CENTER RE-GEN

(An exploration into visualising hospital
as a space of production and delivery of
personalised regenerative medicine)

Research Plan

CP
10
complex projects

TU Delft

2024, Spring studio

COMPLEX PROJECTS
Bodies and Building Berlin
AR3CP100

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INTRODUCTION

01

Personal interest

My interest in hospitals and healthcare facilities stems from personal encounters over the past few years. The first instance was when I visited my grandfather undergoing open-heart surgery. The hospital, specializing in cardiology, housed around 150-170 rooms, marking a medium-sized facility. At the time, I wasn't well-versed in hospital architecture, but certain aspects left me questioning, "Does it really have to be this way?"

Upon arrival, high compound walls and a security presence greeted us, setting a tone of restriction rather than openness. Transitioning from the outside world to the hospital's interior invoked anxiety, marking the onset of a place where anything could happen. As we navigated to the cardiology department's lobby, the architecture and interiors mirrored the somberness and sorrow we felt. Dull colors dominated the space—monotonous grays and whites, small windows, and long corridors with numerous "Please Do Not Enter" signs. To reach the Cardiology department, we had to traverse through other departments, each corridor resembling the last—bereft of natural light, filled with the scent of medical equipment and cleaning solutions, and lined with doors bearing witness to various medical conditions. Witnessing other patients being wheeled through these corridors, pre and post-operation, only intensified the unsettling atmosphere.

Once my grandfather was settled in the patient ward, his room, devoid of external views, further contributed to the sense of isolation. With no colorful decorations or distractions, the room was a canvas of mild grays, accentuated by shiny white tiles and medical equipment. My grandfather, like many patients, spent his days with closed eyes, devoid of stimuli. Reflecting on my stay, it was undoubtedly one of the worst experiences. There was little for visitors to engage with, amplifying the feeling of desolation. Despite the hospital's accolades for its cardiology department, I couldn't help but question how patients enduring immense pain cope in such environments.

The onset of the pandemic exposed the hospital's vulnerabilities further. Overcrowded lobbies, a lack of treatment spaces, delayed diagnostics due to the rush—these issues underscored the need for hospital designs to adapt to evolving healthcare needs. It's not just medical procedures that require adaptation during epidemics, but also healthcare architecture. My experiences resonate with many others, both in India and the Netherlands, who have encountered similar challenges in healthcare facilities. Hospitals, as vital places in everyone's lives, warrant critical examination and improvement in their design and functionality.

Fig-1, Dark and unpleasant corridor clicked in India

Thesis topic

Hospitals serve as the bridge between people and the ever-evolving technological and scientific realm of medicine. They are commonly defined as institutions providing medical, surgical treatment, and nursing care for sick or injured individuals.[1] Architecturally, hospitals embody the dominance of medicine, serving as both shrines and healing apparatus.[2]

In ancient times, before the development of hospitals, sacred places served as spaces for care, with healing primarily based on superstitious acts and prayers. Healing was viewed as the primary method of recovery. However, as technology advanced and new diseases emerged, hospitals evolved into increasingly technical spaces dedicated to shifting from superstitious healing to technical care. This transition aligns with the concept depicted in Fritz Kahn's 1926 lithograph, "Man as Industrial Palace," viewing the human body akin to a complex machine. Industrialization and the introduction of diagnostic equipment, such as X-rays, alongside the clean room typology, transformed healthcare facilities into standalone entities. Here, bodies were perceived as broken machines in need of repair. However, the future of healthcare lies in healing, a concept originally adopted in ancient times. This form of healing is not rooted in superstition but rather in highly scientific and research-based medicine, aimed at facilitating the body's natural healing processes. This coined the term of Regenrative medicine. Regenerative medicine deals with the "process of replacing, engineering or regenerating human or animal cells, tissues or organs to restore or establish normal function".[3] Regenrative medicine is considered the future and this technology has the potential to develop therapies for previously untreatable diseases and conditions. [4] (See fig.-3) Which explains what all diseases can be overcombed by regenrative medicine.

Considering this the graduation project involves the development of a new "Center Re-Gen (hospital for regenerative medicine) located in the city of Berlin. It aims to explore the evolution of this specific healthcare treatments and see how architecture can play its role in defining a hopsital that meets the future requirements and at the same deal with the personalised nature of regenratvie medicine. It is said that regenerative medicine needs highly collaborative envrionment of multiple diciplin for it to operate at its full strength.[5] Incorporating this specfic treatment needs a paradigm shift in the architecture, the process of delivery and care environments for its patients.
This promts us to reconsider the traditional and exisiting hospitals and its architecture to create something that is more future proof and can accomodate differnet functions.

Problem statement

The onset of the Covid-19 pandemic highlighted the shortcomings of the this traditional healhcare facilities and also the delivery of care. Along with this the age and the acmout of chronic diseases is also rising sharply with time. Today, **80%** of people over age of 65 have at least one chronic disease, One in six people in EU have mild to severe disability.[6] The word expentancey rates have increased by 20 years since 1950, but the causes for the deaths are still the same.[7] The chart illustrates the casuses of death in Germany, amongst which majority of them have a common solution as Regenrative medicine. (see fig.-2).

Collaboration and translation of research to clinical prctice-
Since in todays scenario there is an evident gap between the research that is carried out

1. Oxford advanced dictionary (2024)
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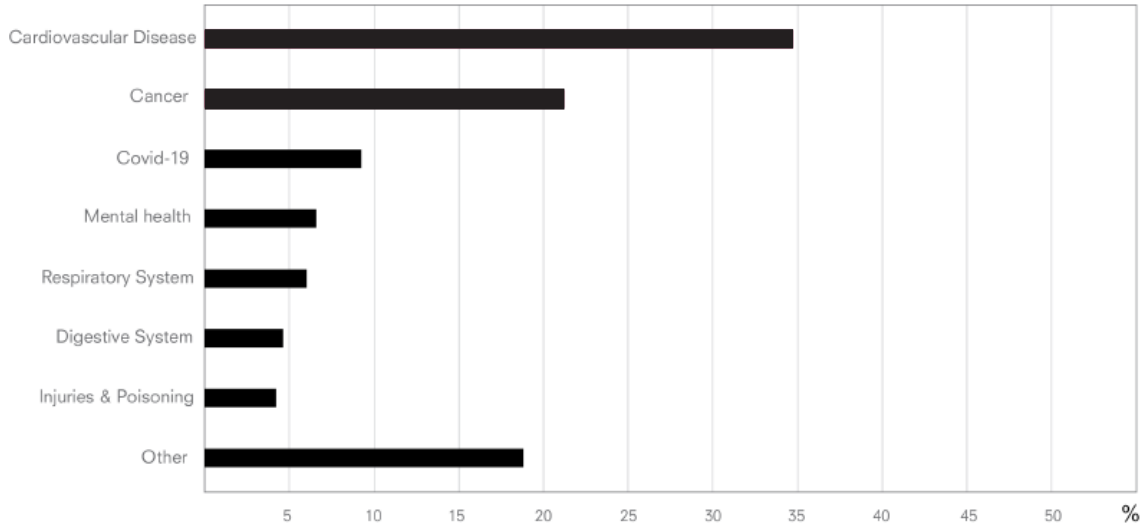

Fig-2, Showing the major causes of death in Germany in 2023, Source - IPSOS global health monitor, surveyec - July-Aug 2022

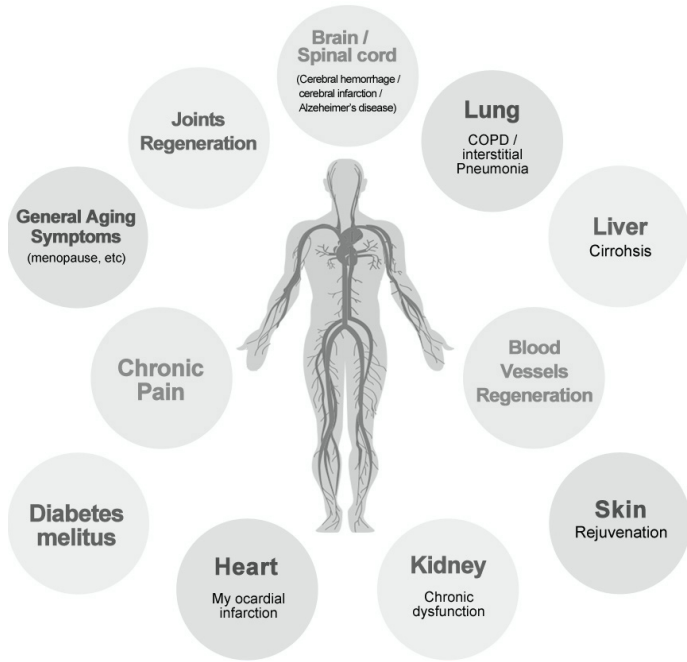

Fig-3, Showing the major major diseases that it can cure Source - Muse dermatology & pain clinic dermatology anesthesiology / musashi-urawa medical centre / 1st floor. Musashi. (n.d.). https://www.musashiurawa.jp/hifuka/en/regenerative_therapy.php

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7. Worldometer. (2023). Retrieved from https://www.worldometers.info/demographics/life-expectancy/

in the labs by private or non private bodies. A lot of research done never makes it way to get implemented for the care of the patients and vise versa, also its the same situation. What happed in the surgical space never reaches the table of the researcher for it to look deeper in that matter. Not only there is gap between the clinical and the surgical part there is also gaps between the these two and the othe parties namely education, production, innovation and bio banking. We still find some connections at the university hospital between surgical and education and research, but also due to its scale and its affiliation with the universty it is not always possible to built one. The question rises are there any possibilites to bring them together to create a hollistic environment of care and reduce the time in transition of information from one disciplin to another?

Adaptability and flexibility
The exisiting healthcare architecture in Berlin or where else is not capable to change and adapt with the changing needs. During the pandemic everyone have vitnessed it in some or other way. Similar experience is also shared in the personal interest page. The hospitals we see are becoming opsolete with the changing healthcare trends and rising of various different health issues .

Delivery of care.
The traditional healthcare process is very much functional oriented or departmental. The patient have to flow through various other spaces to acces the final step.[8] With this system the flows are not optimised. With the focus more on the technical aspects the spatial arrengement and the architecture of the hospital does not effectively promote patient centic care. What if the spaces of hospital move towards patient to heal them more effectively.

Hospital and its relation with the city
The relation of the hospital and the city plays a vital in functioning of it as a shared space where evryone is welcomed. But the hospital as seen today are covered with high walls and even being inside the city are cordened off by fences, they are built slightly away from the city where there there is no cities hustle and noice and patient can be connected to the green. It makes it completely restrcitive for people if such far away hospitals are not connected via mobility modes.

Research question

With the contet of the problem identification and the historical study of hospitals and its surgical settings, its relation to the city, trends in healthcare the following research question arises which would change the way the hospitals are perceived in current times.

How does the architectural design of a hospital facilitate the production and delivery of personalised regenerative medicine while enhancing patient care and experience?

The research question is further bifurcated into smaller topics to focus on much specific themes affecting the development of hospital for regenrative medicine.

1. Surgical setting as the key element of change
2. Spatial arragenemnt and flows within the building and their significance
3. Architecture of regenration and its imapct
4. Connection of the hospital at different scales

The project highlights and represents an example that would serve as an inspiration for the future of healthcare architecture.

8. Amato, C., McCanne, L., Yang, C., Ostler, D., Ratib, O., Wilhelm, D., & Bernhard, L. (2021, December 15). The Hospital of the Future: Rethinking architectural design to enable new patient-centered treatment concepts - International Journal of Computer Assisted Radiology and surgery. SpringerLink. https://link.springer.com/article/10.1007/s11548-021-02540-9#citeas

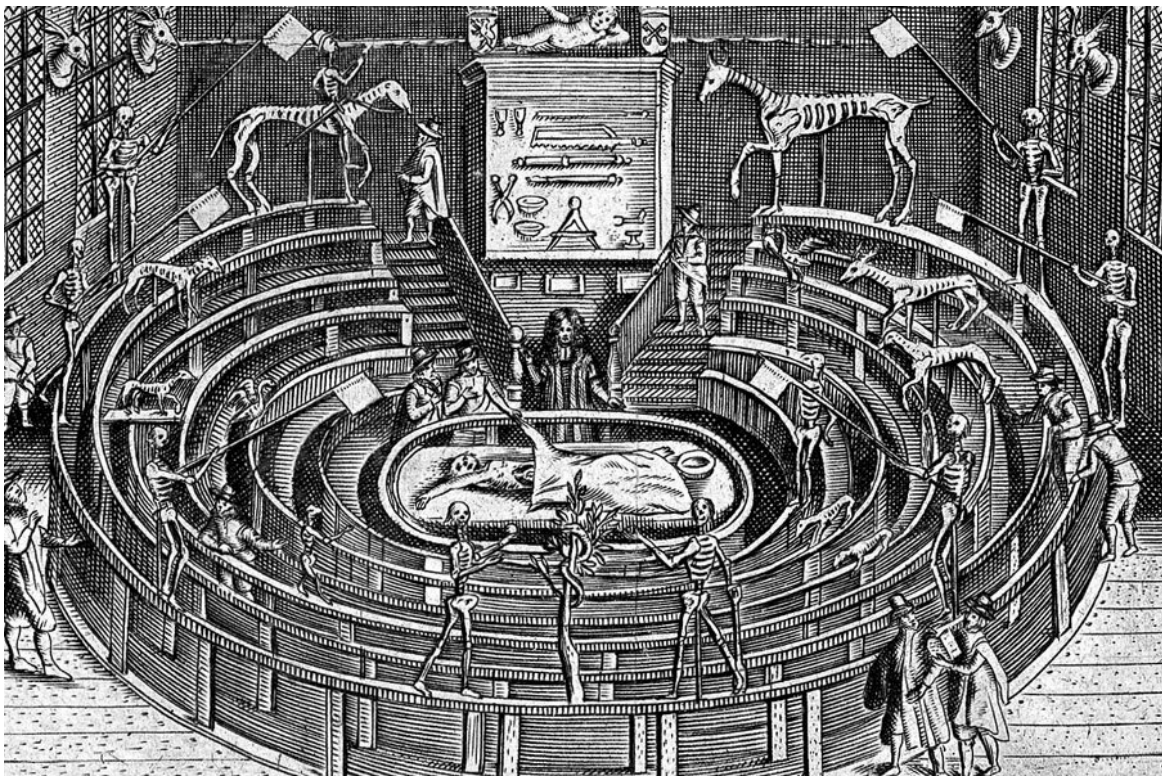

Fig-4, Showing the famous theatre typology of the surgical space

Fig-5, Showing the latest advanced Ai based automatic surgical suit

RESEARCH FRAMEWORK

02

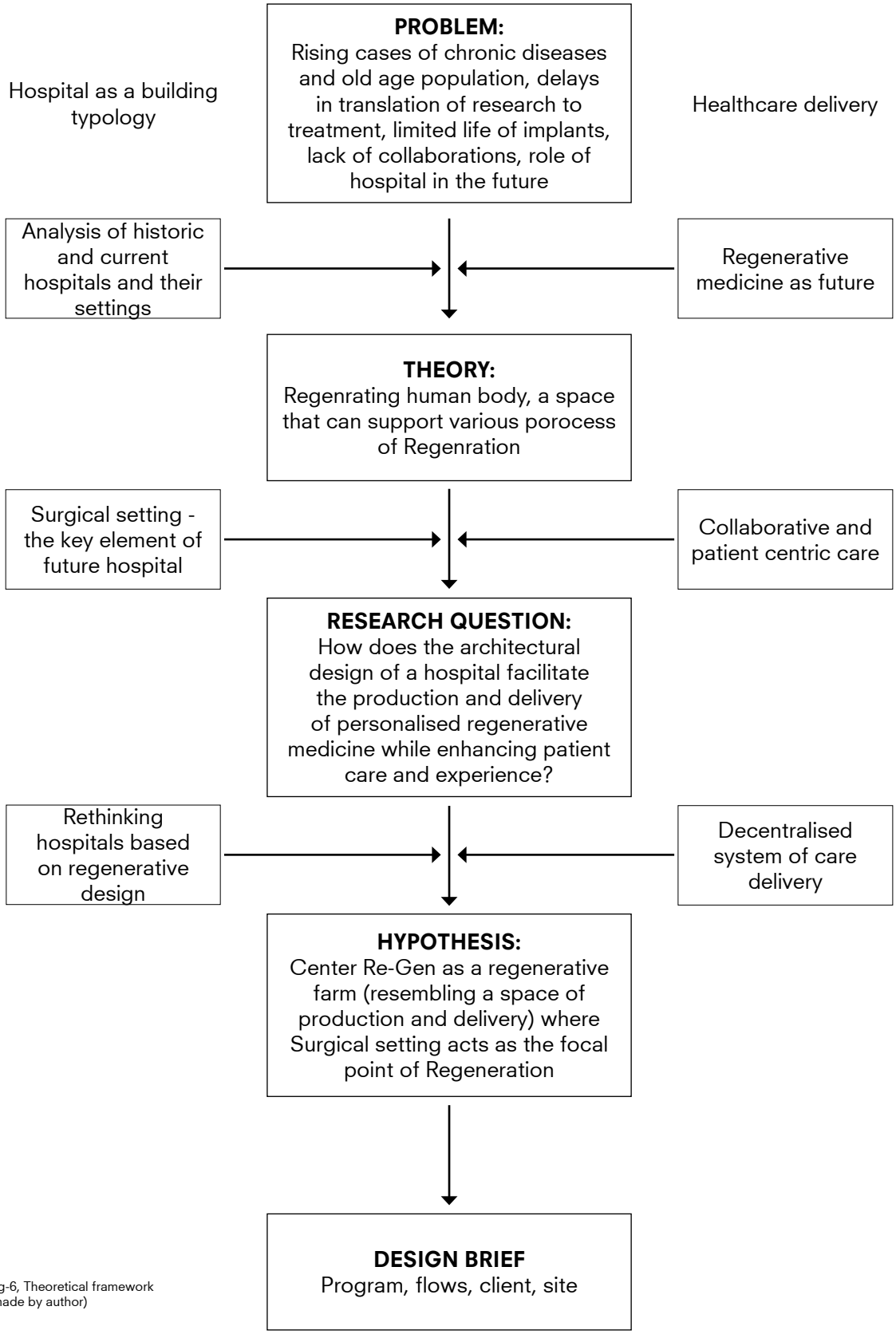

Fig-6, Theoretical framework (made by author)

Theoretical framework

This research will look into the theories, methods, experiments and precedents that deal with specialised hospital design incoporating a bio repository and production spaces for regenrative medicine. It further dives into regenrative design strategies that can provide fundamental support for the development of one of a kind hub. The research framework works on an overarching theme of hospital as a regenrative farm (a space of production and consumption) while also emphasizing sustaiability, healing and connection to nature.

The research employs two lenses to carry out the resarch to understand the role, working and impact on hospital when designing a facility dedicated to regenerative medicine.

1. Hospital as a building typology - This lens is utilised to understand the processes, functioning, layouts and type of design strategies used to otimise its working and how the building cope with the changing needs of the future.

2. Healthcare delivery - This lens explore the impact of regenerative medicine on the hospital buildings and its spaces.

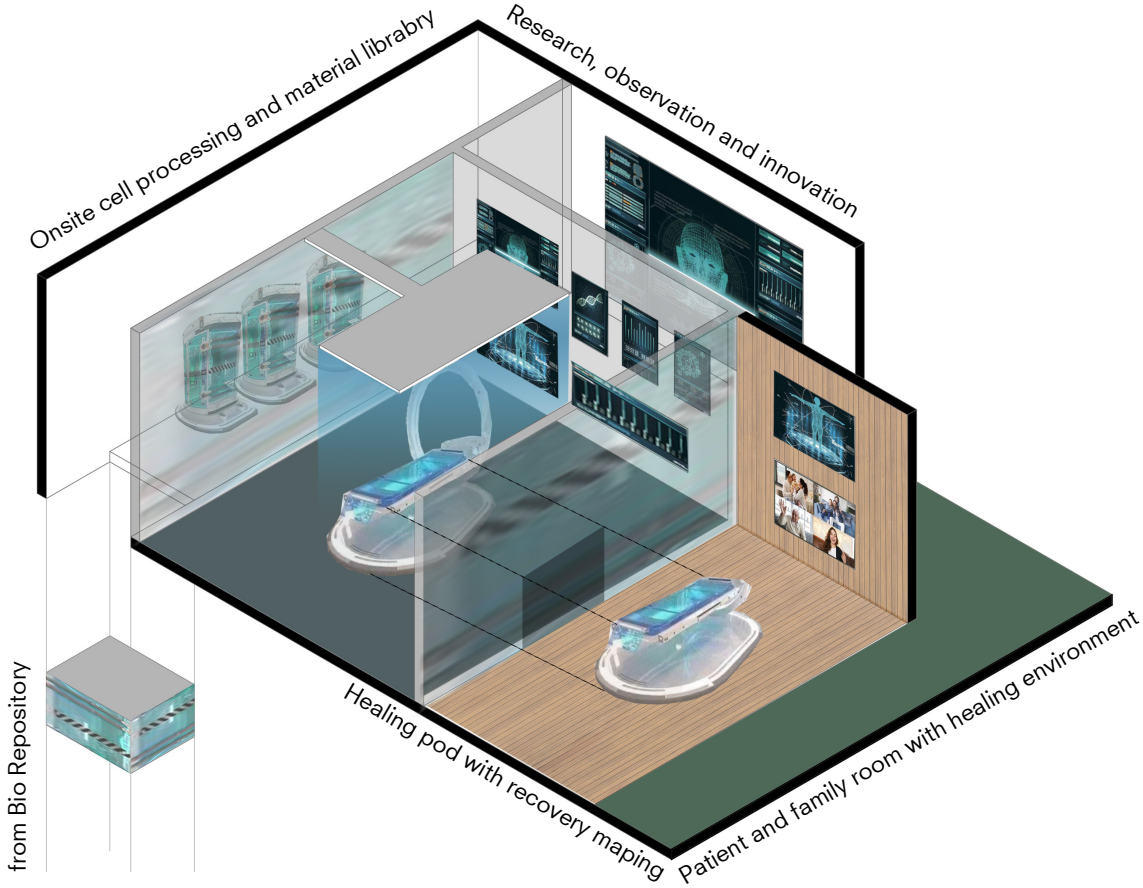

Fig-7, Collage depicting the ambition of creating a surgical space as a collaborativ space of production and delivery (made by author)

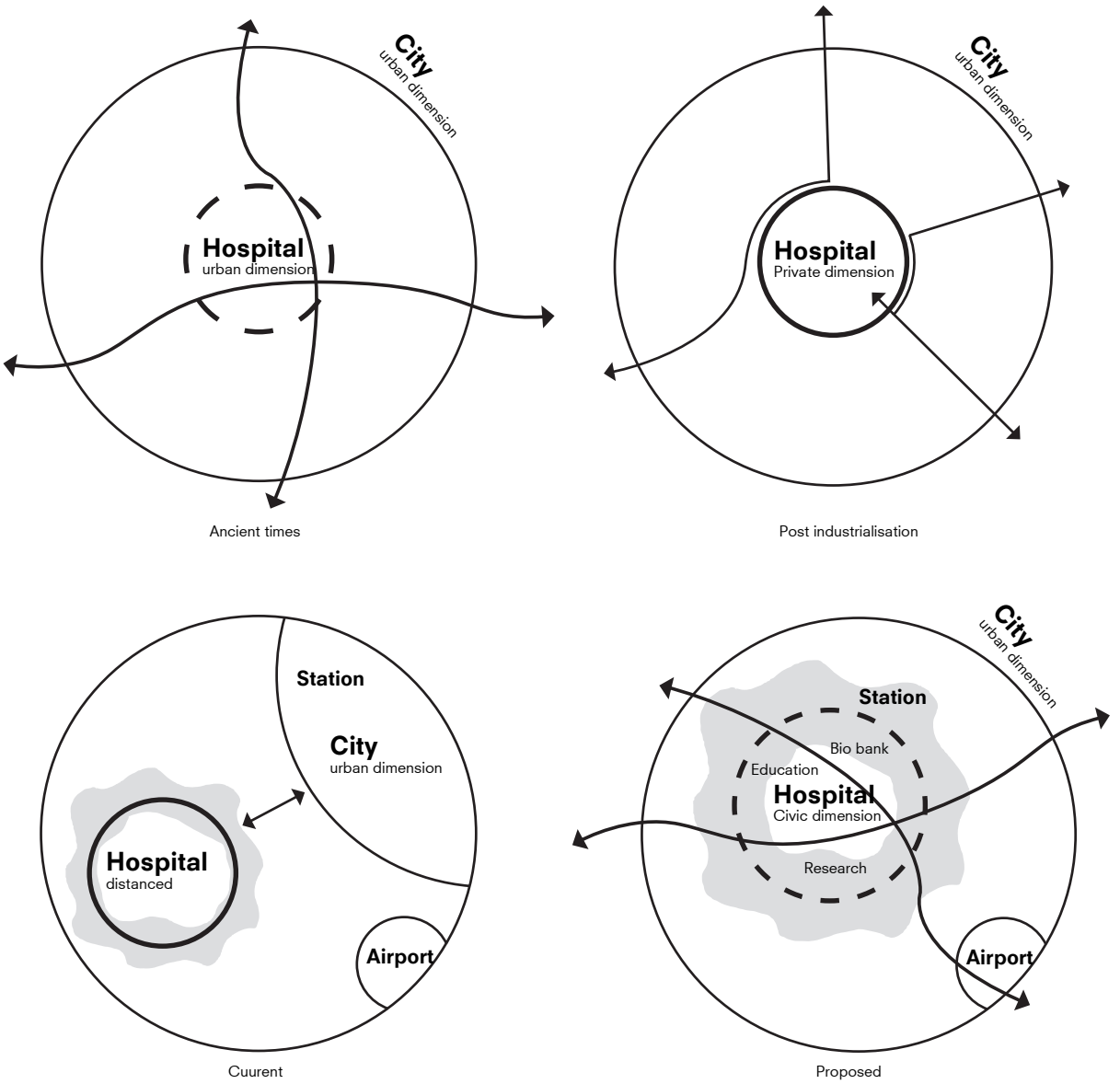

Fig-8, Diagrams showing the chaning relation of hospital with the city (made by author)

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Hospital as a building typology

Hospitals have evolved a lot since last so many years and have served various functions, and their relatons with the city and the people have been continuously changing. Relating this to the idea of Heterotopia given by Michel Foucault [9] fits very well describing hospitals as heterotopias, spaces within spaces where you are supposed to behave in some set manner. Relating back to the storey narrated in introduction, Hospitals now are seen as the isolated islands that are regulated by biological laws of space. By this the main intention is to restrict the peoples entry. Comparing it to the middle ages hospital, they functioned as social institutions placed in the center of the cities.[10] The figure no.- 8 also depicts the change in hospital boundaries and its relation with the city.

Shifting the focus to smaller layer of space, the surgical setting that becomes the vital space of the hospital. Surgical spaces can defined as the physical environment, equipment, and personnel required for the performance of surgical procedures. It includes spaces such as operating rooms, preoperative and postoperative areas, as well as support facilities like sterilization rooms and supply storage areas. The setting is designed to ensure patient safety, maintain sterile conditions, and provide a conducive environment for surgical teams to perform procedures effectively.[11] As the overall scenario of the hospital changed with time the surgical settings also evolved, considering both technical and architectural aspects. The surgical spaces stand as the core of the hospital technically bound with norms and functionalty. It marks as the space where both patient and healthcare staff cometogehter to deliver the care. But with future the relation of patient and doctor should evolve to more patient centric, where patient also becomes and has voice in selecting and personalising care delivery. This requires specific set of space and the ability for the space to change as per the changing needs.

Incoporating regenrative architecture methods can help in defining the way we have been visualising healthcare spaces. Regenrative architecture/design focues on principles that contribute to the health and wellbeing of the individuals, communities and the natural world.[12]
Major aspects of building typology that will frame the deisng and developement of Center Re-Gen.

Healthcare delivery

Today hospitals are seen as the pivotal aspects in the care giving process. The delivery of care goes handin hand with the advancements medicine and the architecture supporting it. With the rise of regenerative medicine it is very important to understand how it works, and what are ways of delivering care. As seen in the introduction the regenrative medicine is not like any other medical procedure but requires specific settings and, infrastructure and environmrnt to carry forward the process. So it needs a detailed and informed study of the how the procedures work, what is the time frame and who needs to participate in the process. As regenrative medicine is highly collaborative process it also requires to rethink on the hospitals could help in multidisciplinary collabrations under one roof.[13]
This further leads in developing a system of decentralised care giving process making the hospital and the process more patient centric. Both dencentralising care process and involving collaboratins will create a perfect setting for patient centric environmrnt.

Relevance

The relevance of the above mentioned topics of city to hospital connection, surgical setting as the key element, regenrative design, decentralised system and collaborations, all lead towards the rising needs of personalisation of care. With rising health issues and since all human bodies are different from one another why is the care same? The whole setup of hospital needs to change from ' one size fits all' approach to 'Personalised treatment' approach.[15]
The future lies in creating personalised and patient centric environments.

RESEARCH METHODS

03

Research Methods

In order to answer the research question and its related sub-questions, the research will be strcutured into three different aspects, namely the Program, Client and the Site. Each aspect will provide insight into the project and will act as the stages of project development. Also the graduation studio works simultaneaously with both group and individual research. Multiple topics are researched parallel to each other which helps to relate the research at multiple scales and visions.

Group

As the last group - X, for the Bodies, Building and Berlin studio the research is informed by two group themes. The aim of Group theme DATA is to come up with a studio book that will act as the element that informs the development of the project. The past works done in the studio are studied to understand how key architectural elements play a role in defining the project and till what extend the element helps in developing new typologies of the future and that resonates with the flows of human body. A comparitive and subject scales will be introduced to study these projects with different lenses.
Along with this the other group theme - Mobility comes into play to inform how the project will sit in to the larger context fo the city of Berlin. The outcome of the group theme layed down a framework of requirements which will help and guide the selection of sites for the individual project, leading to the fulfillment of the group vision. Since the later theme of Mobility was already developed by the previous year students the aim is to look whether the set rules are important for the locating your project or questing the set rules and stating fresh one will better inform your site location. In current situation the grouo theme mobility goes very well with the projects idea of creting a hospital that is connected to people at different scales. Mobility will play a viltal role in the functioning of Center Re-Gen in various fronts, creating a fast time bound transportation line and also connect the facility with people living farther away and people becoming part of the cutting edge regenerativemedicine center.

Individual research

The individual research on the other hand will follow the therorethical framework provided. In order to research different aspects, different methods of photos, literature study, maps, drawings, onsite evaluation of exisiting healthcare faciltiies both in the Netherlands (as it the place of authors stay) and Berlin. Communicating with doctors involve with regenrative medicine could help in establising the real needs of it. (in search as the procedure is new not every doctor is familier with it, as informed by a family doctor form India specialiesd in neuro surgery.) Interview with any other professional from different diciplin related to regenerative medicine. (in progress) These methods could help in deriving a detailed list of requirements leading to a pricise and well informed design brief for designing a one of kind hospital for regenreative medicine.

Program

The final program will be developed based on the literature study aiming at the needs of regenerative medicine and understanding what spaces might need to be enhanced. Refering to the fig.-9,10 It shows the general arrangement and program collaboration to finalise the spatial layout and creating flows that are optimised.
Additionally, the study involves n examination of German and European guidelines for hospital buildings and current developments in information society.

The size of the hospital is defined by its location, the spcialisation it offers, the size of its organisation and importantly its capacity in terms of beds. A large and university hospital will hosuse more than 500 rooms while a medium size and specialised hospital will house around 100-200 rooms and a small hospital with less than 100 rooms. For the proposd project the intention is to focus on a medium scale specialised hospital along with looking into other aspects of the program that will make a collaborative environment.

Site

Based on the hard and data available and the group and typology requirements, GIS mapping will be used to create datasets when overlapped can provide overall scenarios of where the hosptial can be located. With incoporating physical site visit the final site will be identified and photo documented to map the site surroudnings, the life that exsits around the site and also diving deeper to look at the exsiting site situation to not consider it as tabula rasa.

Client

The project is envisioned as a public private partnership to ensure equal authority over the new developments of the regenrative medicine and delivery of care. The client search will mainly happen via the internet but aslo via advertisements or consortium leaflets. The clients will be identified based on the following heads-
Adminstrative partner
Research partner
Hospital partner and
International setups to support global supply.

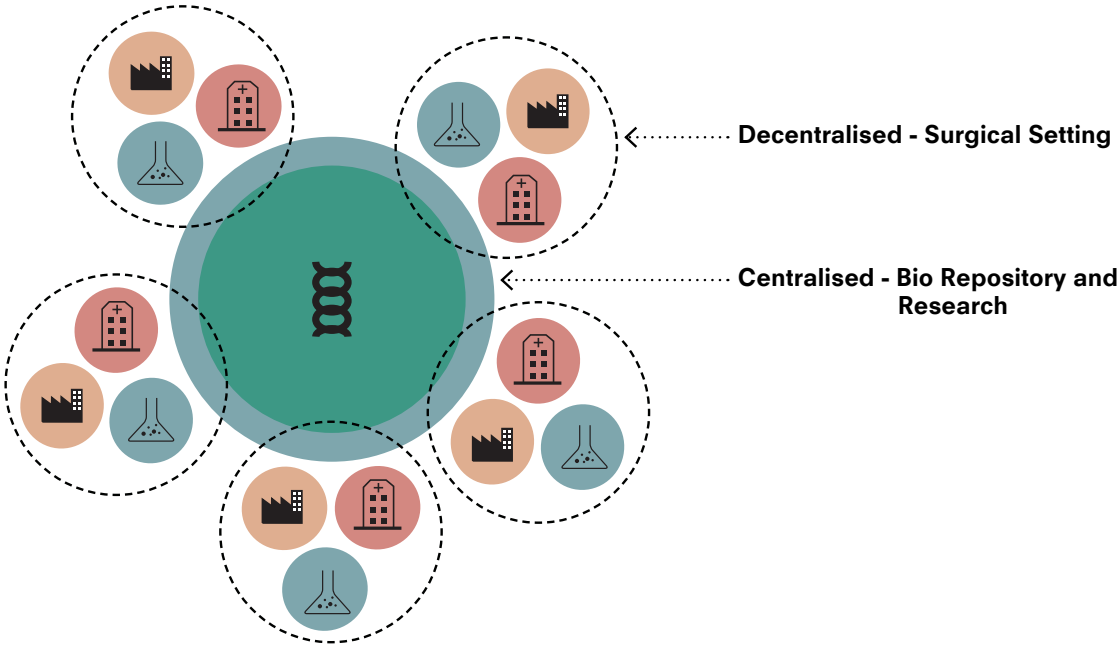


Fig-9, Proposed arregement of functions (made by author)

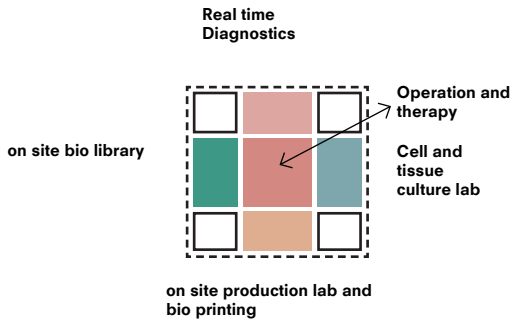


Fig-10, Diagram showing the proposed surgical setting with collaborative spaces (made by author)

DESIGN BRIEF

04

Program

As mentioned the study is focused on a medium scale specialised hospital with a bed capacity between 100-300. Apart from the the specialised hospital the program of the proposed center also consists of other major parts, namely the Bio repository, the factory (regenrative medicine production unit) and the educational and rersearch settings of the university hospital. The case studies of the specialised hospitals focuses on the program development of clinical spaces, public spaces, office and administration, diagnostics and the other supportive spaces. (see fig.-)

Spatial relation

In a hospital generally there are 3 primary user groups - Patient, staff and visitors following a path through different departments one after another. But the Center Re-gen as its main focus lies in its surgical setting the vison is to design a surgical setting that can articulate produce and delivery personalised regenrative medicine creating a multidiciplinary collaboration sapce. This collaborative setting becomes the heart of the hospital which can act independently to create a personalised enironment and medicine for the patient on site. The modues or the setting can be replicated to accomodate multiples procedures at the same time. This governs the spatial reation of the hospital with all the flows excpet the visitors meet at the surgical settings. (see fig.-)

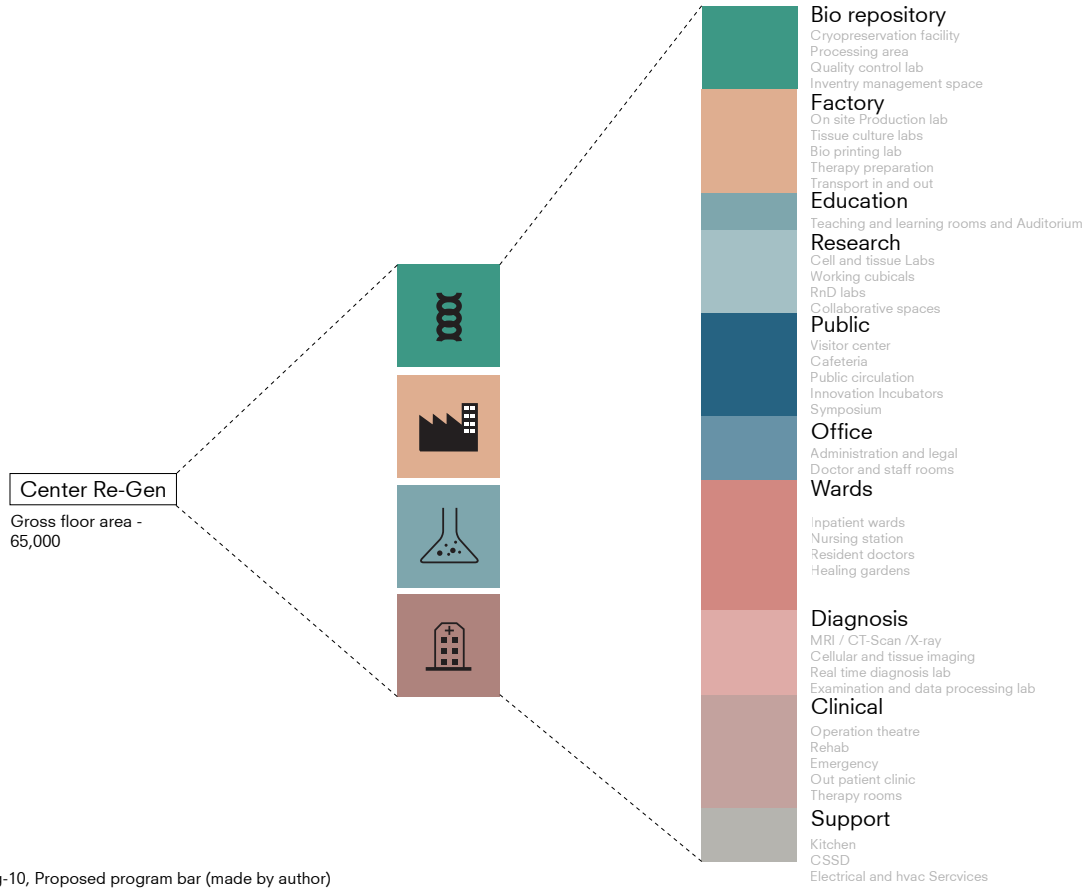


Fig-10, Proposed program bar (made by author)

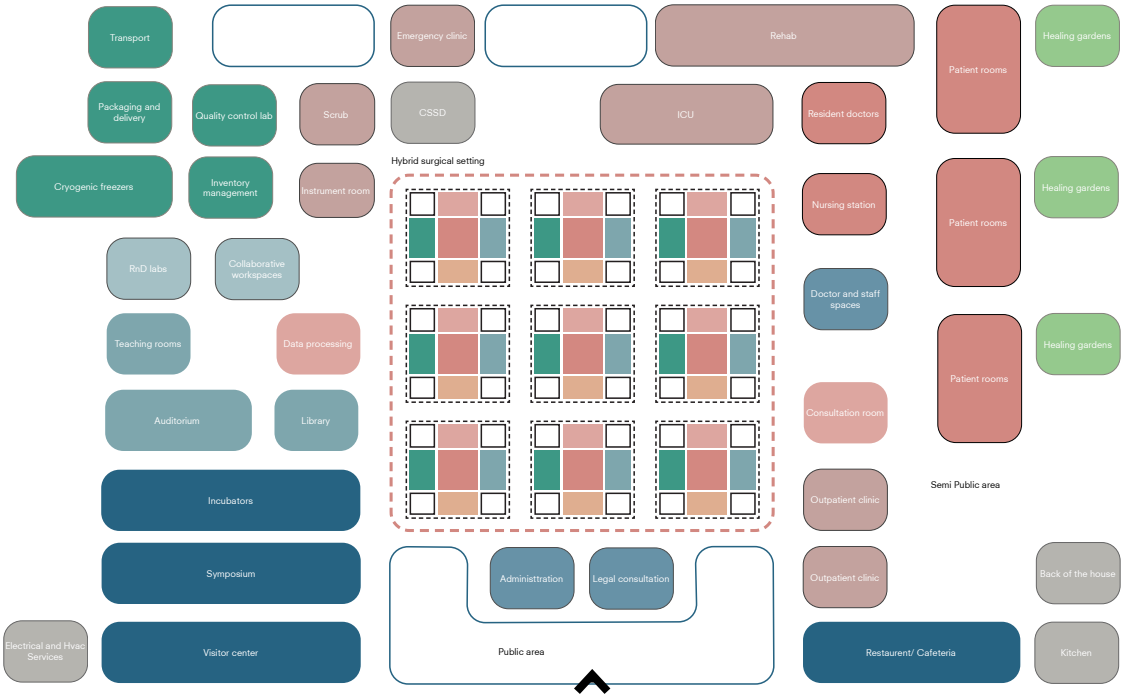


Fig-11, Proposed spatial arrangement highlighting the surgcal settings (made by author)

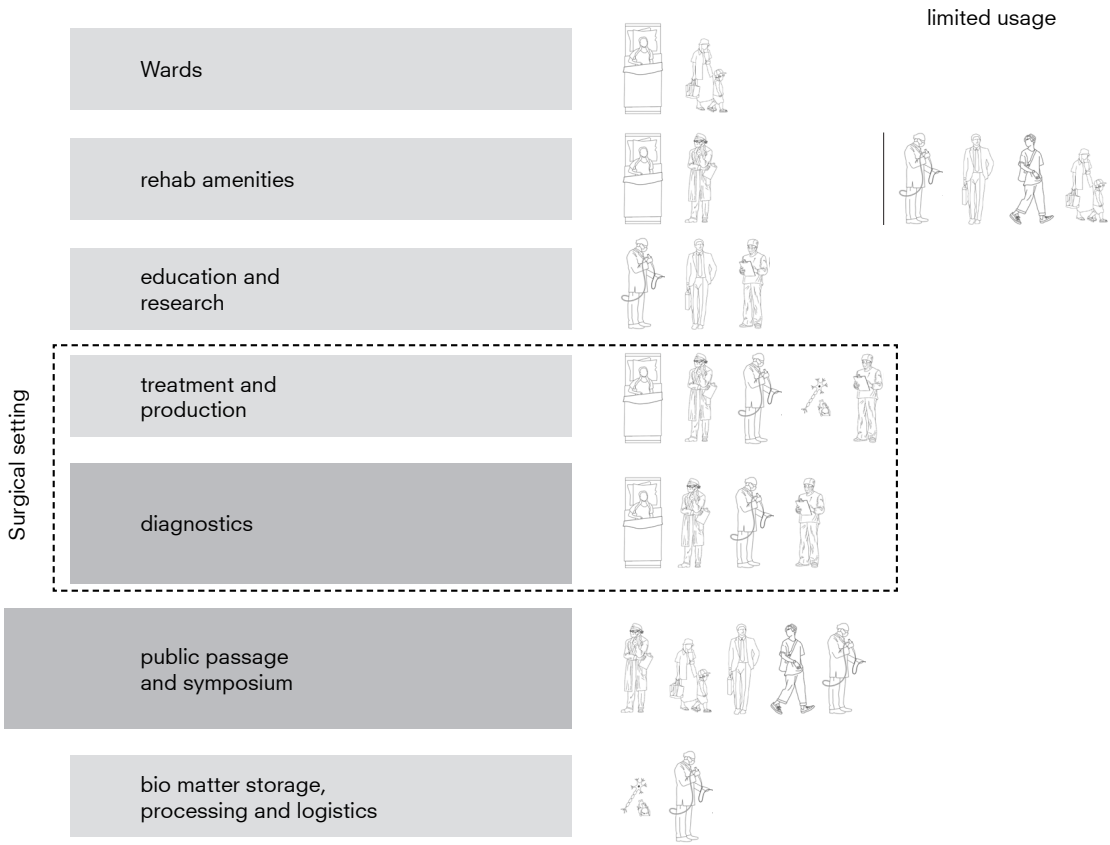


Fig-12, Major programs ans user groups showing multidisciplinary collaboration in surgical settings (made by author)

Client

1. International supply chain
The international stem cell forum and the Euro stem cell forum will invest in the development of the centralised bio bank whch can store various gene strains and biological matter for the future. Both the forums will also play their part in establising a netwrok gene flow from one place to another.

2. Research patners
Berlin Brandenburg center for regenerative therapies is the translational center. They engange in conducting research that focuses on healing processes and develop new therapies and diagnostics. The already setup research initiative in Berlin can support the upcoming facility which will not just focus on research but also make clinical usage a reality.

3. Administration patners
Majority fo the current regenrative market is administred by private research compaines due to which the cost of these procedures are high and not equally available to all. But with making the Federal ministry of health and Berlin state government the administration patners they will not only fund and provide land but will also make the regenrative medicine available to all.

4. Hospital group
Charite group of hospitals is the biggest hospital chain in Berlin operated the Berlin state government. A state owned hopsital will fund and run this specialised center as Charite also have rising interests in regenerative and advanced therapies.

5. Innovation companies and startups.
Many hospitals in Germany are getting shut due to the reduced fundings from the governments, involving these small compained and startups with the incubation center they can support the funding of the hospital and take part in designing and innovating medicine delivery.

International Supply chain

↓

INTERNATIONAL STEM CELL Forum

EuroStemCell

Adminstrative Partners

↓

Bundesministerium für Gesundheit

Federal minitry of health

Berlin State government

Research Partner

↓

BIH Regeneration
BIH Center for Regenerative Therapies (BCRT)

Medical Partners

↓

CHARITÉ
UNIVERSITÄTSMEDIZIN BERLIN

Site

Group criteria

Travel Experience

Located on primary or secondary road network

Reachability

Proximity of mobility hub in 10 minutes by walking

Travel Time

Located with ~30 minutes from center & Berlin's perimeters

Building criteria

Density

Located in medium to high density areas

Hospital nexus

In range of 3km to a large hospital

Water - Green

Connected to Spree river. Surrounded by green areas

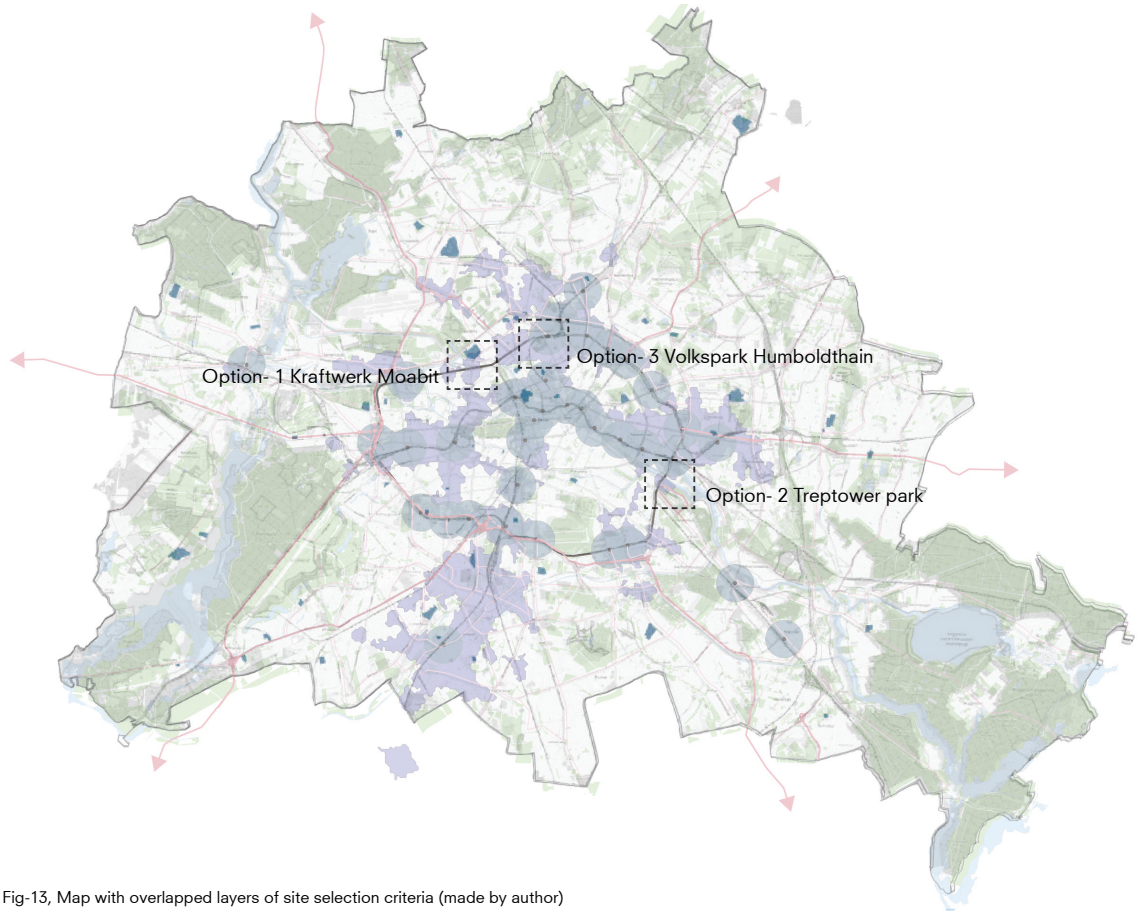
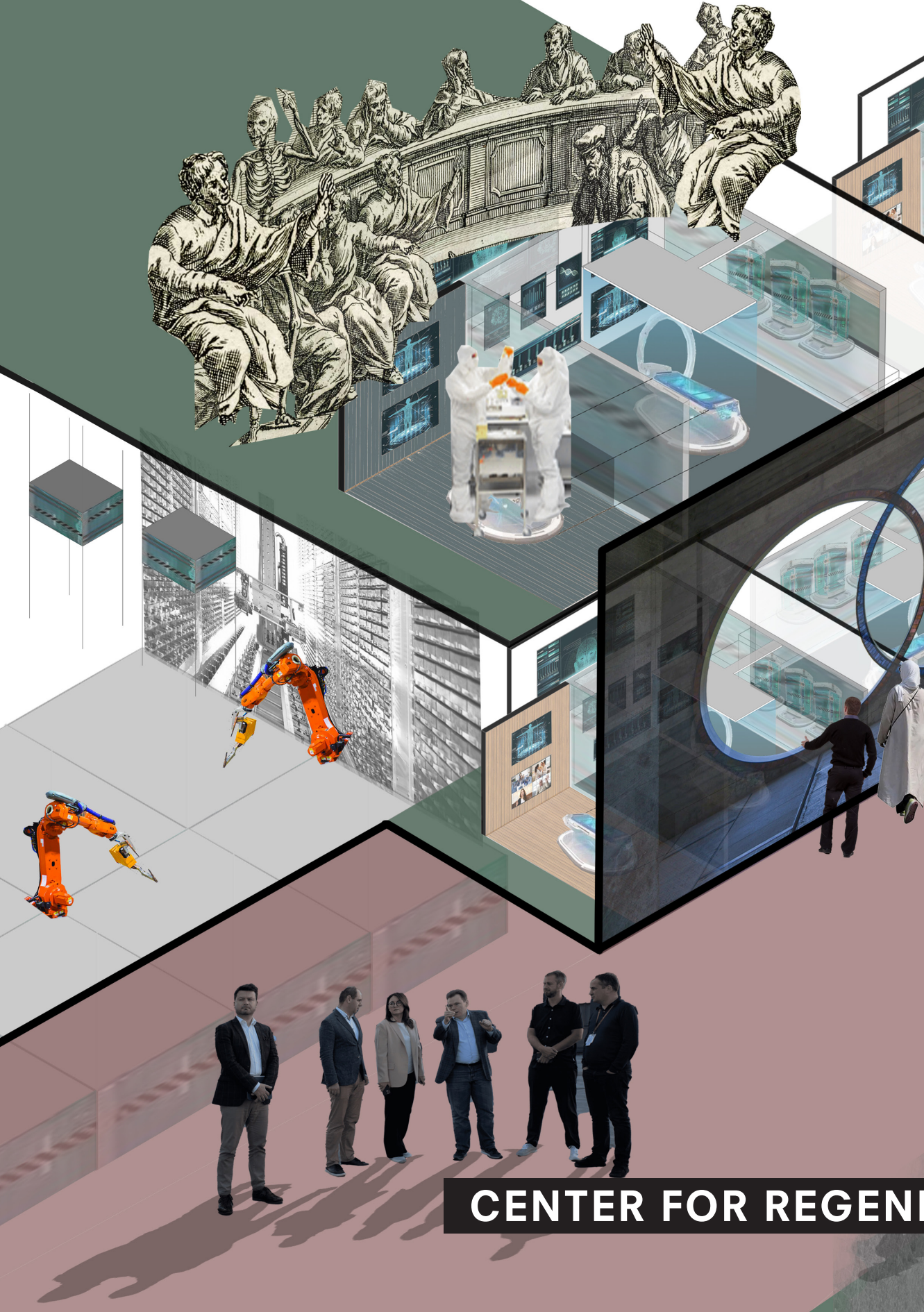


Fig-13, Map with overlapped layers of site selection criteria (made by author)


CENTER FOR REGENE


RATIVE MEDICINE

APPENDIX

05

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