Cameron Geoffrey Knox

TECH FARM:

An Innovation Hub for Green Design and Clean Technology at Wynyard Quarter, Auckland.

The Design for an Intellectual Ecosystem for Sustainable Technology Innovation that enables Creativity, Productivity and Teamwork by using the “Community of Practice” concept.

Dr Dushko Bogunovich

Chris Murphy

Abstract

This thesis is an architectural response to the major environmental issues facing society. One of those challenges is climate change. This issue will likely get worse – the atmospheric CO$_2$ has just reached 400 parts per million due to human emissions, but we still do not see a coordinated global political action to stop the rise in greenhouse gas emissions. At the same time, the number of people living in cities around the globe is set to rise from 3 billion in the year 2000, to 5 billion in 2030.¹ The urban population explosion will create an unprecedented demand for housing, amenities and the necessities of everyday life, and result in increasing greenhouse gas emissions – ultimately putting a tremendous strain on our planet. Only an enormous investment into urban technology innovation can deliver the growth in urbanisation without wrecking the global ecosystem. Tech Farm, Wynyard Quarter is a thoughtfully designed innovation institute, where New Zealand can develop solutions to the world’s sustainability challenges in an accelerated manner.

With the recent rise of the “innovation cluster” typology - with examples such as Silicon Valley in California - and the subsequent specialised activities and goals within these forms; architecture has had unique problems to solve. Knowledge based industries develop successfully in regional clusters, because they enable knowledge to be exchanged, and possess a critical mass of skills that complement one another. The question for the architectural profession is: Does architecture have a role to play in creating workspaces that inspire creativity and productivity?

This project is an exploration and detailed synthesis, based on literature reviews, precedent studies and site analysis, of how one piece of architecture can be designed to encourage the creation of an “Intellectual Ecosystem for Synergy”. The aim is to create a design guideline template for creativity, productivity, teamwork and community.

Tech Farm has achieved these goals with the discovery of the five principles for designing innovation buildings.

1.) The three L’s facing an Internal Atrium, Courtyard and Sky bridges.
2.) Semi Open Plan format with Partitions and Lounges.
3.) Brainstorming Pods and Meeting Pods.
4.) Diverse and intelligent arrangement of spaces for different work modes.
5.) Informal Organisational Culture developed through interior design.

¹ http://www.unfpa.org/pds/urbanization.htm (accessed 12 January 2013)
The design concept is formed of three L shaped prisms framing an internal atrium exhibition space, which acts as the social heart of the project. The solar panelled covered atrium forms a symbolic expression of the intentions and goals of the project, showcasing cutting edge sustainable technology. Transparency is the key quality of the three boomerangs; employees circulate along perimeter halls with glass curtain walls. The constant movement of people animates the complex. The exhibition ground floor space captures the lively interactions and creativity generated through showcasing the latest green science technology. The Atrium separates itself from convention with highly visible exposed concrete structure materiality and thermal responses, it is relying on the conventional rectangular three buildings of the 7 floor Energy building, and 6 floor Water and Waste buildings to support it as it shelters the occupants, and passively regulates the temperature with its northern climate wall. Orientation plays a dominant role in passive design strategy. The rectilinear building is easy to construct, which advances the sustainability goal. It has interesting views to the Westhaven Marina, the Harbour Bridge and eastern central city buildings. The western and eastern sides moderate light with vertical photovoltaic louvres. The transparent exterior facades communicate a connection to the public realm. The bright orange brainstorming pods on the outer envelope push and pull to create a lively and dynamic facade. The circulation strategy has highly visible, lime green grand stairs and the interior aesthetic is driven by visibility and informality. The labs feature private, green balconies on the northern sides.

The shape demands public attention with its interesting dynamic form, showcasing the zig-zag photovoltaic technology and clear, curved, piped seawater systems entering the water’s edge. Appropriate green gardens have been placed on the northern corner and green roof nursery on top of the Waste Building. The corner entrance on the energy building announces itself to the public and establishes a hi-tech green aesthetic within the Wynyard Quarter context.
Acknowledgments

I would first like to thank my parents for supporting me during this demanding time.

This project was the result of the collaboration of numerous minds. I appreciate the teamwork and productive results generated through synergy with my fellow university friends and colleagues, during the development of this project.

Thanks to Regan and Jeanette for their advice regarding the structural concept and Max for the services strategy. Thanks to David and Chris for their design critique. Your extensive experience, insights, world views and opinions regarding design and engineering were much appreciated.

I would like to thank my supervisor, Dushko for his knowledge and mentoring guidance to get this project to fruition.

I would also like to thank Brett for help with laser cutting Tom and Graeme with the Context model and Brendan for proof reading this lengthy document.
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All photographs, drawings and models by Cameron Knox unless otherwise stated.
Chapter 1 - Introduction
Chapter 1 – Introduction

1.0 Aim/Objective

This project is about researching and analysing design strategies that can deliver a highly stimulating and effective research and innovation hub. The aim is to design a building, or a group of buildings, which will provide excellent working conditions for highly creative people in the domain of ecological design and clean technology.

This project, Tech Farm, is a Green Technology and Environmental Science/Innovation Institute which we have imagined would be built on the western edge of Wynyard Quarter - formerly known as the Tank Farm - on the city waterfront in Auckland. Close to research universities, employing and hosting artists, engineers, scientists and entrepreneurs, the hub will facilitate easy and quick access to advanced environmental sciences talent and technologies. The architectural qualities of the institute will inspire the translation of world class research and development into successful entrepreneurial organisations and eco design and clean technology solutions and products.

New Zealand is one of the best in the world at ship building and super-yacht design. With the advanced marine technology premises situated on the western part of the Tank Farm, the idea is to turn the Tank Farm into a “Tech Farm”. The goal is to create an Ecosystem of Brains, whereby specialists from the marine technology and eco technology fields can interact and exchange ideas in the social hub. This is an idea similar to Wenger’s concept of “Community of Practice.” Wenger’s website suggests that “The notion of communities of practice posits that learning and practice occur in social-situated contexts are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.” “Note that this allows for, but does not require intentionality. Learning can be, and often is, an incidental outcome that accompanies these social processes.”

(accessed 24 January 2012)

2 Ibid.
3 Ibid.
4 Ibid.
1.1 Overview of Content

This thesis is based on the reality of social, cultural, economic, scientific, political and intellectual factors occurring currently in New Zealand. The central government and Auckland City Council have agreed to create a “high tech” hub in Wynyard Quarter. At present an Advanced Technology Institute is planned on a 3.4 hectare area within the central part of Wynyard Quarter, as a mixed use, living and working, innovation precinct. Thus, this project is aligned with the current initiatives for Auckland and the economy.

“New Zealand is recognised as a clean energy leader of the world”\(^5\). Numerous experts are developing our hydro – electric renewable energy\(^6\), geothermal energy\(^7\), sixteen wind farms throughout the country\(^8\), and the development of new $600 million tide turbines in the Kaipara Harbour\(^9\). We need to continue this research so that international neighbours can import the advanced technology and systems from us, as the world shifts to carbon – free sources of energy. The building of an eco innovation science institute is a noble goal. With the massive reported changes to the earth’s climate, the global population recently reaching 7 billion inhabitants\(^{10}\), limited and shrinking resources and excessive pollution, this is a step in the right direction to possibly solve many of the significant and urgent problems likely to be facing us for decades. This project is also about using strategies for creative thinking. Just as the institute will host and employ artists, designers, scientists and engineers engaging in activities at the forefront of innovation, the background of this project will investigate the methods and processes of creativity within architecture, particularly for designing science innovation clusters.

\(^5\) As stated in a conversation: Dushko Bogunovich, Associate Professor, Urban Design, Unitec on (29 October 2011)

Figure 1.2: The Proposed Advanced Technology Institute. Wynyard Quarter.

Chapter 1.2 - The Research Question
1.2 The Research Question

The following key research question has shaped this research project.

Question

What architectural strategies should be used to facilitate creativity, collaboration; and productivity and also foster a “community of practice” for a workplace environment dedicated to sustainable technology innovation?

1.2.1 The Research Problem

The design investigation will comprise the design of an Eco Technology and Science & Innovation Institute, where the main driver is the idea of creating an “Intellectual Ecosystem”. An intellectual ecosystem can be described as adopting “the metaphor of the ecosystem, as a way of capturing intertwining strands of research and thought that characterize the modern university and its relationship to the city.”

So, the basis of the main architectural problem will be finding an effective solution, where a wide cluster of professionals can share a proposed social space, thereby creating a perfect environment for synergy. This is also known as a “community of practice.” The success of this project will depend on how well the building entices and facilitates the collaboration of the different creative thinkers, as well as how it inspires creativity. It should also express, literally and symbolically, the purpose of the building, by demonstrating cutting edge ecological design principles and harnessing advanced building technologies.

1.2.2 Project Limitations

The problem of this thesis is how one piece of architecture can solve the world’s ecological problems. The simple answer is that one building cannot. Instead, this project aims to display an example of how architecture can positively influence creativity, productivity, teamwork and foster community in the workplace of an innovation cluster. It is intended that the scientists and thinkers in the proposed development will be more effective at innovation due to the architectural design. It is recognised that only if research buildings are designed en masse with the aims of the thesis project and my developed 5 Principles Guideline Template in mind will they make a difference to the populations’ innovation culture and creativity.

---


Dr Stephen Covey defines synergy as: “Two heads are better than one. Synergize is the habit of creative cooperation. Together they can produce far better results that they could individually.”

Dr Stephen Covey, *The 7 Habits of Highly Effective People*, Fireside, New York, 1990, p. 262.
1.2.3  Project Definitions

In order to solve my Research Question; we need to clearly define key terms used in the sentence: What architectural strategies should be used to facilitate creativity, collaboration, and productivity and foster a “community of practice” for a workplace environment dedicated to sustainable technology innovation?

1.) Facilitate: “to make easier, help bring about.”

2.) Creativity: “Ability to produce something new through imaginative skill, whether a new solution to a problem, a new method or device, or a new artistic object or form. The term generally refers to a richness of ideas and originality of thinking.”

3.) Collaboration: “to work jointly with others or together especially in an intellectual endeavour.”

4.) Teamwork: “Work done by several associates with each doing a part, but all subordinating personal prominence to the efficiency of the whole.”

5.) Productivity: “In economics, a measure of productive efficiency calculated as the ratio of what is produced to what is required to produce it.”

6.) Innovation hub: “Innovation hubs can be viewed as mechanisms for the mediation of knowledge and the facilitation of its use for purposes of innovation. The mediation process involves creating new or strengthening old networks that enable the various actors in the. One of the hallmarks of such a hub is that it spans the boundaries of individual institutions and organisations, accumulating mediating functions that foster the exchange of tacit as well as codified knowledge.”

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Chapter 1.3 - Methodology
1.3 Methodology

The thesis body of research is comprised of four integrated components: a literature review; an analysis of a series of precedents; site analysis and designs for the creation of architectural outcomes for the project. The typology of the research question was generated from research which states that for years architectural design has thought little about the people who occupy its space and what they are trying to accomplish within that space. In this case the goals are enhanced creativity, productivity, teamwork and community, and the key design objective is the workplaces which help facilitate this.

Methodological approach to each Chapter Summary section

Chapter 2.0 - Literature Survey

An extensive literature review has been conducted which has drawn widely from many disciplines, Architecture, Laboratory design, Innovation, Creativity, Design Thinking, Development and Environmental studies, and government policy. The literature based research informs the entire project, but features most prominently in the section Chapter 2 later on. The literature survey comprises a synthesis of research used to develop a framework of architectural strategies of creativity, productivity and teamwork template guidelines, which inform a substantial part of the design. The research consisted of analysing the architectural strategies used to facilitate the innovation and collaboration process from books sourced from various libraries and the internet. Newspapers, internet and books were assessed to understand the activities of a scientist and what their day involves in innovation. I also acquired a general experience with creativity books, to understand the principles of creativity. I informed myself with the historical background of the site. During the first summer break, analysis of design thinking was used to generate an understanding of design paradigms of various experts in the design field to aid in the processes of solving the architectural problem. Also, theory based models based on the understanding of engineering and structure, helped define a grid layout system which defined the layout of the columns and interior planning. The structure in this case defines the planning. These factors formed the structural, formal and social nature of Tech Farm.

19 http://sensingarchitecture.com/category/articles/design-process/ (accessed 23 May 2012)
Chapter 3.0 - Precedents Survey

The conclusions of precedent studies were based on information given on the various buildings by architects, and from my own observations during site visits. The focus of evaluation was on architectural strategies that facilitated creativity, productivity and teamwork. An element of subjectivity was inevitably involved in interpreting what architectural strategy contributed to creativity, productivity and teamwork, as these are difficult to quantify. Examples of successful precedent features, inform the whole project’s development. Those with the most influence feature in Chapter 3. The overall “personality” of the building was analysed for how it could contribute to the satisfaction, creativity, increased teamwork and productivity of the building user. The parameters of the design aesthetics were correlated with design styles of modern New Zealand and the prominent UK office, BedZED. The cultural traditions of these prominent, green sustainable buildings were translated to firstly building plan and later elevation and were used as the main drivers in the aesthetics-versus-function debate. The case studies of similar buildings were used to analyse and predict the energy performance of the design.

Chapter 4.0 - Site Analysis

The alignment of street frontages aided the conceptual massing development as a method for understanding the connection and relation to the context. Contextual and cultural factors added weight to the aesthetic design decisions, style, materials and colour. The history of Wynyard Quarter helped an understanding of the relationship to New Zealand culture and the occupants. The orientation of the building was defined by what angle would generate the most passive energy flows and generation of renewable energies from the wind and sun. The present context was analysed for people activity flows and the connection to the coast meant a wharf extending to the west would enhance the site. A goal for preserving a proportion of the site for landscaping would allow a place for biodiversity to develop. The future buildings indicated in the Waterfront plans were analysed so Tech Farm would fit appropriately into the Wynyard Quarter streetscape. The language of the dynamic roof design of the new ASB building and the incorporation of the zig-zag roof shape of Tech farm would create a distinctive roof character to the area.
Chapter 5.0 - Design Process

Based on theoretical research the methodology outlines the formal approach that has been chosen to solve the architectural problem. The development of the design was carried out throughout 2012 to 2013 with several qualitative assessment events of the design.

The design exploration component was through concept drawings in pencil, pen, charcoal, ink and stick, physical models, computer models and plans and critique by others. It comprises about half the main, central component of this research. A tactile process of continuously sketching and articulating thoughts with a pencil was used, much like Pete Bossley’s strategy, and a series of dialogues discussing these moves and adaptations. Bossley states that “the lines appear on the page almost before the thought has been formulated; it is as though one is thinking with a pencil.” The central role of continuously sketching, sometimes playfully, was used to clarify ideas and thoughts regarding the design.

Physical modelling was used to investigate several alternative methods of conceptual massing and programme and the priority of aesthetics was one that remained fixed throughout the design. The development allowed visual and intuitive assessment of each of the design decisions and their relationship to the context, and the visual gestalt wanting to be achieved. Other alternative solutions to the sub problems of the architectural problem were investigated and explored. The solutions with the most advantages to solving the research question were chosen.

There were a series of different physical model concepts to choose from, analysing the advantages and disadvantages and goals of the research question, and a step by step conceptual exploration process. Design thinking paradigms were used aiding the design, these being theory based thinking models from design experts. These are spread throughout the thesis and tested against reality. A large, complex, clear perspex model was made to evaluate the engineering strategies employed using a piece by piece process, much like Renzo Piano’s design philosophy. The critical appraisal and conclusion evaluates the formal design process and theoretical approach taken to the final architectural solution. Design decisions were judged against the research question and stated goals of the building.

1.4 The Brief and Site

The preliminary design framework suggests the idea of three separate buildings representing the sustainability sector: Energy, Water and Waste building united by a social space. This framework informs the brief and entire project.

![Figure 1.3: The Preliminary Design Framework](image)

The basic requirements are to house the various innovation environments these include:

- Laboratories
- Education Research
- Commercial Activities
- Meeting Areas
- Social Areas
- Brainstorming Pods
- Eco Library
- Gymnasium
- Lecture Theatre
- Workshops
- Cafeteria
- Waste to Energy Power-plant

Tank Farm is a large site of 35 hectares. The Wynyard Quarter waterfront is effectively the front porch of Auckland, the face that Auckland presents to the world. The area is flat land and is not natural, consisting of artificial landfill towards the back and of wharves near the front. Featuring good views to the harbour, this building should benefit from the proximity of the marine technology industry. Due to proximity to the sea and elements and exposed location, solar and wind power is celebrated as part of the architecture. Additionally, Wynyard Quarter is already bounded by technology companies. The new Telecom headquarters is in Victoria Street, Vodafone, Hewlett – Packard and Microsoft are in Viaduct Harbour, Fanshawe Street has Air New Zealand with its own incubator offshoots and the marine technology precinct is already established. Then there is the SiloX park area and the ASB Bank which has just been built.

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22 As stated in a conversation: Dushko Bogunovich, Associate Professor, Urban Design, Unitec on (24 October 2011).
The Site location

164 - 188 Beaumont Street

Auckland Central

Auckland 1010

Figure 1.4: Auckland Geographical Position

Figure 1.5: Location Plan- Auckland CBD

Figure 1.6: Close up of Proposed Site and immediate context.
Chapter 2 - Literature Survey

CURRENT STATE OF KNOWLEDGE

2.1 Why design for creativity, productivity, teamwork and community?

For years, architectural designers have thought little about the people who occupy the space and what they are trying to accomplish within that space. With the development of the modern world, an advanced, technological age, more thought in architecture needs to be encouraged to design places which facilitate a business organisation’s goals. In this case it is increased creativity and collaboration.

The design of workplace spaces plays a significant role in increasing morale and productivity. It is estimated that productivity increases by about 20% due to a well designed office. Research suggests the goal in design is to place emphasis on spaces, both formal and informal, that support interaction and collaboration. There is also the goal to overcome organisational hierarchies which have been dictated by interior planning in the past. A major question posed then, is not so much about the design of spaces, but rather how corporate culture can be developed by the role that design of the physical environments can play.

There is evidence of links between poor workplace design, higher levels of stress experienced by employees and lower business performance. Some statistics suggest differences in productivity of 25% reported between comfortable and uncomfortable staff, due to basics such as temperature, air quality, overall comfort, noise and lighting. Both adequate daylight and good lighting design and have been linked to a 15% reduction in absenteeism and increases of between, 2.8 and 20% in productivity and staff satisfaction. Other research suggests workplace design is responsible for 24% of job satisfaction and can affect staff performance by 5% for individuals and 11% for teams. The BP Blue Chalk programme redesigned their workplace and this later contributed to 13% greater performance, 15% greater

communication, 18% greater collaboration and 10% increased creativity. Architectural strategies, such as contact with the natural world, impact our sense of well being, productivity and satisfaction. Also, windows that admit daylight from ample and pleasant views can dramatically affect productivity, mental alertness, and psychological well being. Regular contact with daylight regulates physical and mental function through our natural responses to the rhythms of light environments. The physical work environment affects thoughts, emotions and behaviours. Psychologically; employees are satisfied with their working relationships if they feel safe within the workplace; and their work will yield favourable outcomes. Research suggests that employees who feel and display positive actions and emotions are more likely to experience positive outcomes with their careers. These positive emotions results in better relationships with their co-workers and promotes persistence with challenging situations, greater task activity, and enhanced cognitive functioning. Those in the workplace who express pleasant attitudes are considered more likable and rated positively for the ability to cooperate with others. The arrangement of the workplace can affect the scientist’s opportunity to build a solid rapport with other workers and management team, as well as thwarting it.

Also discrimination in the workplace design based on age, sex and race all create employee stress, which leads to usually negative emotional and behavioural side effects. If the scientists and thinkers within Tech Farm are situated in a configuration which does not discriminate upon these factors the individual is more apt to produce higher quality work.

In an ideal workplace environment, managers would be seated near their staff to observe any behaviour which could negatively affect the morale of the team. One such behaviour is workplace violence. This is claimed to be the greatest threat to a company followed by theft of proprietary information.

There is a collective failure in architecture to understand how the work environment shapes business performance. A thoughtfully designed space can increase productivity, foster a sense of community and minimize environmental impact, this is what I set out to achieve in Tech Farm.


2.2 Innovation Clusters in the World

IT giants’ new head offices - Apple, Facebook, Google, and Amazon are in a race to construct their largest and best designs in the world. For example below, Apple’s new headquarters features a breathtaking curved-glass, circular-shaped research campus, with 6000 trees, opening in 2016 - in Silicon Valley. The new campus will be right across the street from the world’s best visual computing technology company, Nvidia, with its existing headquarters in Santa Clara. Nvidia co-founder, president and CEO Jen-Hsung Huang claims the building is “the symbol, the physical manifestation, of our vision for the company”.

Likewise, Frank Gehry is designing the new Facebook Campus. “The idea is to make the perfect engineering space: one giant room that fits thousands of people, all close enough to collaborate together. It will be the largest open floor plan in the world, but it will also have plenty of private, quiet spaces as well.” Gehry’s design shows a snapshot of a mixture of rational and chaotic thinking. In this thesis, Tech Farm has adopted Gehry’s prevalence of rational/mechanical and chaotic/imaginative processes, though Tech farm is a “watered down” version of Frank Gehry's formal/informal design processes.

Figure 2.0: The New Apple Headquarters proposed design.

Figure 2.1: Gehry’s new proposed Facebook design.

Google’s new headquarters is being built on 8 acres of restored wetlands. Designed to encourage casual collisions in the workforce and opening in 2015, designers, Seattle architecture firm NBBJ, used compiled data from Google, who carefully studied how its employees worked. Using the data they gathered, the architects designed the new headquarters to maximize employee productivity. The bent rectangles in the design are supposed to encourage employees to bump into each other. The campus is designed to be 1.1 million square feet, yet Google claims no employee will be more than a two and half minute walk from another employee.

Amazon plans futuristic, greenhouse-like spheres in the middle of its new Seattle campus. The five-story, tri-domed structures will be large enough to accommodate mature trees, allowing employees to work and socialize in a more natural, park-like setting.
Here in the Global Innovation map we can see the ranks of the most innovative nations. Technology plays a vital role in economic progress. Technology and innovation is measured according to three main metrics: research and development effort, scientific and research talent and the level of innovation. These factors are then combined into a new comprehensive Global Technology index. As you can see in figure 2.4, innovation remains extraordinarily concentrated and spiky, mainly in the North American, Eastern Europe and Japan regions.  

![Figure 2.4: World Map showing Concentration of Patent activity.](image)

Figure 2.4: World Map showing Concentration of Patent activity.

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2.3 History and Development of Workplace/Innovation Hub

(380-335 BC) - The Ancient Greek Research Workplaces

The first research areas of antiquity understood the important role of nature fostering a place for thinking. One such example is Plato’s Academy; “Plato’s Academy was founded in 388 or 387 BC, in a public garden for gymnastic purposes, donated to Athens by Academus (or Hecademus) – there of its name. It was in the outskirt, about six stadia, a little more than one kilometre, from the city. A wall was built around it, and the area contained statues, temples and sepulchres of noted Athenians.”  Likewise the Lyceum; is a name of the Gymnasium and garden with covered walkways near the temple of Apollo Lyceus at Athens. This Athenian school was founded by Aristotle in 335 BC, in a grove sacred to Apollo Lyceus. The ancient philosophers understood the role of physical activity being important in fostering an Intellectual Ecosystem. This was demonstrated by the habit of walking about the grove while Aristotle lectured his students, and this school, and its students, acquired the label of Peripatetics (Greek peri, “around,” and patein, “to walk”). Tech Farm adopts this strategy with its dominant grand stair system encouraging use and a gymnasium on level 1.

1000 – 1750 AD The Dark Ages Monasteries

The medieval monasteries of Europe were built by wealthy landowner monks whose goals were to spread the ideas of the church. These buildings based on the classical system of the orders generated a plan and shape of harmony and proportion. Some insight from analysing this period’s structures reveals the architectural implications of its design and its role in influencing creative thinking. In this case further knowledge can be gleaned from the study of a typical monastery. Jonas Salk teamed up with Louis Kahn to create a place for scientists to work, whereby the architecture impacts and fosters creative thinking and behaviour. In fact, Jonas Salk profoundly believed that architecture, (specifically a monastery he visited) helped him foster a mindset to come up with the idea that ultimately helped him find the cure to polio. In this case the architecture generating this mindset was probably the technique of an enclosed orthogonal cloister, surrounded by high walls, with high expansive space above. These types of spaces could create an environment for abstract thinking, and has been replicated in the geometry of the social heart core of Tech Farm.

The Rise of the Modern Workplace 1900 -1990

From 1900 to 1950 economic growth and the development of reinforced concrete and modular ceiling and grid systems, provided greater amounts of leasable business space as well as the creation of several business opportunities. The Industrial revolution meant people moved to a central location as the emphasis shifted from agriculture to manufacturing. This shift of workers to cities caused urban areas to become more densely populated, creating downtown business facilities and the need for ample transportation. Office environments changed considerably since the “Great Workroom” at Frank Lloyd Wright’s Johnson Wax Building built in the late 1930s. Under the largest span of space in the building, the Great Workroom, rows and rows of desks were arranged where the employees did methodical work. This concept still had a lot of influence in the 1980’s, as process and efficiency still were a company’s main goals.

From 1950 to 1970 the expansion of corporate culture was promoted, later causing the organizational space in the building being allocated based on the employee’s hierarchy. Job titles and ranking resulted in a standard amount of space per employee. This is when office environments were designed on the concept of open planning, with entry level employees being positioned together, based upon their function and department classification. High ranking employees such managers or supervisors were given the prime real estate of the office, with window views. This hierarchy based floor plan allowed management to view employees from their desks as the open planning arrangement meant there were no boundaries within eyesight. The hierarchy based interior planning of the past has been eliminated from Tech Farm.

From 1970 to 1990, information technology and the importance of electronic communications defined the time. The shift in work related tasks to relying on technology meant a larger focus on independent efficiency. This caused the development of modular furniture systems which were flexible, easy to assemble, electrified and customizable.

The Contemporary Research Workplace: 1990 - present.

From 1990 to the present office environments there was a shift to catering for wireless technology, as well as adjustable settings. During this time, environmental sustainability and individual control over lighting and thermal comfort were important drivers in workplace design. Working hours have now become integrated to accommodate any person, anywhere with 24/7 operations. Telecommuting, hotelling, webinars, smart phones and downsizing are popular buzzwords which have been integrated into the technological workplace of today.
Chapter 2.4 - Conclusions Drawn from the Literature Survey
2.4 Conclusions Drawn from the Literature

Survey: Guidelines for Creativity, Productivity, Teamwork & Community Template

1.) Including the public within the Intellectual Ecosystem

Creativity springs from unexpected places and sources, from a walk in the park to a block of uninterrupted time. People find that their best ideas did not always come from the bustling, lively office environment, but instead while hanging out with people not necessarily in their own line of work. This is why Tech Farm’s social core is designed as a public space to include the minds of the public within its designed Intellectual Ecosystem.30

2.) Workspaces are informal lounges

Recent research indicates offices should be more like lounges; in order to get people to do their best work.31 A study by Christian Jarrett;32 showed that furniture defined by straight edges was rated as far less appealing and approachable than curved furniture. So, within the informal lounges of the institute, creative people can appreciate textures and curved shapes with round sofas and bean bags.

3.) The implications of colour on creativity

A 2009 article in Science showed that psychologists at the University of British Columbia were looking at how the colours of interior walls can influence a person’s creativity.33 They recruited 600 undergraduates, and had them perform a variety of cognitive tasks displayed against blue, red or neutral coloured backgrounds. Findings indicated that those tested in the red condition were much better at skills that required accuracy and attention to detail. It was believed that people associate red with danger which makes them more alert and aware. Likewise, those with the blue background performed worse on short term memory tasks; they did far better with those questions requiring some imagination, such as coming up with as many creative uses for a brick. In fact those in the blue group generated twice as many creative outputs as subjects with the red background. Scientists claim the colour blue has associations with the sky and the ocean. Thinking of expansive horizons makes it easier for us to daydream more and as a result we tend to focus less on what is right in front of us. These discoveries were incorporated into the design of Tech Farm. The laboratories have blue walls, to aid the scientist’s imagination, and the private work areas have red to aid focussed concentration.


4.) The implications of Ceiling Height on Creativity

Joan Meyers Levy, a psychologist at the Carlson School of Management, conducted experiments that examined the relationship between ceiling height and thinking processes. She demonstrated that when people are in low ceilinged rooms they are much quicker at solving anagrams associated with the present environment of confinement, such as restrained, restricted or bound. In contrast people in high ceilinged rooms do very well at anagrams in which the answer touches on the idea of freedom, such as liberated and unlimited. It is assumed the airy spaces apparently make us feel free. Furthermore, high ceilings can also cause people to engage in more abstract styles of thinking. Instead of focusing on the details of things, people are better able to zoom out and see what those particular things have in common. This is the difference in thinking style between item specific, versus relational processing. This proves that if we want to come up with creative solutions, we should design an expansive space, especially if it has blue walls. Likewise, those tasks requiring accuracy and concentration are best suited for low spaces with red walls. The point is that these factors in architecture have real cognitive consequences. These discoveries were used in the design with the high ceiling of the main atrium of Tech Farm aiding more abstract styles of thinking.

5.) Open Configurations to encourage Teamwork & Productivity in the Workplace

The two types of office workstation configurations are an open office environment and a closed office environment. Both have their advantages and disadvantages and this will be quantified for the unique situation in the lab. The open office configuration, with equal opportunities for all, is a good strategy for Tech Farm. The workplace design strategies implemented depends on how each department functions, the primary modes of communication, needed adjacencies and cultural position of the organisation. This means in the design of a working environment, form follows function.

6.) Innovation Centres Design Guidelines

European Union Framework suggests that to encourage creative behaviours and support innovation designers should:

1.) Emphasise the dislocation of innovation processes from day to day activity
2.) Eliminate organisational hierarchy
3.) Encourage participation and focus on
4.) Collaboration face to face communications, mind body and physical activity including play rather than technology.


Chapter 3 - Precedents Survey
Chapter 3 – Precedents Survey:

CASE STUDIES ANALYSIS: INFLUENCES IN THE DESIGN
The third part of the investigation begins with the examination of successful innovation and workplace cluster, endeavouring to understand the architectural strategies used to answer the architectural problem. These principles will be examined to enable the design of a perfect environmental Intellectual Ecosystem for Tech Farm.

3.1: CASE STUDY 1: Thomas Extension, Biology Building

The University of Auckland


Strategy Adopted: Interior planning framework.

The Thomas building adopted strategies to increase communication. The interior planning featured large areas of open planning for write up and areas for the students. The internal planning included positioning the offices and laboratories towards the edges of the main plan shape on the western and southern sides. This formal interior planning integrates with a rational grid structural system. A similar approach to the rectangular structural grid system and proportions for open planning cubicle planning has been integrated into Tech Farm.

Figure 3.2: Biology Building Plan

Figure 3.1: Photo of Thomas Extension

Figure 3.3 Biology Building Structure
3.2 CASE STUDY 2 The Ford Foundation Building

Architects: Kevin Roche & John Dinkeloo, Midtown Manhattan, 1963


Donald Schon argues that the basic process involved in solving an architectural problem is the perception of intuition of analogies, which he calls “the displacement of concepts.” An existing concept is used as a metaphor for handling the new situation in design situations. In this case the metaphor was the Ford Foundation Building. This informs a major part of Tech Farm, as its plan configuration, articulated here, answers the goal of “fostering community”. The mass of the building is a large L-shaped office block, wrapped around a spacious courtyard garden, forming a near perfect square, but the design reveals considerable complexity. One significant factor is that workers in the conference rooms are able to survey almost half of the employees simply by looking out the window.

Why this strategy is adopted: Advantages:

- The principle that people can see other co workers in the organisation is a key rule to enable them to meet and talk to one another.
- There is total awareness of the organisation’s activities, which is how I want to foster community in Tech Farm.
- The building subtly encourages the moral mission of the organisation.
- Sight acts as a form of control, and successfully allows elements of the power dynamic to hold others in check, as people are constantly under gentle scrutiny by the fact of the building.

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3.3 CASE STUDY 3: ASB Building & Sovereign House


**Strategy Adopted:** Manipulating casual collisions in the workplace through positioning of needed circulation and amenities in social centre.

Sovereign House has a Buerolandschaft layout. The five levels stacked with three large floor plates determine the social and light areas which are left over as void between them. The main atrium acts as the central space of the building. This is like Tech Farm as both have atriums defining the social heart of the institute with a strong vertical internal connection between the floor plates. Tech Farm has also adopted the use of Sky Bridges from Sovereign House.

Likewise, the important positioning of needed amenities; those things that everyone in the hub has to use in one place encourages the members of the community of practice to bump into one another. In the case of the ASB building, the toilets are positioned in the centre of the building. Tech Farm also adopted this strategy by placing the needed amenity of the cafeteria on the ground floor of the social core so scientists can socialise and eat while discussing prototypes.
3.4 CASE STUDY 4: Google Offices

Architects: Clive Wilkinson 2012

Strategy Adopted: Programmatically similar encouraging an Intellectual Ecosystem for accelerating relationships.

The Googleplex building aims at functioning largely in terms of the culture of the organisation. Google offices achieve productivity by creating a diversity of spaces, places for relaxation, and are low to medium rise construction. Their aim seems to be to create a place to accelerate relationships. Their goal is to bring together the diverse elements of the company, in a casual informal manner where interaction can occur and knowledge be exchanged. The result is an office that truly operates as a self contained city providing for every facet of employee life. These precedents were integrated into the programmatic language of Tech Farm. Places to relax, nap and use a spa are dispersed around the building as communal spaces.

Figure 3.10: Photograph of Google Offices

Figure 3.11: The Plans of Google Offices

3.5 CASE STUDY 5: Cooper Union Morphosis

Architects: Morphosis, 2006

Strategy Adopted: Organised Functional Layout and dominant corner entrance.

Tech Farm was modelled on the corner entrance of Cooper Union. A language of separating the different functions in Cooper Union has been adopted for Tech Farm. In their case they have used vertical rows of offices, laboratories and social spaces while Tech Farm organises its programme in a vertical stacking.

Figure 3.12: Photograph of Cooper Union Entrance.

Figure 3.13: Diagram showing spatial organisation of Cooper Union.
3.6 CASE STUDY 6: Biotechnology Industry

Architects: Marlene Imirzian & Associates, 2009

Strategy Adopted: Brainstorming Pods (Displayed on the western/eastern Facades of Tech Farm.)

The collaborative brainstorming pods in this building will be adapted to Tech Farm. This is a recurring theme in innovation hubs.

Figure 3.14: Photograph of Biotechnology Industry Research Pods.
Chapter 4 - Site Selection & Analysis
4.0  The Chosen Site:

The chosen site is the intersection of Beaumont Street and Madden Street. It exists as an undeveloped site, in an area of 15,400 m² in surface area. The site's dimensions are 110m (wide) by 140m (length). The Auckland City Council plan is to continue Madden Street to the coast. This reduces the site area to 12,198m². The photographs on the next page indicate the vicinities of the immediate buildings around the proposed site. The Western Reclamation land is almost uniformly flat and is 1.3 metres above sea level.
4.1 Site Evaluation

Site selection was based on a comparative study of four multiple sites, undertaken prior to this proposal, followed by the ordinal ranking of the site’s ability to meet the specified criteria.

Perceived Benefits

- Close to the major universities in Auckland (University of Auckland and Auckland University of Technology) and the Central Business District. There are numerous minds to contribute to the intellectual ecosystem, including investors, entrepreneurs, science professors and students.
- Surrounded by a range of industrial areas, shops, cafes, restaurants, bars and offices.
- Flat site.
- Engineering specialists in the marine precinct to collaborate with.
- Provision of public access along the waterfront edge and opportunity to engage with it.
- Architectus urban design awards for park area on adjacent site.
- Opportunity to create a focal point of Jellicoe Harbour with visitors to the Quarter.
- Able to utilize the reed bed systems.
- Nature of area to maximise pedestrian use and cyclists.

Perceived Problems/ Restrictions

- Historical background and character of the area presents restrictions in building height, form and, in order to be sustainable the design concept must respect the context.
- Rain and humidity problems of Auckland.
- Monotonous low rise building heights mandated in the official master plan.
- Compromise the loss of the marine and passenger operations.
- Contaminated land from tanks.
- Corrosion from proximity to seawater.
- Unable to have a basement due to water table.
Figure 4.0: Views adjacent the Site

East view adjacent the site: See new ASB building

South of the site looking up Beaumont Street

Westhaven Marina and coast towards the west.

6 Pac Silos north of the site
Figure 4.1
The Contextual Site Plan: The Present

Scale 1:2000

The Site:
Height: 107m x Length: 114m

= 12,198m²
Figure 4.2
The Contextual Site Plan: The Future
Scale 1:2000
4.3 Urban Design: Beaumont Street

Summary

The inclusion of the street’s visual and industrial aesthetic character into Tech Farm should enhance the development. Setting aside a proportion of the site for landscaping, will also help preserve the biodiversity of the waterfront. A larger scale office building, increasing density, will generate greater economic activity and create a greater sense of community. Each building in Wynyard Quarter has been built in the architectural style that was fashionable at the time. Tech Farm has done the same as a way of preserving the eclecticism of the area and as generating an architectural timeline for the future.
4.4 Historical Context:

Wynyard Quarter represents the north western extremity of the Central Business District. Three of the area’s sides are bounded by sea; and by Fanshawe Street on the southern boundary. It consists of 35 hectares of land reclaimed between 1920 and 1940 on the foreshore of the Waitemata Harbour. Being reclaimed land it is almost uniformly flat. It is made up of two distinct land shapes, corresponding with the two phases of land reclamation in the past. The first shape in the southern area is 500m square and the second is a northern finger 175m wide and 500 m long aligned 66 degrees to Jellicoe Street. Wynyard Quarter is primarily characterised by industrial, commercial and marine activity. The Marine Industry area is 2.9 ha. Existing marine services of ship repairs, fish processing mart, berthing and other marine related events play an important economic and social role for the area.

The existing built forms includes a collection of character buildings, marine and industrial structures, and features that provide a background context to the area’s historical development. The style of the area is an overall industrial aesthetic defined by structures and buildings with robust materials and simple details. This simple, technological focus has been replicated in Tech Farm.

Industrial development, including tanks storing dangerous goods, has been situated here since the early 1920’s. At the present time, the disconnection of Jellicoe Street from The Eastern Viaduct means vehicle access is limited to Beaumont Street, Halsey Street and Daldy Street. This could result in capacity issues if intensive development continues. The chosen site is bounded by Beaumont Street and Madden Street and is located in business zone 3 as defined by Auckland City Council.
Chapter 5 – The Design Process

5.1 Physical Massing Studies

CONCEPT 1: Three Forest Towers

How does this massing facilitate creativity, productivity, teamwork and community?

- The site is orthogonal, so it is logical to assume the most efficient building shape is orthogonal to make best use of the space.
- Increasing the vertical scale has meant that the professionals inhabiting the space are separated many metres high up into the air. This massing exercise proves that high rise buildings will not aid the thesis question. People need closer proximity to interact and share.
- Although the massing is orthogonal, like the site, the height of the building’s do not fit the surrounding Wynyard Quarter context as it has been designated by the official master plan as low rise to medium rise.
- The northern tower blocks and shadows the area behind it. This is not the best position to maximise solar gain.
CONCEPT 2: Inverted Ford Foundations

How does this massing facilitate creativity, productivity, teamwork and community?

- The architectural strategy of a low rise feel mirrors the positive aspects of the successful Silicon Valley innovation hubs and suits the research goals.
- The positioning and alignment with the street frontages looks disjointed and may affect the psychological journey of pedestrians walking down the street.
- The feature of the building engaging and overlapping the water’s edge could be explored further.
- The central community zone in the centre could be developed further, creating a social heart for the complex.
- The orientation does not maximise solar gain.
- The four empty corners appear as a waste of space, or at least indicate difficulty finding a purpose for all of them.
CONCEPT 3: Ford Foundation’s Strategy

How does this massing facilitate creativity, productivity, teamwork and community?

- The central community area in the middle could be a good place for the scientists and engineers to interact. The massing of these buildings is excellent for everybody in the community of practice to see one another by looking out the windows, promoting community.
- The street frontages in the context are aligned with the continuity of the street unlike concept 2, respecting the context and the intentions of the official master plan for Wynyard Quarter.
- The northern space preserves the natural biodiversity and allows more access to the sun through this orientation.
- The waterfront needs to be developed with regard to pedestrian accessibility.
- This massing strategy holds much promise in aligning with the research question.
CONCEPT 4: Scattered Tanks

Figure 5.16: Concept 4 Plan

How does this massing facilitate creativity, productivity, teamwork and community?

- The massing of numerous tank shaped buildings reflects the surrounding context of the numerous fuel tanks on Tank Farm.
- Although the concept of the circle is good for community and communication with people all facing one another inside that building, the previous formal language of a waste, energy and water building gives the project some structure.
- The haphazard arrangement of circular buildings means there is a lot of wasted space.
- This massing strategy does not align with the thesis goals.

Figure 5.17: Photo of Concept 4 Massing
CONCEPT 5: Massive Solid with random Atria

How does this massing facilitate creativity, productivity, teamwork and community?

- The main social hub in the centre would help the scientists meet. The discovery that the institute needs a central social heart has been reaffirmed here.
- This massing covers the whole site and does not preserve any of the natural biodiversity of the site.
- The idea of a central, community atrium could be developed further.
- The street alignments are covered, though the large, predictable cube shape does not seem adventurous enough and viewing it does not inspire creativity.
- Problems with daylighting anticipated.
5.2 Design Process & Outcomes

Literature and precedent surveys revealed that innovation buildings needed to be low to medium rise to benefit from the ease of movement and communication across large floor plates and reflect the campus like feel of the successful Silicon Valley innovation centres.

Precedents acted as a starting point to find a new building programme, explore initial massing and massing and create a suitable design framework. After analysing the successful architectural strategies of 6 main case studies and an investigation of 5 massing concepts, one concept stood out as the best strategy to foster a sense of community while at the same time addressing the key site attributes with ease.

Chosen Concept: (Concept 3) Ford Foundation Principles Strategy

Chosen Form:

Figure 5.21: Photo of Concept 3 Physical Massing.

The interior social atrium was identified as a strategy that would offer the workers a communal gathering area next to the eco library, cafeteria on ground level, and gymnasium on level 1. The building form was chosen as a replicable generated model with the site defined by the continuation of Madden Street to the water.

The remainder of the site next to the marine precinct would be developed into landscaping and car-parking. The concept increased the density of the site as part of a wider environmental plan and will affect the height of the development. The Auckland district plan stated buildings on this site should be no more than 50 metres, and the proposed building keeps within these boundaries at 31.5 metres high. This is an appropriate design strategy which increases the density of the area without disrespecting the historical goals and
nature of the area. The massing of the buildings was devised for New Zealand sun angles to generate the greatest density to sun exposure.

Advantages of chosen massing strategy

The development receives sunlight on the angled solar roof, photovoltaic louvres on the western and eastern facades and direct sunlight for the northern placed climate wall which passively heats and distributes conditioned air through convection.

- Increase in density
- Lower section allows continuity of existing street facades scale orthogonal nature of the western and eastern facades. Continuation of rational street frontage alignment.
- Accentuates desirable views towards inner city and Westhaven Marina, Harbour Bridge and Wynyard Quarter.

Disadvantages

- There may be overshadowing of marine precinct property
5.3.1 Arriving at the Building Programme

John Chris Jones’ key thinking paradigm is that he “turns an overcomplicated problem into one that is simple enough to solve by attending to the sub problems in sequence rather than simultaneously.” The next major sub problem after massing and form is the programme. This problem has been solved by linking what functions need to be next to each other and establishing the relationships with the different functions.

The pancake layering technique for defining the functions of the building has been adopted. The pancake technique was tested against putting the functions in rows, but due to the vertical cross disciplinary nature the pancake option proved a better alternative.

Figure 5.31: Stacking the functions on rows proved a better alternative to rows vertically.

5.3.2 Functional Organisation

The different aspects of the wider community need to be integrated to make an efficient innovation centre. Student and academic researchers associated with the local universities, who are also employed by the multinationals and laboratories, are included in the hub and also spaces for the commercial business entrepreneurs who turn the research of the scientists into marketable commodities. There also need to be large workshops for testing and making initial prototypes. The research centre is owned by a large Sustainability Science Multinational Corporate. They employ consultant scientists and entrepreneurs to research in this building.

<table>
<thead>
<tr>
<th>Workshop Level</th>
<th>(x1 level)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Research Level</td>
<td>(x1 level)</td>
</tr>
<tr>
<td>Scientific Laboratories Levels</td>
<td>(x 1 level)</td>
</tr>
<tr>
<td>Commercial Business Levels</td>
<td>(x2 levels)</td>
</tr>
<tr>
<td>Sky Bridge</td>
<td>Informal Gathering Stations</td>
</tr>
<tr>
<td>Eco Library</td>
<td>Bike Stand</td>
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<tr>
<td>Gymnasium</td>
<td>Green Spaces</td>
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<tr>
<td>Visualization Theatre</td>
<td>Workshop</td>
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<tr>
<td>Virtual Reality</td>
<td></td>
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</tbody>
</table>

| Cafeteria                     | Spa and Relaxation |
| Bar                           | Games Room pool tables |
| Open Plan informal lounge offices| Reflection Area |
| Plant Rooms                   | Terrace Social gathering |
| Green roof                    | Exhibition Public Space |
| Administration                | Seminar Room |
| Nap Room                      | Security |
| Recycling Centre              | Play Room |
| First Aid                     | Basketball Court |

Waste to Energy Power plant Recycling waste facilities are located near Jellicoe Street for easy maintenance.

Energy Centre Technical room with utilities, sand filter, rainwater storage tanks, boiler, chiller heat pump.

Work floor space: 21,940m² Number of Researchers/Entrepreneurs:

Designed for 1000 researchers/entrepreneurs at a building occupancy of 21.3m² per person.
From these lists of functions, a sectional function schematic is developed:

Figure 5.32: Schematic Cross section conceptual sketch.
Chapter 5.4 - Concept Explorations
5.4 Concept Explorations:

5.4.1 Exploration 1: The Central Social Community Core

The three ‘L’s, based on the Ford Foundation principles, were chosen as the massing concept to develop further. Between the three boomerang ‘L’s facing each other is the internal, central, community atrium, or courtyard, which acts as the social heart of the institute. This is where the latest and greatest sustainability technologies are displayed. The community core will be a place of movement, interaction and activity where scientists and engineers can bond over their common points of interest. Here, very large prototypes are tested and displayed.

A decision was made to designate the southern ‘L,’ the Energy building, and give it the corner entrance. This is an important urban design feature entrance, where engineering cross-bracing intersects, which will be seen from Beaumont Street, and will act as an element to draw people into the atrium area and promote the use of the exhibition space. Three exploratory entrance alternatives were generated in pencil, though the corner entrance solution had the most qualities. This alternative enabled a short cut through the space.

The entry was adapted from the precedent Cooper Union building. This entry is closer and more visible to the marine specialists within the marine precinct who we want using the building to interact with the scientists within Tech Farm. The Water building is the western ‘L,’ due to its intended engagement and proximity to the water, and the eastern ‘L’ is the Waste building due to its proximity to the reed bed systems. There is also greater corner accessibility for all the refuse being delivered and processed from within Wynyard Quarter to convert into energy at the Level 1 Waste to Energy power plant. The various processes converting the refuse into energy are visible to the occupants. A restaurant and coffee area will be placed at ground level adjacent the courtyard for informal gathering and to encourage communal interaction at eating times. This design strategy is adopted from the ASB building precedent. We want all the scientists bumping into each other by thoughtful design. Everyone has to eat and, by positioning the only central free cafeteria in one place, the intent is to get all the scientists meeting and interacting with each other in this area at eating times. The seminar room is positioned on the ground floor of the Waste building.
There is also the goal of transparency of the building with the public to encourage the collaborative synergies between the public and the marine specialists from the western marine precinct. The scientists enter the buildings with swipe access cards. A green landscaped space with barbeque area is included at the northern corner. Adequate sound proofing via the structure of the building could combat noise issues generated by the atrium.

**Advantages**

- Gives centrality to the project, and all three buildings face the area. The internal atrium was selected as a functional and aesthetic strategy to employ within the design. The advantages are maximising heat gains, create good heat distribution, provide good storage and reduce heat losses.
- Creates a focal area of innovation activity. This is a good concept for a built Intellectual Ecosystem.
5.4.2  Design Exploration 2: Orientating the building

A strong built form is wanted, with the sense of an intersection at the corner of Madden and Beaumont streets. This is where the main visible engineered entrance is placed. The massing of three L’s facing each other looks too uniform and homogenous, so the corner Energy building massing has been extruded up two storeys, further emphasising the dominant corner and generating a good, balanced architectural form.

Cantilevering overhangs are placed along the western and eastern sides. This is an effective way to provide shading for pedestrians, providing steadier temperatures in summer and acknowledging the intersection, sympathetically framing the corner. All facades are made of tinted low E glass, double glazing with a degree of transparency in order to create the idea of connection. There is single glazing for internal facades in the atrium.

This Energy building is 7 floors high. Christopher Alexander states “the form is the solution to the problem; the context defines the problem.” He states that the architect, when designing, has to put “the context and the form into effortless contact or frictionless coexistence.” This is monitored on the vertical scale. The buildings mirror the height of the nearby new ASB building east on Jellicoe Street with 7 to 6 floors. The Energy building has a cafeteria and library at ground floor and administration.

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The climate wall (adapted from Motat Hangar⁴¹, New Zealand) has been positioned on the northern side of the complex to allow passive heating of the exhibition air space, achieved through convection of the air in the channel. The northern sides of the buildings feature 2.5 metre overhangs and decks to prevent the northern sunlight penetrating in summer. The eastern and western sides will feature photovoltaic vertical louvres to utilize and control the sun penetration. The summer south-westerly breezes will be utilized with vertical wind turbines placed on top of the Water building. This is the best integration between energy and light principles, project aims and structural integration of environmental systems, although it needs further resolution to enhance the benefits of the chosen strategy.

Advantages

- Perfect passive design principles.

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5.4.3 **Design Exploration 3: Theming the Buildings:**

There was the suggestion that there could be a deliberate theming of the buildings by showcasing the different goals or specialities of each building.\(^{42}\) The Water building is near the water, so a HVAC heat exchanger salt water heat pump system is incorporated. The sea presents an opportunity to use the sea water as a source of heat for the heat pumps which power the HVAC systems. This was developed further by the goal of not hiding, but celebrating, these processes with huge visible clear glass piping entering the water’s edge and wrapped up into the Energy Centre Section.\(^{43}\) The building now actively engages with the coasts, show cased with long, crystal clear, glass pipes sucking up the sea water for everyone to see. A vibrant Energy Centre containing water tanks, sand filter, a saltwater heat-pump exchanger, transformers, thermal tanks, chillers, utility rooms is placed under a concrete extrusion which aligns adjacent to the water. The main colour of the Water Building’s glass facades will be an aqua colour, the colour of water.

\(^{42}\) As stated in a conversation crit ;, Mike Cooper, Lecturer, Unitec on (29 April 2012)
\(^{43}\) As stated in a conversation: Max Hynds, Senior Lecturer, Architecture, Unitec on (29 June 2012)
The Energy Building will feature the renewable energy technologies and also a series of themed flashing white lights running up the facade. The glass curtain walls will be a distinct gray tinted colour.

The Waste Building is positioned closest to the reed bed systems. Its main function would be a lecture theatre on ground level with a recycling centre, waste processing area. It also features a waste to energy power plant above on Level 1 with its processes displayed for scientists to watch. A focal feature of two large, glossy, steel chimneys run up the side of the building to get rid of the steam in the energy transfer process. The Waste building’s glass facades are tinted green in colour.

**Advantages**

- Publicising and differentiating the distinct and separate sectors of sustainability with the different specialists within each is an important part of advertising the cross-pollination of different fields through the Energy, Waste and Water buildings.
- Formalistic concerns addressed, becomes an interesting and dynamic part of Wynyard Quarter streetscape.
- Publicise the green roofs and cutting edge technology, creating more awareness of a distinctive “Tech Farm” brand and the public are aware of the organisation’s goals.
- Natural colours have been chosen fitting the context.
5.4.4 Design Exploration 4: Showing the Bones

The technology of the building in the detailing and structure will be expressed to educate the viewer. The key architectural strategy of the Media Tic Building celebrating and expressing its structural make up is one of the reasons for its successful design. This philosophy will be integrated as a significant idea into Tech Farm. Understanding the core principles of how the buildings were constructed in the design of this Intellectual Ecosystem, could aid the imaginations of the institutes’ scientists. They have to understand the field of engineering, when designing prototypes for sustainability. The core structure will be made of concrete raised floors for the benefits of thermal mass and concrete columns encased with recycled steel I beams for strength. The concrete will include recycled glass aggregates for sustainability goals.

An exposed structure, with an 8 by 9 metre grid system of columns, has been aligned with the arrangement of interior floor layout, where the structure defines the interior floor planning layout, which will be explained later in the structural concept. The layout has been aligned so that the columns do not interfere with the people flows. Thus there are no leftover spaces.

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44 Andrew Charleson, Structure as architecture: a sourcebook for architects and structural engineers Oxford: Elsevier, 2005

Figure 5.47: Photo of Laser cut Engineering Model

**Advantages:**

- Shows the structural reality, where columns/engineering is not hidden, aiding the innovation process.

- A technical visual aesthetic is achieved, promoting pride in the organisational culture being developed.

- Educating the public of its construction.
5.4.5 Design Exploration 5: Dynamic ZIG-ZAG Roof

The massing of the Energy building reaches 7 floors and 6 for the Waste and Water buildings. This is not extreme and fits the surrounding context. It now has a more dominant and visually interesting street presence. The courtyard will have a large dynamic roof structure with inclined solar panels aligned horizontally towards the north, adapted from the Meridian Building, Wellington. These zig-zag inclined panels improve the visual gestalt from most directions. The atrium from the southern side does not look to be actively promoting itself, though it is visually effective in form, from north, east and west sides. There are southern windows on the atrium, so the harsh light will not cause overheating.

Advantages

- Auckland’s version of the waterfront Meridian Building
- Visually dynamic
- Showcases the photovoltaic technology from sea view.
- Now the building has a recognisable facade both from the front, north, and the sides east and west.
- Centres the building shape, gives a sense of visual balance and proportion.

http://www.meridianbuilding.co.nz/#/ (accessed 10 June 2013)
5.4.6 Design Exploration 6: Catering to the different personalities

The social spaces are randomly dispersed throughout the three buildings to encourage specialists from different fields to spread their expertise to other professionals within the sustainability field. This distribution of social spaces enables a cross-fertilisation of different thinkers, increasing the chances for them to meet and socialise together. The setting is designed like the Google offices, creating an organisational culture for accelerating relationships. There are private spas, lap pools and saunas on the 7th floor of the Energy building. Relaxation in these facilities aids creativity. The width of the building is 18 metres, so daylight can penetrate successfully from both sides of the building. Individually a lot of the workday is taken up with the tasks that are better served by working in private offices. It is estimated that 25 percent of the population are introverts. Introverts are naturally more comfortable toiling alone. One module on each floor has been designed for private work to cater for this personality type. The blue side walls of the laboratories have places to pin up charts, graphs and brainstorms. Half of the usable wall space on each floor is white screens on which people can write their brainstorms and research. Much of the planning strategies have been adopted from the campus of the Gates Foundation. They spent $500 million dollars researching and finding solutions for the most effective office space. Foundation executives propose that 70 percent of all offices be of the closed variety. “The model evolved to be a mix of 60 percent open and 40 percent closed with a variety of open and closed “retreat” spaces that enable different personalities to find the work environments they need.”

As stated in a conversation: David Chaplin, Senior Lecturer, Unitec on (15 March 2012)


5.4.7 Design Exploration 7: Attaching the Brainstorming Pods

Bryan Lawson claims that design requires “both imaginative thought and mechanical calculation.” So far there has been a lot of rational, rectilinear architectural planning, much like a precedent of the University of British Columbia building. The statement by Lawson indicates that we need to integrate some chaotic thinking with the already prevalent rational thinking processes. This will be done on the outside facades. The outside envelope is quite uninteresting to the eye, so a series of 4.0 by 4.5 metre brainstorming pods have been designed for the eastern and western facades. These imaginative additions are pushed and pulled to create a lively and dynamic facade. This breaking up of the facades with bright, orange box extrusions will make the building more interesting from every direction. The boxes come out at varying dimensions. It is as if the architecture in its design is playing, some box pods playfully hide further in behind the set of louvers, while others point further out. There are no dull spots.

The building is designed so that employees arrange and align their actions to maintain harmony with their surroundings. Thus, since the environment develops a strong goal orientation, employees are more likely to align their individual goal orientations with the norms of the environment to maintain harmony with their surroundings.

Advantages

Follows the innovation guidelines.

Figure 5.51: Image of Brainstorming Pod

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52 http://cirs.ubc.ca/building (accessed 10 May 2013)

5.4.8 Design Exploration 8: Circulation Strategy

The circulation pattern has been designed as one of the key vehicles for ‘innovation maximisation’ – the idea that the more chance encounters generated the better. Main circulation templates are central, lime green spiral stairs, supported by elaborate engineering. This has resulted in the adaptation of the rectangular ‘L’s in plan to have a circle indent shifted out of the inside L to include the circulation route. With the spiral staircase at the edge of the building it allows visual communication with others, perhaps indicating to others to come down to the community plaza to have a coffee or snack.

The circulation routes are exciting to use with a single, wedge shaped, central goods lift. They have been placed in the centrally visible location with bright, appealing colours to attract use. In the atrium the round feature in plan of the stair will be decorated with vertical vines to be a focal design feature. The circulation is designed to encourage walking and exercise. The stairways are also designed to end at an informal gathering station with a coffee station, copy machine and bright curving couches to make it easy to sit down if you want to continue that unexpected conversation a bit longer. An emergency fire stair is placed on the edge of the building for each ‘L’. Bright slides used on the level 5 commercial floors are included to underpin the informal philosophy of the organisational culture we are trying to develop.

All personnel can move freely around the Tech Farm campus, working wherever they want in either of the Energy, Water and Waste distinct specialities facilities. Everyone’s laptop is equipped with a platform that enables instant messaging, phone and videoconferencing and people finding tools. The views along these circulation journeys include natural and designed landscapes, nearby architecture and interior views of people oriented activities in the exhibition spaces. Natural lighting is abundant through the communal atrium. There is a bike area located near the climate wall to encourage the use of sustainable transportation. The spiral staircase will contribute to ventilation and stack effect, with wind cowls above the grand stairs. A large waterfall at the bottom of the Waste Building will act as “white noise”.

Figure 5.52: Final image of slide for the informal organisational culture in lounges
5.4.9 Design Exploration 9: The Lab space

The intent with the laboratories is to create virtual fish bowls, with two glass walls, where one glass wall folds out to create shared space with the lounge living collaboration area. This will be an open extension of the workplace. This openness allows the scientists to be seen by other people and to show leadership and earn trust.

Tom Heath’s thinking paradigm says that situations present themselves, where they lead to the architect concerned “having an image of ‘the problem’ and ‘the task environment’, with him implying these images are the problem spaces.”54 In this case, the ‘the problem spaces’ involve the activities of the scientists physically playing with gadgets and parts. An activity preceding this would be modelling the conclusions of these investigations with parts and machines on a laptop. At the same time, ‘the task environment’ has the third task of interacting and socialising with other colleagues in the field; refining a shared understanding of these experiments.

The outer laboratories are positioned on the edges with views to the outside streets. The informal, open plan collaboration lounges face towards the social community core of the building, increasing the likelihood of discussions and dialogue. The laboratory shape and size is expressed through the size and shape of the concrete structure divided into grids of 9 by 8 metre modules. These box units have a variety of space functions to accommodate different kinds of work. There is a recognition that the scientists will work in different modes, so various spaces have been designed to accommodate them. A key component is the concept of buzz – conversational noise and commotion is good for the business, and is encouraged within the community of practice. Secondly, private offices and expressions of hierarchy are eliminated in building plan.

### 5.4.10 Design Exploration 10: Diversity of spaces to maintain worker interest

This developed grid language adopted, defined by the structural layout, means the remaining undefined spaces need to accommodate areas to rest, relax and have meetings. So, a nap room, which is dark, with fish tanks for walls has been designed for scientists to recuperate and nap after pressurised meetings. The business culture philosophy of showering to increase alertness and improve mood is incorporated in the design. Generous space for showers, on most floors is included, as showering has been proven to increase productivity.  

Places for pets, such as cats and dogs, have been included in the design of the commercial floors, as pets are said to decrease blood pressure and improve mood. Each floor has the already mentioned brainstorming pods for groups of 4-6. Each floor has larger Meeting Corner for 20-25 people. There is a place for a 100 person seminar room for conferences on ground level. The grid layout has been designed to accommodate different work-zones within the office to allow different tasks, from concentrating on a project, to meeting with colleagues, to sitting back to reflect. The layout has been designed to integrate the latest wireless technology and environmental controls into desktops or key pads, making them undetectable to the eye.

Understanding the ways in which employees utilize their day is important for comprehending the highly occupied spaces throughout the day. Staff eat lunch together, grab coffee together and have drinks after work in the bar. Generous windows on two sides provide views of the downtown skyline and the Harbour Bridge. There are also prominent, darker industrial Virtual Reality Workshops to aid designing.

A leading UK based charity called Mind released a report saying that 71 percent of people report depression decreased after a green walk, whereas 22 percent report depression after an urban walk. Nature is the preferable option. This is addressed with a green roof and nursery on top of the Waste Building. Here, urban gardening on the green roof with community vegetable gardens brings scientists together. There are terraces on the Water Building where people can socialise and enjoy the fresh air and views.

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5.4.11 Design Exploration 11: Cross Pollinisation of Sky Bridges

An important feature of the project is the design of appropriate sky bridges to allow cross-fertilisation. There are lounge areas between each functional layer (Workshop, Educational, Laboratory, Commercial) and connection between the buildings to encourage the distinct specializations to spread their ideas through to the other scientists in the different Energy, Water and Waste buildings. Lounge spaces are open to the atrium social core.

Sky bridges allow easier access of movement in the higher spaces of the atrium. The frequent movement of scientists and students crossing these bridges would add motion and dynamics to more than just the ground floor. Scientists would spend much of their time in the relaxed, informal, open plan lounge areas facing the atrium. This is where they would collaborate with other scientists. Then, when they require private space, they retreat to the laboratories on the edges, which can open to become part of the collaborative open plan area. They would spend time in here researching, with a northern deck to take time out. In good weather scientists could migrate outside to enjoy the varied landscapes in the northern courtyard. Favourite locales could be the noisy atrium, games room or basketball court.

People can appreciate the options. Maybe just moving from a usual space into another place that is really interesting, maybe that has glass all around, changes the thinker’s perspectives of what is possible. Spaces for congregating allow people to eavesdrop productively. The scientists and entrepreneurs can hear other colleagues talking about something, they realize it is relevant to them; and they can seamlessly integrate into it without having to schedule a meeting. The complexity of the sustainability prototypes makes it critical to work collaboratively with different areas of expertise. With the different artists, designers, engineers, scientists you struggle to determine who does what when they get together. They are located together, they share the same goal, with spaces designed to facilitate achieving these goals and they have exactly the same preoccupation of creating the right prototype.

Figure 5.5: Development image of Sky Bridge
Laser-cut model Engineering Development

Figure 5.56: Model development 1

Figure 5.57: Model development 2
Figure 5.58: Model development 3

Figure 5.59: Model development 4
Figure 5.60: Model 90% complete: Front

Figure 5.61: Model 90% complete: Side
Chapter 5.5 - Developed Design
5.5 - Developed Design

5.5.1 Aesthetics

The project aims to use the tech-look developed at the BedZED project in the UK as the model. The idea is to create a technical-green aesthetic sense. The Beddington Zero Energy Centre is now a worldwide recognised example of carbon neutral development, so it seemed appropriate that Tech Farm would be influenced by BedZED’s environmental flamboyant styling design ethic. For example, Tech Farm has copied the use of bright wind cowls and the extravagant showcasing of sustainable technology.

Understanding the context of the character buildings of the Wynyard Quarter area means a grey, concrete, industrial look would be adopted in an effort to retain and enhance the previous industrial and marine related uses and incorporate grey, seawall character elements. The contextual pattern of a dynamic roof, like the new ASB building on Jellicoe Street, has been emulated to add a distinctive roof character to the area. Hopefully, other new buildings in the Wynyard Quarter area will do similar gestures with their roofs, and eventually, when the whole process of redevelopment is over in a few years, the entire Wynyard Quarter will have a sophisticated ‘green-tech’ look, visible from afar.

Figure 5.62: Photo of BedZED Development.

Figure 5.63: Photo of Tanks at Wynyard Quarter
Greenstar Active Features

- Tech Farm is a 6 star building, displaying carbon neutrality.

5.5.2 Energy Strategy

There are numerous integrated green star strategies with appropriate selection of sustainable materials. The building has been designed to operate using an average of 1200kWh a day for a 16 hour day operation, which equals 192,000 watts for every hour of operation. The principles of renew, reuse and recycle have been utilized in the design of the building, with energy generated from renewable resources.

There is 192,000 watts/21,940sq m = 8.75 watts generated per square m.

- **Waste to Energy Power plant**: Level 1, Waste Building.
  Generates 55% of building’s energy.
  660kWh a day

- **Zig Zag Solar Panels**: on Atrium Roof.
  Generates 25% of building’s energy.
  300kWh a day

- **Vertical wind turbines**: on Water Building Roof.
  Generates 10% of building’s energy.
  120kWh a day

- **Photovoltaic Louvres**: on eastern and western facades.
  Generates 10% of building’s energy.
  120kWh a day

Some energy can also be borrowed from the other tenants of the Tech Farm symbiosis of Wynyard Quarter. Some can be also be supplied from the grid, but supplied by Meridian Energy who generate from renewable sources. In times of excess waste processing, excess energy generated from the waste to energy power plant can be sold back to the grid.
5.5.3 Environmental Efficiency

The building uses active, passive, mechanical modes for heat and ventilation. The first strategy is orientation. The building is oriented for a north facing climate wall which passively heats the air for the exhibition space through convection.

The atrium acts as a solar thermal collector, in winter the air is heated inside the atrium and used to heat the rest of the building. High volumes permit the warmer air to rise and the cooler air to stay around the floor level. Venting the air at the top with the BedZED wind cowls on each of the three buildings creates a convection force sufficient to drive the ventilation of the building.

The wind cowls directly above the spiral stairs also have the stack effect. There are concrete raised floors used for thermal mass effects.

The building also uses cross ventilation. Windows are programmed to open and close, depending on the wind direction. There is also the use of high tech, mechanical ventilation via a central station VAV air plant. The Energy Centre near the water’s edge contains the seawater heat pumps, boilers, chillers and transformers. Heating and cooling occurs via the sea water heat pump system where energy is extracted from the sea water and pumped to the HVAC systems. This system is expressed with clear pipes entering the seawater’s edge. The HVAC system incorporates an under floor air
displacement system with chilled beams. The under floor air conditioning allows personal control of temperature.

5.5.4 Waste Management

Reed bed systems filtrate the waste water, which is reused in the grey water systems. All waste from Wynyard Quarter is collected in trucks and distributed to the ground floor of the Waste building of Tech Farm. This is sorted, with recyclables put into the recycling centre and other waste transformed into energy using a steam process with the power plant on Level 1. This ensures the recycling of waste streams is 100%.

5.5.5 Materials

Mainly local materials are used to generate employment opportunities using regional skills. The surrounding tanks are dismantled and all metals reused and incorporated into the construction of engineering frames of Tech Farm.

- Bamboo: light materials for flooring
- Sustainable concrete with aggregates for columns and floors.
- Local timber for the ceilings, decks and furniture.
- Recycled glass aggregate in Precast Concrete.

All materials are made out of post consumer recycled materials, or renewable materials that were harvested without harm to the environment.
5.5.6 Water Collection Calculations

Rainwater is collected via a main gutter from the Atrium roof and the three buildings, feeding to the Energy Centre. The main water load is directed to the sand tank in the energy centre which acts as a silt filter and is then pumped to 4 larger filtered rainwater storage tanks nearby. The tanks have a combined volume of 250,000 L to allow for Auckland’s 3 month drought period. Rainwater and grey water from the showers is used for the toilets, and the building has an efficient reed bed purification system located opposite the Waste building. Showers and spas use minimally treated rainwater. There is appropriate use of solar hot water heating for the showers. The water strategy protects water resources by minimizing demand, reusing and recycling the site water.
5.5.7 Structural Concept

The programme Resist was used to calculate possible earthquake forces and the appropriate selection of columns. Square 800 mm steel I beam columns encased in concrete will be used for the rectilinear Waste, Energy and Water buildings.

There was advice from engineering experts and the use of precedents, such as the long spanning Renzo Piano’s airport and Motat Hangar; to make an intuitive assessment of the engineering required for the long spanning atrium roof. Columns and lattice frame bracing are made of steel and truss framing, connected to piles 10 metres deep into the landfill earth until it meets rock.

Figure 5.66: Laser cut Model showing engineering strategy
Chapter 6 - Final Building: Drawings
Figure 6.4: LEVEL 3 LABORATORIES
Scale 1:1000
Figure 6.7: LEVEL 6 SPAS & RELAXATION
Scale 1:1000
Figure 6.8: Tech Farm’s perspective of the Northern Facade
Figure 6.9: Tech Farms Western Facade
Figure 6.10: Tech Farm’s Southern Facade Beaumont Street
Figure 6.11: Tech Farm’s Eastern Facade
Figure 6.12: Perspective Social Core Intellectual Ecosystem
Figure 6.13: Perspective of Interior Lounges and Workspaces
Figure 6.14a: Perspective Section through AA
Chapter 7 - Critical Appraisal
Chapter 7 - Critical Appraisal

The purpose of this project was to design a piece of architecture which adheres to expert knowledge found through literature reviews and precedent surveys on how buildings enable creativity, productivity and teamwork, and foster a “community of practice” with a particular focus on a workplace environment dedicated to sustainable technology innovation.

Innovation in this field is critical to find solutions to sustainability issues which humanity is facing in the 21st century. To a large extent the world is relying on scientists to monitor green house gas emissions, but creating statistics is not enough. Engineers, architects, designers and entrepreneurs must come up with solutions. These solutions have to be produced in settings which entice and support creativity and imagination. Therefore, our built environments have a role to play in enhancing research culture and innovation for green design and clean technology. The Tech Farm institute attempts to achieve this with respect to the site and context chosen, as well as a high-tech, green-tech focus, visually communicating the goals of the organisation.

Tech Farm is based on the European Union Framework.58

1.) Emphasise the dislocation of innovation processes from day to day activity.

2.) Eliminate organisational hierarchy.

3.) Encourage participation and focus on

4.) Collaboration, face to face communications, mind body and physical activity including play, rather than technology.

The next sections will explain the key five architectural strategies used to answer the research question. These represent my guidelines for designing innovation buildings as a result of the culmination of this research.

1.) **The three L’s facing an Internal Atrium, Courtyard and Sky bridges.**

This significant architectural strategy of three ‘L’ shaped forms in plan, facing an internal courtyard was the key design move, whereby the “community feel” is created – the main goal of this research project, while the separate identities of the three key institutes are preserved. This configuration and distinct shape of the Energy, Water and Waste buildings – the three L’s around an atrium - is the underlying principle for how the design fosters community. Here, everyone can see nearly everyone in the community of practice trying to achieve the organisation’s goals just by looking out the window. Scientists can circulate along free flowing, long perimeter halls with glass curtain walls facing the inner atrium courtyard. The constant movement animates the complex. Personnel can indicate to others visually within the community of practice or increase their chances to meet and collaborate down in the central ground floor social core, perhaps having a bite to eat, or coffee, to discuss the design of their prototypes. The interesting views of the hive of community activity in the social core are present when circulating.

The whole design is based around face to face communication and meetings based on number 4 of the European Union Guidelines. The inclusion of the exhibition to the central community core, as a public space also allows ideas to be generated through interaction with the public.

The strategy of the inclusion of sky bridges, one at each separate functional level (Workshop, Education, Laboratory, Commercial) links the floors between the buildings and animates the complex with movement further up. This connection of the three buildings Energy, Waste and Water - is about facilitating communication between the three disciplines. They are physically open to the community core, so they can communicate vocally with others below.
2.) Semi Open Plan format with Partitions and Lounges

Likewise, another key architectural strategy to facilitate collaboration is the semi open plan format. The basis of the interior planning is semi open plan with partitions. The structural grid of columns defines the interior planning. The ‘L’ in plan is divided into half. The outside half, facing the urban context, is divided into 8 by 9 metre partitions. The internal half is an open plan, informal lounge, facing the social community core. It is believed the creative workers will do their best work in a relaxed, comfortable lounge, home like atmosphere, rather than the more formal, cubicle office. Here they record their data or research on the lounge walls. This planning allows visibility and connection and supports collaboration and teamwork. This technique follows the recommended proportions suggested by the Gates Foundation Research.

3.) Brainstorming Pods and Meeting Pods

Following the European Union guidelines is the recommendation to emphasise the dislocation (separation) of innovation processes from day-to-day activity. This has been addressed with the strategy adopted from precedents of Brainstorming Pods. These have been specifically designed to be 4.5 by 4.0 m, hanging off the sides of the complex. This is the distinct dislocation of idea-generating, brainstorming activity, from the general invention and analysis laboratories. They feature as lively, pushed and pulled extrusions, in bright orange, protruding off the western and eastern facades of the institutes. Scientists within Tech Farm are likely to align their behaviours with the activities the architecture has been designed for.

Another key architectural strategy was the design of Meeting Pods. The understanding of the activities of the employee’s work day has meant the inclusion of meeting pods throughout the building. These informal gathering stations are arranged around the main spiral circulation route where people bump into each other and chance encounters happen. Larger meeting rooms are found in the corner of the ‘L’ for larger groups, and a 100 person conference room for seminars on ground level. These, purposefully designed meeting spaces, allow for face to face communication to interact or share.

4.) Diverse and Intelligent Arrangement of Spaces for different Work Modes

Another key architectural strategy was the specific arrangement of the programme. To encourage people to move around the buildings, interesting social activities have been randomly spread across the institute to maximise chance encounters. The activity that everyone has to do, such as eating, is positioned in one central place, to encourage socialisation. Following the Gates Foundation Research a variety of workspaces have been included. This is to accommodate numerous work-modes and personalities with appropriate retreat spaces, such as the nap rooms to recuperate after a busy meeting. There are areas to relax the mind, such as a massage, sauna and spa area on the top floor. This is to allow the mind to ponder and daydream and a chance to socialise. Mind and Body activities of European Union Guideline 4 has meant the inclusion of a play room and gym on level 1. There is also the design of the outside, landscaped northern gardens at ground level with basketball court.

5.) Informal Organisational Culture developed through interior design

Another major architectural strategy was the design of the interior environment to create an informal organisational culture. This is number 2 of the European Union framework: the recommendation to eliminate organisational hierarchy. This was achieved by removing the private offices of the hierarchy based interior planning of the past. The internal environment has been designed to reflect the organisation’s goals by the use of space and, ultimately, improve the morale and productivity of the building’s occupants. The personality of the building aesthetically has been designed to promote a culture of technical prowess, pride and creativity. The layout has been designed to maximise views, for plenty of natural light to penetrate and aid productivity. The use of colour and the inclusion of slides on the commercial levels shape the informal business culture. The building has been designed for the inclusion of pets, as they reduce blood pressure and increase productivity. Accessible showers on every floor are available so people can feel refreshed and relaxed on the job. Natural ventilation and HVAC systems monitor the work comfort area with individual adjustable controls. The building incorporates greeneries. Plants have proven benefits of absorbing noise pollutant and converting CO₂ to oxygen. The incorporation of nature by means of plants in the lounges and green roof gardens on top of the Waste building allows vegetable gardening for productive, safe and pleasant social interaction.
Chapter 8 - Conclusion
Chapter 8 – Conclusion

I have watched with some concern the increase of extreme weather events recently, both worldwide and nationally. For example, the last December tornado in Auckland which killed three people, the current drought affecting the North Island of New Zealand and the June winter storm and floods. Most scientists now do agree the strange weather is due to global warming.

Clearly, human activity, greed, excess and overpopulation are changing the ecological balance of our natural systems. From statistics and reports we can conclude that civilization is in danger.

What is the role of architects and developers in this? Assuming adequate political action and regulatory pressure will soon create different market conditions and a different culture towards the ecosystem, the next most important step is a design and technology revolution. This means we will need a wave of innovation, innovation on a massive, industrial scale.

My proposal for the Tech Farm Innovation Cluster at Auckland’s Wynyard Quarter has endeavoured to design the perfect Intellectual Ecosystem for Creativity, Productivity and Teamwork and to foster a Community of Practice. Based on the assessment conducted in the previous chapter with the help of the five principles, I conclude that this undertaking has been successful, the Tech Farm building would indeed deliver a workplace which fosters creativity, innovation and collaboration.

As a programme, this Institute would be a step in the right direction to ensure New Zealand has a leading role to play in the global struggle to develop the Green Economy and make the world a safer place.

Now let's build it.
Figure 8.1: Final Banner Presentation

Site Plan
Scale: 1:500

Plan
Scale: 1:500

Tech Farm
An Innovation Hub for Green Design and Clean Technology at Wynyard Quarter
Cross Section Perspective (A)
Scale: 1:200
Figure 8.2: Final Model Northern Elevation & Context
Figure 8.3: Final Model Western Elevation & Context
Figure 8.4: Final Model North Close up and Climate Wall
Figure 8.5: Final Model Southern Close up
Chapter 9 - Bibliography


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