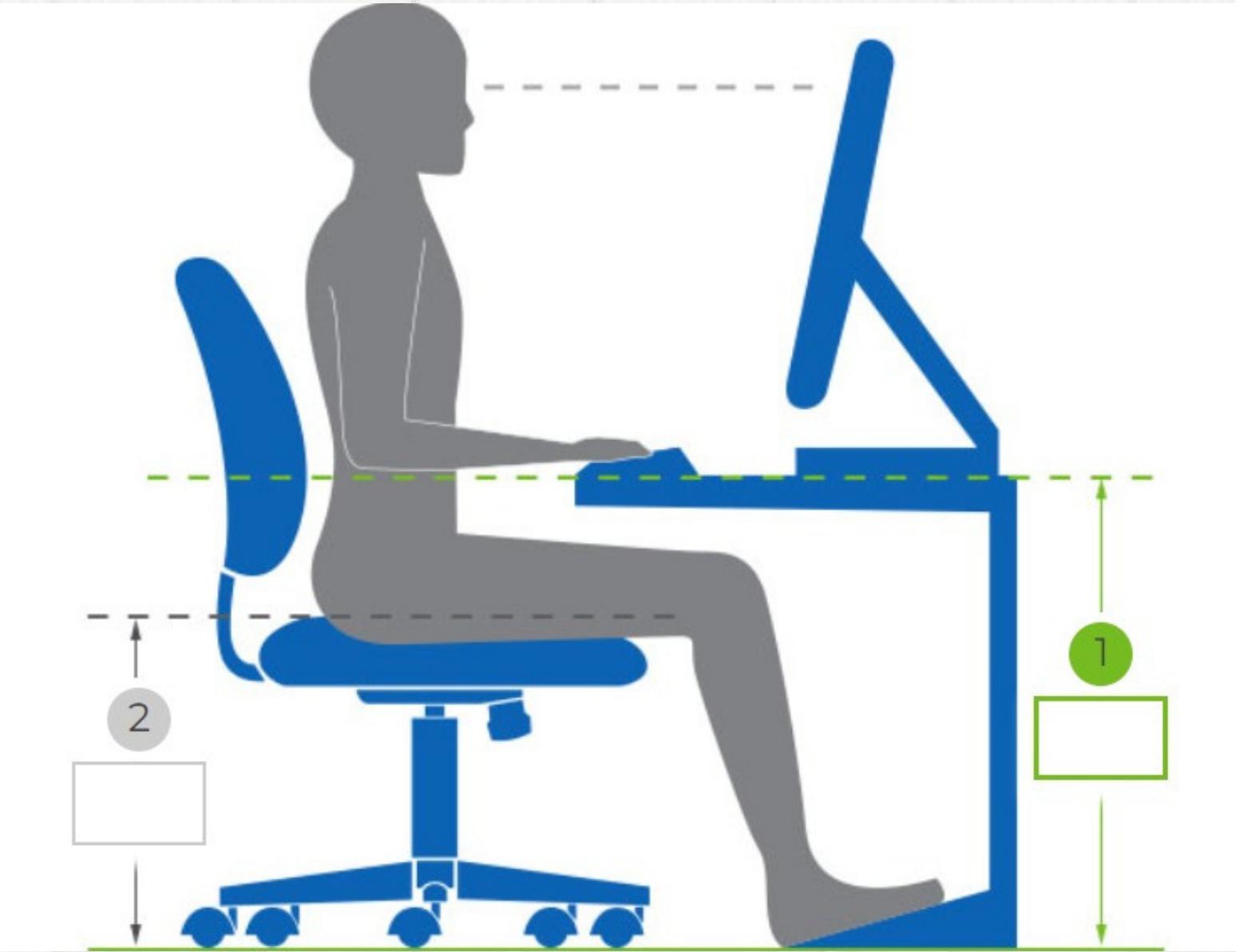
Stakeholder's requirements	Technical requirements	Unit of measurement	Relative Importance (1:lowest,5:highest)	Desired/Wanted
Inclination angle of the chair need to be adjusted to correct degree.	Incline-angle B: $95 < B < 105$ degrees	Degrees	4	W
The chair's armrest height and width need to adjusted.	armrests height should be <b>7"-9"</b> from chair base with a width of <b>2"</b>	Inch	2	D
Height of chair needs to be adjusted properly.	optimal seat height range is to <b>subtract 10"</b> from the work surface height.	Inch	5	W
Sufficient padding must be added to the chair's seat.	Measurement of <u>Indentation Load Deflection (I.L.D.)</u> of cushion	lb(pound)	4	W



**Ideal Inclination angle between our thighs and chair's back should range from 95-105 degrees**



**As described in H, armrests height should be ideally between 7-9" inches with a width of 2" from chair base**



*The general rule that should be followed for optimal seat height is that your **eyes must be in line with the top of the screen or laptop**. The elbow must be in line with the keyboard.*



*The chair's seat must have appropriate cushioning, not too soft and not too hard. This measure of softness is calculated by ILD.*

## Foam firmness

Foam firmness is a technical measurement indicating how easily a foam will compress. Lower firmness offers a “**sinking**” effect when pressure is applied, whereas a firmer foam remain “**stiffer**” under pressure.



## Indentation Load Deflection

<u>FIRMNESS</u>	<u>ILD RATING</u>	<u>DENSITY</u>	<u>DESIGNATED USE</u>
soft	17-25 ILD	4.1	‘standard’ back cushion
medium	26-30 ILD	4.7	‘firm’ back cushion
firm	31-35 ILD	5.0	‘standard’ seat cushion
extra-firm	36-42 ILD	5.3	‘firm’ seat cushion

## How do you calculate ILD?

ILD is measured by applying downward pressure from a 12-inch round disk into a 4-inch piece of foam. Pressure is slowly applied until the foam compresses to 25% or one inch into its surface.

**A 6-inch seat cushion will need an ILD of about 30 to 35 in order to be “firm” enough for the average person to be comfortable.**

# Quality Function Deployment

## Step 1.1 Enlist product attributes from "List of Customer Requirements"

List of customer requirements	Product Attributes
Inclination angle of the chair need to be adjusted to correct degree.	The chairs should able to tilt back and forth
The chair's armrest height and width need to adjusted.	The armrest needs to be corrected
Height of chair needs to be adjusted properly.	Chair dimensions need to be revised
Sufficient padding must be added to the chair's seat.	Sufficient cushioning in seat
The employee's lower back must have some kind of support with the backrest of chair	Lower back should have support

# Quality Function Deployment

## Step 1.2 Relative importance (1-5)to product attributes ( by the customers)

Product Attributes	Relative Importance(1-5)
The chairs should able to tilt back and forth	4
The armrest needs to be corrected	3
Chair dimensions need to be revised	5
Sufficient cushioning in seat	5
Lower back should have support	4

## Step 1.3 Benchmarking the attributes of our product with competitor's product

Product Attributes	Our Product	CELLBELL Chairs
The chairs should able to tilt back and forth	2	4
The armrest needs to be corrected	3	3
Chair dimensions need to be revised	2	5
Sufficient cushioning in seat	3	5
Lower back should have support	2	4

## QFD Step 1.4

Comparison of our product with competitor's product

Competitor

Our product

Product Attributes	1	2	3	4	5
The chairs should able to tilt back and forth					
The armrest needs to be corrected					
Chair dimensions need to be revised					
Sufficient cushioning in seat					
Lower back should have support					

## Step 1.5: Calculate Improvement Rate, Weight and Weight %

**Improvement Rate** = Target Value / Rating of your product

**Weight** = Improvement Rate \* Relative Importance

Product Attributes	Target Value	Improve- ment Rate	Weight	Weight %
The chairs should able to tilt back and forth (4)	5	5/2	20/2	23.16
The armrest needs to be corrected (3)	4	4/3	12/3	9.27
Chair dimensions need to be revised (5)	5	5/2	25/2	28.96
Sufficient cushioning in seat (5)	4	4/3	20/3	15.45
Lower back should have support (4)	5	5/2	20/2	23.16

## QFD Step 2.1

### Identification of Technical Parameters

<b>Gap between spine and chair's back</b>	<b>Inclination angle</b>	<b>Height of chair-base from ground</b>	<b>Width of armrest</b>	<b>Height of armrest from chair's base</b>	<b>ILD Ratings</b>	<b>Density of material</b>
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# STEP 3- Interrelationship between Technical Parameters



Positive

Nature



Negative



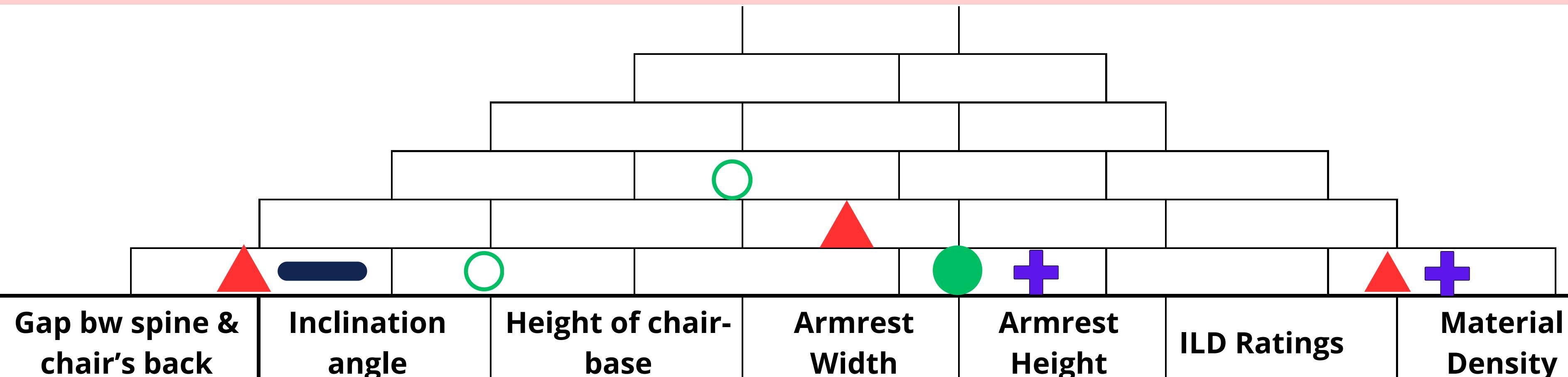
Strong



Medium



Weak



## **STEP 4.1- analyzing the relation between the product attributes and technical descriptors**

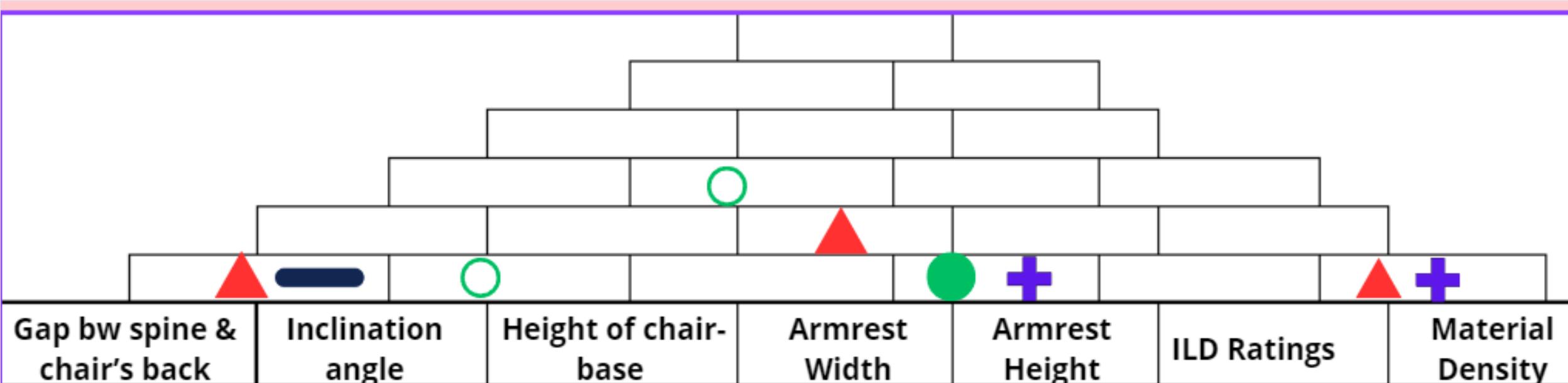
	Gap between spine and chair's back	Inclination angle	Height of chair-base from ground	Width of armrest	Height of armrest from chair's base	ILD Ratings	Density of material	Relative Importance	Weight%
	cm	Degrees	Inches	Inches	Inches	lb(pound)	kg/m^3	No unit	%age
The chairs should able to tilt back and forth (4)								4	23.16%
The armrest needs to be corrected (3)								3	9.27%
Chair dimensions need to be revised								5	28.96%
Sufficient cushioning in seat (5)								5	15.45%
Lower back should have support (4)								4	23.16%

## STEP 4.2- Calculating the inter-relationship for each colored cell

	Gap between spine and chair's back	Inclination angle	Height of chair-base from ground	Width of armrest	Height of armrest from chair's base	ILD Ratings	Density of material	Relative Importance	Weight%
	cm	Degrees	Inches	Inches	Inches	lb(pound)	kg/m^3	No unit	%age
The chairs should able to tilt back and forth (4)	208.44	208.44	23.16					4	23.16%
The armrest needs to be corrected (3)			27.81	27.81	27.81			3	9.27%
Chair dimensions need to be revised	260.64	86.88	86.88		86.88			5	28.96%
Sufficient cushioning in seat (5)						139.05	139.05	5	15.45%
Lower back should have support (4)	69.48	69.48					23.16	4	23.16%
Priority	538.56	364.8	137.85	27.81	114.69	139.05	162.21	1484.97	
Priority %	36.27	24.57	9.28	1.87	7.72	9.36	10.92		

Relationship between Attributes and Parameters: Weight% \* Interaction Score

# Step 5 & 6 - Specifications & Target specifications of our product and competitor's product



**Target specification of the new product :**  
**Initial Specification of our Product\*Improvement Rate**

	Gap between spine and chair's back	Inclination angle	Height of chair-base from ground	Width of armrest	Height of armrest from chair's base	ILD Ratings	Density of material	Relative Importance	Weight%
	cm	Degrees	Inches	Inches	Inches	lb(pound)	kg/m^3	No unit	%age
The chairs should able to tilt back and forth	208.44	208.44	23.16					4	23.16
The armrest needs to be corrected (3)			27.81	27.81	27.81			3	9.27
Chair dimensions need to be revised (5)	260.64	86.88	86.88		86.88			5	28.96
Sufficient cushioning in seat (5)						139.05	139.05	5	15.45
Lower back should have support (4)	69.48	69.48					23.16	4	23.16
Priority	538.56	364.8	137.85	27.81	114.69	139.05	162.21	1484.97	
Priority %	36.27	24.57	9.28	1.87	7.72	9.36	10.92		
Measurement Unit	cm	Degrees	Inches	Inches	Inches	lb(pound)	kg/m^3		
Our Product	2.5	85	18	1.5	4	42	5.3		
Competitor's Product	0.5	105	22	2	6	26	4.1		
Target Value	1 (2.5 / (5/2))	106	24(18*4/3)	2(1.5*4/3)	5.3(4*4/3)	31.5 (42 / (4/3))	3.98 (5.3 / (4/3))		

# Competitor Analysis

**Identify competitors of your product**



# Herman Miller Aeron Chair

## Specifications:

- **Materials:** High-performance mesh (8Z Pellicle elastomeric suspension), aluminum frame, graphite or polished aluminum finishes available.
- **Adjustments:** Seat height, arm height and angle, tilt tension, forward and rear tilt limiter.
- **PostureFit SL:** Adjustable sacral and lumbar support.
- **Size Options:** Sizes of A, B, and C to accommodate different body types.

## Where It Excels:

- **Ergonomics:** Its mesh construction provides dynamic support and features like the 'PostureFit' SL promote healthy spinal alignment.
- **Durability:** Herman Miller has a reputation for high-quality materials and construction. The Aeron comes with a 12-year warranty.

## Where It Lacks:

- **Cost:** The Herman Miller Aeron is a premium office chair with a price tag that might not be accessible for budget-conscious buyers.
- **Potential Complexity:** With so many adjustment options, some users might find it takes time to fine-tune the Aeron perfectly to their preferences.



# Steelcase Leap Chair

## Specifications:

- **Materials:** Has a variety of frame and base finishes.
- **Adjustments:** Seat height, seat depth, arm height/width/pivot, back height, lumbar support, flexible back with 'LiveBack' technology.
- **Natural Glide System:** Recline mechanism adapts to the user's weight and movements for continuous support.

## Where it Excels:

- **Adaptive Support:** The Leap's 'LiveBack' technology is designed to mimic and support the natural shape of your spine as you change postures.
- **Comfort:** Users often praise the Leap for its plush, comfortable seat cushioning and overall support.

## Where it Lacks:

- **Cost:** Like the Herman Miller Aeron, the Steelcase Leap sits in the premium price bracket.
- **Bulk:** The Leap's design can be visually imposing. It may not be the best fit for smaller workspaces.



# Problem Brief

## Initial (Specific) Problem Statement:

Design an office chair which reduces pain in their backs and legs for people who sit at their desks for long hours and feel discomfort while sitting on uncomfortable seats increasing spinal injuries and poor satisfaction rate of the employees.

## Iteration 1: Broadening the Focus

Design an office chair that minimizes common physical discomforts (back pain, neck strain, leg fatigue) experienced during prolonged periods of sitting and mitigate spinal injuries reducing the risk of musculoskeletal disorders .

## Iteration 2: Addressing Underlying Causes

Design an office chair that minimizes discomfort by adding elements and giving personalization options like : Customizable Lumbar Support , Seat Height Adjustment, Armrest Customization and Recline Functionality.

# Problem Brief

## Iteration 3: Fostering Holistic Well-being through Design Integration

Design an office chair that promotes optimal posture by making height adjustable chairs ,providing lumbar support and appropriate seats depths and cushioning.

## Iteration 4: Prioritizing User Experience

Design office chair that provides comfortable sitting experience and minimize negative health impacts due to prolonged sitting.

## Final (Solution-Neutral) Problem Statement

*Design a chair maximizing comfort and minimizing the negative health impacts of prolonged sitting.*

# KANO Analysis

## STEP1: IDENTIFYING PRODUCT ATTRIBUTES (already done in QFD)

**ATTRIBUTE 1:** The chairs should able to tilt back and forth

**ATTRIBUTE 2:** The armrest needs to be corrected

**ATTRIBUTE 3:** Chair dimensions need to be revised

**ATTRIBUTE 4:** Sufficient cushioning in seat

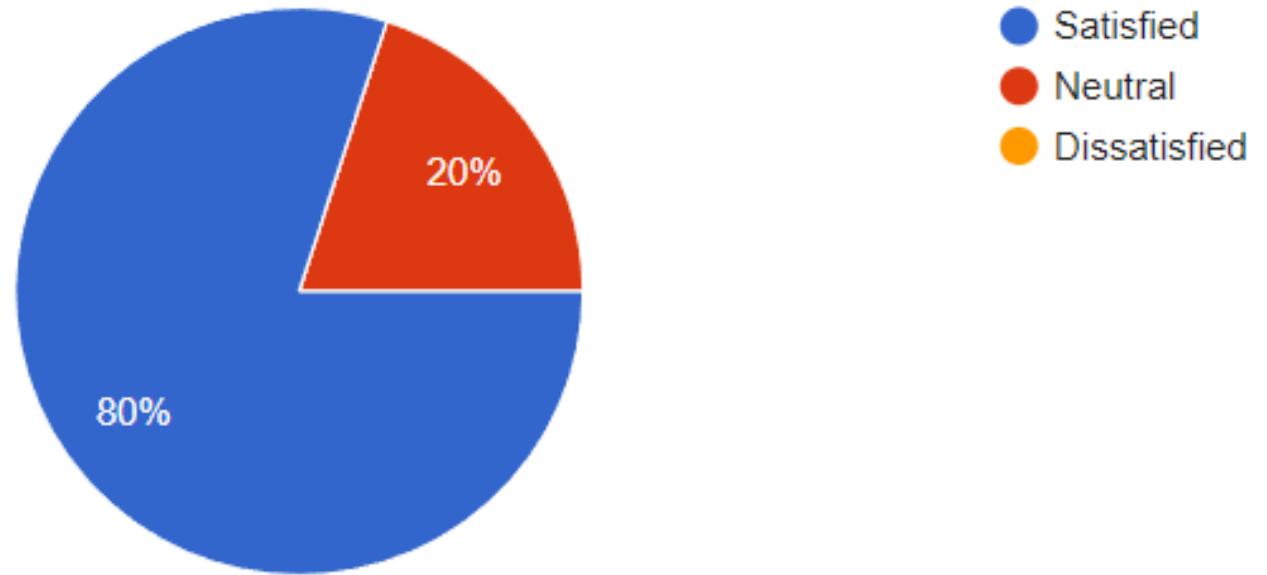
**ATTRIBUTE 5:** Lower back should have support

## STEP2: For each Product attribute, Surveying “FUNCTIONAL” & “DYSFUNCTIONAL” Questions

### KANO Analysis Survey Response

How would you feel if your chair would be able to tilt back and forth(flexibly change inclination angle) ?

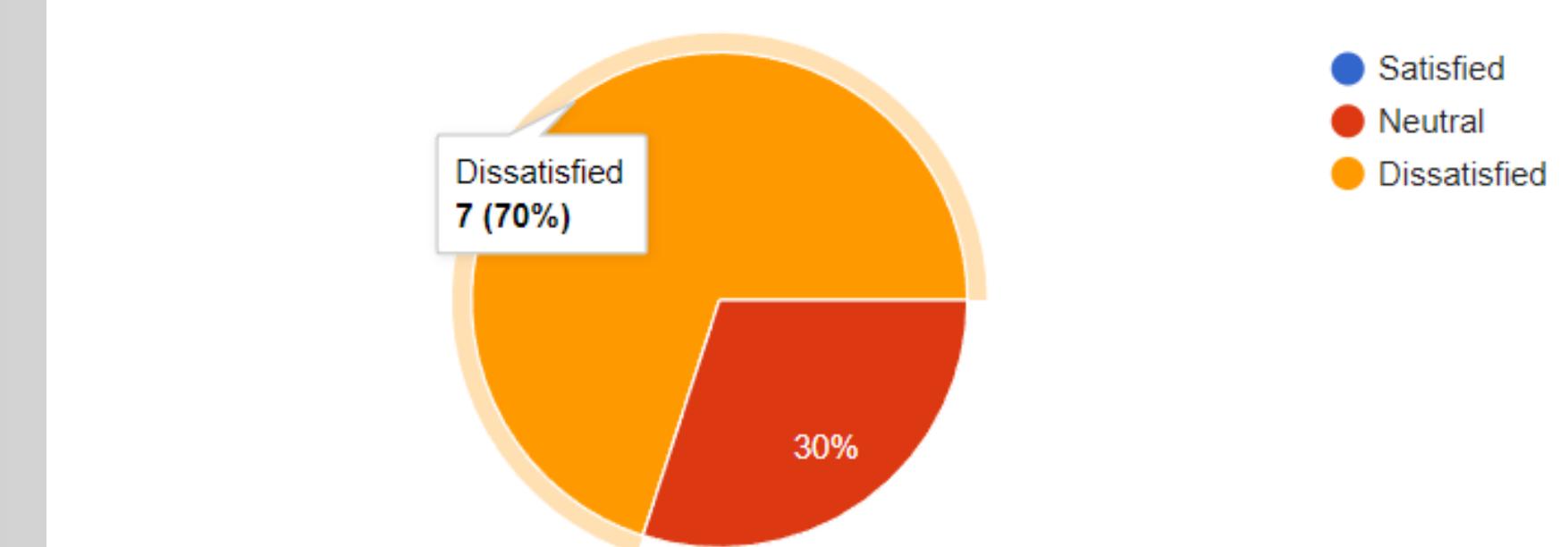
10 responses



#### ATTRIBUTE-1

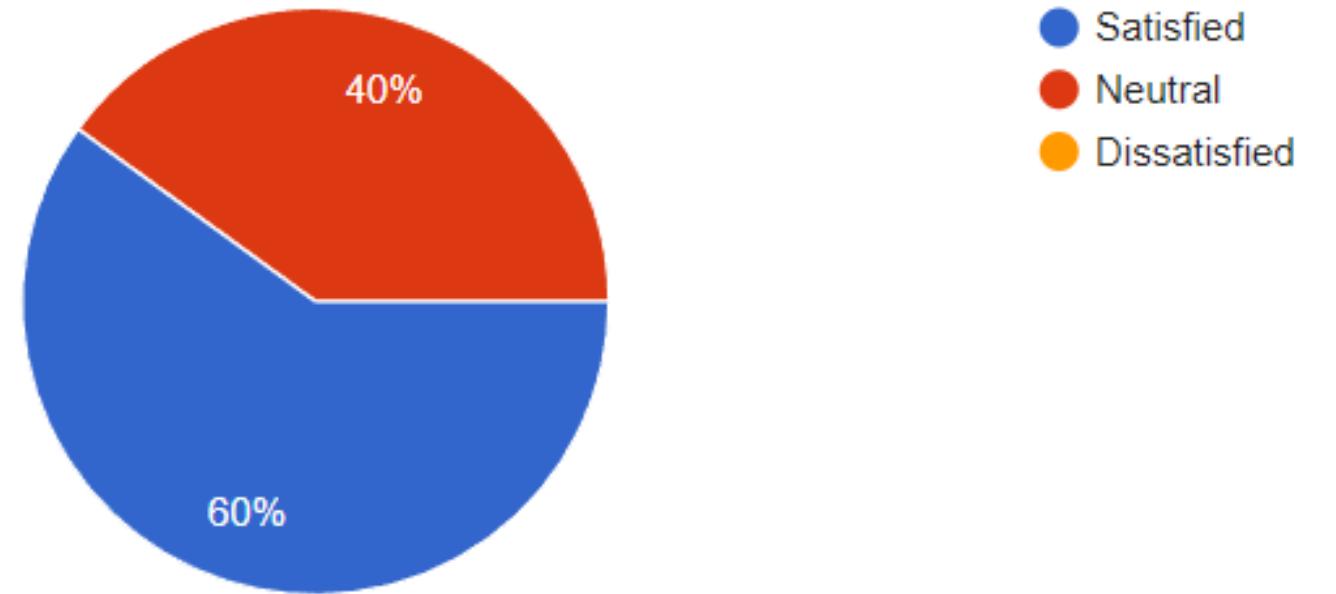
How would you feel if your chair would **NOT** be able to tilt back and forth(flexibly change inclination angle) ?

10 responses

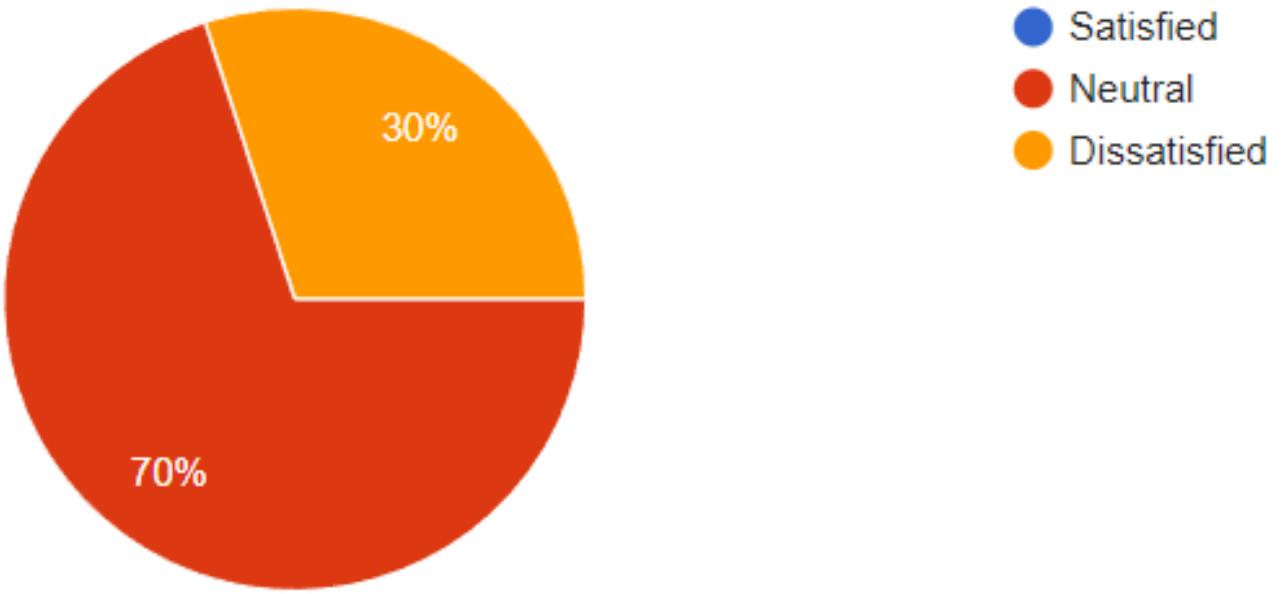


## ATTRIBUTE-2

How would you feel If the armrests are adjustable and meet your requirements?  
10 responses

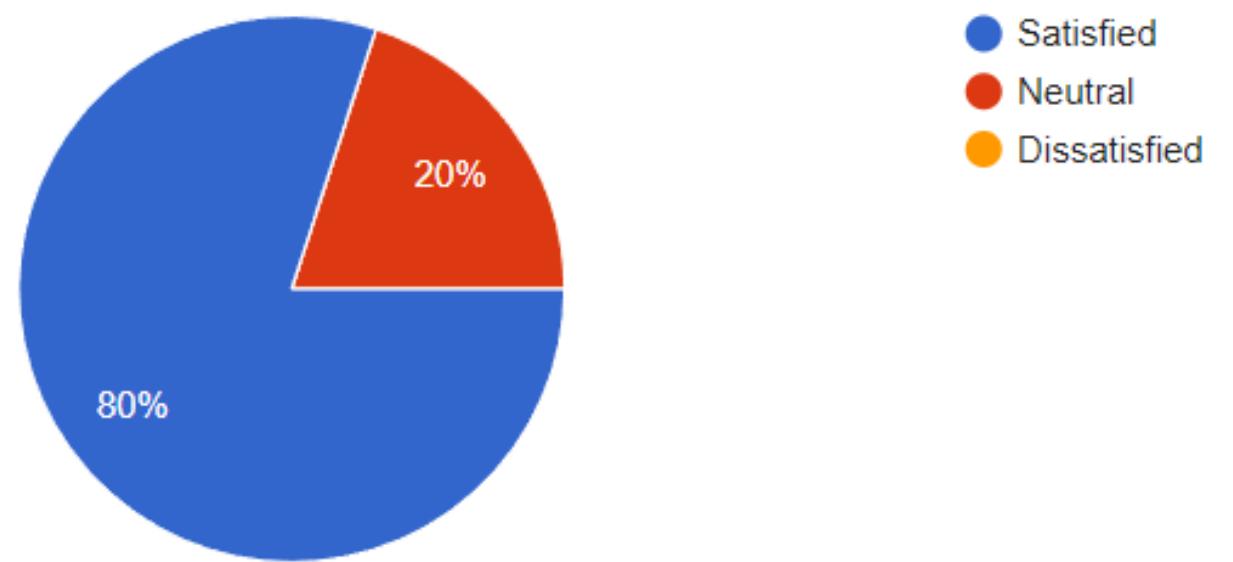


How would you feel If the armrests are **NOT** adjustable and **DOES NOT** meet your requirements?  
10 responses

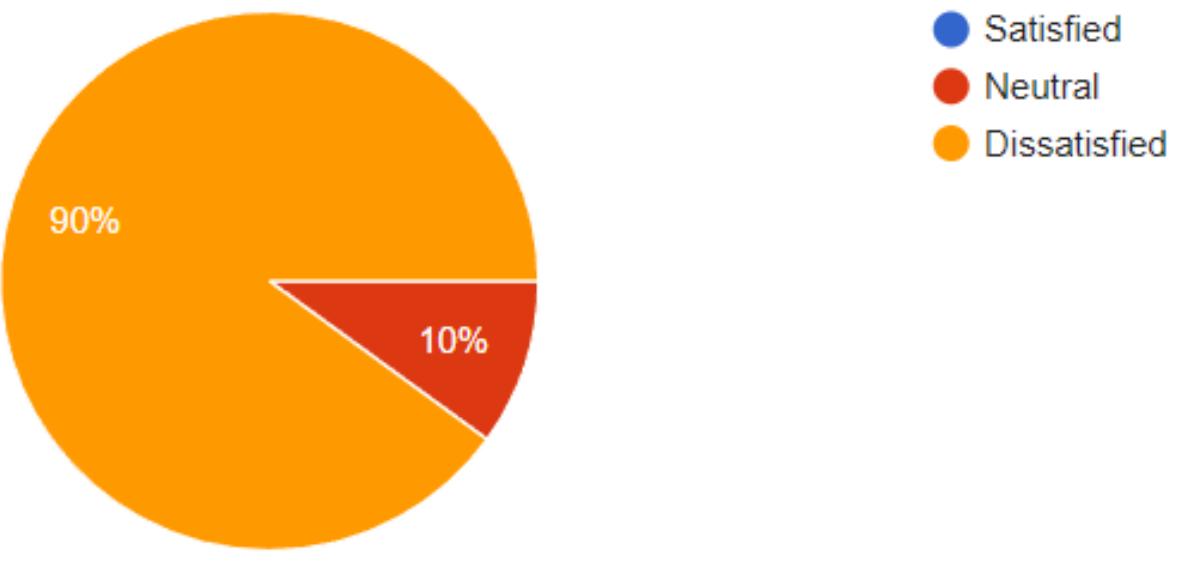


## ATTRIBUTE-3

How would you feel If the chair dimensions (height, width, depth) are suitable for your needs?  
10 responses



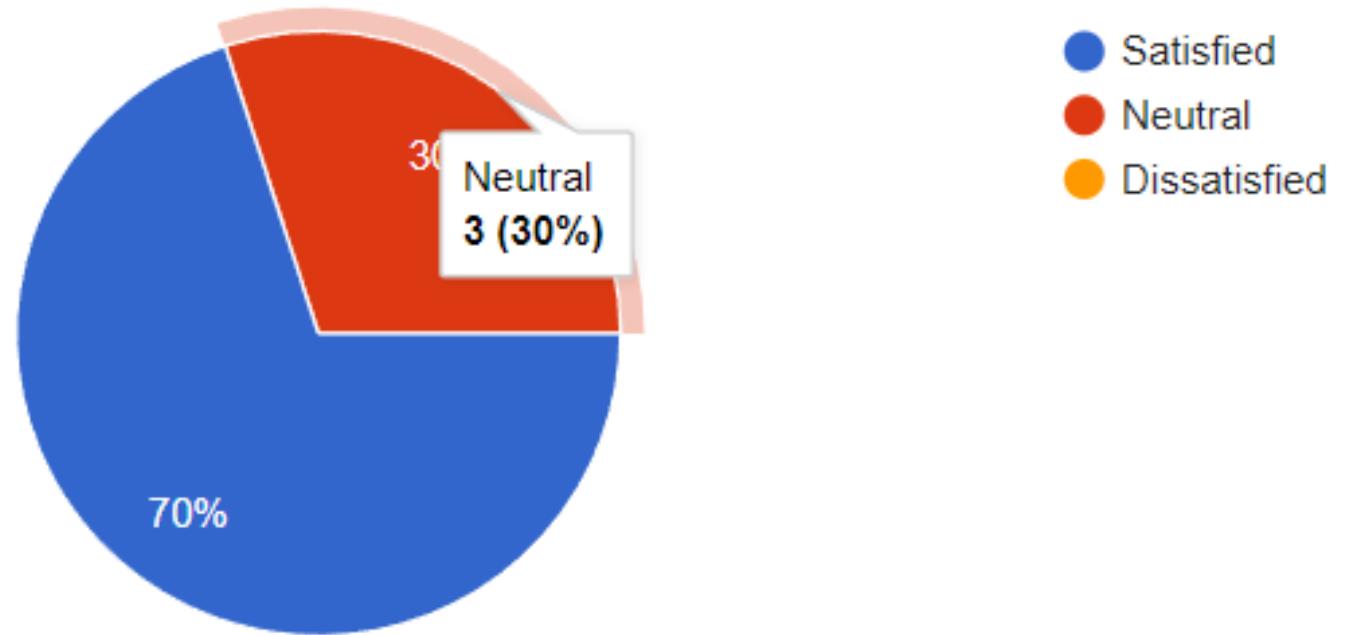
How would you feel If the chair dimensions (height, width, depth) are **NOT** suitable for your needs?  
10 responses



## ATTRIBUTE-4

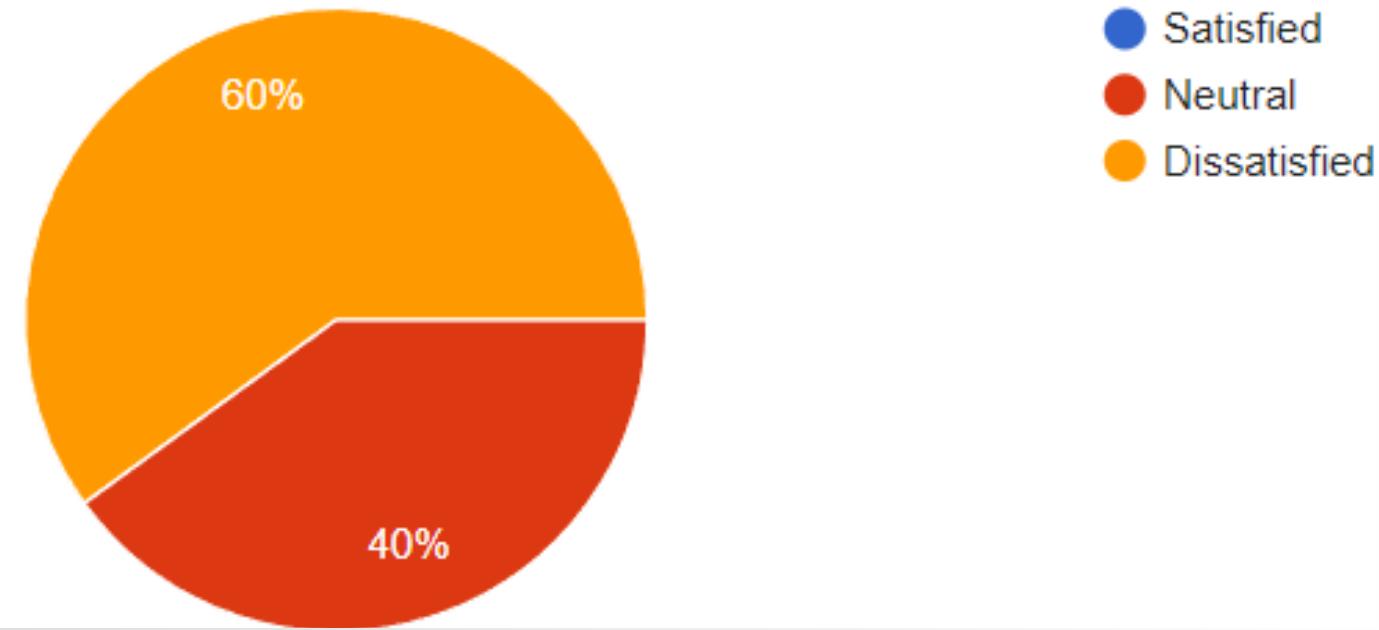
How would you feel If there is sufficient cushioning in the seat?

10 responses



How would you feel If there is **NO** sufficient cushioning in the seat?

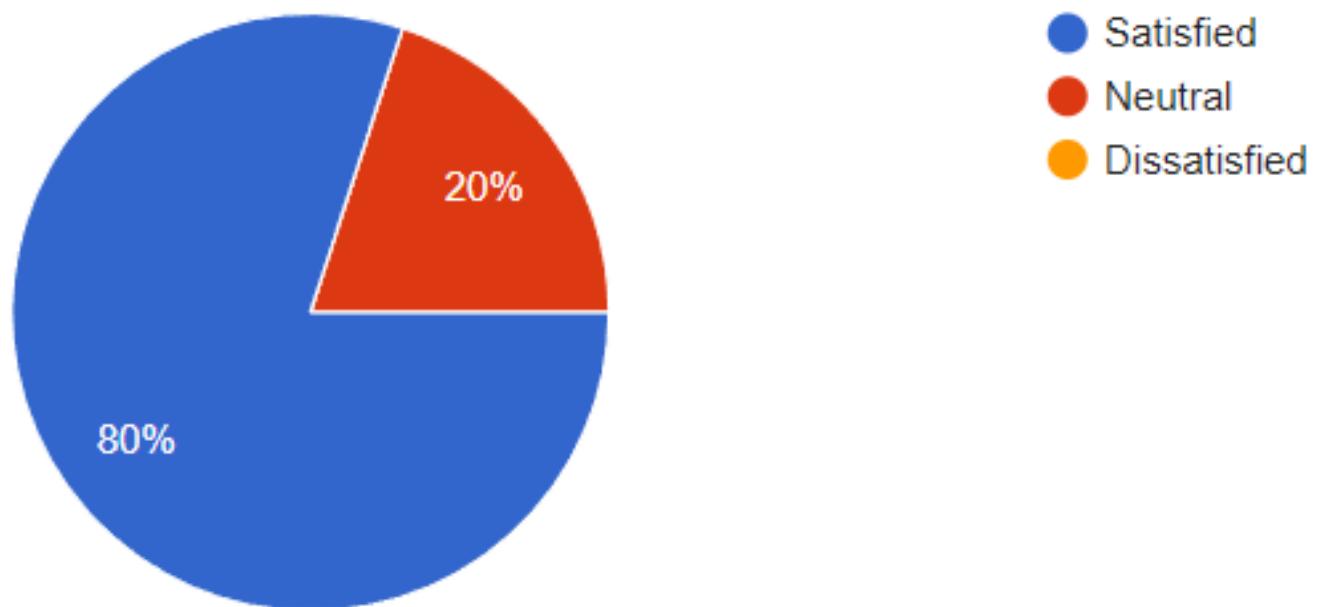
10 responses



## ATTRIBUTE-5

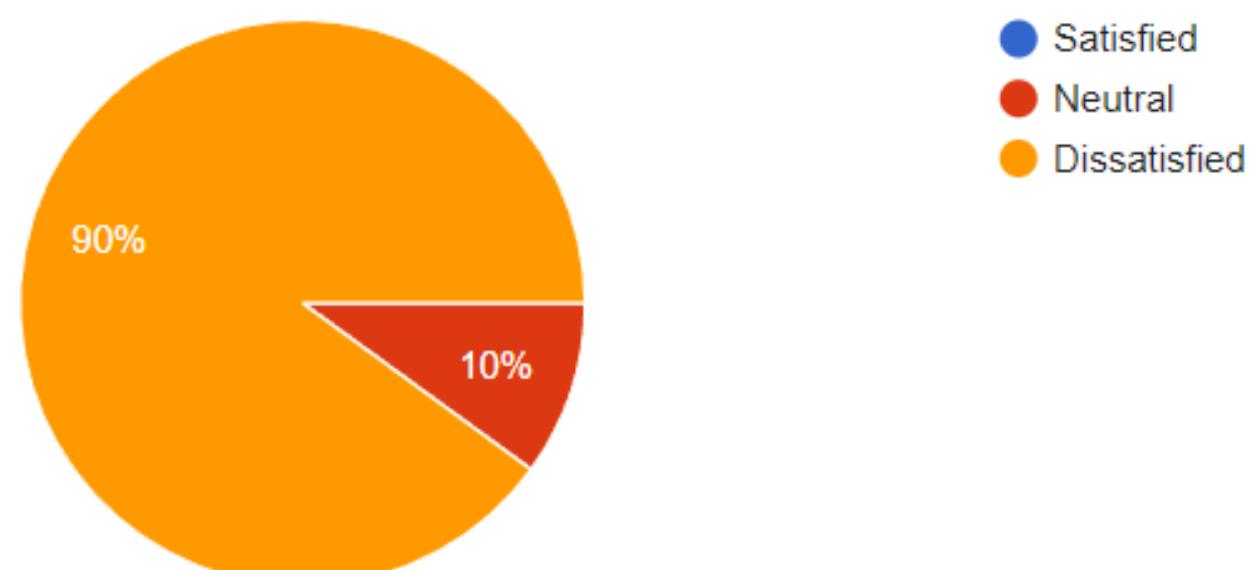
How would you feel If the chair provides adequate support to the lower back?

10 responses



How would you feel If the chair **DOES NOT** provide adequate support to the lower back?

10 responses



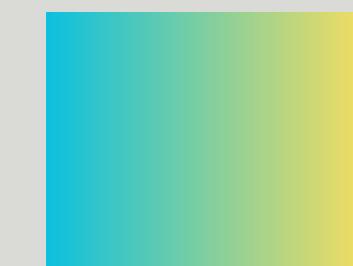
# ANALYSIS OF USER-SURVEY RESPONSES

<b>ATTRIBUTES</b>	<b>SURVEY QUESTIONS</b>	<b>SATISFIED</b>	<b>NEUTRAL</b>	<b>DISSATISFIED</b>
<b>ATTRIBUTE-1 FUNCTIONAL</b>	<b>How would you feel if your chair would be able to tilt back and forth ?</b>	<b>8</b>	<b>2</b>	<b>0</b>
<b>ATTRIBUTE-1 DYSFUNCTIONAL</b>	<b>How would you feel if your chair would NOT be able to tilt back and forth?</b>	<b>0</b>	<b>3</b>	<b>7</b>
<b>ATTRIBUTE-2 FUNCTIONAL</b>	<b>How would you feel If the armrests are adjustable and meet your requirements?</b>	<b>6</b>	<b>4</b>	<b>0</b>
<b>ATTRIBUTE-2 DYSFUNCTIONAL</b>	<b>How would you feel If the armrests are NOT adjustable and DOES NOT meet your requirements?</b>	<b>0</b>	<b>7</b>	<b>3</b>
<b>ATTRIBUTE-3 FUNCTIONAL</b>	<b>How would you feel If the chair dimensions (height, width, depth) are suitable for your needs?</b>	<b>8</b>	<b>2</b>	<b>0</b>
<b>ATTRIBUTE-3 DYSFUNCTIONAL</b>	<b>How would you feel If the chair dimensions (height, width, depth) are NOT suitable for your needs?</b>	<b>0</b>	<b>1</b>	<b>9</b>

# ANALYSIS OF USER-SURVEY RESPONSES

**SATISFIED**

**DIS-SATISFIED**



ATTRIBUTES	SURVEY QUESTIONS	SATISFIED	NEUTRAL	DISSATISFIED
		7	3	0
ATTRIBUTE-4 FUNCTIONAL	How would you feel If there is sufficient cushioning in the seat?	7	3	0
ATTRIBUTE-4 DYSFUNCTIONAL	How would you feel If there is NO sufficient cushioning in the seat?	0	4	6
ATTRIBUTE-5 FUNCTIONAL	How would you feel If the chair provides adequate support to the lower back?	8	2	0
ATTRIBUTE-5 DYSFUNCTIONAL	How would you feel If the chair DOES NOT provides adequate support to the lower back?	0	1	9

# PRIMARY CATEGORY ALLOCATION TO DIFFERENT ATTRIBUTES

I	B	C	D
	How would you feel if your chair would be able to tilt back and forth(flexibly change inclination angle) ?	How would you feel if your chair would <b>NOT</b> be able to tilt back and forth(flexibly change inclination angle) ?	Category
	Satisfied	Dissatisfied	Desired
	Satisfied	Neutral	Exciter
	Satisfied	Dissatisfied	Desired
	Neutral	Neutral	Neutral
	Satisfied	Dissatisfied	Desired
	Neutral	Neutral	Neutral
	Satisfied	Dissatisfied	Desired
		Primary Category	Desired

## ATTRIBUTE-1



## ATTRIBUTE-2

E	F	G
How would you feel If the armrests are adjustable and meet your requirements?	How would you feel If the armrests are <b>NOT</b> adjustable and <b>DOES NOT</b> meet your requirements?	Category
Satisfied	Neutral	Exciter
Satisfied	Neutral	Exciter
Satisfied	Dissatisfied	Desired
Neutral	Neutral	Neutral
Satisfied	Neutral	Exciter
Neutral	Neutral	Neutral
Satisfied	Neutral	Exciter
Neutral	Neutral	Neutral
Satisfied	Dissatisfied	Desired
Neutral	Dissatisfied	Required
Primary Category		Exciter

## ATTRIBUTE-3

H	I	J
How would you feel If the chair dimensions (height, width, depth) are suitable for your needs?	How would you feel If the chair dimensions (height, width, depth) are <b>NOT</b> suitable for your needs?	Category
Satisfied	Dissatisfied	Desired
Satisfied	Dissatisfied	Desired
Satisfied	Dissatisfied	Desired
Neutral	Neutral	Neutral
Satisfied	Dissatisfied	Desired
Neutral	Dissatisfied	Required
Primary Category		Desired

## ATTRIBUTE-4

K	L	M	
			Category
How would you feel If there is sufficient cushioning in the seat?		How would you feel If there is <b>NO</b> sufficient cushioning in the seat?	
Satisfied	Dissatisfied	Desired	
Satisfied	Dissatisfied	Desired	
Satisfied	Dissatisfied	Desired	
Neutral	Neutral	Neutral	
Satisfied	Neutral	Exciter	
Neutral	Dissatisfied	Required	
Satisfied	Neutral	Exciter	
Neutral	Dissatisfied	Required	
Neutral	Dissatisfied	Required	
Neutral	Dissatisfied	Required	
Primary Category			Required

## ATTRIBUTE-5

N	O	P
		Category
How would you feel If the chair provides adequate support to the lower back?	How would you feel If the chair <b>DOES NOT</b> provides adequate support to the lower back?	
Satisfied	Dissatisfied	Desired
Satisfied	Dissatisfied	Desired
Satisfied	Dissatisfied	Desired
Neutral	Neutral	Neutral
Satisfied	Dissatisfied	Desired
Neutral	Dissatisfied	Required
Satisfied	Dissatisfied	Desired
Primary Category		Desired

	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5
Required	0	1	1	4	1
Desired	7	2	8	3	8
Neutral	2	3	1	1	1
Exciter / Delighter	1	4	0	2	0
Questionable	0	0	0	0	0
Anti-feature	0	0	0	0	0
Primary Category	DESIRED	EXCITER/DELIGHTER	DESIRED	REQUIRED	DESIRED

### STEP-3: Cross referencing question pair using the matrix



Color palette used

<u>Attribute-1</u>	Satisfied	Neutral	Dissatisfied
Satisfied			
Neutral			
Dissatisfied			
Desired			

How would you feel if your chair would NOT be able to tilt back and forth(flexibly change inclination angle) ?

How would you feel if your chair would be able to tilt back and forth(inclination angle) ?

How would you feel If the armrests are adjustable and meet your requirements?

<b><u>Attribute-2</u></b>	Satisfied	Neutral	Dissatisfied
Satisfied			
Neutral		Exciter / Delighter	
Dissatisfied			
<b><u>Attribute-3</u></b>	Satisfied	Neutral	Dissatisfied
Satisfied	Questionable	Anti-feature	Anti-feature
Neutral	Exciter/ Delighter	Neutral	Anti-feature
Dissatisfied	Desired	Required	Questionable

How would you feel If the armrests are NOT adjustable and DOES NOT meet your requirements?

How would you feel If the chair dimensions (height, width, depth) are NOT suitable for your needs?



How would you feel If the chair dimensions (height, width, depth) are suitable for your needs?

How would you feel If there is sufficient cushioning in the seat?

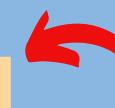
<b><u>Attribute-4</u></b>	Satisfied	Neutral	Dissatisfied
Satisfied	Questionable	Anti-feature	Anti-feature
Neutral	Exciter/ Delighter	Neutral	Anti-feature
Dissatisfied	Desired	Required	Questionable

How would you feel If there is NO sufficient cushioning in the seat?

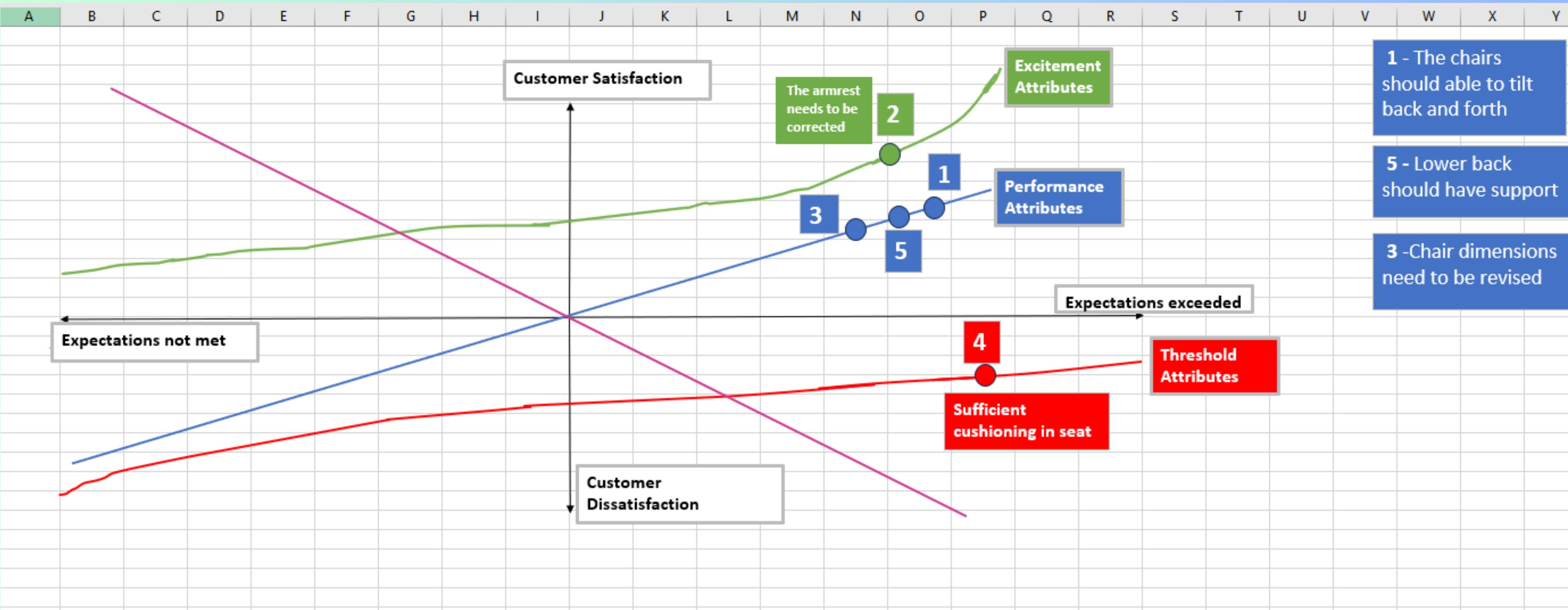
<b><u>Attribute-5</u></b>	Satisfied	Neutral	Dissatisfied
Satisfied	Questionable	Anti-feature	Anti-feature
Neutral	Exciter/ Delighter	Neutral	Anti-feature
Dissatisfied	Desired	Required	Questionable

How would you feel If the chair DOES NOT provides adequate support to the lower back?

How would you feel If the chair provides adequate support to the lower back?



# STEP-5: Mapping each attribute into its respective region based on PRIMARY CATEGORIES



THANKS

YOU