

# 03

## THE PADDY INNOVATION CENTRE AT SIMPANG EMPAT, PERLIS

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### ABSTRACT

The paddy industry is vital in Malaysia, contributing around 300,500 hectares to rice production. However, the sector requires improvements to achieve self-sufficiency in rice production. Currently, Malaysia relies on rice imports to meet national food security needs. Several issues affect rice production in Malaysia, with social issues being the most prominent, followed by environmental and economic concerns. Additional challenges includes lack of innovation in developing new paddy varieties and insufficient awareness and education regarding modern farming technologies and innovations in the paddy industry. Therefore, to ensure a secure future, the paddy innovation center aims to enhance the quality and quantity of local paddy production, by introducing innovations in the paddy industry and integrating the farming community into a collaborative laboratory environment with researchers. The center also offers educational and entertaining experience for the people. Consequently, the research output will be a fully developed innovation center that educates the community about the importance of the paddy industry and fosters collaboration between researchers and the community. This collaboration will facilitate knowledge exchange and practical demonstrations of innovations and technologies in paddy farming. Additionally, it aims to raise awareness and engagement among farming communities and attract the younger generation to participate in the process and improve the paddy industry in Malaysia.

**Keywords:** *Paddy, Innovation Centre, Living Lab, MADA paddy, Simpang Empat, Perlis*

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### PROJECT INTRODUCTION

The paddy industry in Malaysia is recognized as a crucial agricultural sector that significantly contributes to the country's Gross Domestic Product (GDP). In the fourth quarter of 2017, the agriculture sector contributed 8.2% to Malaysia's economy (Fig. 1) (<https://www.dosm.gov.my>). Within the national paddy industry, MADA (the Muda Agricultural Development Authority) is the largest contributor to paddy production, encompassing the northern regions of Peninsular Malaysia, including Perlis, Kedah, and Penang (Fig. 2)(Sarena et al., 2019). Approximately 38.8% of Malaysia's total domestic paddy production comes from MADA paddy areas. According to the Khazanah Research Institute, "Rice is an essential food in Malaysia and part of our culture. Malaysians consume the grain daily, either as cooked rice or indirectly in the form of rice flour (Sarena et al., 2019).

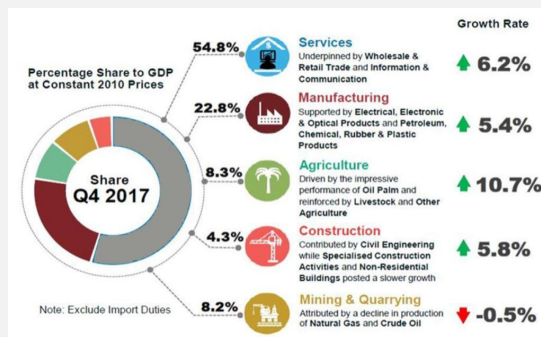


Figure 1: Malaysia's Economy Q4 2017 (source: <https://www.dosm.gov.my>)

Rice is a critical component of Malaysia's food security. However, the country's paddy industry has shown slower progress compared to neighboring countries such as Thailand, Indonesia, and the Philippines. Malaysia's paddy development suffers from a lack of innovation. Figure 2 illustrates the demand and supply trends in Malaysia. (<https://rice-processing.com>, 2020). Therefore, for a secure future, the industry needs enhanced facilities to boost innovation in the paddy sector, raise public awareness, and educate the public on new agricultural technologies in the paddy industry.

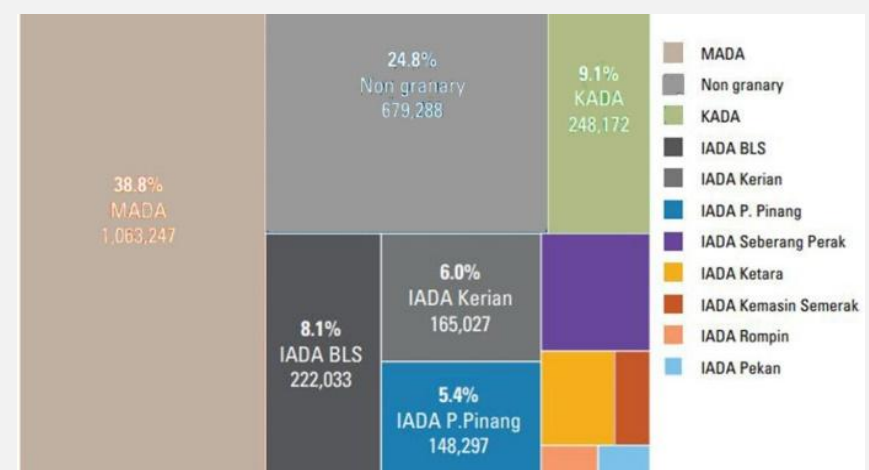


Figure 2: Paddy contributor in Malaysia (source: Sarena et al., 2019)

## PROJECT INTRODUCTION (CON'T)

The average rice consumption among Malaysian citizens is approximately 82.3 kg per year. The total market for rice consumption has been increasing year by year. Currently, Malaysia faces a shortfall of about 40% in rice supply to meet the national requirement.

Market Year	Domestic Consumption	Production	Unit of Measure
2010	2690	1642	(1000 MT)
2011	2710	1690	(1000 MT)
2012	2715	1694	(1000 MT)
2013	2725	1755	(1000 MT)
2014	2750	1800	(1000 MT)
2015	2800	1800	(1000 MT)
2016	2825	1820	(1000 MT)

Figure 3: Rice demand and supply in Malaysia (source: <https://rice-processing.com>, 2020)

The Paddy Innovation Centre aims to enhance the quality and quantity of local paddy production by integrating the community into a collaborative laboratory environment with researchers, while also providing an educational and entertaining experience in a natural setting. The centre will pioneer the recognition of innovations and technologies in the paddy sector, offering learning and training facilities for farmers and the community to explore agricultural advancements specifically related to paddy farming. The design of the centre will also foster awareness and engagement among the local community and attract the younger generation's participation to improve Malaysia's paddy industry.

## RESEARCH ISSUES

The research issues are classified into three categories namely social, environmental and economical issues, which then can be further categorized into the sub issues as illustrated in Figure 4.

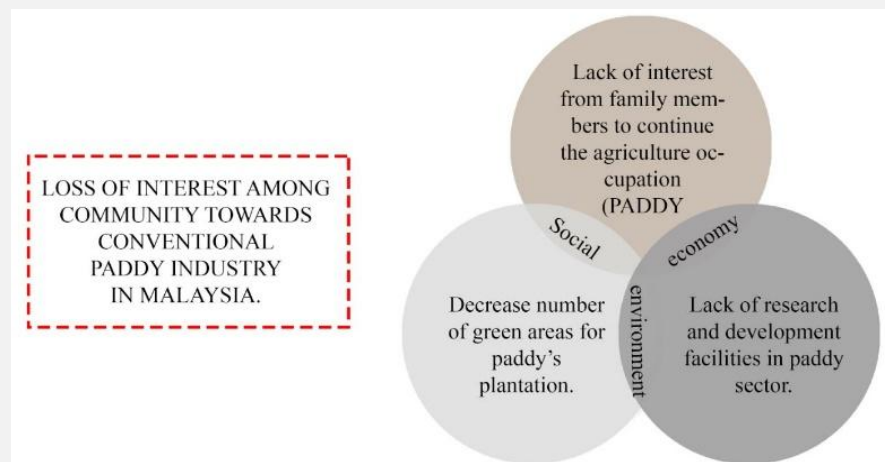


Figure 4: Core and sub issues

## SOCIAL ISSUE: LACK OF INTEREST FROM FAMILY MEMBERS TO CONTINUE THE AGRICULTURE OCCUPATION

The paddy industry faces several key social issues contributing to a decline in the community's participation. Negative perceptions within local communities regarding the high risks and low returns associated with paddy farming have significantly impacted the industry. Moreover, there's a lack of interest among family members in continuing the legacy of agricultural occupations, particularly by the youth due to similar negative perceptions. (Ismail, 2019). In addition to that, the low income earned by paddy farmers, as highlighted by reports from Malay Mail News and Malaysia's Agrofood Policy (NAP 2011-2020), often leads to their classification within the B40 income group, which represents the most financially disadvantaged segment in Malaysia. These combined factors may lead to the paddy industry becoming even more unpopular occupation among the younger generation.

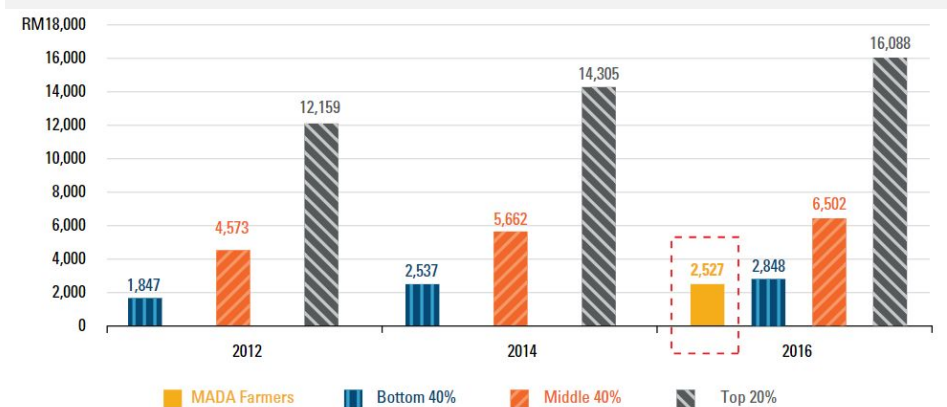


Figure 5: Mean monthly household income for Malaysians and MADA paddy farmers, 2012 – 2016 (RM)

(source: Khazanah Research Institute, 2016)

Moreover, the demographic composition of paddy farmers has been steadily declining over the years, and mostly from the older generation, typically aged 50 and above. According to Buku Perangkaan MADA (2016), the average age of paddy farmers is 60.2 years. Only 1% of the farmers fall below the age of 30, indicating minimal youth involvement in the paddy industry. This data suggests a concerning trend whereby there is insufficient representation of younger individuals in the paddy farming sector, which could jeopardize its sustainability in the long term due to lack of future generations interest to carry it forward

TABURAN UMUR (TAHUN)	PERATUS (%)
< 30	1.0
31 – 40	6.4
41 – 50	18.7
51 – 60	26.4
61 – 70	25.6
> 71 tahun	21.9
<b>JUMLAH</b>	<b>100.0</b>

Figure 6: Average age paddy farmer MADA (source: Buku Perangkaan MADA 2016)

## ENVIRONMENT ISSUE: DECREASE NUMBER OF GREEN AREAS FOR PADDY'S PLANTATION

Environment issues could be seen in the northern region of Malaysia, encompassing states like Penang, Kedah and Perlis. The reduction of green areas for paddy plantation was due to uncontrolled infrastructure development such as commercial and residential areas.

The factor influencing the paddy farmers to sell their paddy land was the higher offer from developers for the paddy's land and the lost of interest in paddy farming among the community. Berita Harian News (M Jasni Majed, 2021), mentioned that in Kedah, within a duration of ten years, 35,000-hectare paddy's land has been converted to other developments and due to this situation, the Paddy industry has lost about 350,000 tons of the commodity and that is equivalent to the value of RM 320 million paddy per year (Fig. 7). In addition to that, farmers tend to sell their paddy land because their field has various risks which make it less profitable. This matter may have caused the lost of "culture" among the paddy community in the country which has affected the quality and quantity of paddy production in Malaysia.

Difahamkan susulan 'kehilangan' sejumlah besar tanah itu mengakibatkan penyusutan sebanyak 350,000 tan padi setahun dengan jumlah RM320 juta.

Figure 7: Decrease of paddy land  
(source: M Jasni Majed, 2021)

Furthermore, there has been an environmental impact from the unregulated utilization of paddy seeds. Paddy fungal disease (*Pyricularia oryzae*) and stalk rot (*Pyricularia oryzae*) have been occurring as results of farmers utilizing unauthorized paddy seeds. Farmers are often unaware of the consequences associated with using unauthorized paddy seeds obtained from legitimate sources (<https://www.sinarharian.com.my>, 2020).

## ECONOMY ISSUE: LACK OF RESEARCH AND DEVELOPMENT FACILITIES FOR NEW PADDY VARIETIES

The economic issue can significantly affect and lower the production of rice due to the low quality and quantity of paddy varieties. Many factors had become the cause of the slow progress in research and development for the paddy industry. According to Khazanah Research Institute, Malaysia is still lagging in producing new rice varieties compared to other rice-producing countries. The country is still lacking research and development facilities at the private and universities sectors. "The participation of breeders from the private sector and universities should be encouraged to help speed up the production process of new varieties" (Sarena et al., 2019).

Thailand and Vietnam are big players in world export of rice, while Indonesia, Malaysia and the Philippines rely on imports to meet their national requirement  
Figure 1.5. Rice trade balance in Southeast Asia, 2016 (m MT)

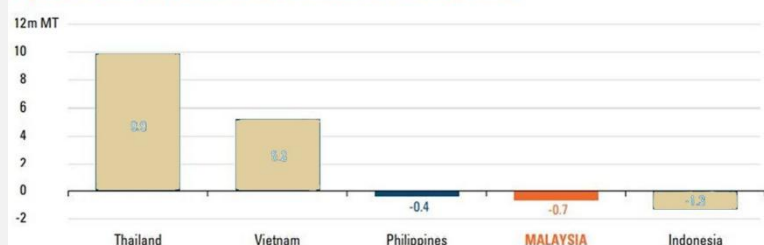


Figure 8: Rice Trade balance in Southeast Asia  
(source: Khazanah Research Institute)

She added, "The production of a new rice variety takes between 10 to 12 years. Therefore, its production dependence should not lie with the Malaysian Agricultural Research and Development Institution (MARDI)." (Sarena et al., 2019). Malaysia also needs to rely on imported rice from neighboring countries such as Vietnam and Thailand to meet its national food requirements. According to the Khazanah Research Institute, as shown in Figure 9, the statistics indicate that paddy production in Malaysia remained constant from 1990 to 2018. Additionally, low rice production due to the poor quality and quantity of paddy varieties has led to a reliance on imported rice to achieve self-sufficiency in rice for Malaysia.

Malaysia's rice production remained relatively constant compared to other countries, which have shown an increasing trend since 1990  
Figure 1.6. Total rice production in the Southeast Asia region, 1990 – 2016 (m MT)

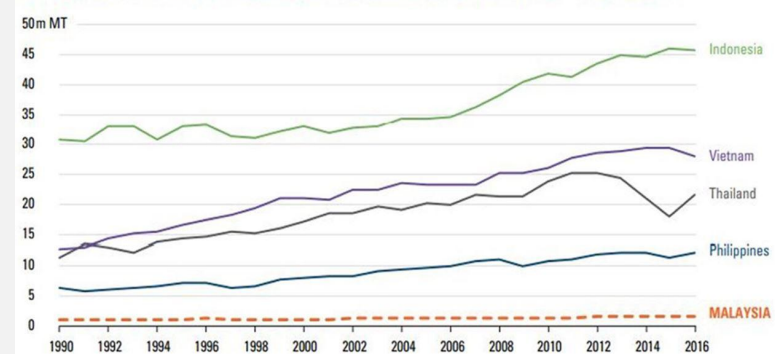


Figure 9: Total rice production Southeast Asia  
(source: Khazanah Research Institute, 2016)

## AIM

The idea of paddy innovation centre is to propose a design for education and innovation on modern paddy research and development that provide advance facilities and technologies and the space design that allow public engagement, learning and training for future paddy development.

## RESEARCH QUESTIONS

In order to achieve the targeted aim, few questions have been listed as follow:

1. What is the architectural solution to increase the paddy quality and quantity for paddy production?
2. What are the potential innovation that could be implemented in paddy industry?
3. What is the initiative to promote and attract the community towards paddy industry?

## RESEARCH OBJECTIVES

In order to achieve the targeted aim, few objectives have been listed as follow:

1. To enhance the quality and quantity of paddy production in Malaysia.
2. To promote the innovation in paddy industry and encourage the farmers and community into new technologies.
3. To create awareness in the community on the importance of paddy industry

## THEORETICAL FRAMEWORK

The theoretical framework comprises the whole idea of the research, which mainly focuses on converting the conventional towards the modern paddy industry. Several causes lead to the weakening of the traditional paddy industry such as financial issues and negative perception that led to psychological and physical affect. The built environment has also contributed towards the cause in forms of the lack of space and facilities design for research and development and the loss of green areas.

The modern paddy industry could be achieved by strengthening the paddy community's culture and improving the resources for paddy development. The innovation and technology could help the paddy industry with improvements of better social relationship, healthy environment and stable economy

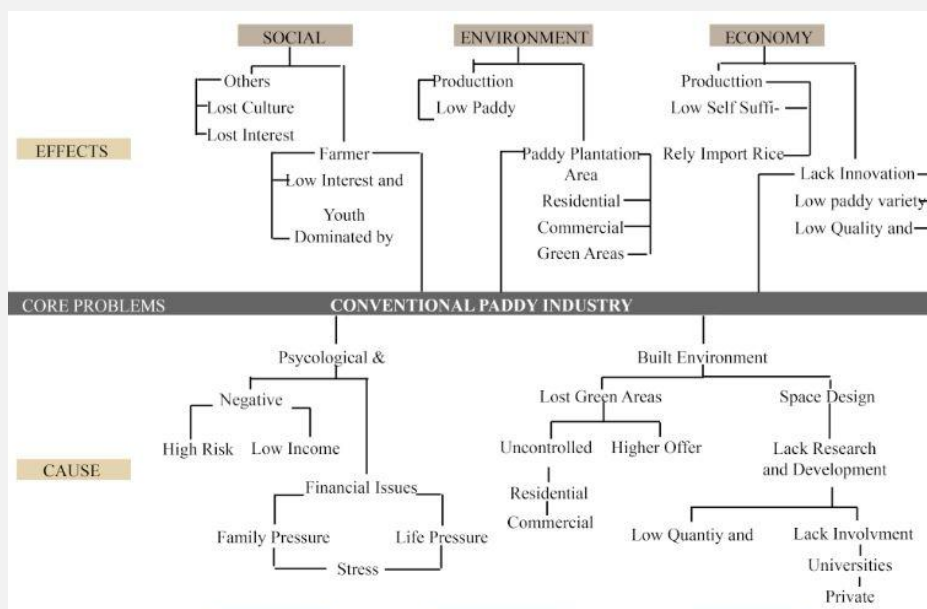


Figure 10: Core Problems Framework (source: author)

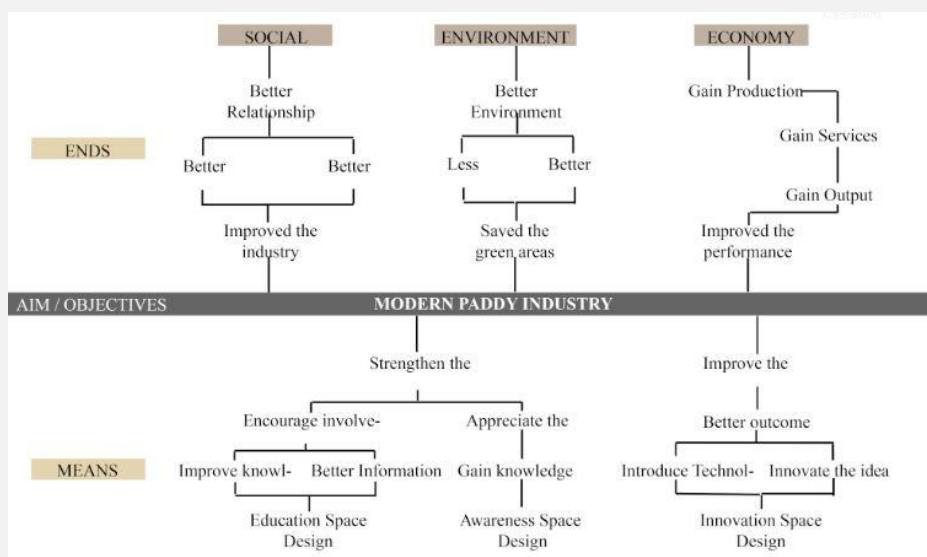


Figure 11: Aim/Objectives Framework

## METHODOLOGY

A few stages of approaches focusing on data gathering, data analysis, and data synthesis have been identified to achieve the goals of this research. The sequence of the approaches is as illustrated in the figure below.

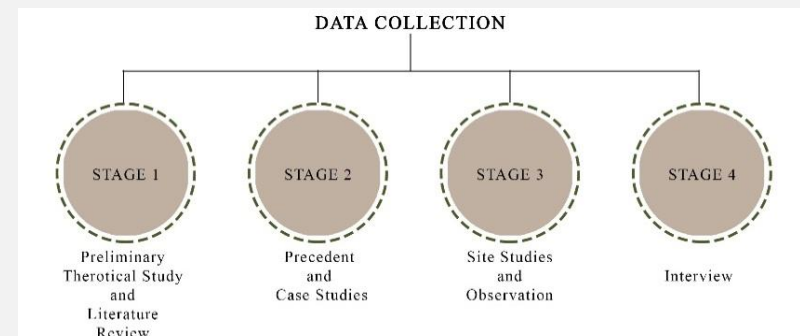


Figure 12: Stages of Data Collection

## RESEARCH FRAMEWORK

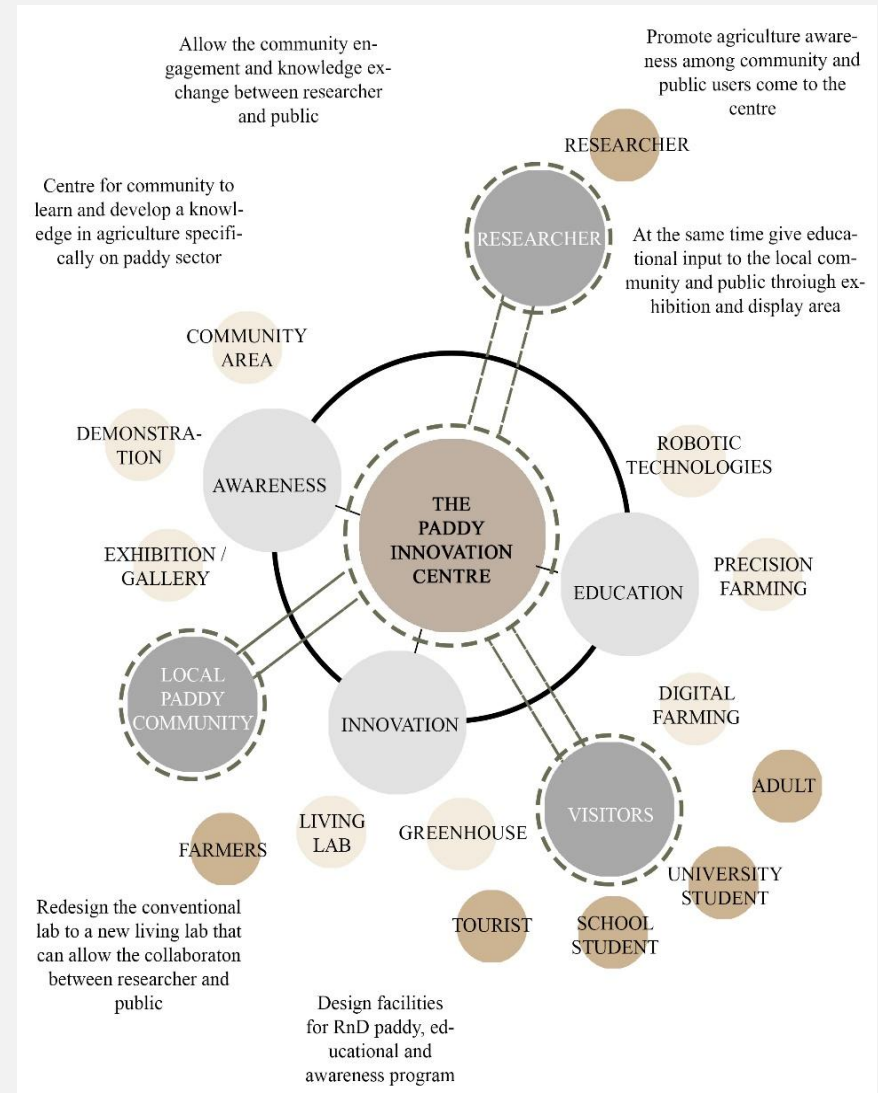


Figure 13: Program Framework

## SITE INTRODUCTION

The proposed site is located in the state of Perlis, Malaysia. It lies at the northern part of the west coast of Peninsular Malaysia and has the Satun and Songkhla Provinces of Thailand on its northern border and the state of Kedah on its south. Simpang Empat or known as Simpang Ampat is a small town located in Perlis, Malaysia at a distance of 14 km from Kangar town and 11.5 km from Kuala Perlis town. The location is selected based on several criteria such as:

1. Site accessibility
2. Near institutional and public facilities
3. Near community area
4. Strategic location
5. Agricultural activities area

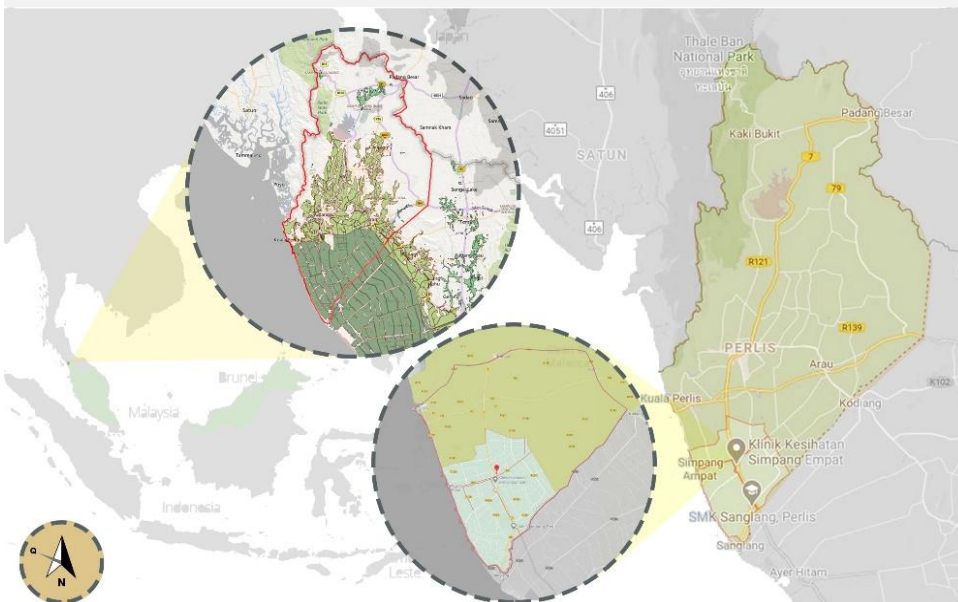


Figure 14: Key plan of the proposed site



Figure 15: Location plan of the proposed site

## Z4 - PERLIS NATIONAL FOOD SECURITY ZONE

### Simpang Empat

- National Granary Area
- Estate Management Model 2.0
- Community-based tourism
- Cottage industries

### Sanglang Integrated Maritime Development Zone

- Tourism
- Logistics
- Fisheries
- Aquaculture

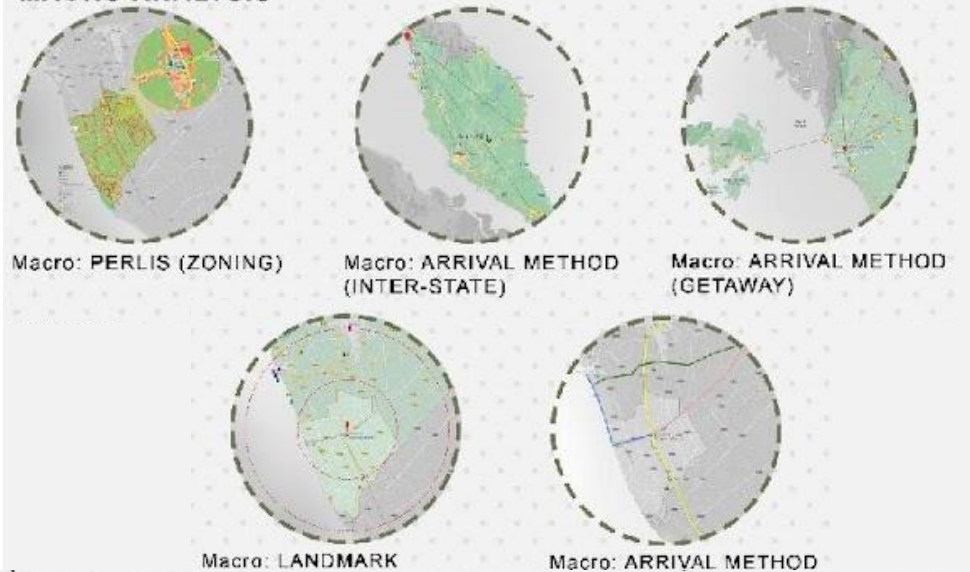
Figure 16: Perlis's Economy Zones

(source: <https://www.ncer.com.my/about-us/perlis>, 2020)

## SITE SYNTHESIS

Based on the study, the analysis consisted of macro and micro aspects; the synthesis is used to provide important responses or strategy for the proposed building. The building is oriented towards the southwest, which is responding to the wind direction and vista. The building design is placed far from the main road to avoid noise pollution and create continuity with the existing paddy field. The symmetrical zoning is used to divide the landscape and building area and allow the users to experience in the proposed site.

### MACRO ANALYSIS



### MICRO ANALYSIS



Figure 17: Macro and Micro Analysis & Synthesis

## DESIGN CONCEPT

Rejuvenation through architecture may be defined as reviving or restoring an architectural design into a fresh design approach that improves and attracts people to the building while also imparting well-being to those who utilize it. The rejuvenation consisted of new exposure to the paddy sector, a unique experience to the public, a new connection between the user and the building, new revivalism in architecture, and a new living building that allowed the user and researcher's engagement.

The paddy environment, paddy plant characteristics, and paddy autonomy were used to develop a building design philosophy. From the seeds to the matured rice plant, the evolution of the paddy plant reveals how it innovates. The natural process of paddy development is reflected in the building typology, which reflects new approaches that consider the context, flow and building design strategies in the planning and designing facilities for the proposed project.

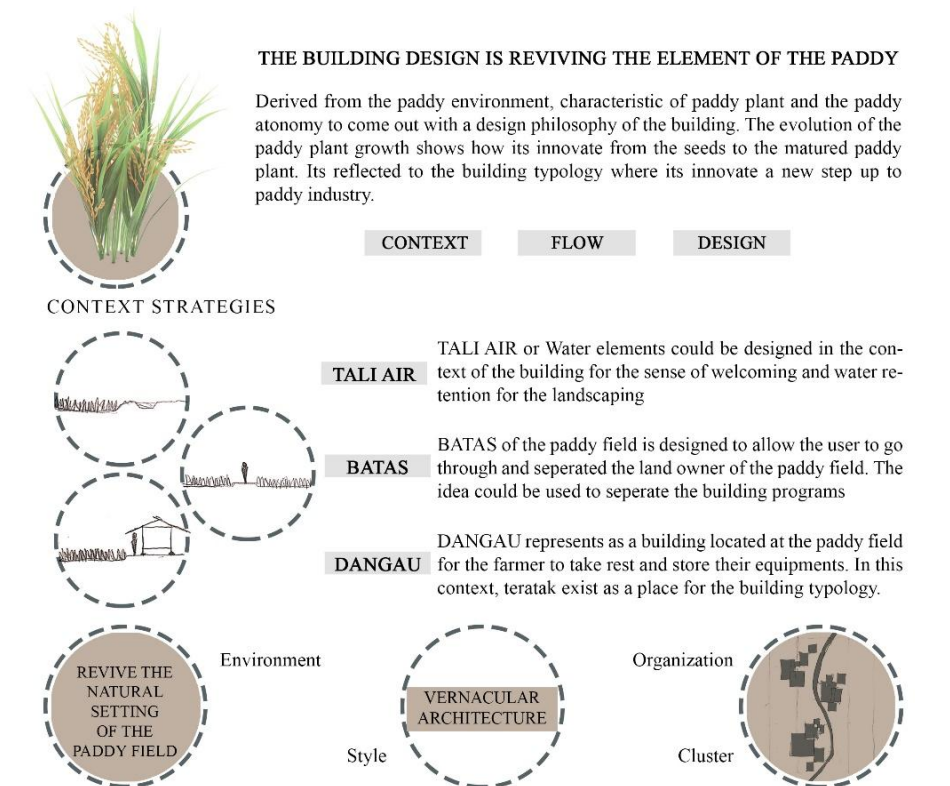
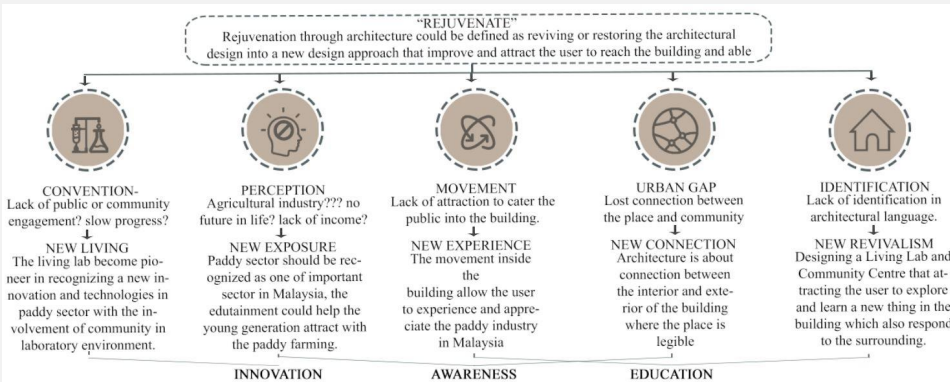


Figure 18: Concept Diagrams

## SITE PLANNING

The site planning of the proposed project is responded to the microclimate and surrounding context. The building design is orientated towards the southwest to cater the prevailing wind flow and vista at the proposed site. The green barrier is used to buffer the noise pollution from the main road; thus, the building is placed far from the road. The planning of the proposed site will create a continuity between the building and the landscaping to create harmony in the proposed area and also responded to the existing paddy field. In addition to that, the vehicle and pedestrian network is strengthened as means to connect the proposed building with the community.

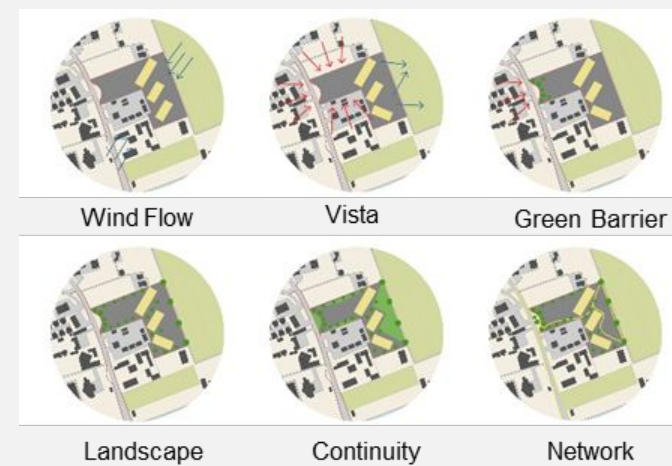


Figure 19: site analysis elements

## DESIGN DEVELOPMENT

The site strategies include development with architectural elements and direct responds to the microclimate by methods of symmetrical approach used to separate the landscaping and building design, respond to the site axis and edges, implement hierarchy as the entrance at the axis interception, create datum element to hold the building zoning and instill harmony relationship between building and landscaping. The design development consisted of two primary considerations, which are site planning and building form design. Furthermore, the site planning could be divided into three main elements namely placement, network, and continuity on the proposed site. The building form on the other hand shall consist of cluster organization, edge to edge of additive form and transformation towards vernacular style.

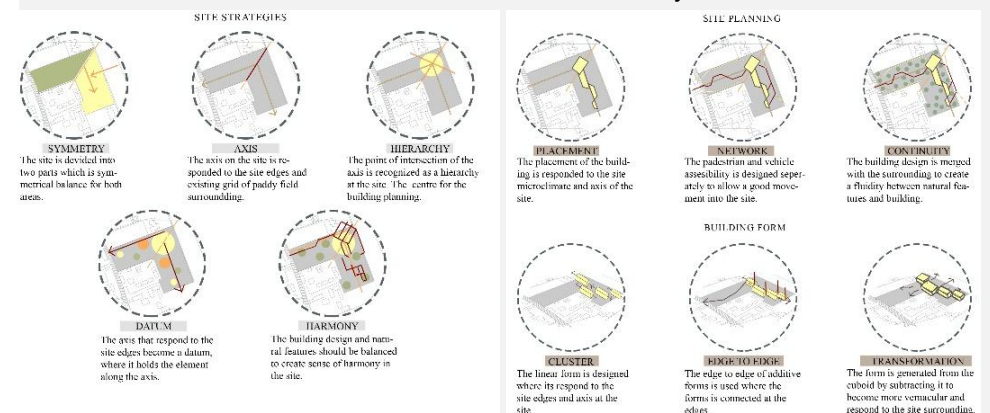


Figure 20: Design Development Diagrams

## RESEARCH / PROJECT FINDINGS

### SITE PLAN

The proposed site is located along the main road that links the state of Perlis and Kedah. The main idea of the overall site plan is to revive the paddy environment and bring the user to a full natural setting experience. The site is easily accessible from the main road and consist of 2 different entrances separately placed for public and service entrances. The pedestrian walkway is linked with the existing walkway at the proposed site, and there are three separate site entrances for the pedestrian to access the main building entrance.



Figure 21: Key & Location Plans

From the parking area, the user will travel through the paddy field to the main building entrance, either by using an autonomous pod or walking through the natural setting of the paddy field. The paddy field consisted of rejuvenated batas and dangau of the paddy environment. The site also implements the “tali air” system for paddy farming in the paddy research and development area. The placement of the building project is at the southwest of the site to allow for good vista and wind flow and created a continuity to the proposed site.



Figure 22: Site Plan

### GROUND FLOOR PLAN

The Ground Floor plan is the level with the most activities in the proposed building. The floor area consisted of 4 different zones namely the reception and commercial, innovation gallery, living gallery, and living lab zones. There are also an open plaza and dangau zones where the public could easily access and experience the paddy natural setting within the proposed site.



Figure 23: Entrance view from main road



Figure 24: Ground Floor Plan

## RESEARCH / PROJECT FINDINGS

### FIRST FLOOR PLAN

The main entrance and reception area are strategically placed at the first-floor plan where the lobby and waiting areas are located. On the innovation gallery, the user will experience the 360 digital tunnels. There is also a viewing deck for the public to see the outdoor demonstration area. The observation area is located at the living gallery, where the public could see the flow of rice production. For the living lab, the first-floor plan mainly for group pods consisted of indoor and outdoor areas.

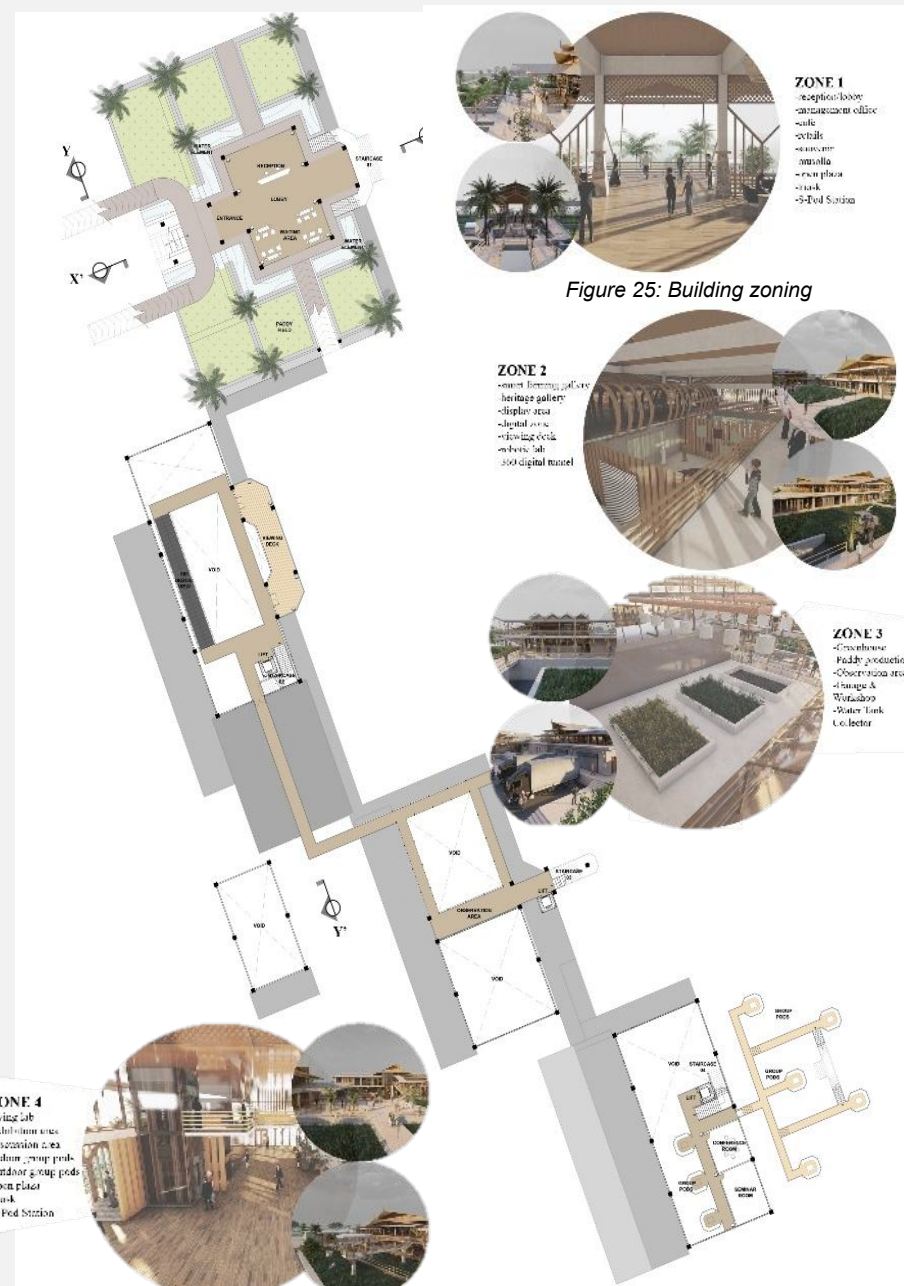


Figure 25: Building zoning

Figure 26: First Floor Plan

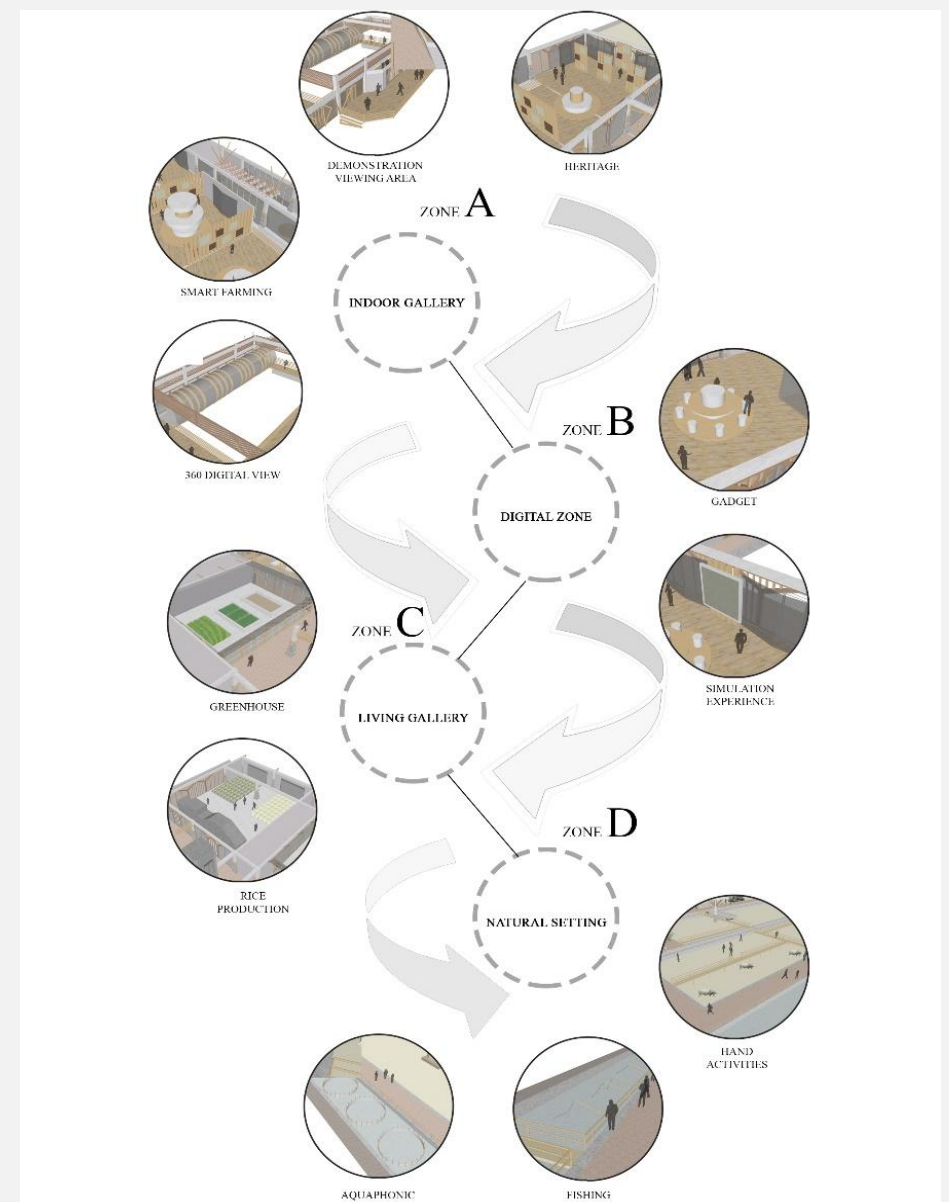


Figure 27: Gallery zoning

The gallery zones consisted of 4 different zones and the design of the flow of the gallery experience shall start from Zone A: Indoor Gallery to Zone B: Digital Zone in the innovation gallery building, then proceed to Zone C: Living Gallery and the last one is Zone D: Natural Setting where people could experience the hand activities in the paddy field.



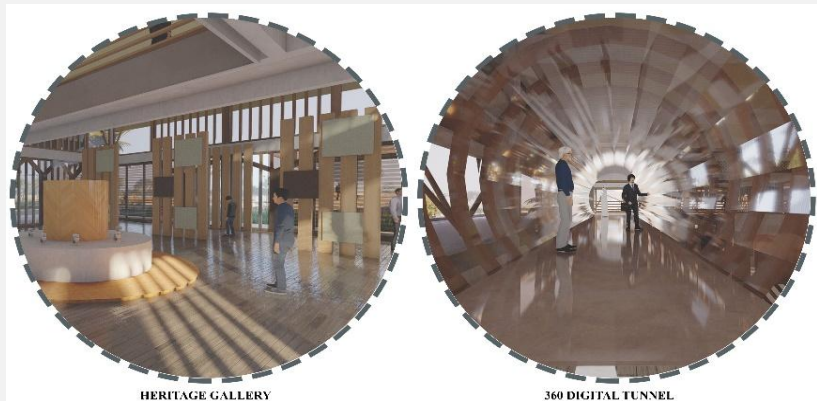
Figure 28: Interior view Living Lab and Café



## RESEARCH / PROJECT FINDINGS



Figure 29: Internal view of lobby area



HERITAGE GALLERY 360 DIGITAL TUNNEL  
Figure 30: Internal view of heritage gallery and 360 digital tunnel



GREENHOUSE RICE PRODUCTION  
Figure 31: Internal view of greenhouse and rice production



Figure 32: Internal view of smart farming gallery



Figure 33: Exterior view of main entrance



PARKING AREA TRAIL  
Figure 34: Exterior view of entrance and bendang trails



OPEN PLAZA GALLERY  
Figure 35: Exterior view of open plaza and gallery building



Figure 36: Exterior view of natural setting and open plaza



Figure 37: Exterior view of Outdoor Demonstration area



Figure 38: Exterior view of living gallery and living lab



Figure 39: Exterior view of group pods and dangau trails

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## CONCLUSION

In conclusion, the Paddy Innovation Centre is intended to enhance the quality and quantity of paddy production in Malaysia, by promoting innovation in the paddy industry, and raising awareness about the importance of this sector, which is crucial for the nation's food security. The centre demonstrates means of improving paddy production, which can be attained through the adoption of advanced agricultural practices and high-quality paddy varieties. The Paddy Innovation Centre also encourages innovation and the use of new technologies, which will not only boost productivity but also make the paddy industry more resilient and sustainable. Lastly, the centre creates community awareness on the significance of the paddy industry, which will foster greater support and involvement from the community and all stakeholders.



Figure 40: Section Y-Y and Sectional Perspective X-X



Figure 41: Elevations and Sectional Perspective

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