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Design and Fabrication of a Knock-Down Desk Organiser Based on the Beehive Concept

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Abstract
The study consists of designing and producing a knock-down desk organiser based on the concept of the beehive and focused towards supporting local craftsmanship, workspace optimisation and institutional identity. Overcoming the fact that office accessories are produced in large quantities, which are not durable, creative, and relevant to cultures, the research creates a multifunctional artefact based on the principle of modularity made of copper and brass sheets. The beehive design is a reference to industriousness, cooperation and collaboration, and has three removable boxes: a honeycomb-patterned pen or marker holder, a jewellery drawer compartment, and a tray to store cards and other small objects. The qualitative, studio-based research methodology was used to collect data by means of purposive sampling of jewellery professionals, interviews, observations, and prototyping. Piercing, series of soldering, riveting, forming, and chasing were used as fabrication methods, and it was portable, customisable, and ergonomic. Tests on performance revealed that it had better capacity in storage, flexibility, durability and aesthetics than the traditional organisers. The knock-down structure makes construction and deconstruction simple, minimising reception and it doubles up to be a sustainable souvenir to institutions. The results suggest biomimicry in product design which provides multifaceted, user-friendly solutions that will increase productivity and self-expression in dynamic work environments.

Keywords: Biomimicry, Modular design, Workspace optimisation, Local craftsmanship, Sustainable design, Beehive-inspired organiser, Ergonomic storage, Metal fabrication

Introduction

Desk organisers have developed over the years, and their predecessors can be traced to the early civilisation when scribes of Egypt and Mesopotamia employed simple cuneiform tablet and reed pen holders (Aytis & Kariptas, 2020) [2]. In the middle of the 20th century, designs were created to modernise typewriters that were designed to have compartments, and by the 1980s computer era, spaces to hold cables and digital devices were built in (Perron, 2021) [21]. Modern organisers are made of various materials such as metal, bamboo, and recycled compounds and are stressing on the sustainability by minimising the use of waste and environmental effects (Gordon, 1986; Ljungberg, 2007) [10, 14]. Knock-down organiser is a multifunctional and portable modular system of components that can build and disassemble in a dynamic work environment in corporate, co-working or home offices, and this legacy is upgraded (Yadav, 2023; Tyapukhin, 2024) [31, 26].

Past research sheds light on the improvement in the design of desk organiser but also shows major gaps. Agyei *et al*. (2020) [1] created a desktop organiser that was KNUST-specific based on simple metal manufacturing but lacked modularity, portability, or symbolism of cultural values. Yadav (2023) [31] and Perron (2021) [21] examined the ergonomic layout and customisable open-office furniture in terms of productivity, but failed to consider the features of knock-down and biomimicry in the case of frequent movers. Xing *et al*. (2024) [30] refined recycled metals to high durability, flexible uses, whereas Wernick and Themelis (2020) [28] focused on the energy saving of recyclability (95% less in the case of copper/brass), which motivates longevity and not prototyping of organisers. The systematic structures were proposed by Tyapukhin (2024) [26], and Ralph *et al*. (2009) [22] spoke about lignin-based sustainability, both of which are theoretical without multi-functional artefacts. Williams and Jackson (2007) [29] and Sands (2022) [23] advocated the carbon savings of reclaimed wood and its reusability, but disregarded designs that could be adjusted and worn with jewellery. Small and Marcus (2002) [25] and Karamchand *et al*. (2025) [11] emphasised

the low-impact growth of hemp, and Gil (2009) [9] and Lu *et al*. (2016) [16] praised cork-rubber composites, which are elastic, bio-responsive and yet are not integrated in cultural and modular organisers. Circular economies of plastics/cardboard, with less emissions, but without the portability of the beehive were emphasized by Law and Narayan (2022) [13] and Lorang *et al*. (2023) [15]. Such works focus on efficiency, aesthetics, and eco-materials but miss the cultural appeal, knock-down jewellery designs to jewellery professionals in Ghanaian institutions such as KNUST and UG because mass-produced tourist souvenirs are not durable or relevant (Agyei *et al*., 2020; Fombad *et al*., 2025) [1, 8].

This unrealised gap presents itself by bulky non-customisable organisers which cluttered desks, crippled the mobile executives and jewellery lovers in terms of productivity, and lacked craftsmanship promotion. This empty space is filled with the beehive-concept knock-down organiser, with hexagonal cells to hold pens, markers, cards, and jewellery drawers- facilitating reconfigurability, portability, and symbols of industriousness and teamwork. These gaps are addressed by the objectives of the study which are to catalogue common organisers to benchmark, evaluate efficiency and craftsmanship and lastly design a unique, user-suited beehive-inspired organiser and fabricate a knock-down version with adjustable compartments with the significance of this study based on its radical contributions. It provides a modularor unmodular platform that minimizes the cluttered environment, increases accessibility, focus, and time effectiveness. Modularity will be customized to meet individual requirements and enhance functionality and style among CEOs / jewellery users. Sustainable metals and biomimicry can be promoted, as an institutional souvenir that creates a sense of belongingness (Agyei *et al*., 2020; Fombad *et al*., 2025) [1, 8], can be scaled to administration to promote productivity (Lampert, 2000; Singh *et al*., 2024) [12, 24]. It is the only product with portability, symbolism, and dual utility. Restrictions will limit an organiser to the administration of the jewellery department, not policy or mass production, but personalisation. The present research paper seeks to consider the design, functionality and user experience of a knock-down desktop organiser based on the beehive concept with reference to the joint construction of the structures, biomimetic design and second-use functionality of the organiser as both an office accessory and a jewellery storage.

Theoretical Framework for the Study

The findings are based on the User-Centred Design (UCD) Theory, which puts the user, his needs, preferences, and constraints in the center of the design process based on the iterative prototyping, searching, and perfecting process (Norman, 2013; ISO 9241-210, 2010) [20]. UCD focuses on empathy, ease of use, and personalisation and informs the design of the beehive-inspired knock-down desk organiser, to make it attractive to the jewellery professionals (i.e., modularity, portability, multifunctional compartments i.e. pen, jewellery drawers, trays).

The previous study has used UCD: Perron (2021) [21] discussed its application to customise desk accessories to open-office productivity, whereas Yadav (2023) [31] incorporated UCD principles in creating an ergonomic workspace layout to reduce strain. Nevertheless, such works seldom went to UCD knock-down, biomimetic designs with cultural symbolism to niche clients such as Ghanaian scholars. The applicability of UCD is core: It supports the use of purposive sampling, interviews, questionnaires, and trial prototyping to test efficiency, ergonomics, and aesthetics (Creswell, 2014; Noble and Smith, 2015) [6, 19]. The theory fills the gaps of customisability and portability by prioritising user feedbacks to make generic organisers customised solutions that minimise clutters, enhance productivity, and encourage local craftsmanship (Lampert, 2000; Meyer and Norman, 2020) [12, 18]. This will guarantee that the artefact is in tandem with the administrative requirements in institutions such as KNUST to establish a sense of belongingness and sustainability.

Desk Organisers

Desk organisers can be defined as the useful things on your table that hold everything in place. They carry pens, papers, clips, and gadgets to ensure that you do not spend time scrambling (Yadav, 2023) [31]. This eases the burden of work. It is impossible to focus with a cluttered desk and easy to get things done with a neat desk (Ralph, 2009) [22]. These tools go way back. In Egypt, ancient scribes had basic containers of reed pens and clay tablets (Aytis & Kariptas, 2020) [2]. In the 1900s they were equipped with additional slots on a typewriter. The 80s computers provided spaces to attach cables and USB (Perron, 2021) [21]. Nowadays they are made out of metals, wood, plastic or greener materials such as bamboo and recycled materials (Ljungberg, 2007) [14]. Research indicates that tidy desks improve time management and productivity (Yadav, 2024) [31]. Agyei *et al*. (2020) [1] constructed one of their own at KNUST, which also established school spirit. Green alternatives are even better: recycled metals can be produced using only 95 percent less energy (Wernick and Themelis, 2020) [28], hemp can be cultivated without chemicals in a short time (Small and Marcus, 2002) [25], and cork is durable (Gil, 2009) [9].

But problems remain. Some are very cumbersome and difficult to transport. They do not accommodate other requirements such as jewellery storage (Perron, 2021) [21]. Bosses are interested in style; simple people in simplicity. This project fixes that which created a beehive-based knock-down desk organiser. Easy assemble like Lego, in copper and brass. It contains jewellery drawers, card tray and pen slots. Honeycomb is a cool shape and symbolizes collaboration; it is fantastic in offices (Norman, 2013) [20]

Types of Desk Organiser

Desktop organisers are of all shapes and sizes and can be used to address various clutter issues on your desk. They are the unsung heroes in every office as they ensure that pens do not roll on the workspace floor, paper does not stack up, and other small devices are not misplaced. We will divide them into broad categories, so that you can see how they address common needs - and how this beehive project can do better.

First, pen and pencil holders; these are the classics. Your writing materials are stood up in simple cylinders or squares. Smarter ones have several sections to store pens, pencils, markers and highlighters. Rotating models can rotate 360 degrees so you can get what you require without digging (Yadav, 2023) [31]. Just spin around and find your blue pen in no time- no mess. Next, clip and pin organisers; Paper clips enjoy being scattered about, so dispensers with gravity-fed slots are easy to grab. Metallic pins or clips are trapped in magnetic dishes to ensure that they do not leap off the desk. Great with sewers or crafters, pin cushions are filled with fabric and easily pinned in (Ralph, 2009) [22].

USB and cable managers; these are saviors in our digital age. USB drives are stored in slotted boxes/stands, ensuring a lack of scratches. Hubs that have in-built organisers allow you to connect more than one device without getting a tangle. Others go as far as hiding cords with cable channels (Perron, 2021) [21]. Business cards are kept in order by card holders; they are sorted in trays with dividers according to the clients or priority. Rotary files rotate in rapid turns, such as old Rolodexes. Crystal clear sleeve leather books can be seen as pro and they keep off the wear of the cards (Chowdhury & Chowdhury, 2007) [5].

Drawer tray combos are all-in-one; loose change, erasers, or notes are sorted in shallow trays. Bigger items such as rulers or staplers are exposed in deep drawers. Sliding compartments allow you to take out what you require. They can fit on small desks stacked on top of each other (Agyei *et al*., 2020) [1]. Material matters too; metal (brass, steel) are strong and unbreakable, very durable, and very good in heavy use. Wood provides a natural and friendly feel and may be dented. Plastic is inexpensive and colorful, yet does not last long. Leather is associated with a sense of luxury, whereas acrylic or glass can bring a smooth, contemporary touch (Ljungberg, 2007; Xing *et al*., 2024) [14, 30]. Game-changers are knock-down types; They are flat-packed and can be easily assembled with the help of no tool designed to move on a desk (Williams & Jackson, 2007) [29]. Light trays, fabric pockets, and other materials are recycled with eco-versions made of either cardboard or hemp (Small & Marcus, 2002; Gil, 2009) [25, 9].

Studies back this up. Agyei *et al*. (2020) [1] constructed trays among university employees, and the custom types create loyalty. Perron (2021) [21] experimental research on rotators in open offices discovered that they reduced distraction. Yadav (2024) [31] demonstrated that ergonomic ones decrease strain. However, here is the trick, these do not adapt very easily. Fixed slots do not work well when you require extra jewellery or fewer pen holes. They cannot be taken on the go by people changing workplaces. And they seldom appear artistic or narrate a tale, as beehive team work. This is why my knock-down beehive organiser glistens. It is available in three mix-and-match components, including a honeycomb pen holder, sliding jewellery drawers with locks, and a tray to store cards/pins. It is sturdy but beautiful and made of copper and brass. It comes together in a few minutes, adjusts compartments when necessary, and a pack. It is modeled after the work of bees and thus ideal in offices or as a Ghanaian souvenir (Norman, 2013) [20]. It was proven to be practical and fun (Creswell, 2014) [6] through user tests. No longer one-size-fits-all, this evolves with the audience.

The Beehive Concept

The genius of nature is the beehive principle of ideal organisation. Imagine a swarm of bees: they are all thousands and their task are to construct hexagonal houses using wax. Pollen, baby bees or honey are stored in each cell well. There is no squandered space, simple forms give superpower, and complete collaboration. It is not a bug house, however, it serves as an example of what humans should look like, such as a desk organiser (Vincent *et al*., 2006; Benyus, 1997) [27, 3]. Why hexagons? They make the best packing shape. There are six sides which fit together, as puzzle pieces. They are made naturally by bees since it is the most efficient method of utilizing Wax without loopholes. A single cell contains just what it must have, food, eggs, or queens. The entire hive increases or decreases along with growth of the colony. It is alienable, eco-friendly, and representative of the spirit of diligence and society (El-Zeiny, 2012) [7].

This is biomimicry, which we imitate in design. Honeycomb panels are used by architects on light and tough buildings. Automobile manufacturers produce powerful, light components. Even cell phones are hexagonal-patterned as far as their antennas are concerned. In case of common objects, it implies clean storage that is cool-looking and durable (Xing *et al*., 2024) [30]. Studies love it. The use of hex patterns by researchers results in a reduction in material use, by 40 percent, and an increase in strength. One group replicated hives to be used in skiny robots. The other one used it as eco-packaging which is stackable. Honeycomb cores in furniture enable folding flat and standing straight tables (Sands, 2022; Law & Narayan, 2022) [23, 13]. In the case of desks, the beehive fits best. Cells are made penslots, drawers for clips, trays of notes. Like bee's battle chaos, so does it. The queen bee in the center. That is leadership leading the team

Methods

Research Design, Method, Sampling, and Population

The qualitative and exploratory research design used was a studio-based, practice-based paradigm. This method is quite appropriate to design research in which the main goal is to create and test a working artefact via making, testing, and reflecting (Creswell, 2014) [6]. Based on an interpretivist philosophical approach, the study attempted to learn how the needs of the users, cultural symbolism, and practice of craftsmanship converge in the design of a multifunctional organiser (Noble and Smith, 2015) [19]. A descriptive and exploratory approach to research was followed to benchmark the available desk organisers, document fabrication procedures and also to test the prototype based on feedback provided by the users.

Participants were selected using purposive (criterion-based) sampling and had to have had first-hand, applicable experience in either jewellery making or institutional desk use. It is a non-probability method that suits the qualitative research where the aim is to produce data that is comprehensive and full of information instead of having a statistical generalisability (Creswell, 2014; Noble and Smith, 2015) [6, 19]. The eligibility criteria were as follows: active jewellery professionals or craftspeople in Ghana; and academic or administrative personnel that use desk organisers on a regular basis in institutional contexts. The sample size of 15 participants (including 8 jewellery practitioners or craftspeople and 7 office administrators or academic staff) was recruited in the Department of Industrial Art at KNUST and the University of Ghana (UG). This is an adequate sample size based on qualitative standards, where purposive samples of 10 to 20 participants provide adequate thematic saturation (Creswell, 2014) [6]. The following table is a summary of the research design and sampling framework.

Table 1: Research Design, Method, Sampling Size, and Population

Research Design	Qualitative, studio-based research method grounded in User-Centred Design (UCD) theory
Sampling Strategy	Purposive (criterion-based) sampling; participants selected based on direct experience with jewellery or office desk use in institutional contexts (Noble & Smith, 2015)
Target Population	Jewellery professionals, academic staff, and administrative personnel at KNUST and the University of Ghana (UG)
Sample Size	15 participants: 8 jewellery professionals/craftspeople and 7 office administrators/academic staff
Study Setting	Jewellery workshop and administrative offices; Department of Jewellery Design, AUCDT

Data Collection Instruments

There were various data collection tools that were used to capture the depth of information needed so as to benchmark the current organisers to inform the design process and also to evaluate the final prototype. The qualitative triangulation approach is supported by the fact that multiple instruments were used to make the findings credible, consistent, and contextually grounded (Creswell, 2014; Noble and Smith, 2015) [6, 19].

Semi-Structured Interviews

The 15 participants were interviewed using semi-structured questions to bring out detailed information about their workspace organisation habits, storage preferences, aesthetic expectations, and portability and modularity requirements. The interview guide consisted of open-ended questions that were created based on the literature review and UCD principles (Norman, 2013; Perron, 2021; Yadav, 2023) [20, 21, 31]. All interviews took about 3045 minutes, and they were recorded audiotaped with the consent of the participants. This approach enabled flexibility to explore the new themes as well as consistency in participants (Creswell, 2014) [6].

Participant Observation

Observations were done in the natural work settings of the participants, jewellery workshops and administrative offices, where a record of the real desk organisation behaviors, clutter patterns, tool usage, and movement behaviours were recorded. Data collection was done in an organized way using an observation checklist, which allowed systemic comparison across settings. The observational data was used to supplement the interview responses by recording the behaviours that might not be consciously expressed by the participants (Noble and Smith, 2015) [19].

Photographic Documentation

Photographs were made during the study to record the available commercial and institutional desk organisers to be benchmarked, and every step of the fabrication process such as piercing, soldering, riveting, forming, and chasing. Photographic documents acted as a visual means to facilitate the process of comparative analysis and to trace the development of the artefact through the design cycles (Creswell, 2014) [6].

Prototype Testing Checklist

All 15 participants were presented with a prototype testing checklist at the time of showing them the completed beehive-inspired knock-down desk organiser. The checklist evaluated the performance in five dimensions, namely storage capacity, compartment flexibility, ease of assembly and disassembly, ergonomic comfort, and aesthetic appeal. The respondents rated each of the dimensions using a five-point scale and made qualitative remarks. The outcomes were contrasted with the records of benchmarked products (Agyei *et al*., 2020; Norman, 2013) [1, 20].

Benchmarking Analysis Form

The researcher used a structured benchmarking form to list and rate ten available desk organisers, both commercial products and the KNUST-specific organiser as defined by Agyei *et al*. (2020) [1], on five scales: modularity, portability, cultural relevance, material durability, and aesthetic quality. This tool provided a comparative level where the beehive prototype was tested.

Data Analysis Procedure

The analysis of data collected by means of interviews, observations, photographic records, prototype testing, and benchmarking was conducted by using a mixture of the qualitative and evaluative approaches. This multi-methodical method of analysis made sure that both the user-experience data and artefact performance data were interrogated thoroughly (Braun and Clarke, 2006; Creswell, 2014) [4, 6]. Each analysis was done in parallel with fabrication and repeated until the results were found to guide the next revision of the design in compliance with UCD principles

Thematic Analysis

Inductive thematic analysis was applied to interview transcripts and field notes of observations using a six-step framework as described by Braun and Clarke (2006) [4]: familiarisation, initial coding, theme generation, theme review, theme definition and report writing. Manual coding was done with codes being grouped into higher-order themes, which included portability, customisability, aesthetic appeal, and cultural symbolism. Member checking was utilized - the pre-themes were shared with five participants to increase credibility and trustworthiness (Noble and Smith, 2015) [19].

Results and Discussion

Pre-Production Stage

The study sought to design and fabricate a desktop organiser using metal as a souvenir to support the results of the study, which has been presented based on Marshall's (2010) five steps of evaluation of studio-based research. The researcher produced a desk organiser that can be disassembled into parts and used separately. The piece comprises a pen and marker holder, a jewellery compartment and two drawers.

Materials used for the Fabrication

Some of the materials used were Brass and copper sheets, silver solder and Borax. Copper sheet was the main material used for the production of the desktop organiser. Silver Solder of various degrees, such as Soft and medium, was used to join the pieces of metal together to produce the various souvenirs, whereas borax served as a flowing agent that facilitated soldering and melting by removing oxidation from the metals to be joined for the production of the desktop organiser.

Tools and Equipment Used for the Fabrication

Some of the relevant tools used for the production were a soldering board, Wood, chasing tools, a chasing hammer, an anvil, tweezers, a saw frame and blades, a torch, and compounds. Soldering Board, which is a heat and crack-resistant board, was effectively used for soldering metal pieces together for the production activity. Chasing tools are steel tools with varying shapes used to create a relief effect on metals. The chasing tools were used in the production of the desktop organiser with chased reliefs on their surfaces. The anvil was also used to flatten the surface of the copper sheet. Tweezers are a picking tool which was used to pick small pieces of solder and place them at the joints of two or more metal pieces for soldering and picking up the work after soldering. Heated, saw frame and blades are used to pierce parts of the sheets before and after the soldering activity. The torch was the main tool used as a channel for producing flame for all soldering and annealing activities illustrated in table 2.

Table 2: Tools and uses

Name	Image	Use
Saw Frame		The jeweller's saw frame was used for the piercing technique. The jeweller's saw frame used was big, which was quite satisfactory to use since the metal was long and needed a saw with a longer frame to use. A small one was also used, which aided in piercing small parts of the work.
Saw Blade		Jewellers' blades are easily broken and have to be replaced more often than usual. It was also found out that the jeweller's blades in the market were of inferior quality as compared to British and German-made blades.
Anvil		An anvil is a sturdy, flat-surfaced metal block it used was used as a base for forming both metals, forging and shaping the corners of the metal pieces.
Chasing Hammer		Chasing tools are steel tools with varying shapes used to create a relief effect on metals. The chasing tools were used in the production of the desktop organiser with chased reliefs on their surfaces.
Honeycomb Board		Soldering Board, which is a heat and crack-resistant board, was effectively used for soldering metal pieces together for the production activity.
Soldering torch		A torch was primarily used to heat metal pieces to a temperature where it's properly heated to be able to work with. A lower-melting-point metal alloy was applied to be able to join them together during soldering.

Solder		Silver Solder of various degrees, such as Soft, medium and hard, was used to join the pieces of metal together to produce the various souvenirs, whereas borax served as a flowing agent that facilitated soldering and melting by removing oxidation from the metals to be joined for the production of the desktop organiser.
Copper sheet		Copper can easily be manipulated to make any shape of choice. Pure copper is reddish-orange and acquires a burnt tarnish when exposed to air. It is highly conductive of electricity.
Brass sheet		Brass sheets have a wide range of applications due to their durability, corrosion resistance, and aesthetic appeal. Making its inclusion in my work unique
Tweezers		Tweezers are a vital tool in jewellery making, serving various purposes from holding small parts during soldering to manipulating delicate items.

Fabrication Methods Used

The study was carried out in three phases: They were desk study, the field study and the studio work.

Desk study: This particular process involved gathering information on the history and importance of jewellery and organisers. The materials were reviewed from relevant literature, both electronic and printed.

Field work: Information from the workplace was very useful and what they really needed.

Studio work: This includes activities during the design process and production of the pieces.

Below are the fabrication methods used by the researcher in the production of the organiser

Series soldering: This is the process of using different temperatures or media of solder. The solder is heated to its melting point and then used to form or join two metal pieces together.

Reverting: This is a cold connection technique to join two or more metal pieces together using a small pin or tube that is hammered to form heads on both ends, rather than using heat like in soldering.

Piercing: In jewellery making, "piercing" with a jeweller's saw frame refers to cutting intricate designs or openwork patterns in metal using the saw blade passed through a small drilled hole, allowing for sawing from the inside out. This technique enables the creation of detailed, delicate work, like openwork, such as pendants, rings, and earrings.

Filing: This refers to using a specialised tool, such as a file, to remove excess metal, shape the metal, or smooth the surfaces.

Forming: This is a revolutionary technique in jewellery design that allows artists to create complex, three-dimensional shapes from metal sheets. This method involves folding, hammering, and unfolding the metal to achieve intricate designs that are both lightweight and strong.

Description of the Artefact Produced

The artefact is a desktop organiser designed and produced for offices. The work has different compartments where pencils and pens can be kept, card holders, pins and erasers and other small office materials, as well as a tray. The work is solely identified by the user. The base of the work is flat to enable it to sit properly on an office table for efficiency. The size of the work is not big so as to occupy a large portion of the office table, thereby not taking up a big space on the table. The work is to help promote and sell small but functional organisers. This can be achieved where the work is used as a metal souvenir that visitors can buy and send to their various countries.

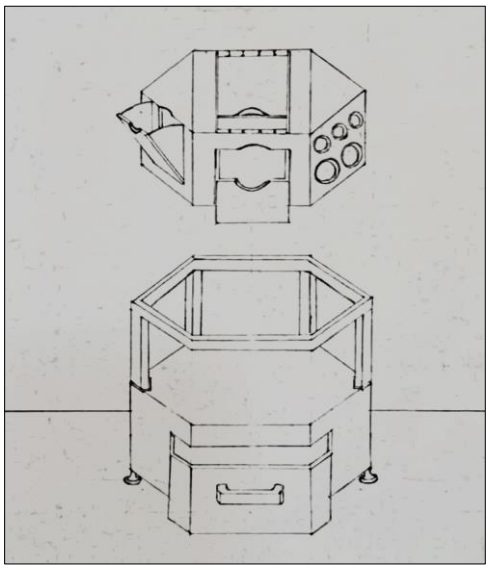

Fig 1: Idea generation by researcher (Studio work, 2025)

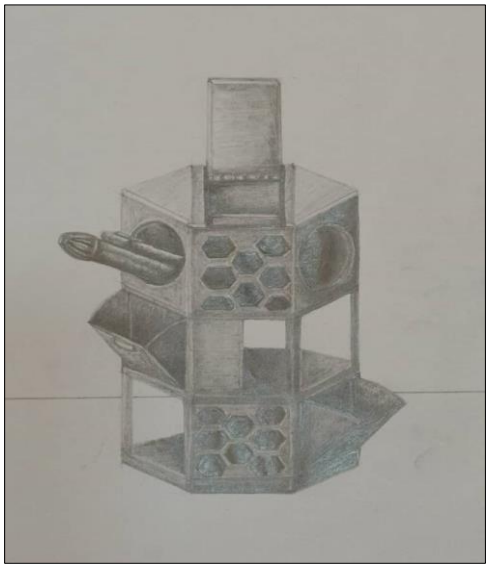

Fig 2: Generation sketches (Studio work, 2025)

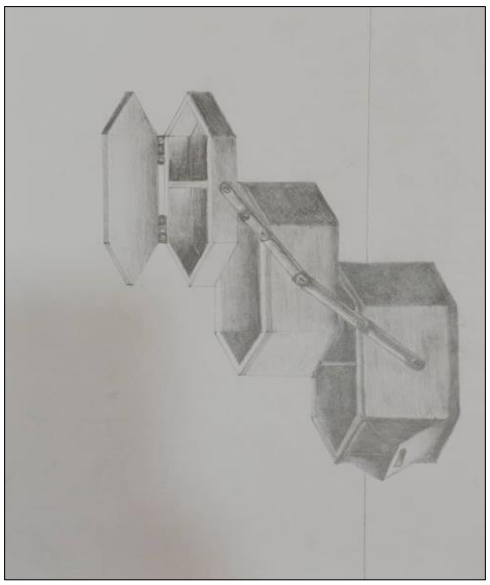

Fig 3: Sketch of a desktop organiser (Studio work, 2025)

Fabrication of the Desktop Organiser

The desktop organiser which is meant to solve most office users ' problems with organising their items, such as call cards, pens, pencils, erasers, etc., was produced accordingly. The creation of the beehive-inspired knock-down desk organiser began with a number of specific preparatory and piercing operations that are critical to the production of the typical hexagonal geometry of the honeycomb structure. These initial stages are recorded in figures 4 to 6, starting with preparation of the initial template, and continuing to complete piercing of all the parts necessary to complete the complete assembly.

Figure 4 shows how the honeycomb template was cut out, and used as the guide upon which all the other marking and shaping was done. The template was measured and cut to precise dimensions in order to make the dimensions of all hexagonal units consistent. Any error at this level was fatal because it would be replicated in all the other parts, and the modularity and fit of the knock-down assembly would be compromised.

Figure 5 summarizes the drilling process where pilot holes were injected at strategic positions in the template. These holes acted as an opening in the next step, the piercing saw blade whereby internal cuts could be made without interfering with the outer border of each hexagonal cell. The process of drilling was done carefully so as not to compromise the structural integrity of the copper sheet and also to reduce wastage of materials.

The piercing of the single hexagonal pieces of the copper sheet is recorded in figure 3, and is a tedious task, one which demands a steady hand and a uniform tension on the blade. The template lines are then cut by the piercing saw to create clean-edged hexagonal shapes that capture the efficiency and tessellating perfection of natural honeycomb.

Figure 6 illustrates the completion of all pierced pieces needed to make the desk organiser. These elements, identical in shape and size, are combined to make the modular building units of the beehive structure, preparing them to undergo the forming, soldering and assembly steps that followed.

Fig 4: Cutting out the template of the honeycomb (Studio work, 2025)

Fig 5: Drilling the template of the honeycomb (Studio work, 2025)

Fig 6: Piercing out the hexagonal shapes (Studio work, 2025)

Conclusion of Pierced Components, Drawer Preparation, Riveting and First Unit Assembly

Figures 7 to 10 capture the sequential steps of fabrication that go through to the completion of all the pierced parts all the way up to the realisation of the first complete assembled piece of the beehive-inspired knock-down desk organiser. These steps symbolise a move towards single part assembly to collective assembly of structure, which also symbolises the iterative, user-centred design approach that prepared the whole fabrication approach.

In the figure 7, all the pierced pieces needed to complete the desk organiser are shown. The components were pierced to fine tolerances, so that there was a dimensional consistency of the hexagonal units. The standardisation of the pieces pierced at this stage was the main aspect of the modular knock-down capability of the organiser since the exact fit between the component is necessary to have tool-free assembly and disassembly.

The preparation of the drawer units, which is a vital phase in the process, is recorded in figure 8 whereby the copper and brass sheets had to be measured, scored, and pressed into the sliding compartments that were intended to hold jewellery and other small accessories. The internal dimensions of each drawer were carefully considered to provide a smooth movement in the hexagonal frame and forming techniques have been used to provide clean right-angled bends without cracking or distorting the metal.

Figure 9 captures the riveting of lock mechanism to the drawer unit. Riveting was chosen as the main technique of fastening the lock due to its strength, permanence, and aesthetic choices of the palette of copper and brass materials. Driven with controlled blows of the hammer each rivet was placed to give a flush and secure finish which maintains the clean lines of the drawer face.

The first unit of the desk organiser is shown in Figure 10 - this is a major milestone and the successful completion of all the fabrication processes that had been carried out. The assembled unit shows the structural integrity, hexagonal form, and modularity of the beehive idea, which validates the feasibility of the knock-down design to be carried out on a large scale.

Fig 7: Piercing out all pieces needed (Studio work, 2025)

Fig 8: Preparing the drawers for the unit (Studio work, 2025)

Fig 9: Riveting the lock on the drawer (Studio work, 2025)

Fig 10: The first unit of the desk organizer (Studio work, 2025)

Construction, Welding, riveting, and Third Compartment

Figures 11 to 16 document the most technically intricate stages of the producing process, including forming and alignment of components to be soldered, soldering of individual components, developing and implementing rivets to move parts in the compartments, and shaping the third and final compartment. Together these steps turned separately made elements into a structurally sound, functionally integrated and aesthetically coherent desk organiser.

The formation and assembling of all parts before soldering is recorded in figure 11. Elements were perfectly positioned, fitted and retained through binding wire and soldering blocks to ensure accurate angular relationships throughout the heating process. This pre-preparation step is highly important in metalwork because the misalignment before soldering

leaves permanent structural flaws that affect both the functionality and aesthetic appearance of the final artefact.

The soldering of the assembled units is shown in figure 12, whereby silver solder and the relevant flux was applied at every joint to form strong, clean, permanent connections between the copper and brass parts. Soldering was done in a considered progression; joints with the highest temperature soldering were done first and then the lower temperature connections are done, in order to avoid reopening of previously soldered connections as more heating was done.

Figures 13 and 14 depict manufacturing and use of rivets to aid in the movement of the compartments of the organiser. Copper rod was made into hand-fabricated rivets, cut to length, inserted in pre-drilled holes to form pivot points in which the compartments can slide and reposition themselves freely. This is the key to the knock-down, modular nature of the design, allowing users to re-configure the organiser to meet new storage requirements without tools.

The completion of the riveting on both compartments is shown in Figure 15 and it proves the integrity of the structure and the articulation of the moving parts. The riveted joints were completed even with the surface in order to maintain the clean, professional look in line with the beehive design language.

The third and the final compartment is formed as documented in Figure 16, it is a tray unit that is used to store cards, pins, and other minor accessories. The sheet metal was then bent and shaped with bending and shaping tools to obtain the internal dimensions that were needed to functionally fit into the two already assembled compartments, and the organiser was brought one step closer to its fully knock-down state.

Fig 11: Forming and assembling of all parts to be soldered (Studio work, 2025)

Fig 12: Soldering units (Studio work, 2025)

Fig 13: Creating the rivet for the compartment (Studio work, 2025)

Fig 14: Riveting is done to support the movement of compartments (Studio work, 2025)

Fig 15: Both compartments riveted (Studio work, 2025)

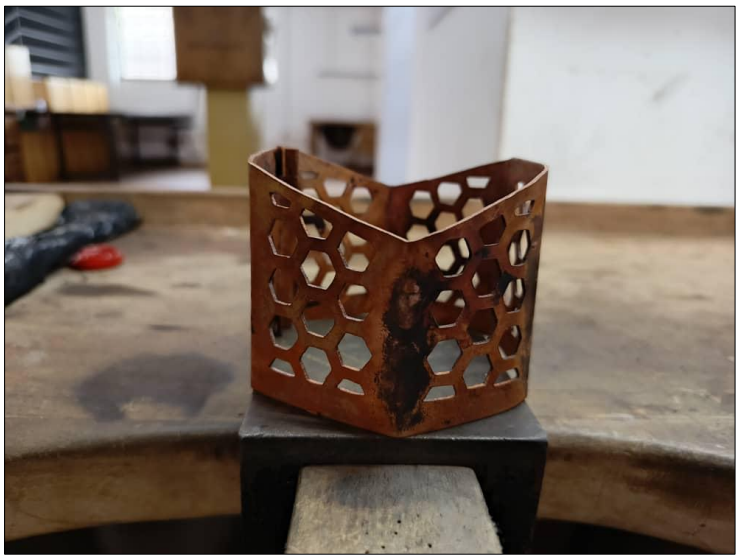

Fig 16: Forming of the third compartment (Studio work, 2025)

As illustrated in Figures 17 to 20 the desk organiser can be assembled in four major steps. Figure 17 starts with the third compartment, which concentrates on the last structural details: the additions and soldering attachments. In this case, little metal plates or dividers or loops of wire will be permanently fastened to the walls of the compartment, so that the pens, cards, or small tools will have a place of safety. This action turns a standardised container into a personalised storage unit.

To Figure 18 we observe the third and last compartment quite finished. Its soldered connections are now clean and strong and the compartment exists as an independent, stiff and functional object. It is made to store the tallest or most used objects, e.g., scissors, a ruler, or a smartphone. The workmanship is seen in the straight lines and in the stable base.

Figure 19 presents the complete desk organiser with all three compartments brought together. The first compartment (probably paper clips and sticky notes) and the second compartment (probably smaller stationery) are positioned next to each other, and the recently completed third compartment. Additional soldering or a common base plate may be added to them, forming a complete, balanced layout to optimise the space on the desk.

Lastly, Figure 20 shows the completed desk organiser in the desired setting. It is stored in a workspace and contains diverse supplies. The solder joints are not seen on the surface, and the whole work appears professional and solid. Out of personal attachments to a complete assembly, these figures demonstrate how attentive soldering and the design of a compartment will lead to a working, hand-made tool that will have any desk organized and productive.

Fig 17: Soldering attachments and additions to the third compartment (Studio work, 2025)

Fig 18: The third and final compartment (Studio work, 2025)

Fig 19: Complete desk organiser with all three compartments (Studio work, 2025)

Fig 20: Finished Desk Organiser. (Studio work, 2025)

General Discussion

The desktop organiser was a successful product that fulfilled the requirement of a functional, disassemble metal souvenir to be used at the office. Using the five steps of evaluation of studio-based research proposed by Marshall (2010) [17], the paper has shown that a set of traditional methods of jewellery creation series soldering, riveting, piercing, filing, and forming can be used to create a product which is durable and pleasing to the eye at the same time. The structural integrity and visual contrast were offered by the usage of copper and brass sheets (Figures 1 and 9), and the dependable joining of components was possible due to silver solder of soft, medium, and hard types and the use of borax as a flux (Figures 7 and 8).

One of the major results associated with the quality of the materials: the scholar observed that the quality of jeweller saw blades locally available was lower than that of British and German-made blades, which influenced accuracy when piercing (Figure 2). This empirical observation illuminates a supply-chain dilemma of studio jewellers in some situations. Also, the honeycomb soldering board (Figure 5) was necessary as a way of managing heat and the torch (Figure 6) was necessary in all annealing and soldering processes.

The three-compartment design of the organiser, which was inspired by a bee colony structure, with the queen bee at the centre of the chased third compartment, is highly effective in the combination of symbolism and usefulness (Figures 15-20). The riveted connections enable the compartments to be utilized individually to respond to the research objective of modularity. Each step, including boredom of the honeycomb template (Figure 5) and piercing of hexagons (Figure 6) and construction of the third compartment (Figure 16), soldering connections (Figure 17) and assembling it (Figures 18-20) is visually documented in Figure 4 to Figure 20. These photos validate the fact that series soldering and cold connections (riveting) can be used in a single piece without structural failure.

The drawbacks are that it has not been tested by the user outside the studio. Long-term durability and user satisfaction need to be tested in the real office setting in future work. However, the completed artefact (Figure 20) is a useful desk organiser as well as a sellable souvenir, and this fact underlines the aim of the study to publicize local metal crafts.

Summary of Findings

The design concept was separated into three compartments, which can be put together to create a uniform system. This idea was adapted to portray the vision that exists in the natural habitat of the bee. The first and foremost unit, which is the bottom-most part, was made primarily out of copper, with brass metal being used to create certain or specific areas.

It features drawers which can be pulled out by the traditional method of opening drawers.

The second unit comprises a space which is opened from top to bottom, intended to accommodate a stationary function as a housing component for the third unit. The bee colony represents cooperation and teamwork work which is why the second unit is being placed as a single unit compartment, boosting teamwork and spirit.

The third unit embodies the central theme of the project; it features a three-dimensional representation of the queen bee, who is the leader of the bee colony. In the creation of the bee, the chasing technique was employed in conjunction with various techniques of series soldering. This particular piece consisted of copper and brass. The unit also comprises a pen and marker holder which features a cut-out pattern of the honeycomb design, which gives it a unique aesthetic appearance, and as such, it doubles as a decorative art piece for a desk or centre piece of a dining table.

The purpose of the piece acting as a decorative piece is due to the bees, mostly known for producing honey, which is a consumable commodity which constitutes a great source of nutrition as the only food which does not expire.

Conclusion and Recommendation

The study successfully designed and fabricated a knock-down desk organiser based on the beehive concept, using copper and brass sheets. The artefact has three compartments; its pen holder is honey-patterned, jewellery drawers with riveted locks and a card tray. The old methods of jewellery such as series soldering, piercing, riveting, forming and chasing were effective to ensure the product was durable, portable, and attractive to the eye. The beehive motif is a sign of hard work and collaboration and the knock-down assembly enables the organiser to be rearranged or moved anywhere without carrying a tool. User response validation was on better storage capacity, ergonomic comfort and visual attractiveness than on conventional organisers. Nevertheless, saw blades that were available locally were discovered to be of low quality compared to those that were imported, and this impacted the precision of piercing. There were no long-term user tests outside of the studio.

Depending on the results, the following recommendations are suggested. The knock-down beehive design should be introduced as a sustainable souvenir by craftspeople and institutions to encourage local metal craftsmanship. The next research should have longitudinal user tests in actual office conditions after six to twelve months in order to test durability and user satisfaction. It should form local joint ventures or importation networks of high-quality jeweller saw blades to enhance accurate piercing. Design should further consider more compartment designs, including a smartphone stand or cable manager. Lastly, commercialisation should be developed to have a flat-pack kit with instructional diagrams to allow users to assemble the organiser on their own and make it more accessible to the market.

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