

**Research Report**

**Space-Pal: A Space Saving Solution**

**For Small Offices**

**National University of Science & Technology**

**School of Art, Design & Architecture**

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# **Space-Pal: A Space Saving Solution For Small Offices**

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## **Abstract:**

This thesis report focuses on the design and development of innovative furniture solutions to optimize space utilization in small businesses. The objective is to address the challenges faced by small business owners who often struggle with limited space availability. By employing user-centered design principles and space optimization techniques, this study aims to create functional and visually appealing furniture that maximizes space efficiency. About 70 percent of employees do not find their workspace comfortable and innovative which also effects their work productivity. Space-pal is a furnishing solution that allows the user to experience vertical storage solution with open spaces and multiple utility. Space-pal allows the user to interact with the product according to their space need while also helps small corporations or businesses to make the most out of their allotted space which is not being used but paid for.

***Keywords:** small business space, furniture design, space optimization, user centered design, functionality, multi functional design, vertical storage solution...*

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# 1 Introduction & Background

## 1.1 Why do we need space saving furniture?

Space-saving furniture is crucial for various reasons. One of the primary benefits is efficient space utilization, particularly in urban areas and small living or working environments where space is limited. By incorporating space-saving furniture, individuals can make the most of their available space, optimizing functionality and comfort within constrained areas. These furniture solutions allow for versatile layouts and organizational options, making the space adaptable to different needs and activities. They offer the flexibility to reconfigure the space as needed, ensuring that every square meter is utilized effectively. This versatility is especially valuable in small businesses where space needs to accommodate various activities and requirements throughout the day.

Space-saving furniture is designed to prioritize functionality without compromising on comfort or aesthetics. These designs integrate innovative features such as built-in storage compartments, hidden compartments, and convertible elements. Such features enhance the furniture's functionality, allowing for efficient organization and storage of belongings, thereby reducing clutter. Moreover, these furniture pieces are ergonomically designed, considering the human body's needs for proper support and posture. This ensures that even in limited spaces, users can enjoy comfort and well-being, investing in space-saving furniture can be cost-effective. Instead of incurring expenses for larger premises or additional storage solutions, individuals and businesses can maximize their existing space with these furniture designs. This not only saves costs but also eliminates the need for extensive renovations or expansions. It offers a practical and economical solution for making the most of limited space.

My main idea is to design a space saving solution that the employee feels comfortable to use plus providing multiple utility so that if a certain space is not being used the vertical storage design solution acts as a wall barrier to create a room to cater other serving departments. The design is made for small businesses where usually the office is used up for other purposes after working hours so Space-Pal shrinks in size by folding the unwanted compartments making it easy to move and rearrange. Furthermore after the pandemic most of employees ought to work from home hence Space-Pal is designed in such a way that could be used in any small space either at homes, dorms or apartments.



## **Work Space Ergonomics**

Body position while working is very important to maintain because of many joints and muscle related issues occur while working for straight hours. Gravity constantly exerts a downward force on our bodies. Parts of our body in contact with a supporting structure (the seat of chairs, armrests, floors, table etc.) will feel pressure from the structure to balance this force. Following are some standard angles and facts that allows a human body function optimally.

- Soles of the feet making an angle of  $90^\circ$  with the lower legs.
- Thighs approximately in a horizontal position and lower legs vertical with feet resting on the floor or on a foot rest.
- Erect or upright spine.
- No twisting of the upper torso.
- Shoulders are relaxed and upper arms hang normally at the side of the body.
- Elbows stay close to the body and are bent between  $90^\circ$  and  $120^\circ$ .
- Hands, wrists, and forearms are straight, in-line and roughly parallel to the floor.
- Head and neck is upright (not turned, tilted, flexed or extended). Generally it is in-line with the torso.
- Feet are fully supported by the floor, or a footrest may be used if the desk height is not adjustable.
- Back is fully supported with appropriate lumbar support when sitting vertical or leaning back slightly.
- Thighs and hips are supported by a well-padded seat and generally parallel to the floor.
- Knees are about the same height as the hips with the feet slightly forward.
- The in-line sight is between the horizontal and  $35^\circ$  below the horizontal (up and down), and with a  $30^\circ$  range as optimal line-of-sight angle. Vertically (side to side) the optimum viewing is directly in front of you, with  $15^\circ$  to either side.  $35^\circ$  side to side is maximum.

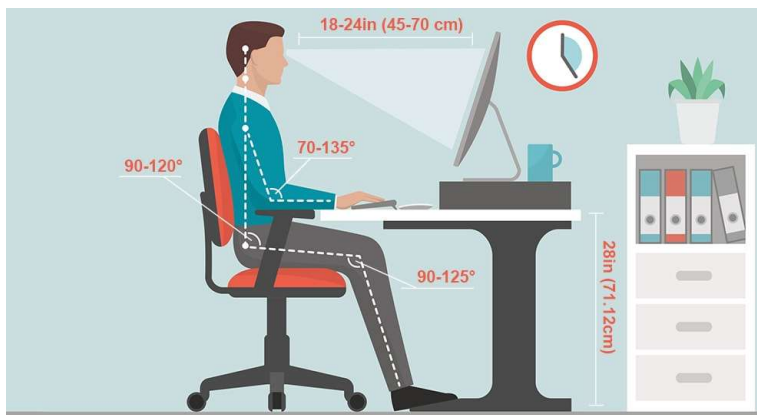
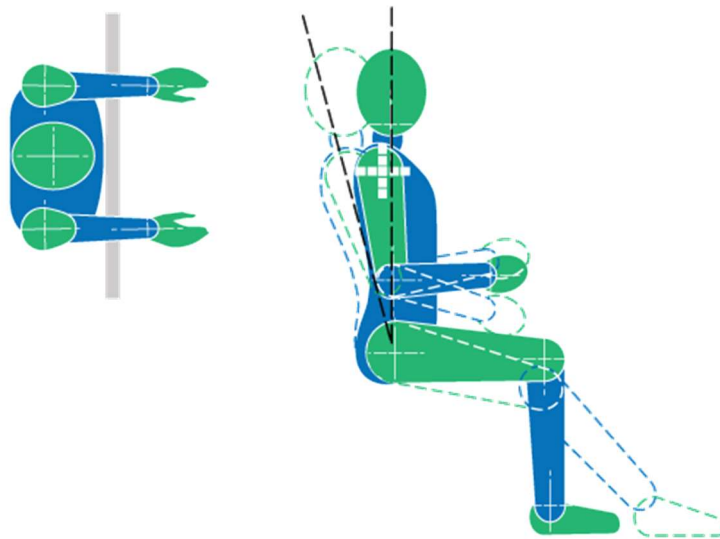
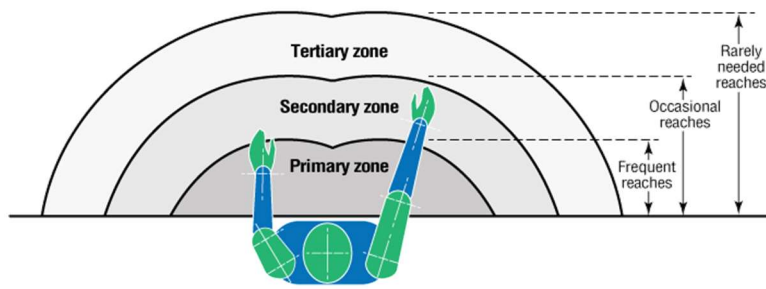


Figure 2(a)

## 2 Research Methods

### 2.1 Survey

To start off with my development I had conducted a survey that included 44 participants of different age groups, the participants included students, workers, teachers, office employees, the participants also included people living outside of Pakistan.

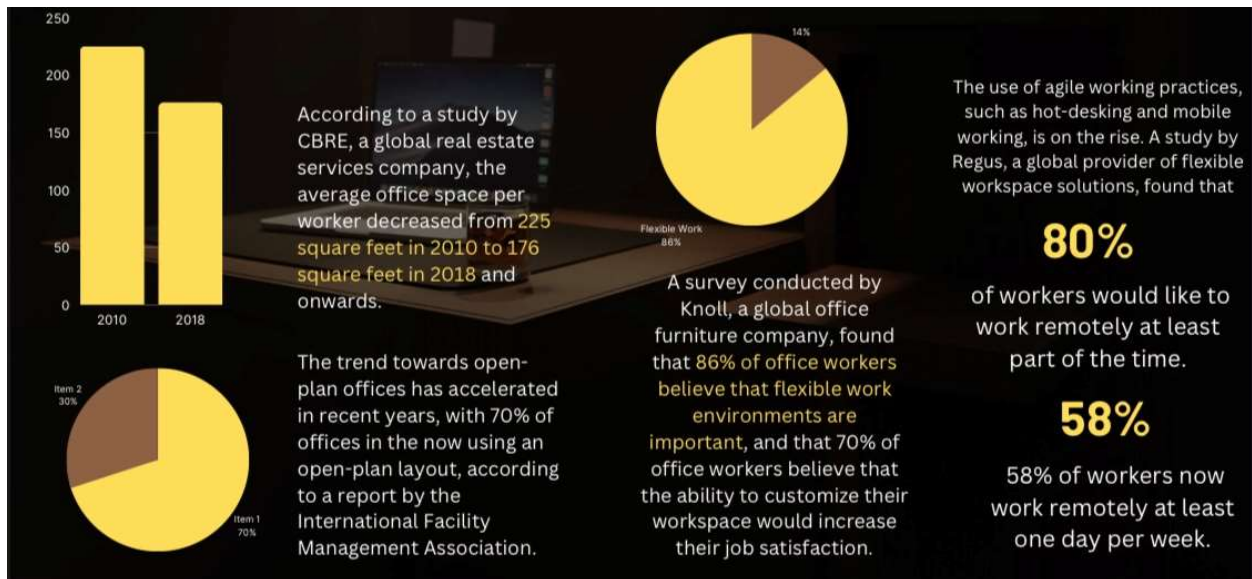


Figure 4(a)

## 2.2 Empathy map diagram

The method helped in identifying the attributes of the persona and in pointing out the problems in the given scenario



Figure 4(b)

### 3 Case Studies & Analyses

#### 3.1 Designed proposed by Sakamoto

Sakamoto proposed a design for home offices. The design is basically a workspace that transforms into a bunk bed. The thought of inspiration behind the design is applicable in every kind of small space including student dorms, small offices, and apartments as seen in *figure 5(a)*



*Figure 5(a)*

### 3.2 Designed proposed by Hinata

Hinata a Japanese designer designed a space saving pod for users to rest and go as seen in *Figure 5(b)*. The product is designed for rest areas in airports and other lay over areas for general public. The design using pop up technique but with sturdier materiality.



*Figure 5(b)*

### 3.3 Designed proposed by Akira

The Japanese use a lot of wood in their furniture design, in order to connect homes to nature and see it as more than just a space. Japanese designed sliding wooden bookcase as a wonderful example of space saving furniture, which is similar to our custom made wardrobes. Wardrobes are unique to you and designed to

work for your apartment. They do not take up space and in fact create more storage in your home as seen in *figure 5(c)*



*Figure 5(c)*

## **4 Design Development & Ideation**

### **4.1 Development**

Based on the case studies and my research findings, I started off with simple designs and started exploring different set of shapes incorporated in furniture design. The approach was a vertical design solution so that maximum space is saved in the workplace. The majority of the case studies were designed to be attached with a wall so vertical solution was mandatory for efficient approach to save space and also include modularity in it so it is easier to stack/disassemble/ store .The biggest draw back while designing was the

competitive market of woodworking and furnishing who all are working towards the same idea of space saving and modularity. After roughly about 15-20 ideas one was further developed with multiple shelves, storage solutions and a folding workspace which was further developed after conducting usability testing.

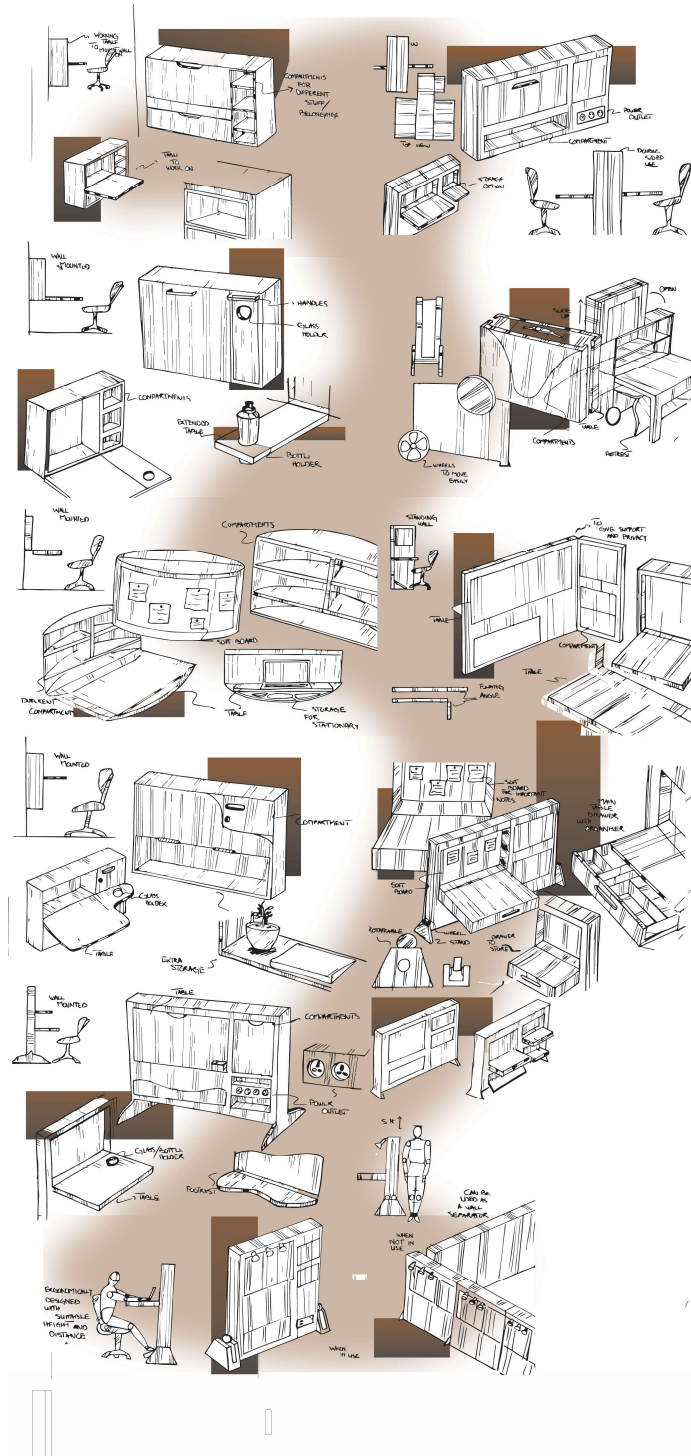




Figure 7(a) – Ideation Process

## 4.2 Final design

The design consists of an adjustable footrest, thigh support and arm rests that can be used for support. The main components of the commode consist of the toilet bowl, seat cover with thigh support, rubberized footrest and arm rest, the seat lid and the flush tank as shown in *Figure 7(c)*

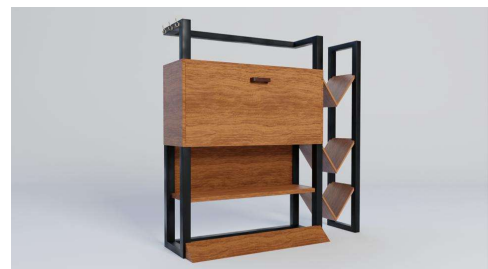
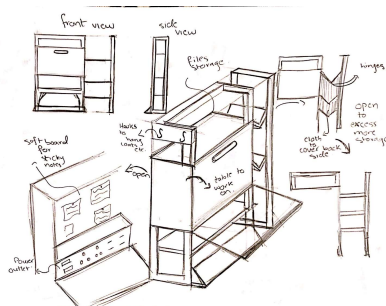
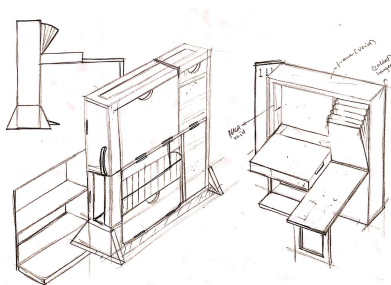


Figure 7 (b) – Further Development

Figure 7 (c) – Final Design

### 4.3 Ergonomics

The workspace is designed considering the standard dimensioning of an office environment which are as follows: The height of the workspace is 2.5 feet (30 inch) above ground level. The length of the workspace is 2 feet (24 inch). The total height of the workspace is 5 feet (60 inch) which means the top shelf is reachable by the user while working. The side shelf are at 3 levels each with length of 1.5 feet (18 inch).The workspace table is 2 feet (24 inch width) by 2.5 feet (30 inch length).

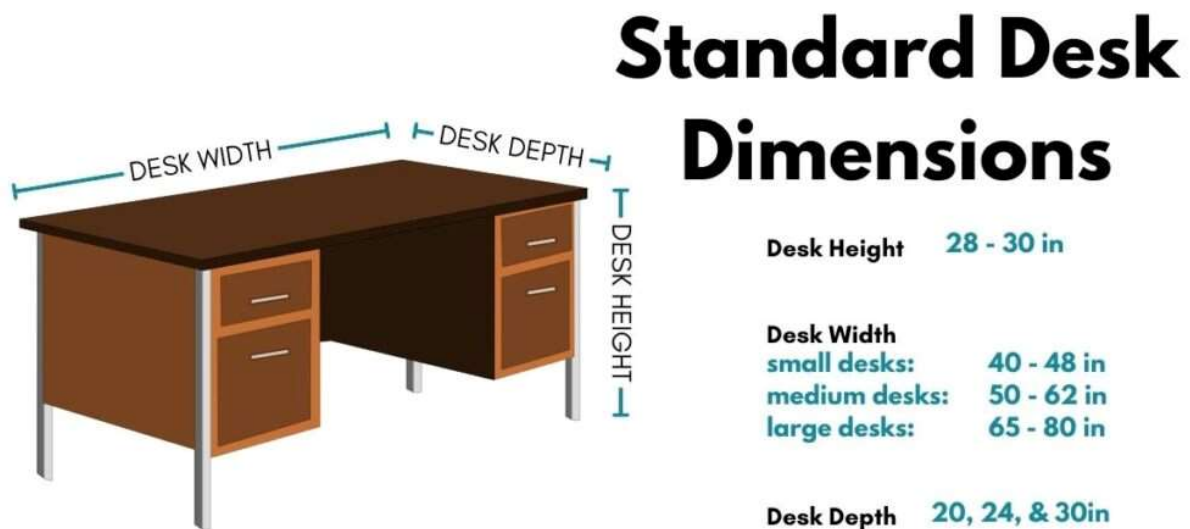
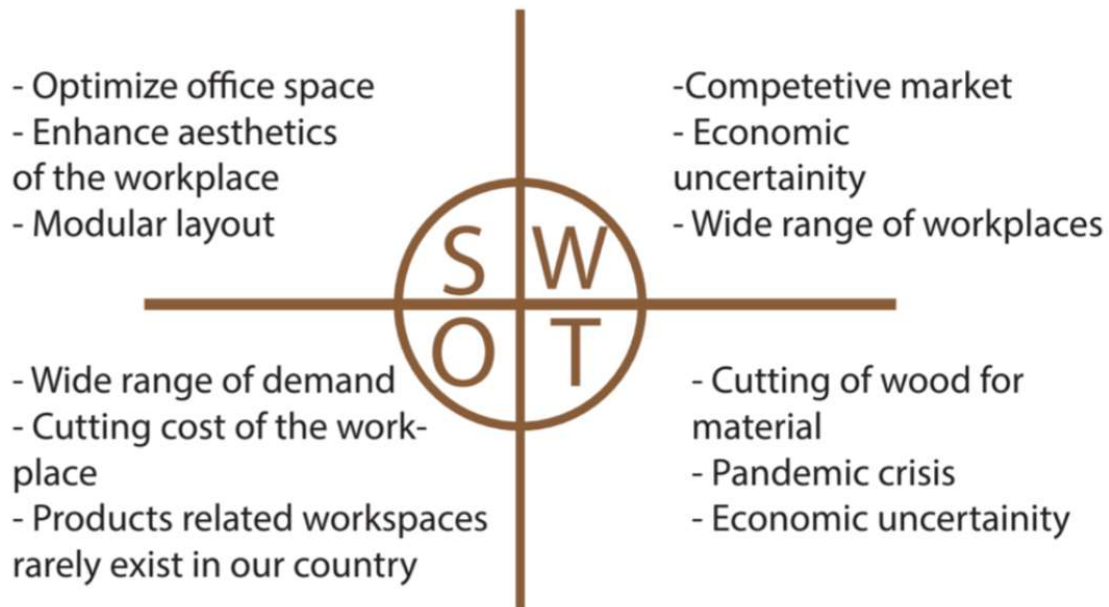


Figure 7 (e) – Ergonomics

## 5 SWOT Analysis



## 6 Material

## **7 Manufacturing Processes**

Ceramic: Extrusion, slip casting, pressing, tape casting, and injection molding are some of the most prevalent ceramics forming procedures. These "green" ceramics are heat-treated (called firing or sintering) after the particles are created to generate a stiff, final product.

Plastic: Injection molding is a procedure in which plastic pellets are melted and injected into a mold to create a plastic toilet seat.

Wood: A wooden toilet seat is made from a mixture of wood powder and melamine that has been heated to 300 °F (149 °C).

Stainless Steel: When nickel, iron ore, chromium, silicon, molybdenum, and other raw components are fused together, stainless steel metal is created. Stainless steel metal is made up of a number of fundamental chemical elements that, when combined, form a strong alloy.

Components made out of different materials are then assembled together to form the final product.

## **8 Conclusion**

This study presents a brief overview of various device designs that allow a user to squat for defecation in order to alleviate constipation. Squatting for defecation is difficult for the elderly due to a variety of musculoskeletal difficulties. The designs mentioned in this study, as well as commercially marketed squat assist platforms, do not fully solve the concerns faced by senior people who have difficulty with their lower limbs. Despite the fact that various designs (including the proposed solution) have been proposed, very little has reached the prospective beneficiaries. As a result, a cost-effective, comprehensive mechatronic assistive system must be created and developed to address the challenges that the elderly have with squatting and defecating.

## **9 References**

## **10 Acknowledgement:**

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