



Process Improvements for Custom Design and Construction Projects

Abstract:

The project undertakes an investigation of Totalspan's custom design and construction projects. These projects, referred to as Specific Designs, are inherently risky due to their complexity and uniqueness. Such issues are exacerbated by a lack of knowledge retention and reuse from project-to-project. This report aims to develop recommendation for improving the efficiency and profitability of Specific Design Projects. It explores ways to reduce the time employees spend on non-value-added activities. This will allow for more time spent on activities such as sales and project management, which increase the profitability of the business as a whole.

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Prepared By:

Sean Fitzgibbon
Master of Engineering Management
University of Canterbury
Civil/Mechanical Engineering L2 Rm E15

Phone: (03) 349 1267
Mobile: 027 333 6914
Email: sfitzgibbon@spanbild.co.nz
Website: www.spanbild.com

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EXECUTIVE SUMMARY

INTRODUCTION

Totalspan specialises in the design, manufacture and construction of prefabricated steel buildings. The company operates using a franchise model, meaning there is independent locations around the country who manage each project from quote to completion.

Totalspan has a number of Standard Designs, which are pre-engineered and ready to produce. However, in some instances, the scope of a project falls outside of the standard ambit (see below). If a project falls under any of these categories, it will require a custom design from an engineer, also referred to as a Specific Design:

- Building characteristics – dimensions, bracing, openings
- Site characteristics – site-specific loading (wind, snow, earthquake), soil characteristics
- Intended use – standard ranges are IL1, any habitable building requires engineering

Specific Designs make up around 15 percent of projects by volume [1]. However, they contribute to a significant amount more angst, uncertainty and risk than standard projects. This project investigated the core issues surrounding Specific Design projects. It was then possible to develop some recommendations for improvement.

PROJECT APPROACH: DESIGN THINKING

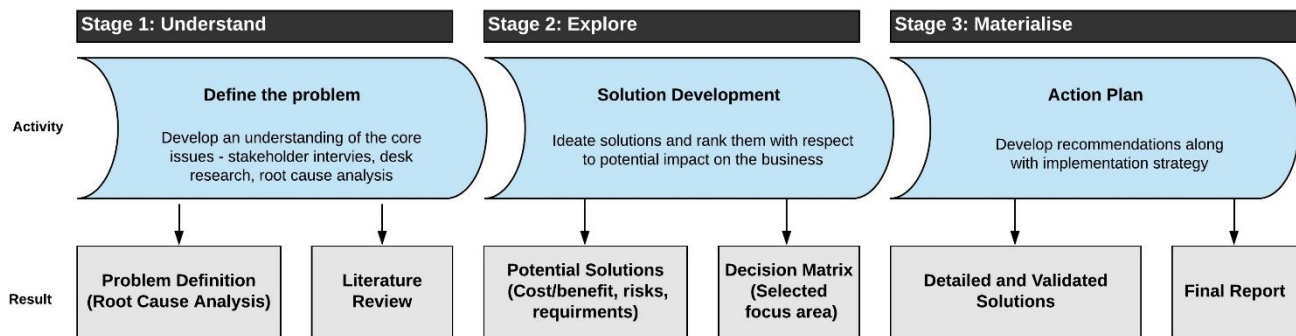


Figure 1: Shows the three distinct stages of the project: understand, explore, and materialise

CURRENT CONDITIONS

Totalspan is a subsidiary of Spanbild NZ Ltd. Spanbild provides a range of products and services that facilitate Totalspan's day-to-day operations as a business. This includes capabilities such as manufacturing, IT, management and marketing. However, these resources can also be allocated to Spanbild's other brands, which creates a complex system hierarchy.

The figure below gives an outline of the Specific Design process. Franchise project managers play a critical role in this process because they provide the link between each of the stages. Effective project management requires clear and efficient transfer of information between the parties involved.



Figure 2: Specific Design Process Overview

PROBLEM DEFINITION

Table 1: Summary of core issues and their root causes.

Problem Area	Key Issues	Root Causes
Engineering Inconsistency	Design Variability	<ul style="list-style-type: none"> Multiple engineers providing signoff that each have their own philosophies and practices Limited reuse of designs due to a lack of planning and effort recording historical data.
	Turnaround Inconsistency	<ul style="list-style-type: none"> Quotes can range anywhere between 2-6 weeks depending on the time of year. Influxes during promotional periods. Missed deadlines due to a lack of accountability from engineers
Project Overrun	Price Overrun	<ul style="list-style-type: none"> Inaccurate job costing due to time constraints and data limitations Pricing strategy favours Standard Designs over Specific Designs
	Time Overrun	<ul style="list-style-type: none"> Delays from engineering due to poor workload management or scope changes Delays on site due to rework or mistakes made when completing the factory order
	General Process Inefficiencies	<ul style="list-style-type: none"> Franchisees spend most of their time on admin, pricing and BoM creation rather than sales and project management Manual data entry and double handling of information due to echo system sitting outside of TRS Software limitations makes it difficult to draw and order anything non-standard through the factory
Communication & Collaboration	Remote Working Environments	<ul style="list-style-type: none"> Focus on the negative interactions - lack of conflict resolution Tend to assume the other party is falling behind due to lack of effort.
	Echo System Ineffectiveness	<ul style="list-style-type: none"> Unreliable notification system - missed messages and delays Excessive back and forth to get an engineering project up and running (receiving/returning SFAs)
	Limited Project Learning & Knowledge Sharing	<ul style="list-style-type: none"> Limited inter-franchise collaboration and open discussion due to a lack of appropriate platform Lack of planning and ownership surrounding Knowledge Management (KM) processes
Innovation	Limited Strategy Driving Innovation	<ul style="list-style-type: none"> Tend to focus on product and service innovation rather than continuous improvement of internal processes Opportunity to build internal capabilities and reduce the amount of money spent outsourcing
	Silo Working Mentality	<ul style="list-style-type: none"> Limited interactions between departments due to the geographical spread of the Christchurch head office. Limited opportunity or social interactions outside of work
	Resistance to Change	<ul style="list-style-type: none"> Fear of the unknown and how changes will affect their routine Lack of buy-in from employees due to limited consultation during development process

RECOMMENDATIONS

Table 2: Summary of core issues and their root causes.

Project	Tasks	Risks and Mitigation Strategies	Requirements	Results
Echo Development	<ul style="list-style-type: none"> Encourage engineers to use the echo system to its full functionality – fill management, scheduling etc. Improve notification system. Electronic quote acceptance (no paper SFA's). Echo statistical reporting - analyses job volumes. Request engineering through TRS (echo-TRS link). TRS documents automatically transfer to echo with engineering request (reduce franchise admin). 	<ul style="list-style-type: none"> Push back from engineers because of data entry. Need to incentivise compliance and outline benefits. Statistical reporting data underutilised by management. Requires simple and function system. Legal issues surrounding electronic quote acceptance. TRS is quite slow to load, it may be best to leave echo as a standalone app that sends/receives data from TRS. 	<ul style="list-style-type: none"> Planning & Consultation (Sean) ~ 2 weeks Software Development (Sam) ~ 2 weeks 	<ul style="list-style-type: none"> Capture project statistics. Design retention & reuse. Reduce time making engineering request ~30 mins per job. Reduce SFA processing time ~ 1 day per job.
Collaboration Software	<ul style="list-style-type: none"> Upgrade SharePoint to Office 365 package including cloud based file management and collaboration software. Configure and migrate database. Get employees on board and familiar with software Create buy-in through regular engagement: Polls, discussions, publications and activities. Maintenance and support services plan. 	<ul style="list-style-type: none"> Collaboration software will result in an increase in informal communications. Need to develop processes and responsibilities for formalising lessons learned. Lack of buy-in from users because of resistance to change and miscommunication of benefits. Managers and team leaders need to lead by example. SharePoint to be the single point of access to critical information. 	<ul style="list-style-type: none"> Licence purchase (various options) Infrastructure development (David) ~ 1 week User training FLT Champions 	<ul style="list-style-type: none"> Project management planning, scheduling & communications. Host KM database. Collate & share learnings. Open-discussion and innovative thinking.
Knowledge Management System	<ul style="list-style-type: none"> Explore the shortcomings of current KM system and business value of improvements. Design knowledge flow process and KM protocols. Communicate roles and responsibilities for KM. 	<ul style="list-style-type: none"> KM strategy does not align with business strategy. Outline corporate expectations and priorities. KM repositories structure for retrieval and reuse. Lack of buy-in and realisation of benefits. 	<ul style="list-style-type: none"> Consultation and planning between management and KM system users 	<ul style="list-style-type: none"> Clear vision, outcomes and KPIs for KM Structured, functional KM database (SharePoint)
Pricing Service: Preliminary Job Assessment & Guaranteed Quote	<ul style="list-style-type: none"> In-house service for pricing Specific Designs, providing guaranteed price for framing only. Quotes returned via echo within 1-2 days or the franchise will lose clients. A service fee of \$100 added to the quoted value to cover the cost of the service. This takes into account that only 35 percent of quotes convert to sales. 	<ul style="list-style-type: none"> Totalspan head office assumes risk of underestimating engineering upgrades from the franchisee. However, higher volume numbers mean Totalspan are better equipped to handle gains and losses on jobs. Need to have additional staff that are capable of using quoting tools to handle influxes in requests. Small fee in comparison to factors added by franchisee 	<ul style="list-style-type: none"> 1 FTE (Sean) Training using Spreadsheet & Pricing Software (Jamie) Access to back-costing data 	<ul style="list-style-type: none"> Franchise spends less time quoting jobs and more time selling them. Increased quoting accuracy resulting in higher conversion rate. Quoting data & statistics
Design Service: Construction Drawings & BoM Creation	<ul style="list-style-type: none"> Existing design service is limited to a small number of franchisees due to resource constraints. Recruit someone with appropriate skillset to fill the role: quantity surveyor or similar within company. Further development of in-house software to improve quality and efficiency of service. 	<ul style="list-style-type: none"> Totalspan head office assumes ownership of BoM. Mistakes may occur: liable for replacement parts but will not compensate lost time or labour hours. Need to outline parameters for error and continually improve. Service will take time to improve efficiencies and remove errors. Incremental release to the network. 	<ul style="list-style-type: none"> 1 FTE – Graduate QS ~\$45K-\$50K per year Design Service Supervisor (Jamie) \$60/h service fee 	<ul style="list-style-type: none"> BoM creation on its own takes franchise 6 hours. Service can complete BoM & Construction Drawings in 5 hours total. Reduce rework & delays

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GLOSSARY OF TERMS

Term	Meaning
ADAPT	New software and product range in final stage of development project: includes drawing tool, BoM creation (see below), expanded standard design range
Bill of Materials (BoM)	A list of parts, components and the quantities of each needed to manufacturing
Design Change	Work state, processes or methods that differ from the original construction plan or specification i.e. scope changes or quality issues
Echo	Internal system franchisees use to make requests for engineering. Used to exchange files, job information and communications with engineer.
Extras	Non-standard parts that have to be added the BoM manually
Franchise	Totalspan location which handles sales, project management and construction
Franchisee	Totalspan franchise owner and manager of operations
FLT	Franchise Leadership Team
IL1	Importance Level 1 Building – (uninhabitable, un-lined, e.g. farm shed or garage)
IL2	Importance Level 2 Building – (habitable dwelling or commercial use)
Knowledge Management (KM)	KM is a systematic set of processes that enables the collection and communication of personal information and experience to the wider organisation.
Rework	Repeated work measures required to conform to the original job requirements
SFA	Short Form Agreement - Conditions of engagement.
SharePoint	File management system
Specific Design	Building that does not fit into the Standard Design category (custom engineering)
Standard Design	Building that has existing engineering, drawings, and documentation to support it
Totalspan	Construction-manufacturing company (project sponsor)
Totalspan Retail System (TRS)	Internal system used to store project information, manage contracts, order manufacturing, and record financing
TS Quote	Legacy quoting system used to produce drawings, BoM, and quote

1. INTRODUCTION

1.1. BACKGROUND

Spanbild is a construction-manufacturing company based out of Hornby, Christchurch. The company consists of a number of brands, which operate independently in specific areas of the construction market (see below). This report focuses on the Totalspan brand, who produce rural, residential and commercial steel buildings.



Figure 3: Spanbild's Associated Brands

Totalspan specialises in the design, manufacture and construction of prefabricated steel buildings. Their offerings include a range of Standard Designs, which are pre-engineered and ready to produce. However, in some instances the standard solutions do not meet specific user requirements (table 1). In such cases, the design is referred to chartered structural engineer for custom engineering (Specific Design). This adds time, cost, complexity and uncertainty to the scope of the project.

1.2. PURPOSE

The purpose of this project was to investigate the difficulties and risks surrounding Specific Design projects. These learnings will mould the recommendations for improving the efficiency and profitability of such projects. The key focus areas of the project are:

- Reduce the time and resources it takes to complete Specific Design projects
- Improve the speed and accuracy of initial project estimates
- Improve collaboration and communication
- Enable the analysis and reuse of historical project data
- Develop and retain the skills, knowledge and resources

1.3. DESIGN THINKING APPROACH

This project was based around the concept of design thinking (figure 1). Design thinking is a user-centric approach to problem solving that can lead to innovative solutions and competitive advantage [2]. The main differentiation between design thinking and alternative problem solving techniques (Six-Sigma DMAIC, PDCA) is its focus on human values and empathy at each stage of the process. Insights into user behaviour and continuous user engagement will lead to a solution that best fits their needs.

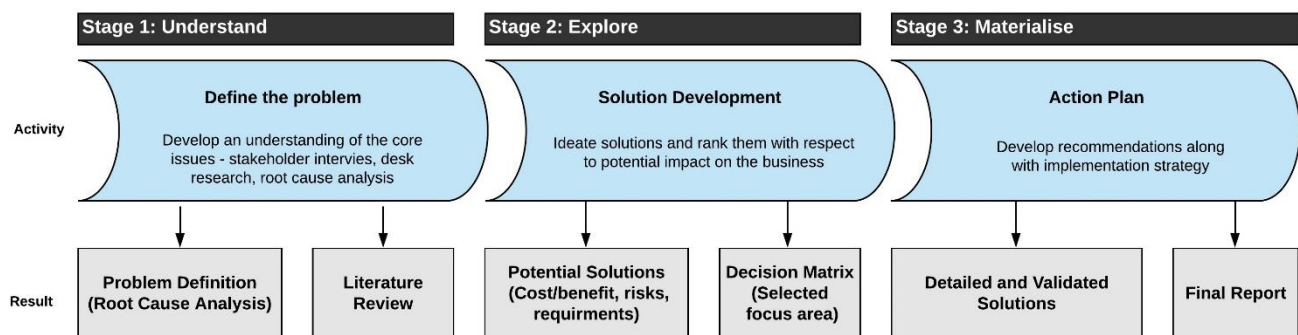


Figure 4: Shows the three distinct stages of the project: understand, explore, and materialise

2. CURRENT CONDITIONS

2.1. BUSINESS ENVIRONMENT & HIERARCHY

The following figure outlines how the various parties in and around the Totalspan Project Environment interrelate (figure 3). Totalspan operates using a franchise model, meaning there is a network of independently owned and operated business around the country. These franchises manage their own projects from quote to completion; including sales, project management and construction.

Spanbild facilitates the day-to-day operations of each franchise through a range of products and services. However, a number of these resources are shared between multiple brands. Any development projects that use shared resources such as IT require approval from Spanbild management. For these projects to gain approval, they need to benefit to the business as a whole, e.g. software that can facilitate multiple brands.

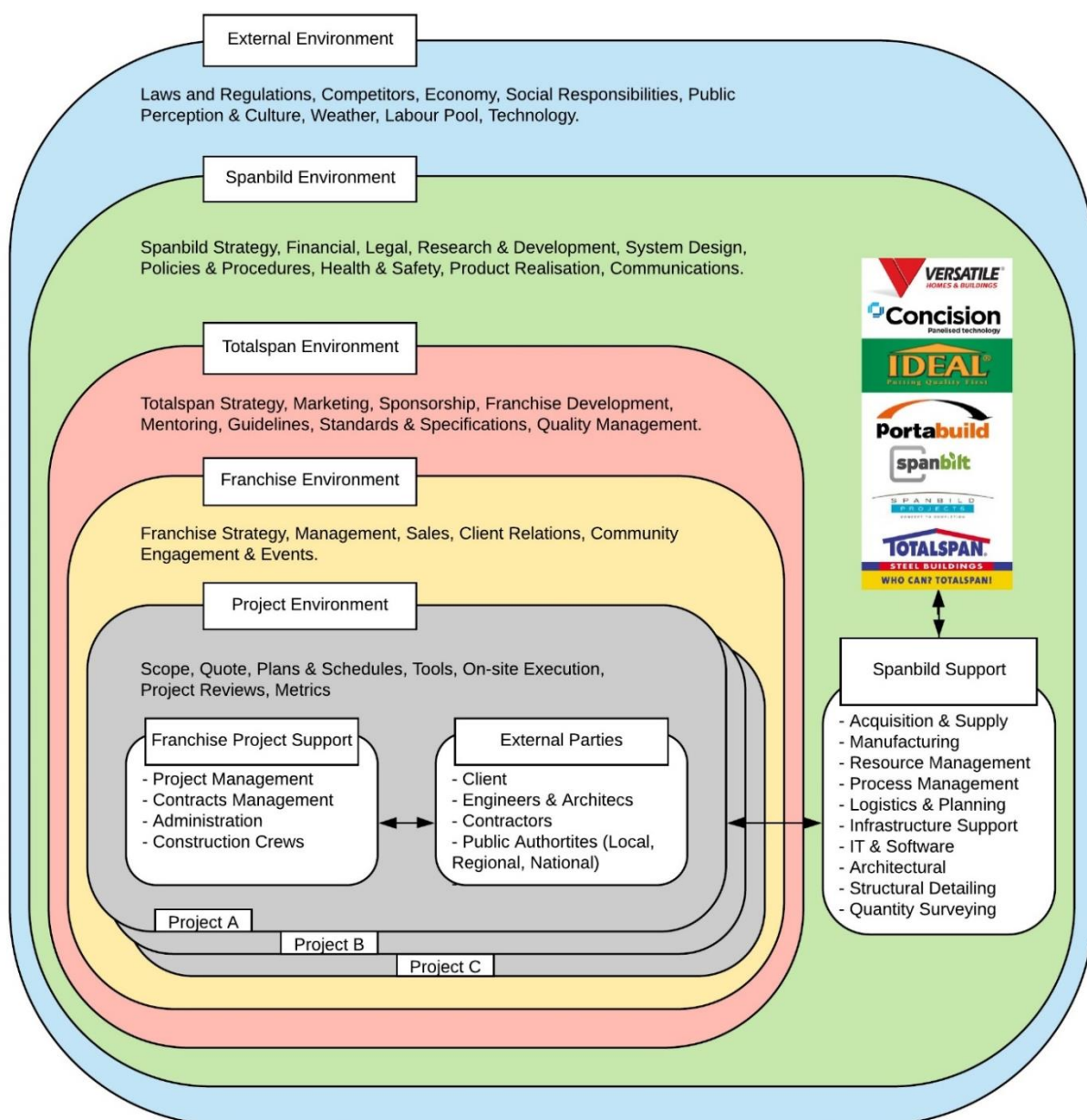


Figure 5: Shows the complex organisational hierarchy and responsibilities

2.2. SPECIFIC DESIGN LANDSCAPE

Below is an explanation of the various reasons a project may require a Specific Design. The projects that result in the most uncertainty and risk are those with extreme site-specific loading characteristics. This is because the engineer will need to upgrade the frames and sometimes the foundation to handle the additional load.

Table 3: Specific Designs: If the scope of the project falls under one of these categories, it will need to be referred to an engineer.

Specific Design Category	Reasoning
Building Characteristics	<ul style="list-style-type: none"> • Dimensions – maximum span, bay spacing, height, pitch • Bracing – buildings have a minimum number of bays that must be void of openings for cross-bracing • Openings – only allow for standard openings that are supported by engineering (no solar panels), limitations to size and materials etc.
Site Characteristics	<ul style="list-style-type: none"> • Site-specific loading – wind, snow or earthquake • Soil characteristics – minimum bearing capacity, non-liquefiable soil, no high-plasticity clay
Intended Use	<ul style="list-style-type: none"> • Standard ranges are IL1 (non-habitable and un-lined) • Buildings for habitable or commercial need to be upgraded to IL2



Figure 6: Example of a Standard Design (left) and Specific Design (right)

A recent survey of Totalspan Franchisee owners found that only 15 percent of all buildings were Specific Design [3]. However, they result in a significant amount of the angst and difficulty experienced by employees. The company aims to bring this down to around 10 percent through further standardisation and improved utilisation of standard solutions [4]. However, the volume of Specific Designs has been increasing recently due to a number of reasons:

- **Technology pull** – Spanbild Projects (larger commercial developments) attempting innovative projects. Shows clients and other franchisees what the product is capable of achieving.
- **Market push** – Clients wanting increased flexibility with their designs or restrictions imposed by councils or engineers

Franchises tend to take on more Specific Designs when it is quiet, because they can invest the required time and effort into them. If they are overly busy or short for resources, they will tend to try to push them in the direction of the standard ranges [5].

2.3. SPECIFIC DESIGN PROCESS

Below is a summary of the stages involved in a Specific Design project. Please refer to Appendix B for a detailed outline of the task involved and a flow diagram explaining some of the decision-making. The franchises project manager plays a critical role in this process because they provide the link between each of the stages. Effective project management requires clear and efficient transfer of information between all of the relevant parties. This can only be achieved with the appropriate systems in place to support it.



Figure 7: Specific Design Process Overview

2.4. SUMMARY OF CURRENT CONDITIONS

Specific Design projects make up a small percentage of Totalspan’s sales but contribute to a large amount of the angst and difficulty among its employees. Franchisees tend to push clients towards standard options to save then time and cost but in many instances, Specific Designs are the only viable option. Totalspan needs to identify the areas in which risk and uncertainty arise in order to manage and mitigate their effect.

3. PROBLEM DEFINITION

The following section outlines the key issues surrounding Specific Design projects. These issues were ascertained in an extensive stakeholder interview process (Appendix C). They were then analysed using the Five Why’s: Root Cause Analysis method (Appendix D). By repeatedly asking the question “why”, you can peel away the layers of symptoms, which then lead to the root causes of the problem [6]. This gives a structured way to visualise the relationships between the issues and understand how the potential solutions were developed.

3.1. ENGINEERING INCONSISTENCY

Engineering inconsistency creates risk and uncertainty throughout a project’s life cycle. One area that has a significant impact on project outcomes is variability in the final design solutions that engineers provide. Design variability indicates that there is very limited knowledge retention and reuse from project to project. This is likely because there is a range of different engineers from different companies working on the designs. Each can have a different design philosophy and different levels of experience with the product.

A common sentiments expressed by franchisees is that engineers are overdesigning some of their buildings. They have observed that some designs come back heavier than others do, even though characteristics of the design highly similar. However, there is no real way of ascertaining whether this is actually the case or just confirmation bias. There needs to be a better way of collating and comparing the designs coming through the network as a whole. This would require a standardised way for recording design changes to producer statements, rather than the ad-hoc red pen method used currently.

Engineering lead times have become longer and less reliable than they ever were in the past [7]. Quotes on turnaround times on Specific Designs are typically 2-3 weeks, but can sometimes be as many as six. There is also no guarantee that the engineering consultancy will stick by the due date they have estimated [3]. This causes immense difficulty when project managers have already scheduled out the rest of the project [8].

Table 4: Summary of core issues and root causes - Engineering Inconsistency

Key Issues	Root Causes
Design Variability	<ul style="list-style-type: none"> Multiple engineers providing signoff that each have their own philosophy's and practices Limited reuse of designs due to a lack of planning and effort recording historical data
Turnaround Inconsistency	<ul style="list-style-type: none"> Turnaround times on engineering vary significantly due to the time of the year. This is due to fluctuating demand created by promotional periods. Missed deadlines due to a lack of accountability on engineers behalf

3.2. PROJECT OVERRUN – PRICE & TIME

Specific Design pricing results in angst and uncertainty for franchisees. In rare cases, jobs are declined or re-evaluated, as they would be too risky for the franchisee to take on [5]. When a customer makes an inquiry on a building, the franchise needs to formulate a quick and accurate quote. The franchise must complete this quote without a full understanding of the engineering upgrades that may occur. One option for gaining a better understanding of what the final design will consist of is to get a preliminary design completed by the engineers. However, this requires time and money up front, when the client just wants a free no-obligation quote. The franchise would ideally provide a quote within 48 hours, if not overnight [9].

The quoting process starts with the franchise entering the job into the Totalspan Retail System (TRS). The system incorporates a drawing tool, which can provide sketches and quotes for all of the standard design options. However, the system is unable to render any non-standard options, meaning the franchise will have to draw up something as close as possible to what the client has specified, using the Standard Design options. They will then take the standard kit price and add a safety factor of around 30-40 percent to account for any upgrades that occur during engineering [5].

The process for estimating the potential upgrade from engineering tends to be quite intuitive and objective. The franchisees have limited technical knowledge around design so they just make a few assumptions based off past job experience. Interviewees expressed that they were regularly underestimating the cost and durations of projects [10]. This significantly reduces the profitability of their business because they are liable for any discrepancies between the quote and the final cost of the build [8].

Table 5: Summary of Root Cause Analysis – Project Overrun

Key Issues	Root Causes
Time Overrun	<ul style="list-style-type: none"> Delays from engineering due to poor workload management or scope changes Site delays due to rework or errors made when ordering building (manual data entry)
Price Overrun	<ul style="list-style-type: none"> Inaccurate pricing estimates due to time constraints and data limitations Pricing strategy favours Standard Designs over Specific
Process Inefficiencies	<ul style="list-style-type: none"> Franchisees spend most of their time on admin, pricing and BoM creation rather than sales and project management Software limitations makes it difficult to process anything non-standard Double handling of information due to a lack of interconnectivity between echo & TRS

3.3. COMMUNICATION & COLLABORATION

Collaboration is a critical part of any franchise business as it helps identify inefficient workplace practices [11]. Effective collaboration within the Totalspan network will enable the company to harbour and reuse the knowledge gained from previous projects. One franchise may be quoting a job that is exactly the same as one that another just completed, but they have no way of knowing that. Requests for advice and information tend to occur via email, which does not harbour open discussion among large groups [12]. It is also difficult to collate and distribute any of the learnings for future use.

Knowledge Management (KM) is the process of converting personal information and experience into something that can be used by the entire organisation [13]. Effective KM requires clearly defined processes and responsibilities [14]. System owners and developers need to consider how knowledge flows through the organisation. It is important to understand the activities that lead to new learnings and any barriers that impede the information flow to the point of use [14].

Breakdowns in communication between franchisees and engineers contributes significantly to project delays [15]. There tends to be a lot of unnecessary back and forth via emails would have been quicker and easier to resolve via the phone [3]. Many of the franchisees come from a non-technical background, meaning they prefer to discuss and explain things via the phone than email or messaging [16]. There is also limitations to the echo notification system, which means it can take days in between each reply [7]. In many cases it can take over a week to get a job up and running when it should only take one or two days [8]. Franchisee also have no way of knowing how the job is progressing once it has gone live.

Table 6: Summary of Root Cause Analysis – Communication & Collaboration

Key Issues	Root Causes
Remote Working Environments	<ul style="list-style-type: none"> • Tend to focus on the negative interactions due to a lack of conflict resolution • Tend to assume the other party is falling behind due to lack of effort
Limited Project Learning & Knowledge Sharing	<ul style="list-style-type: none"> • Limited open-discussion between franchisees due to a lack of appropriate platform • Lack of planning and ownership surrounding KM processes
Echo System Ineffectiveness	<ul style="list-style-type: none"> • Unreliable notification system results in unread messages and excessive delays • Back and forth during initiation phase of engineering (receiving/returning SFAs)

3.4. INNOVATION

Innovation can be defined as “any change that adds value” [17]. Innovation can occur in a range of different ways, but typically involves exploring new ideas to develop a product, process, or service. It is important to understand that the execution of the idea is often more critical than the quality of the idea itself [18]. The organisation needs to cultivate and communicate the idea in order to extract its highest possible value.

Having a dedicated strategy for innovation will give a company direction and goals for innovation. This is because it gives managers a structured and actionable way to approach limitations with their current capabilities. Without a dedicated strategy, process improvements can become disjointed and inefficient. Similarly, a company may find that the new products or services they are exploring do not align with their underlying company strategy. A good innovation strategy creates transparency through all levels of the organisation.

Table 7: Summary of Root Cause Analysis – Innovation

Key Issues	Root Causes
Innovation Strategy	<ul style="list-style-type: none"> Lack of formalised strategy behind innovation. Tend to focus on product and service innovation rather than continuous improvement of processes. Opportunity to build internal capabilities and reduce money spent outsourcing
Silo Mentality	<ul style="list-style-type: none"> Limited interactions between departments due to the geographical spread of the Christchurch head office. Limited opportunity or social interactions outside of work.
Resistance to Change	<ul style="list-style-type: none"> Fear of the unknown and how changes will affect their routine Lack of buy-in from employees due to limited consultation during development process

3.5. SUMMARY OF CORE ISSUES

Specific Design projects are complex and variable in nature. This makes it difficult to quote such projects accurately and manage them effectively. The core issues behind these difficulties are as follows:

- Engineering inconsistency – variable turnaround times and design specifications on similar projects
- Project overrun – projects go over time and budget due to planning constraints and data limitations
- Communication – limitations to communication systems resulting in double handling of information
- Collaboration – remote working locations makes it difficult to share project knowledge and learnings
- Innovation – tend to focus on individual projects rather than continuous improvement of processes

Totalspan needs to focus on knowledge retention and reuse, rather than re-inventing the wheel each time. This will require effective standardisation and regulation of internal processes. Totalspan can also free up time and resources for franchisees by taking responsibility for some of their time consuming processes.

4. SOLUTION DEVELOPMENT

The following part of the report outlines the exploration stage of the design thinking process. This involved ideating and prototyping potential solutions. It was important not to evaluate any of the ideas during the initial brainstorming process to keep the solutions open and innovative. Following this, the solutions were ranked with respect to their potential impact on the business. Each were given a feasibility and priority rating of low (1), medium (2), or high (3). Anything with a combined score of five or more was appropriate for further development. The final recommendations section gives a summary of the chosen solutions.



4.1. ENGINEERING INCONSISTENCY

Table 8: Potential countermeasures to engineering inconsistency

ID#	Action	Description	Notes	Feasibility	Priority
E1	Engineering Guide: How the code works and potential upgrades	<ul style="list-style-type: none"> Quoting guide with information on wind speed calculations, frame upgrades, foundation upgrades how to avoid them. Preliminary engineering spreadsheet for franchise use. 	<ul style="list-style-type: none"> Would still be a significant amount of uncertainty when quoting a building regardless. Potentially too technical for some franchisees. Checkwind software now available. 	Medium	Low
E2	Network Reporting & Analysis Function (echo)	<ul style="list-style-type: none"> Tool that produces summary reports and invoices from echo (Prototype - Appendix E) Gives management access to volume numbers, job types, quote details and 	<ul style="list-style-type: none"> The data is already there, just need to make it presentable for managerial use [19]. Requires software developer for half day. 	Medium	High
E3	Instant Capacity Overview Function	<ul style="list-style-type: none"> Visual representation of the engineering teams' current capacity to take on new jobs. If the franchise can see that one engineering firm has 20 jobs and the other only has five they can choose to go with the less busy one. 	<ul style="list-style-type: none"> How many jobs you have on is not a good representation of capacity. The engineers may not want the franchisees to see this information. Could result in unrealistic expectations. 	Low	Medium
E4	Formulate Design Best Practices	<ul style="list-style-type: none"> Develop a guide for best practices when designing a Totalspan building. i.e. when a member/bracket needs to be upgraded, which member/bracket is the preferred solution. 	<ul style="list-style-type: none"> The nature of Specific Design means there is no one size fits all solution or best practice. Would require extended consultation with engineers and they will likely fail to agree on some points. 	Low	Medium
E5	Engineers Must Fill Out Job Description Fields (echo)	<ul style="list-style-type: none"> The engineers completing initial assessment of job should fill out fields detailing results. Clearly and concisely describes all relevant job information to the client – wind/snow loading, price, design type (Standard/Specific) etc. Means engineer can build a searchable database of complete engineering for reuse purposes 	<ul style="list-style-type: none"> System is already in place, just not being used. Need to educate the engineers about benefits. Only takes around 20 seconds to fill out required information. Most of the work has already been complete by the franchisee. Need to educate engineers how to use search functionality to gain full benefit from it. 	High	High
E6	Design Summary Field (echo)	<ul style="list-style-type: none"> Engineers fill out a design summary field when submitting a producer statement through echo. Would also make it easier for an engineer to assess reuse potential at glance when revisiting the design. Supports information flow to the factory 	<ul style="list-style-type: none"> Would be very easy to add a new tab in echo. However, the engineers often fail to fill out the existing data so asking them to fill out more will likely fail. 	Medium	Low

4.2. PROJECT OVERRUN – PRICE & TIME

Table 9: Potential ways to reduce the risk of price and time overrun

ID#	Action	Description	Notes:	Feasibility	Priority
P1	Improve Workload Management Functions (echo)	<ul style="list-style-type: none"> Shared echo calendar outlining the jobs that each engineering team member has due each week. Gives management a better understanding of capacity when completing initial quote. 	<ul style="list-style-type: none"> Adding this sort of functionality would not be difficult. Could be included in network reporting project (E2). However, this is a low priority as it is ultimately the engineers' responsibility to deliver on time. 	High	Low
P2	Lock Design Once Sent Away For Engineering (echo)	<ul style="list-style-type: none"> Once a building has been sent away for engineering, another employee from the franchise can go in and change the job specifications in the manufacturing system (TRS) Can order building slightly different to the one engineered. 	<ul style="list-style-type: none"> Only feasible if TRS and echo systems are linked (P7) There are significant consequences if the building produced is not as designed by engineers. May fail council inspections or require re-engineering. 	Medium	Medium
P3	Measure & Classify Rework	<ul style="list-style-type: none"> Rework is a significant contributor to project overruns [20]. Standardizing and recording rework would enable Totalspan to identify trends and formulate countermeasures. This can be achieved by defining, quantifying, and classifying any rework that happens in the field [21] 	<ul style="list-style-type: none"> Implementing a system like this would require vigilance from the franchise and their construction crews. In many cases, instances of rework tend to go unreported due to a reluctance to report bad news [20]. 	Low	Medium
P4	Design Service: Construction Drawings & BoM Creation	<ul style="list-style-type: none"> BoM creation and ordering the parts through the factor takes significant time and care to complete (2 hours/job). Totalspan has existing paid service that completes this process for franchisees, along with a detailed set of construction drawings. However, requires more resources to facilitate the entire network. 	<ul style="list-style-type: none"> Totalspan service takes complete ownership of the BoM, i.e. remove risk from franchisee. Would require additional full time employee: draughtsperson/quantity surveyor. Cost neutral charge out rate to franchisees. Gives franchise time to focus on value-added activities 	Medium	High
P5	Critical Evaluation of Pricing Strategy	<ul style="list-style-type: none"> Analyse the current pricing strategy - SWOT Identify potential improvements and any risks and uncertainties that come along with them. Develop some detailed recommendations going forward. 	<ul style="list-style-type: none"> Totalspan projects have two stages of pricing to consider. Firstly, the kitset price that the Totalspan Factory sells the building to the franchise for (B2B). Secondly, the price that the Franchise sells the product to the customer for. 	Medium	Medium
P6	Specific Design Pricing Service	<ul style="list-style-type: none"> In-house service offering preliminary design and pricing. Guarantee price and take the risk away from franchisees. Need to develop tools to improve the efficiency of the calculation/modelling process. 	<ul style="list-style-type: none"> Cost neutral charge out rate to franchisees. Standing by the quote creates risk for Totalspan business. Requires retention and reuse of project knowledge along with continual improvement quoting methodology. 	Medium	High
P7	Link Echo & TRS	<ul style="list-style-type: none"> Enable the transfer of job information and specifications through internal systems (removes double handling) Request engineering button in TRS which locks the job and sends through details, drawings, and PS1 with request 	<ul style="list-style-type: none"> Existing web-based platform for echo is limited in functionality. May be best to re-think completely. Will require approximately three full day's work for full time developer. 	High	Medium

4.3. COMMUNICATION & COLLABORATION

Table 10: Potential ways to enhance communication and collaboration within the business

ID#	Action	Description	Notes	Feasibility	Priority
C1	Conflicts Dealt With Face-To-Face or Skype/Phone	<ul style="list-style-type: none"> Avoid dealing with conflicts via email. There is no substitute to Face-to-face interactions. However, use Skype/Phone if necessary [22]. 	<ul style="list-style-type: none"> Encourage employees to deal with any minor issues before they manifest into anything larger. Encourage engineers to be contactable by phone. 	Medium	Medium
C2	Project Updates and Progress Reporting (echo)	<ul style="list-style-type: none"> Making sure the engineer updates the job status each time that it changes, i.e. moves from Job confirmed waiting in queue to in progress. Early notification of potential for delays 	<ul style="list-style-type: none"> Can suggest these improvements but ultimately up to the engineering consultancy (tools are there). What's in it for them? Improved professionalism and increased understanding when delays occur. 	Medium	Low
C3	Improve Notification Frequency and Visibility (echo)	<ul style="list-style-type: none"> Current notification system uses very small thumbnail at bottom of screen. Hard to tell the difference between read and unread. Would be good if it changed colour or opened up the program when notifications were received. 	<ul style="list-style-type: none"> Ideated using email notification, however issues with system firewall blocking the messages. Maximum 1 hour program if just changing icons. Would work better if echo was upgraded to an SSH system - force pop-ups onto the screen [19]. 	High	Medium
C4	Electronic Quote Acceptance Function	<ul style="list-style-type: none"> Short form agreements (SFA) sent out and signed electronically through echo. Quote details recorded on project file. Engineer needs to fill out editable fields such as price, due date, calculations yes/no etc. IPENZ conditions of engagement form referenced in contract. 	<ul style="list-style-type: none"> Can takes days to receive, sign and return SFA. Minimal programming work required as most of the functionality is already in place in echo. Requires mandatory use of quote data fields. Requires agreement from both engineers and franchisees over details of contract. Legal review to make sure contract is binding. 	High	High
C5	Collaboration Software	<ul style="list-style-type: none"> Online platform for sharing information, files, News feed, forums, message board Enhance innovation and collaboration by giving franchisees a platform to share ideas in an open and inclusive environment. Adaptable to specific user requirements and privileges. 	<ul style="list-style-type: none"> Need to create buy-in from the franchisee network. Might be a good idea to have one of the franchisees champion or lead the adoption process. Need to keep up active engagement and regular posts to get the system off the ground. 	High	Medium
C6	KM System	<ul style="list-style-type: none"> Detailed systems and processes for transferring individual knowledge to the wider organisation. Systematic collection and distribution of project learnings through formal processes and collaboration. Defined roles and responsibilities for employees with respect to KM. Guidelines and best practices. 	<ul style="list-style-type: none"> Cultivates a culture of innovation and improvement. Requires adequate training of staff on new tools, technologies, processes and guidelines. Resistance to change can be mitigated through motivation, encouragement, and stimulation of individual employees. 	High	Medium

4.4. INNOVATION

Table 11: Potential ways to enhance innovation within the business

ID#	Action	Description	Notes	Feasibility	Priority
11	Developing an Innovation Strategy	<ul style="list-style-type: none"> An innovation strategy is a vehicle for technology transfer. It defines goals for building capability: core competencies or abilities that add value and in turn, the ability to gain competitive advantage [23]. Outlines the unmet customer needs that are going to be address and clear criteria for success. Outline a plan for building capabilities including the development and monitoring processes. Recognise the barriers that inhibit and the bonds that increase communication and knowledge transfer across organisational barriers [24]. An innovation strategy needs to be truly inspiring. Develop a culture that supports innovation: Empower champions that push boundaries, fail fast and often, give employees the tools they need to make their case [25]. 	<ul style="list-style-type: none"> Need to focus on the value, rarity, & inimitability of capabilities for sustainable competitive advantage. A SWOT spectrum analysis gives an indication of which capabilities need to be developed, improved, retained or phased out [26]. (Prototype Appendix F) An innovation strategy outlines the areas for improvement, the business strategy outlines how best to utilized them for competitive advantage. Many innovation strategies fail to deliver sustainable competitive advantage because they fail to outpace competitors [27]. The company needs to aim higher and push boundaries to stay ahead. An innovative culture revolves around developing and sustaining the people inside it. 	Medium	Low
12	Company Social Club or Sports Teams	<ul style="list-style-type: none"> Activities to promote socialising and inclusiveness amongst work colleagues. Could look into the idea of a company sports team – touch, indoor netball, lawn bowls etc. Investigate the idea of a social club – semi regular employee get together (self-subsidised). 	<ul style="list-style-type: none"> Employees have organised events and games in the past the worked really well. Inter-office sports competition, movie night, quiz night. Might be good if someone to take ownership over the events to make sure they continue with success. Staff are generally willing to pay at smaller social events. 	Medium	Low
13	Project Communication Plan	<ul style="list-style-type: none"> When Totalspan makes changes to products or processes, there needs to be a formalised way for communicating the changes to those effected. A communication plan provides a structured way of planning communication requirements. A communication plan should outline: <ul style="list-style-type: none"> What information will be communicated Who by and to whom (target audience) How it will be communicated (medium – email, SharePoint, phone, meeting) When it will be communicated (frequency) 	<ul style="list-style-type: none"> A communication plan needs to be adaptable to specific project needs. May not be necessary on the average Specific Design project, as there is already formalised communication processes through echo and TRS. More appropriate for larger development projects involving IT and R & D. There needs to be a place where people can go and find this information in future. 	Medium	Medium

5. RECOMMENDATIONS

5.1. ECHO DEVELOPMENT PLAN

Table 12: Summary of echo development plan

	ID#	Action	Tasks	Risks and Mitigation Strategies	Requirements	Results
S T A G E 1	E5	Fill Out Job Description Fields	<ul style="list-style-type: none"> Visit engineering consultancy and go over the software. Explain full functionality and potential. Create instructional video for future reference and training purposes. 	<ul style="list-style-type: none"> Lack of buy-in from engineers. Incentivise compliance by providing them with improved invoicing functionality (included as part of E5). Link with TRS should also make franchisees and engineers have to fill out less information (P7). 	<ul style="list-style-type: none"> Consultation (Sean) ~ 2 Days 	<ul style="list-style-type: none"> Enables collection, analysis and reuse of past jobs
	C2	Updates & Progress Reporting	<ul style="list-style-type: none"> Request that engineers update job status (echo). Request that engineers are available to receive calls during work hours to improve conflict resolution. 	<ul style="list-style-type: none"> Explain that a number of franchisees raised concerns. May currently be the deference between getting their business and not. 	<ul style="list-style-type: none"> Consultation (Sean) ~ 1 Day 	<ul style="list-style-type: none"> Improved project management and scheduling
S T A G E 2	C3	Improve Notification System	<ul style="list-style-type: none"> Update program thumbnail – appearance needs to change significantly there is unread notifications. Increase the frequency of pop-up notification. 	<ul style="list-style-type: none"> Low risk, low cost solution. Still a chance franchise will miss notification. 	<ul style="list-style-type: none"> Developer (Sam) ~ 1 hour 	<ul style="list-style-type: none"> Reduced response time and delays to engineering
	C3	Electronic Quote Acceptance	<ul style="list-style-type: none"> Arrange contract discussions with engineers and franchisees. Determine terms of engagement. Program echo to leave a summary message following quote acceptance by the franchisee. 	<ul style="list-style-type: none"> Non-compliance from engineers or failure to agree on terms. Adequate consultation is required. Standardised resolution processes in case that franchise-engineer disputes occur. 	<ul style="list-style-type: none"> Consultation (Sean) ~ 1 Day Developer (Sam) ~ ½ Day 	<ul style="list-style-type: none"> Aim to reduce turnaround on quote from two days to one.
	E2	Network Reporting Function	<ul style="list-style-type: none"> Develop code to analyse engineering job data, i.e. job volumes, types (Standard vs Specific), range (Portal, Mono, Barn), filter by engr. consultancy. Summarise in table or excel spreadsheet. Can then be turned into graphs like example in Appendix C. 	<ul style="list-style-type: none"> Requires engineers to fill out data (see E5). Still a risk that the data will be underutilised by management. 	<ul style="list-style-type: none"> Developer (Sam) ~ 2 Days 	<ul style="list-style-type: none"> Collect, analyse and utilise job statistics for strategic changes Automatic invoicing saves time & error.
S T A G E 3	P7.1.	Link echo with TRS	<ul style="list-style-type: none"> Enable TRS to transfer information to echo. Function that locks jobs following request (P2) Option to switch to an SSH platform for increased functionality and versatility [19]. 	<ul style="list-style-type: none"> TRS is slow to load, franchise may not want it to host echo due to waiting times. May be better to retain a standalone app outside of the software. 	<ul style="list-style-type: none"> Developer (Sam) ~ 2 Days 	<ul style="list-style-type: none"> Improves project learning potential. Save franchisee ~10 mins per job.
	P7.2.	TRS Document Automation	<ul style="list-style-type: none"> Produce statement, drawings, windspeed calc. Franchisee could produce documents then save to TRS attachments folder for transfer to echo. 	<ul style="list-style-type: none"> Could be difficult to automate due to limitations to certain ranges. Could start with portal range because that has the largest volume of jobs. 	<ul style="list-style-type: none"> Developer (Sam) ~ 1 Day 	<ul style="list-style-type: none"> Save franchisee ~10 mins per job.

5.2. COLLABORATION SOFTWARE

Table 13: Development and adoption of Collaboration Software

ID#	Action	Tasks	Risks and Mitigation Strategies	Requirements	Results
C5.1.	Upgrade SharePoint Software	<ul style="list-style-type: none"> SharePoint's Office 365 version offers cloud based file management and collaboration software. SharePoint is the best option because the basic licencing and infrastructure is already in place. The infrastructure management team has made a proposal to management outlining the various packages available (not part of this report). 	<ul style="list-style-type: none"> Informal communication means there is a risk that learnings will go undocumented. It is important that there is detailed processes and responsibilities for formalising any lessons learned (see section 5.3). For the purposes of this report, management has said to assume this will go ahead. 	<ul style="list-style-type: none"> Detailed costing options outlined IT business case. Requires management approval 	<ul style="list-style-type: none"> Project management planning, scheduling & communications. Develop company knowledge base. Collate & share learnings
C5.2.	System Development	<ul style="list-style-type: none"> Identify the aspects of Spanbild's systems that a most appropriate for cloud migration [28]. Database conversion Database migration 	<ul style="list-style-type: none"> It is important to consider cyber security with any cloud based system, however some of the security practices offered by SharePoint are stronger than what Spanbild can implement in-house [29]. Failing to assess the complexity involved can lead to delays in realising the benefits of the cloud. 	<ul style="list-style-type: none"> IT infrastructure team (David) ~ 1 week 	<ul style="list-style-type: none"> Smooth transition from existing SharePoint database to newer version.
C5.3.	System Adoption	<ul style="list-style-type: none"> Provide employees with access to the platform. Schedule a tutorial session at the next Totalspan conference or virtual meetings via platform. Develop fun and interactive ways to engage with users of the software: <ul style="list-style-type: none"> Totalspan newsfeed Poll to decide inter-office sporting competition Building of the month forum 	<ul style="list-style-type: none"> Without buy-in from the franchisees, the system will fail to reach its full potential. Organisational heads and managers must lead by example. Select someone to champion the process. One option is to simply to deprive users of choice. Make the collaboration software the single point of access for essential information and regular updates. 	<ul style="list-style-type: none"> Employee buy-in TS Head Office champion. Franchisee training session IT Help Desk 	<ul style="list-style-type: none"> All employees have access to system. Competent users Frequent use of the software.
C5.4.	Sustainable Usage	<ul style="list-style-type: none"> Maintenance & Support Services Plan Regular posts to keep up engagement. Continues improvement of KM processes (see section 5.3). Verify the benefits gained from collaboration software once there is measurable returns: time/money saved, solutions reached, ideas and knowledge translated into tangible results. 	<ul style="list-style-type: none"> Increased cost due to licencing and data usage. No longer require server upkeep, which will reduce infrastructure and maintenance costs. Ongoing licencing fees accounted for in budget. One of the major risks with communication software and other forms of informal communication is a lack of documentation and knowledge retention. It is important that any key findings are formally recorded for future reference. 	<ul style="list-style-type: none"> TS Head Office champion. Franchisee involvement IT Maintenance and Help Desk 	<ul style="list-style-type: none"> Continued user engagement and realisation of benefits. Build trust through openness and transparency. Encourage innovative practices and thinking.

5.3. KNOWLEDGE MANAGEMENT SYSTEM (KMS)

Table 14: Approach for developing KMS

ID#	Action	Tasks - [30]	Risks and Mitigation Strategies - [31]	Requirements	Results
C6.1	Call To Action (Appendix H)	<ul style="list-style-type: none"> • Explore business value of KM system • Identify the limitations to the current KMS system i.e. insufficient functionality, lack of information and knowledge, lack of use. • Identify key learnings and knowledge potential • Analyse business priorities and capabilities • Create buy-in from management and staff 	<ul style="list-style-type: none"> • Underestimation of scale of project • Lack of tangible cost/benefit metrics • Lack of interest from management. Mitigated using consultation throughout the development process. 	<ul style="list-style-type: none"> • Consultation and planning 	<ul style="list-style-type: none"> • Business Buy-In • Value Proposition • KM Direction • Confirm requirements for the rest of the project
C6.2	KM Strategy	<ul style="list-style-type: none"> • Develop KM governance structure: <ul style="list-style-type: none"> ▪ Clear corporate expectations for KM ▪ Accountability for ownership of key knowledge areas • Scope and prioritise opportunities • Develop a plan for the system design phase • Create business cases and budgets 	<ul style="list-style-type: none"> • Risk that KM does not align with business strategy. Priorities KM strategies • Risk of declining organisational creativity and innovation – applying past knowledge makes new solutions less attractive. Furthermore, re-use of past solutions without an attempt to remove weakness will result in past mistakes being repeated. 	<ul style="list-style-type: none"> • TBC 	<ul style="list-style-type: none"> • Clear vision, outcomes and KPIs for KM • Alignment with business strategy • KM Strategy • KM Road Map
C6.3	KM System Design	<ul style="list-style-type: none"> • Design knowledge flow process • Form knowledge communities and teams • Develop KM protocols • Design resource model and capabilities • Ratify plans and budgets 	<ul style="list-style-type: none"> • Poorly structured knowledge repositories. For the KM system to be successful, information needs to be access and accurately retrieved on demand. • Poor quality knowledge – documents stored need to display ownership and context to avoid further investigation to verify potential benefits. 	<ul style="list-style-type: none"> • TBC 	<ul style="list-style-type: none"> • Structured Knowledge Base (SharePoint) • Dynamic plans for project and infrastructure
C6.4	Implement KM Capabilities	<ul style="list-style-type: none"> • Train staff on new tools, technologies, processes and guidelines. • Initiate KM protocols • Leverage and enhance IT • Encourage collaborative culture 	<ul style="list-style-type: none"> • Lack of supporting infrastructure. Outsource hosting of knowledge base, i.e. SharePoint. • Lack of end user buy-in or usage. Have to motivate and encourage individual employees. Employees have a natural resistance to withholding knowledge. 	<ul style="list-style-type: none"> • TBC 	<ul style="list-style-type: none"> • KM system protocols assigned and adopted by appropriate staff • Knowledge population
C6.5	Evolve & Sustain	<ul style="list-style-type: none"> • Maintain company knowledge base • Sustained awareness and engagement • Continued improvement of processes • Expand KM resources as required 	<ul style="list-style-type: none"> • Unauthorised sharing of sensitive knowledge • Manipulation or appropriation of knowledge asset • Organisational change or power shift. • Lack of supporting infrastructure and resources. 	<ul style="list-style-type: none"> • TBC 	<ul style="list-style-type: none"> • Values and embedded KM system.

5.4. DEVELOP CAPABILITIES: SPECIFIC DESIGN PRICING SERVICE – APPENDIX H

Table 15: Action plan for developing in-house capabilities – Specific Design Pricing Service

ID#	Action	Tasks	Risks and Mitigation Strategies	Requirements	Results
P6.1.	Plan: Identify the Problem & Potential Solutions	<ul style="list-style-type: none"> Potential engineering upgrades cause difficulty and uncertainty when quoting a job. Quoting takes time away from value added processes such as sales and project management. Totalspan to provide a job quoting service: <ul style="list-style-type: none"> Complete preliminary assessment and provide franchise with a guaranteed kit price for job. Requests submitted via echo and returned within two working days. 	<ul style="list-style-type: none"> Franchisee takes on a significant amount of risk when quoting a building. If the final design comes back heavier than initially accounted for the franchise is liable for the cost. Tend to add safety factors, which makes the price less competitive. Totalspan accepts risk in guaranteeing a price before final design is complete. However, they are better equipped to handle risk than franchisees. 	<ul style="list-style-type: none"> Consultation and planning (Sean) Cost neutral pricing strategy 	<ul style="list-style-type: none"> Management understand and support the need for change Provide appropriate time and resources to further the project (see stage 2)
P6.2.	Do: Develop & Implement Solutions	<ul style="list-style-type: none"> Totalspan has existing software (ADAPT) that can give quick and accurate estimates of frame upgrades and potential price increases. Initially service would only be available for portal product range ~ 60 percent Specific Designs [1]. Other ranges would be too time consuming as supporting software is insufficient. Recuperate costs of employee through: <ul style="list-style-type: none"> Increase in sales because of sales focused franchisees. Less time spent on quoting/admin Service fee added to the quoted price so Totalspan recuperates costs when job is sold. 	<ul style="list-style-type: none"> Not all quotes converted into sales. The break-even service price is \$35, but only 35 percent of these jobs convert to sales. \$100 shall be added to the quoted kit-set price to account for lost jobs. This may seem like it would make the quote less competitive, however it is far less than the safety factors the franchisees would add to their quote. Service could get behind schedule meaning franchise fails to get a quote to the within reasonable time (1-2 Days). Need to have additional staff that are capable of using quoting tools to handle influxes in requests. 	<ul style="list-style-type: none"> 1 FTE (Sean) Training using ADAPT Spreadsheet & Pricing Software (Jamie) 	<ul style="list-style-type: none"> Reduction in network frustration and angst Increased accuracy on initial project quotes Competitive quotes - less fudge factor If each franchise can sell one additional building per year, the revenue from sales alone is proportionate to the FTE Salary.
P6.3.	Check: Study the Results, Measure Effectiveness	<ul style="list-style-type: none"> Evaluate performance and effectiveness of the service i.e. accuracy of quotes, turnaround times on requests, service usage rates among the various franchisees. Validate or disprove initial assumptions. 	<ul style="list-style-type: none"> Unable to collect and analyse required data. Requires network analysis and reporting tool (E2). Highly variable or poor results. May need to consider removing problem jobs from the service. 	<ul style="list-style-type: none"> Automatic updates on manufacturing price for back costing purposes. 	<ul style="list-style-type: none"> Performance data for identifying trends and outliers.
P6.4.	Act: Take Action From Observations Repeat PDCA	<ul style="list-style-type: none"> Modify solutions based on observations; improve quote strategy using back costing. Think of new ways to improve speed and accuracy of quotes then repeat PDCA. 	<ul style="list-style-type: none"> Data limitations Not provided with the appropriate resources to fix the issues. 	<ul style="list-style-type: none"> Input from Management Software Developers 	<ul style="list-style-type: none"> Continual improvement of service capabilities. Expansion of service to other product ranges

5.5. DEVELOP CAPABILITIES: DESIGN SERVICE – CONSTRUCTION DRAWINGS AND BOM – APPENDIX G

Table 16: Summary of design service expansion recommendation – Appendix H

ID#	Action	Tasks	Risks and Mitigation Strategies	Requirements	Results
P4.1.	Plan: Identify the Problem & Potential Solutions	<ul style="list-style-type: none"> Identify key drivers for users of the service: <ul style="list-style-type: none"> Time and effort spent completing BoM Hand calculations and data entry makes it easy to make mistakes on factory order. No construction drawings provided with engineers' producer statement. Generic plans cause on-site rework, especially for kits-set builders with limited product knowledge. Identify & prioritise improvement opportunities Identify recruitment opportunities Develop pricing strategy for service 	<ul style="list-style-type: none"> Franchisee risks ordering the wrong parts to site, resulting in significant cost and time increases. Totalspan can take ownership of this risk by completing the service for them. However, need to outline liabilities if issues arise. Totalspan will accept responsibility for any replacement parts, but not provide compensation for lost time or labour hours. There may be some recruitment opportunities from within the company. Upskill someone in the manufacturing team. Existing knowledge if the product will be invaluable. 	<ul style="list-style-type: none"> Planning and consultation (Sean) 	<ul style="list-style-type: none"> Management understand and support the need for change Quotes provided on a job-by-job basis: price based on estimated time to complete job. Service fee set at \$60 hour. Requires four jobs a week at five hours per job to break-even.
P4.2.	Do: Develop & Implement Solutions	<ul style="list-style-type: none"> Totalspan has an existing service, but can only facilitate a small number of franchisees due to resource constraints. Recruit someone with the appropriate skills to fill the role: quantity survey or similar. Train employee on existing processes. Outline key responsibilities for team members. Identify an appropriate release date and announce the service to the network. 	<ul style="list-style-type: none"> The service may struggle initially as it needs to build up a database of previously completed work. It may be best to open the service up to the network incrementally to make sure it can handle demand. Employee is not the right fit for the job: <ul style="list-style-type: none"> Lack of competency, skills or work ethic Does not align with company culture and values Need a dedicated recruitment process that verifies background, credentials, skills and experience. 	<ul style="list-style-type: none"> 1 FTE – Graduate QS ~\$45K-\$50K per year BoM Creation Training (Jamie) 	<ul style="list-style-type: none"> Service can now be offered to the entire Totalspan network Service reduces time spent on non-values added activities. Reduces likelihood of delays and rework occurring on site.
P4.3.	Check: Study Results Measure Effectiveness	<ul style="list-style-type: none"> Gather feedback from users on the performance and effectiveness of the service i.e. turnaround times, service quality, time saved. Validate or disprove initial assumptions. 	<ul style="list-style-type: none"> Current system runs through emails so it is difficult to track project data and analyse performance. Would be good to run the service through echo and just set up unique project tab for BoM requests. 	<ul style="list-style-type: none"> Develop BoM request button in echo. (Sam) ~ 2 Days 	<ul style="list-style-type: none"> Monitor KPIs and rate of errors on BoM's Identify inefficiencies
P4.4.	Act: Take Action Observations Repeat PDCA	<ul style="list-style-type: none"> Continuous improvement of service based of observations and efficiencies. <ul style="list-style-type: none"> Further development of in-house software to improve BoM creation process 	<ul style="list-style-type: none"> Outsourcing software development is not an option due to the unique specification requirements and intellectual property issues. It is important that the service have access to the appropriate resources 	<ul style="list-style-type: none"> Software Development (as required) 	<ul style="list-style-type: none"> Engineering on the fly: Complete package that draws, engineers, and BoM's building.

6. CONCLUSION

Specific Design projects make up only 15 per cent of jobs by volume but they account for a large proportion of risk and uncertainty. Their unique and complex nature means they are difficult to price and manage from contract to completion. The franchise have to provide a quick quote to clients without full knowledge of what the final design will consist of. They make a few examples based off experience, then formulate a price as best they can. On average, the quote for the kit-set portion of the quote is underestimate on 40 percent of jobs. Of these jobs, projects are typically underquoted by around 20 percent [1]. Project underestimations occur due to a lack of time, engineering knowledge, tools, historical reference data, and strategy (see below).

A good example of price overrun was observed during the franchise interview process. A franchise spent three months working on a large commercial project and made little to no profit on it. That means they allocated a large percentage of their resources to one project that was operating at a loss (construction crews, project manager etc.). The price overruns on this project were due to unforeseen engineering upgrades. Specifically, upgrades were made to the foundations, floor brackets, and main frames. Although the franchisee accounted for some upgrades in their quote, the scale of the upgrades was underestimated. This was due to either a lack of planning on the franchisee's behalf, inconsistent design solutions on the engineer's behalf, or a combination of the two.

Engineering inconsistency makes designs difficult to price because you can get two different solutions for the very same problem. Each engineer can interpret the code or the problem itself differently. This makes it difficult for the franchisees to forecast engineering upgrades based off experience itself. Totalspan needs to develop ways to capture and analyse the designs coming through the network as a whole. This will help them identify outliers and potential overdesign and counter their arguments as required.

Franchisees lack confidence in their quotes, which means they apply larger safety factors. This can be the difference between securing and not securing the project. Franchisees estimate their conversion rates on Specific Design quotes are around 1 in 3 [1]. This means they spend around 8 hours a week spent quoting jobs that never eventuate. Franchisees need ways to verify that a project is viable during earlier stages of the enquiry process. This could include a simplified version of the quoting tool available to head office. It does not need to be a detailed pricing tool; it just needs to help the client decide whether it is viable to pursue the project further.

If Totalspan Head Office were to take responsibility for the BoM Creation and Specific Design Quoting processes, it would enable the franchise to sell more buildings and manage project more effectively. This would increase the performance and profitability of Totalspan as a whole. It is important to make a detailed risk assessment when expanding capabilities and hiring new staff. The main concern with these two services is that they have to be able to handle influxes in jobs during promotional periods. This means there should be additional staff within the company that are capable of completing the tasks if required. For staff to be able to pick up new tasks there needs to be formalised documentation of responsibilities and processes.

This lead in to some final insights with respect to KM and collaboration. Totalspan and the wider Spanbild organisation has a plethora of knowledge, skills, and experience when it comes to individual employees. However, this information is failing to be captured, stored, distributed and applied to the rest of the organisation. Developing a KM strategy and the supporting infrastructure will give this process structure and accountability. It is important to understand that KM is about connection, not collection [32].

"Data becomes information when it's organized; information becomes knowledge when it is placed in actionable context. Without context, there is little value." – Kent Greenes, CKO, SAIC Consulting

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PERSONAL STATEMENT

Working on this project provided a good opportunity to apply and develop the knowledge gained throughout the Masters of Engineering in Management (MEM) course. Below is a brief summary of the learnings that came across significantly during the project.

Table 17: Lessons Learned & MEM Contributions

Lesson Learned	Description
Systems	Systems thinking has been a critical part of this project. It gave me the ability to identify dependencies and connections within the organisation,
Design Thinking	A user-centric approach helped me gain a better understanding of the issues that matter to the franchisees most. Although I had experience working for the company, it was different approaching it from the outside point of view of the franchisee. They can often feel quite isolated and just want someone to hear their thoughts.
Resistance to Change	Resistance to change is a completely natural human behaviour. It is particularly prevalent in the construction industry, where innovation is slow and incremental. When implementing change it is important to take into account the perspective of the person who the change is effecting. You need guide them through any questions they have and explain the potential benefits of the change.
Development Freeze	Due to delays in the initial phase of the project, time was critical during the remainder. I found myself spending too much time ideating various solutions, so I had to create a cut-off date for selecting the focus area of the project. Although some areas of the investigation were under-developed, it was necessary for compliance with the schedule.
Work Breakdown Structure (WBS)	The size and complexity of this project meant it was important to break it down into manageable, achievable parts. This was achieved using a Work Breakdown Structure (WBS). Appendix A.
PDCA	Plan. Do. Check. Act. Is a good methodology to have for any development project. It provides a model for continuous improvement and implementing change. It is particularly beneficial for defining a repetitive work process.
Communication	This project required effective communication due to the remote working environments of stakeholders. It was important to plan communications ahead of time so that the right people received the right information, as required. I have discovered that emails are easy to miss or ignore. It is much easier to reach people by phone and then record any relevant details afterwards.

APPENDIX A: WORK BREAKDOWN STRUCTURES

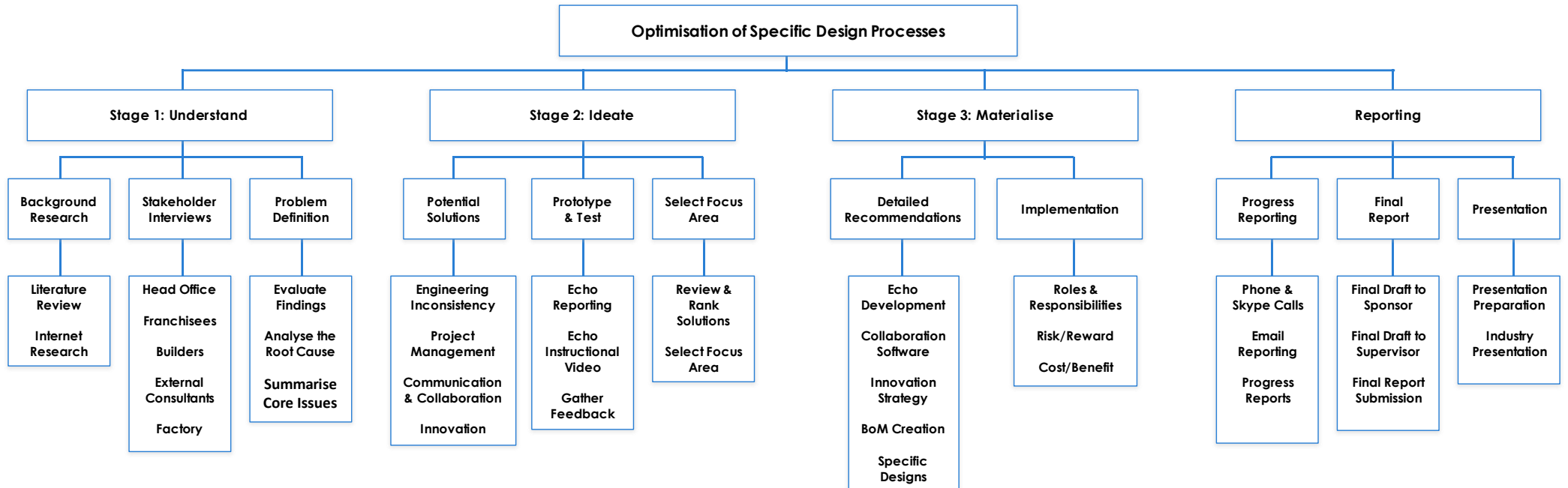
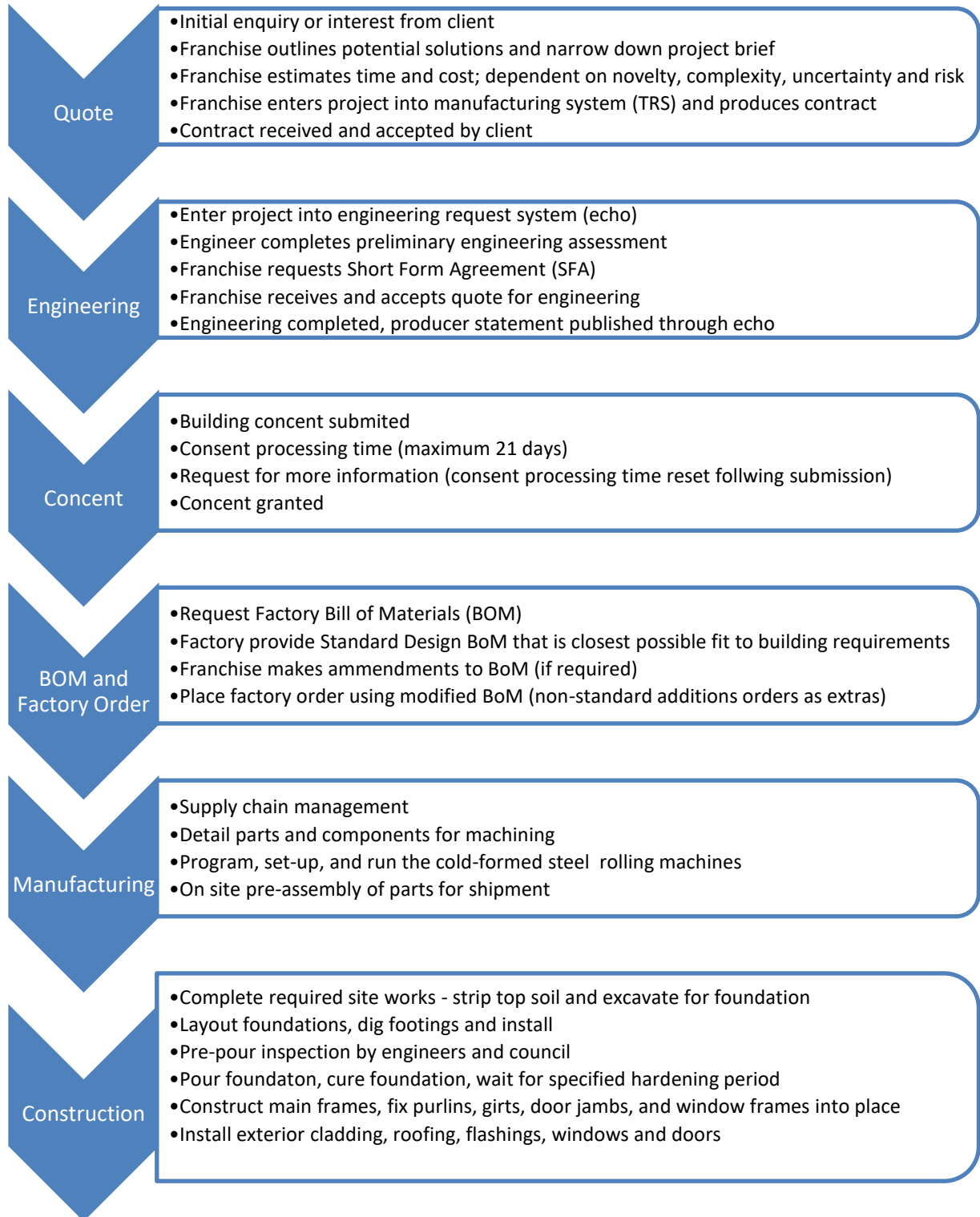


Figure 8: Work Breakdown Structure

APPENDIX B: SPECIFIC DESIGN PROCESS

SPECIFIC DESIGN PROCESS OVERVIEW

Below is an outline of the Specific Design process and tasks involved.



SPECIFIC DESIGN FLOW DIAGRAM

Totalspan developed the following diagram to guide employees through the Specific Design decision-making process [33]. It is particular to new employees entering into the Totalspan Project Environment.

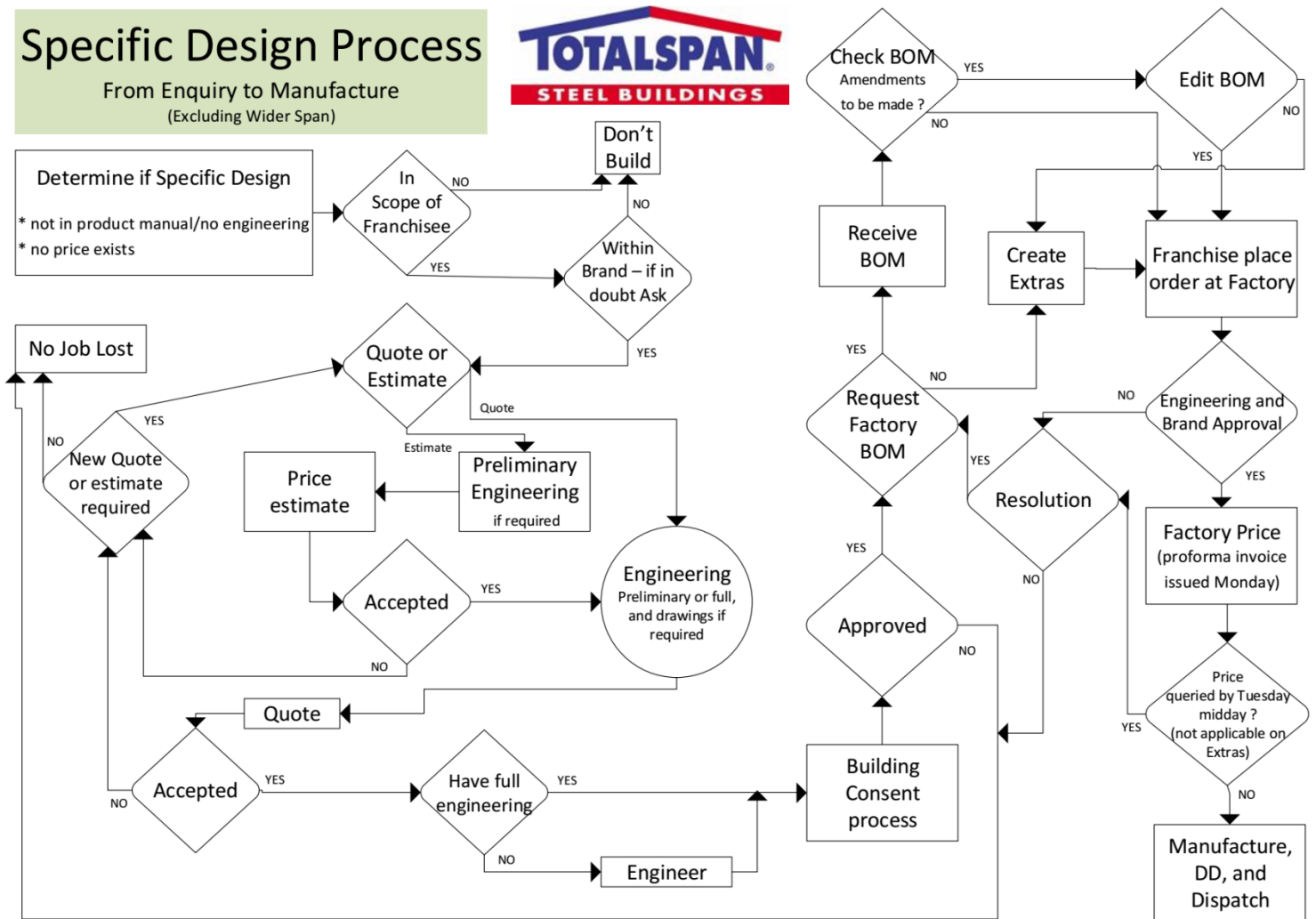


Figure 9: Specific Design Process Flowchart [33]

APPENDIX C: STAKEHOLDER INTERVIEWS

INTERVIEW APPROACH

Understanding the core issues in a system requires true empathy and engagement of all system users [34]. Empathy is the ability to see the world through the eyes of others and gain an understanding of their latent needs and emotions. This requires the empathiser to abandon any preconceived ideas about what they are trying to achieve and listen attentively to what others have to say.

The most effective way to gain empathy comes in the form of immersion: direct experience in the environments and activities of the people you would like to understand [35]. One way of achieving this is going out into the working environment and asking them questions about their day-to-day activities. Below is the general approach that was used throughout the interview process:

1. Ask the questions ahead of time to give you respondent time to prepare well thought answers
2. Structure the interview as a walkthrough - walk through the current system they use, how often they use it? What works well? What parts are an absolute pain?
3. Stop taking notes and use a voice recorder so it flows better
4. Summarise the findings and share them with your stakeholders

To following interview template was adopted to keep the interviews structured and organised.

Stakeholder Interview - Summary		What was the session for?	Project Name	DATE
Primary Objective <i>What goal or outcome is central to your business?</i> <i>i.e. define what quality and performance means to you.</i>	User Groups <i>Who are the intended users?</i>	Critical Content <i>What content plays a vital part in achieving these objectives?</i>		
Pain Points <i>What are the current pain points and frustrations surrounding Specific Design projects? (Pain Points)</i> <i>i.e. Things that amount to the most time/effort/uncertainty/risk</i>		Action Items <i>How does your franchise deal with these issues? Tasks or actions?</i> <ul style="list-style-type: none">• Improving efficiency• Mitigating risks and uncertainties <i>How would you like to see them dealt with long term?</i>		

industrial.

Figure 10: Interview Template [36]

INTERVIEWEE SUMMARY

Table 18: List of people interviewed

Interviewee	Position	Location
Mel Adams	Franchisee	Totalspan Bay of Islands
Mike Brunton	Franchisee	Totalspan West Auckland
Paul Clark	Franchisee	Totalspan Northland
Andrew Eason	Franchisee	Totalspan Far North
Diane Furze	Franchisee	Totalspan East Waikato
Jeff Gealey	Franchisee	Totalspan Canterbury
Denise Gealey	Franchisee	Totalspan Canterbury
Grant Lumsden	Franchisee	Totalspan Hamilton
Jamie Peterson	Franchisee	Totalspan North Canterbury
Bruce Wenzlick	Franchisee	Totalspan Rodney
Greg Wilshire	Franchisee	Totalspan Coromandel
Tony Young	Franchisee	Totalspan Rotorua
Gary Wendt	Sales Consultant	Totalspan Northland
Dave Hall	Sales Consultant	Totalspan Hamilton
Dave Meil	Builder	Totalspan Rodney
Andrew Hortan	Structural Engineer	Transparency Consulting (Christchurch)
Aiden Wallace	Structural Engineer	Calibre Consulting (Auckland)
John McCurran	Structural Engineer	Calibre Consulting (Auckland)
Gregg Somerville	General Manager Totalspan	Totalspan Head Office (Auckland)
Daniel Eggleton	Process & Systems Engineer	Totalspan Head Office (Auckland)
Aaron Yorke	Franchise Development Manager	Totalspan Head Office (Auckland)
Sam Newson	Software Developer	Spanbild (Christchurch)
Matt Baker	IT Team Leader	Spanbild (Christchurch)
Joe Woods	Worksheet Detailer	Spanbild (Christchurch)
Sean Spooner	Worksheet Detailer	Spanbild (Christchurch)

STAKEHOLDER INTERESTS:

Table 19: Outlines the various stakeholder primary objectives and the critical content they need to achieve them.

Stakeholder	Primary Objectives	Critical Content
Totalspan Head Office	<ul style="list-style-type: none"> • Manage and maintain business operations • Support franchise network • Increase sales volumes • Maximise profitability • Continual improvement of products and services 	<ul style="list-style-type: none"> • Structured management with detailed communication lines • Efficient use of company resources • Ability to analyse and assess the network as a whole • Market research and competitor analysis
Franchise Owner/Operator (Franchisee)	<ul style="list-style-type: none"> • Provide a product and service that meets customer needs • Project completed on time and within specification • Maximise profitability • Reduce risk and uncertainty 	<ul style="list-style-type: none"> • Quality range of products – standard and non-standard • Standardised and accurate quoting mechanisms [37] • Simple and functional internal software systems [5]
Builders	<ul style="list-style-type: none"> • Project delivered on time, on budget and to the specifications outlined by the project engineer. • High quality build – quality checks • Health & Safety 	<ul style="list-style-type: none"> • Right parts, at the right place, at the right time. • Detailed construction drawings • Expert knowledge of Totalspan products (difficult for kitset builds)
Engineers	<ul style="list-style-type: none"> • Design building within code requirements - AS NZ 1170 • Provide a professional product and service to their client (franchisee) • Uphold IPENZ code of ethics • Improve efficiency – time and effort taken to complete project [38] 	<ul style="list-style-type: none"> • Agreement on scope and specifications. No changes. • Communication lines with franchisee and in turn the client. • Design software • Standard set of drawings and producer statement.
Designers - Contraction Drawings, BOM Creation, Factory Order	<ul style="list-style-type: none"> • Factory order meets engineering specifications. • Builders have a detailed set of plans on site. 	<ul style="list-style-type: none"> • Clear and consistent engineering specifications • Factory provides closest possible 'standard' design • Efficient factory order system
Factory	<ul style="list-style-type: none"> • Supply chain management • Quality control • Detailing parts for production • Run the machines • Assemble parts • Pack products for shipment • Health & Safety 	<ul style="list-style-type: none"> • Partnerships with high quality suppliers. • Quality standards and checks • Effective maintenance • Skilled and attentive staff • Effective identification of hazards

PROBLEM IDENTIFICATION AND POTENTIAL ACTION ITEMS

Table 20: Summary of Interview Findings

Pain Points:	Action Items
Project Overrun: Difficulties quoting accurately	
<ul style="list-style-type: none"> • Franchisee needs to be able to give customers a quick and accurate quote [39]. • Customer wants a fixed price, don't want any tags i.e. subject to engineering upgrades [40] • Manual pricing rather than a specific system can be time consuming and inaccurate [16]. • Everyone has a different pricing methodology. Different levels of knowledge, understanding and proclivity for risk. • The franchisee will often just take the standard kit price and add in a safety factor of around 30-40 percent to account for any pricing increases incurred because of engineering changes [5] • If there is a slight change that makes it specific design, franchise has to fit the bill [3]. • Hard to get a view on how accurate costing is across the board. Typically under-estimate. • Strike rate on jobs is down because they can't get an accurate quote so have to use safety factors. 	<ul style="list-style-type: none"> • Need a better understanding of what the engineering is going to look like when it comes back. • Need a tool that can calculate extrapolate raw materials a lot quicker and easier - i.e. how many lineal meters of C150, how many bolts, how many square meters of cladding • Inventory of past designs that is quick and easy to analyse. • Some designs are always going to be difficult to quote without a detailed design review. Need someone in-house that can offer this service. Provide quote estimate for kit price that Totalspan will stand by. • Back-costing tool that compares final price to initial estimate.
Inconsistent Engineering: Inconsistent turnaround times and variability of final designs	
<ul style="list-style-type: none"> • Engineers all have different interpretations, design philosophies, levels of expertise and familiarity with the product. • Each provides different levels of detail with their designs (drawings, calculations, etc.) • Lead times are getting longer and less reliable – need some accountability. • Not only adds to the kitset price but also construction. Boxed members take twice as long, heavier frames sometimes need Hi-ab. • The engineers don't seem to understand a lot of the finer points i.e. how the flashings come together, having the screws line up, how the tabs on girts work. • Franchisees are struggling to understand why certain member have been upgraded [37]. • Feels like the engineers tend to re-think the wheel each time rather than reusing designs. 	<ul style="list-style-type: none"> • The more specific you can plans and elevations on the PS1 the better. • Standardised way for recording design changes on PS1s. Changes recorded electronically so information used in other stages of the process. • Would also be good if the engineer could add some reasoning behind why they upgraded certain members. • If an engineer is specifying a specific fixing it should really be available in the factory • Need to provide more information to engineers about member/building performance. Is the testing information published and available to engineers? • Construction guide to get engineers and builders on the same page. Need to explain how the BOM is created, what information they need and things to watch out for.
Communication	
<ul style="list-style-type: none"> • With Specific Design's a phone call is always best, a lot easier to discuss and go over solutions. Non-binding recommendations OK • Sometimes there is just no one to talk to for a quick answer on something. 	<ul style="list-style-type: none"> • Quote acceptance through Echo, remove the need for individual SFAs • Develop detailed communication plan outlining; what information will be communicated, who

<ul style="list-style-type: none"> • Can take over a week to get an SFA sorted. When the franchisee sends a job away for engineering, they just want it added to the queue and completed as soon as possible [8]. • Changes are made to internal systems without proper notification of franchisees • Information that is released to the network can be lost in their emails. 	<p>by and to whom, when and how (email, phone, SharePoint, other).</p> <ul style="list-style-type: none"> • Develop a place for people to go and find all previous communications or information that may be relevant to them. Include a news feed type thing for people to share ideas.
<p>Internal Systems (Echo, TRS, Sharepoint)</p>	
<ul style="list-style-type: none"> • Heritage Barns and Flat Roof are still on TS Quote system. Seriously limited in functionality. • None of the internal systems seems to communicate very well. Results in a lot of double handling and unnecessary work. • Echo notification system does not work very effectively; need to be constantly checking for updates. • Unable to complete internal auditing (head office) • Unable to see that echo message has gone through or that your file has been attached • Too difficult to sort through designs on SharePoint to find similarities. • Need to improve progress reporting. Don't actually know what number it is in the queue, when it is on someone's desk etc. 	<ul style="list-style-type: none"> • Link TRS and Echo – Request engineering button in TRS which sends all of the job information through (Details, Drawings, PS1) • Function to lock job in TRS once sent away for engineering. • Email notifications – Summary of quote or message sent to email. • For quick response i.e. accept quote or yes, you could just respond to the notification email and the system follows it through. • Display files attached by franchisee in echo. • Create internal auditing functions – how many jobs are mod/specific, on time vs not on time, final design member sizes. • Help button in echo – quick tips and tricks • Time-out. Should be able to save requests
<p>Creating Bill of Materials (BOM) and Factory Order</p>	
<ul style="list-style-type: none"> • Factory alters the standard BOM as best they can (portals more than others). They are able to box, bridge, or upgrade members. However, they are unable to add anything non-standard, nor openings and windows in particular places. • Franchise makes any further changes manually. Requires hand calculations and manual alterations to spreadsheets. • Can take up to an hour or two. • Franchise liable for any mistakes • High risk, mistakes can cost thousands. 	<ul style="list-style-type: none"> • Expand in-house BoM creation service through • Reduce the amount and time and effort it takes to complete a BoM
<p>Design and Constructability</p>	
<ul style="list-style-type: none"> • Non-standard brackets are sometimes hard to pick up - delays when it comes to build. • Sometimes a lintel will be upgraded but the door jambs will not be – does not line up. • Engineers will occasionally design a strong doorjamb, but connect it to an unboxed 80x40 gutter purlin [41]. • Heritage Barn with multi-brace going to a piece of C80x40 gutter purlin is useless. Multi-brace will bend the building when you are tensioning before it does any use [41]. • Stack-bracing on Heritage barn non-standard. The factory supply full length girts and the builder will have to cut them on site [41]. 	<ul style="list-style-type: none"> • Could revert back to the old apex and knee ties too and just put two folds in them if extra capacity is required [41]. • On the heritage barn purlin layout section, the top part might outline an extra row or something but this doesn't flow down to the actual drawings below which the client is working off. • Would be good if there was a standard detail for a small standalone bathroom.

APPENDIX D: ROOT CAUSE ANALYSIS

ENGINEERING INCONSISTENCY

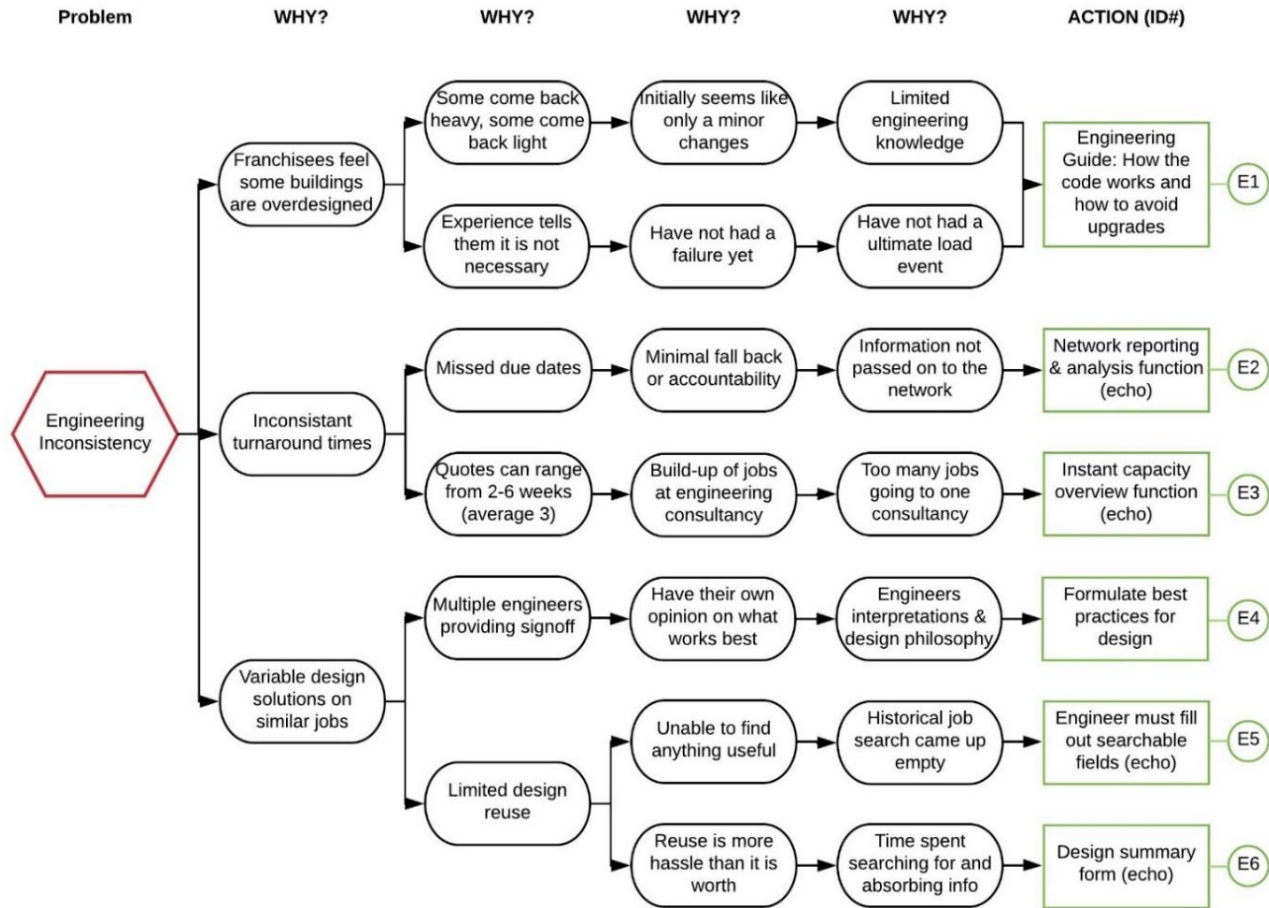


Figure 11: Root Cause Analysis and Potential Countermeasure – Engineering Inconsistency

PROJECT OVERRUN - PRICE & TIME

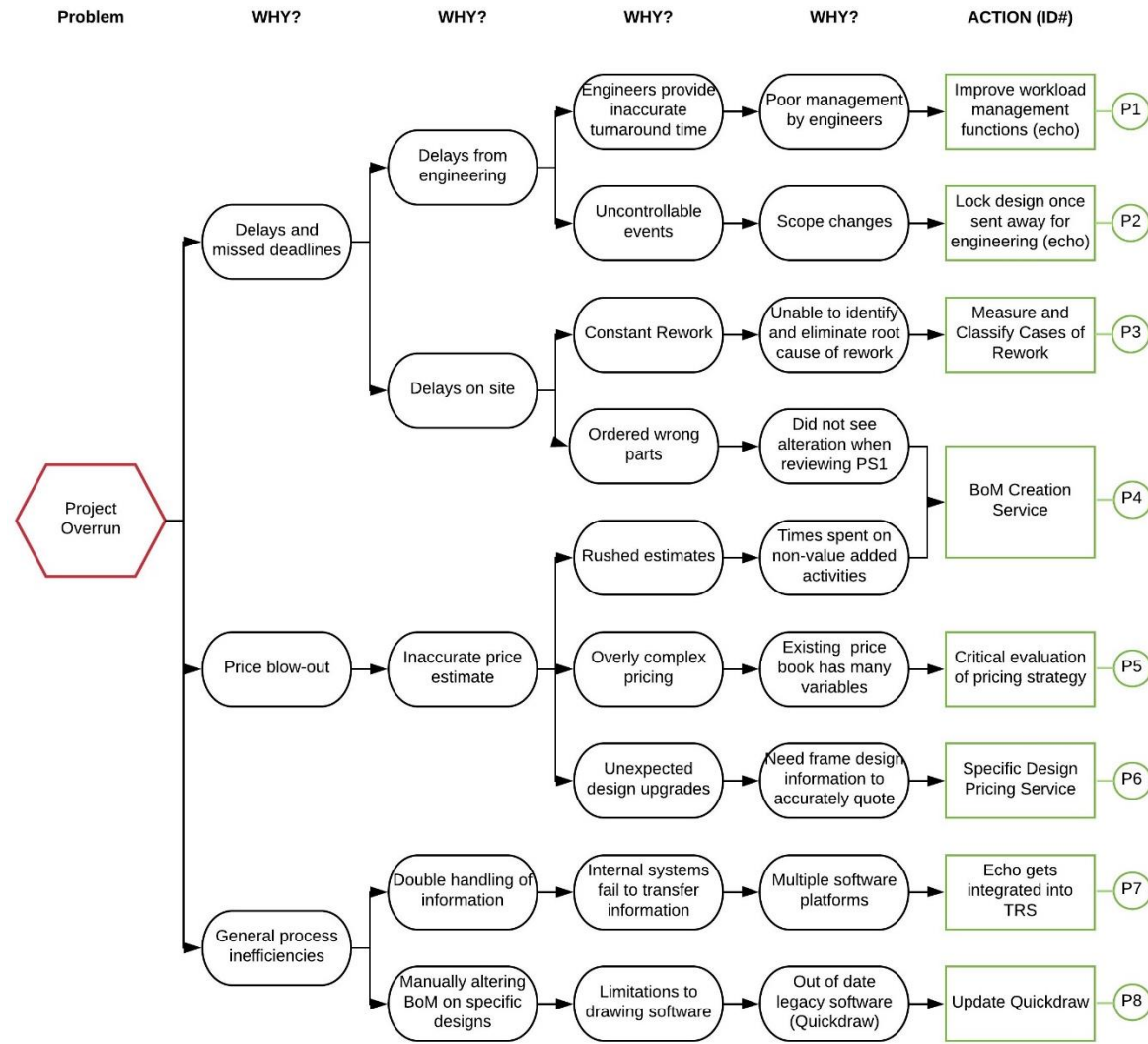


Figure 12: Root Cause Analysis and Potential Countermeasure - Price and Time Overrun

COMMUNICATION & COLLABORATION

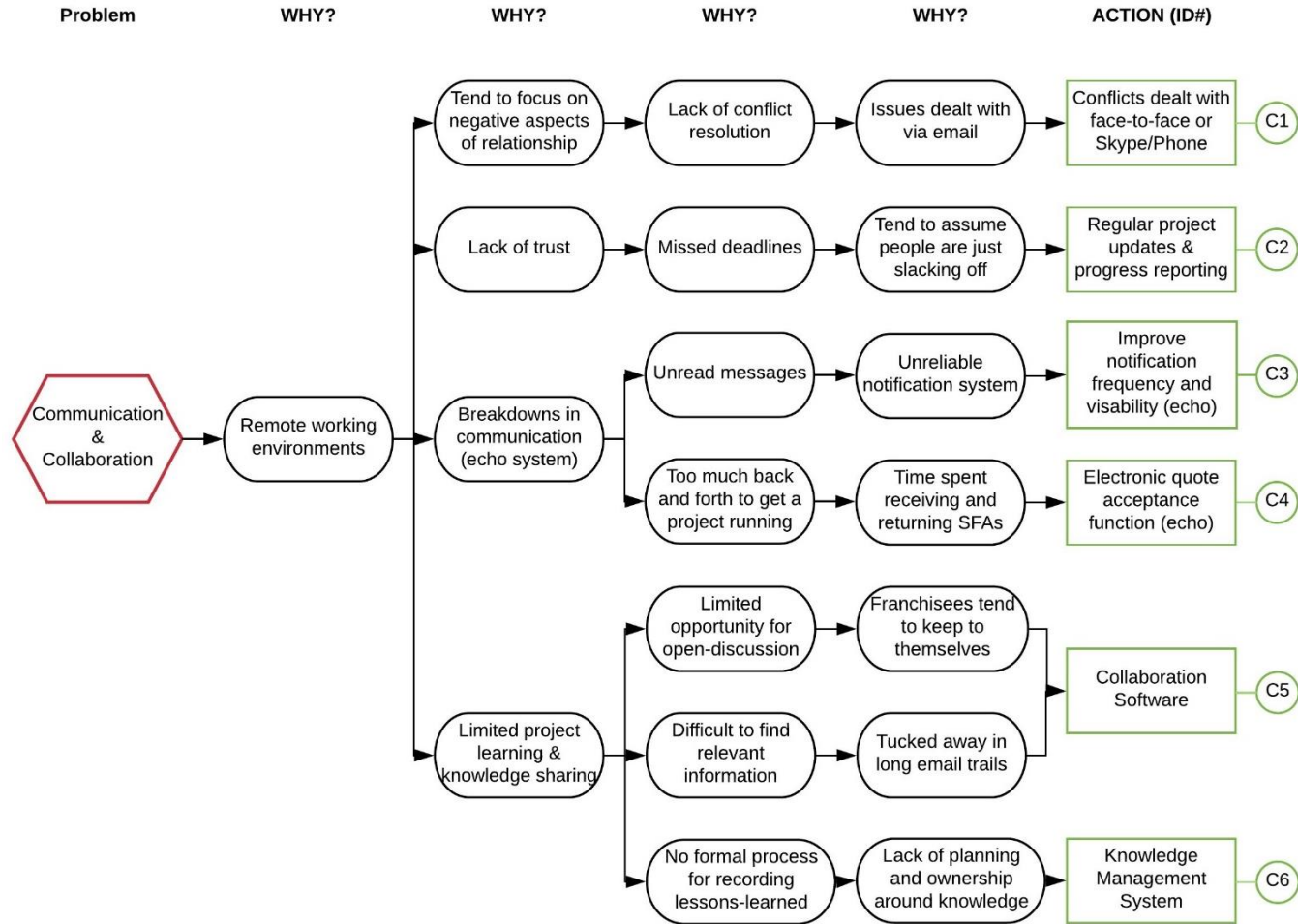


Figure 13: Root Cause Analysis and Potential Countermeasures - Communication and Collaboration

INNOVATION

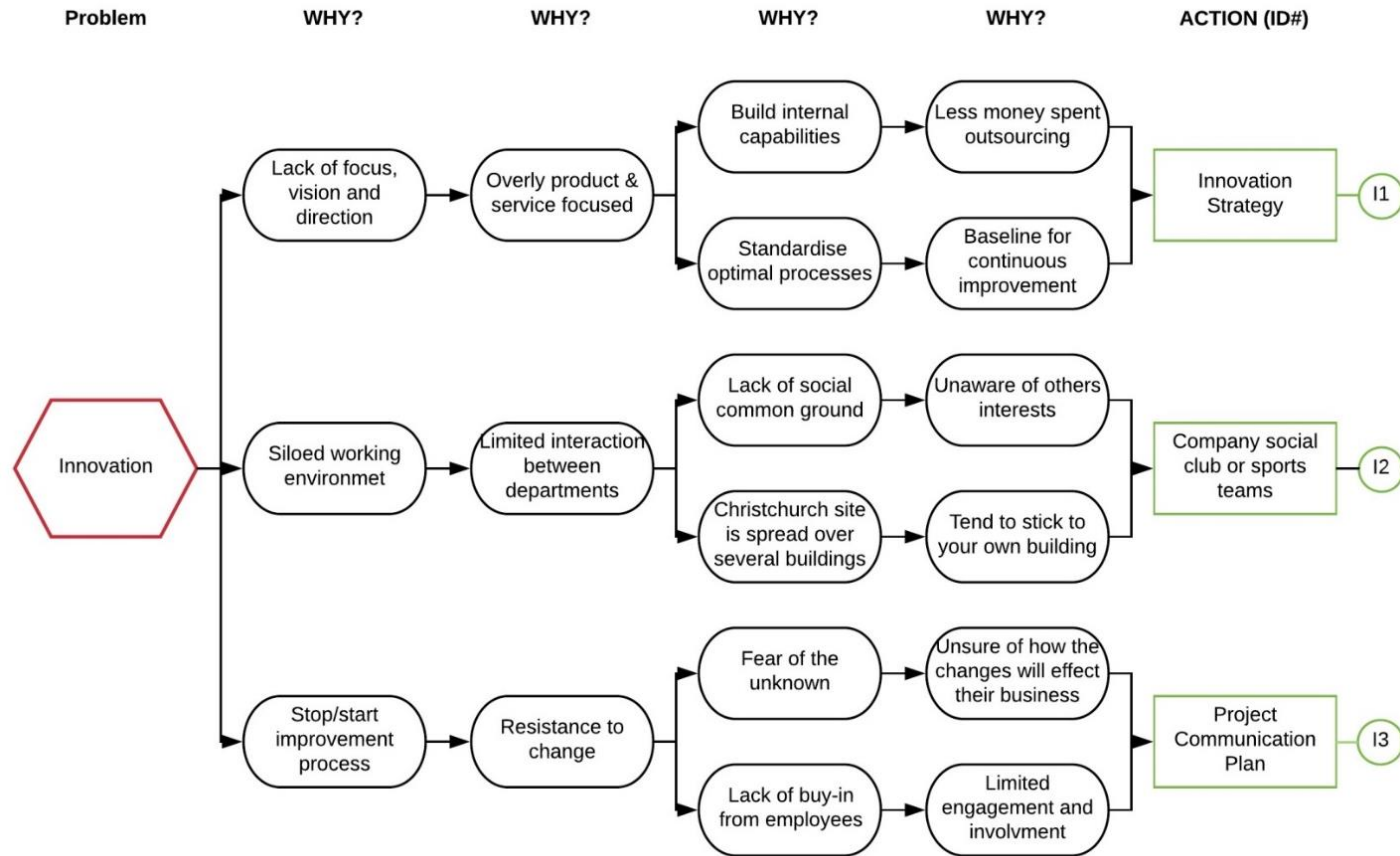


Figure 14: Root Cause Analysis and Potential Countermeasures - Innovation

APPENDIX E: NETWORK REPORTING AND ANALYSIS

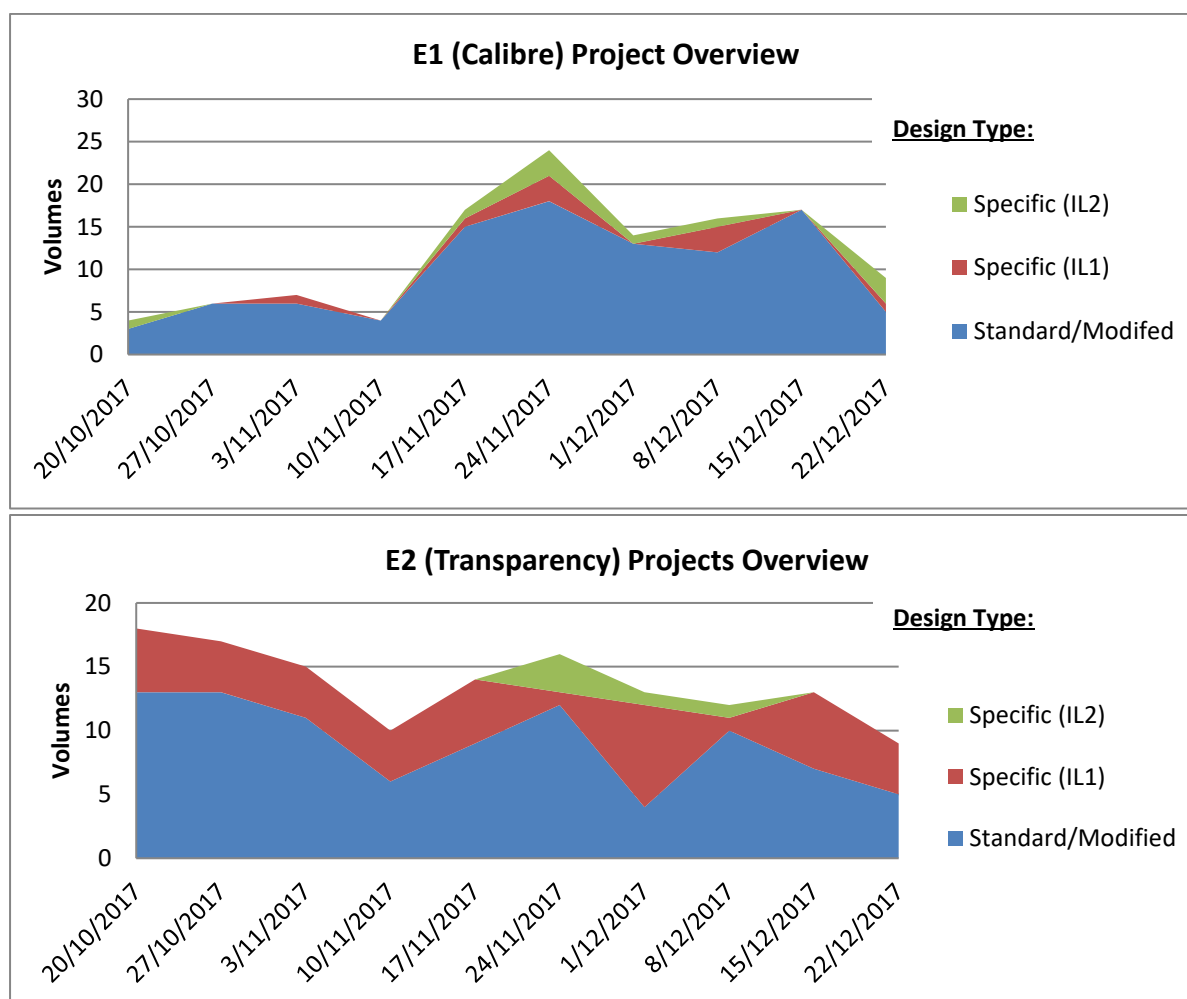
At present it is difficult to analyse the jobs going through Totalspan’s engineering management system (echo). This information could be used to compare external engineering firms based on:

- Project Volumes - Standard vs Modified vs Specific Designs (see example below)
- Specific Design Pricing statistics from each consultancy - mean, median, range, standard deviation
- Efficiency - Average turnaround times on the various types of jobs
- Reliability – Percentage of jobs that finished when they were scheduled to do so

This data could be used by Totalspan in a number of different ways:

- Statistical analysis for planning and investment purposes. Identify trends among Specific Designs so the company can select areas for further standardisation.
- Enable franchisees to choose the best engineering consultancy for their particular job (price, turnaround time, reliability).
- Reporting would also encourage the engineering firms to improve their performance and accuracy of initial turnaround times because it has a direct impact on the wider networks decision making.
- Accounting and invoicing purposes.

Figure 15: Comparison of engineering firms based on project volume. This data was gathered manually by looking at individual job files but could easily be automated.



APPENDIX F: SWOT SPECTRUM ANALYSIS

INTRODUCTION

SWOT analysis was used to evaluate the current capabilities of the Totalspan and wider Spanbild organisation (table 9). One of the main issues with the basic SWOT analysis is that it tends to force isolation of strengths, weaknesses, opportunities and threats. However, realistically the lines are blurred and the categories are not mutually exclusive. It is also impossible to rank each of the observations with respect to urgency or priority. To attempt to address this problem, researchers developed a tool know as the SWOT Spectrum (figure 14). This uses a multi-dimensional spectrum in order to understand the relationships and severity or prioritisation of each observation. This can then provide the basis for developing any recommendations going forward [26].

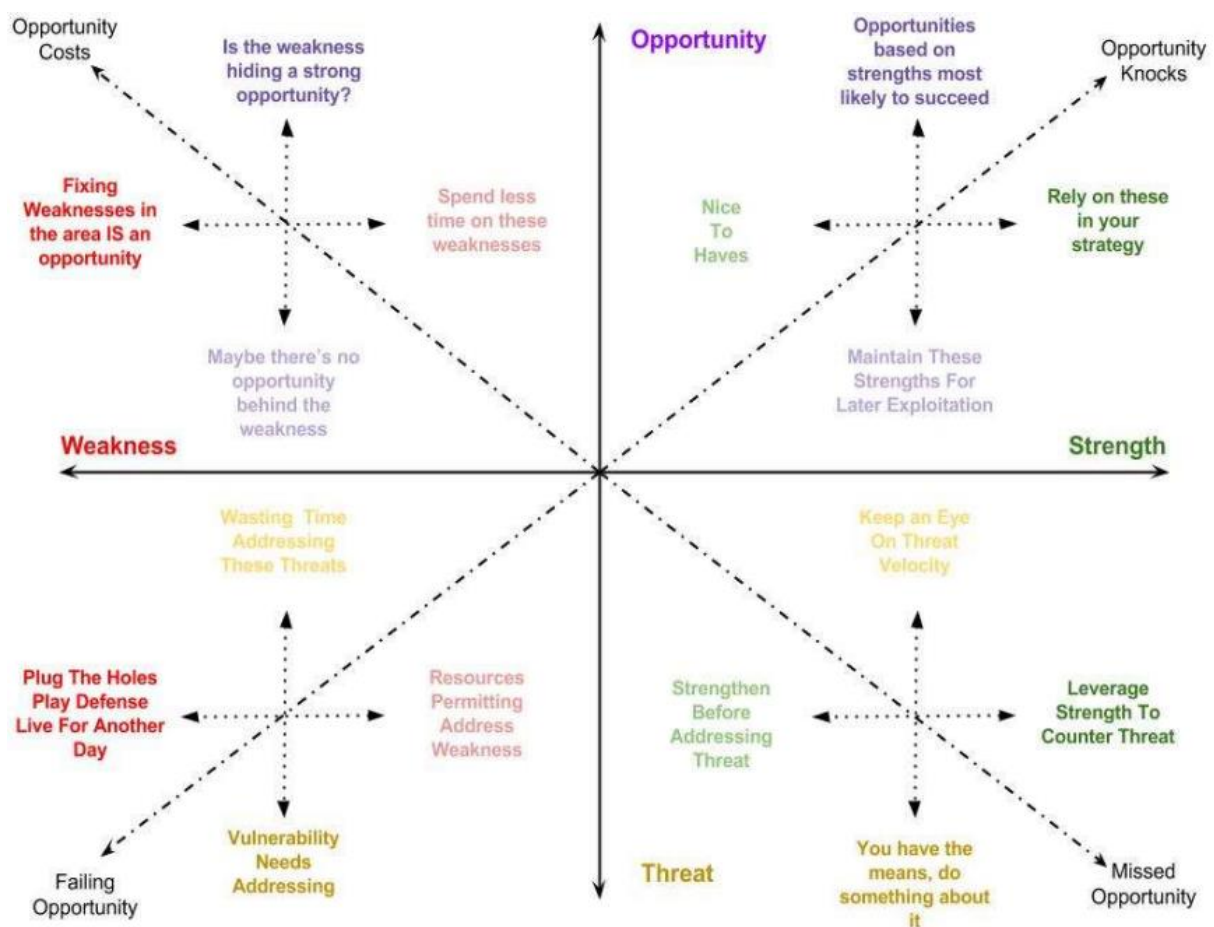


Figure 16: SWOT Spectrum template explains how to address the capabilities that fall in each area of the spectrum.

SWOT SPECTRUM ANALYSIS

Table 21: SWOT Analysis of Totalspan's current capabilities (core competencies and activities as a business)



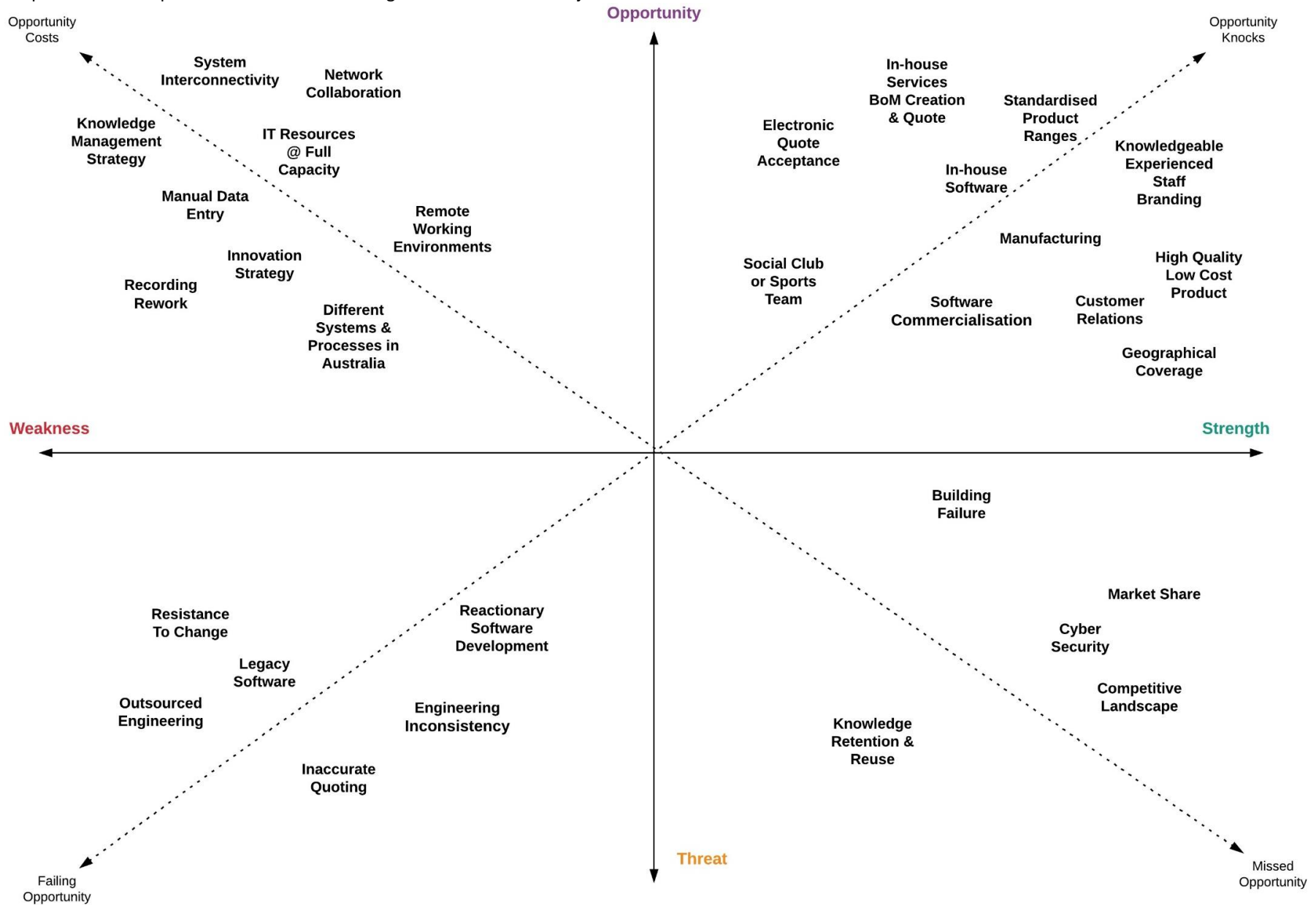


Figure 17: SWOT Spectrum Analysis

APPENDIX H: SPECIFIC DESIGN PRICING SERVICE

PROCESS OVERVIEW

Process Drivers:

- Specific Design pricing results in significant risk and uncertainty for franchisees. Because of this, some Specific Designs are put in the “too hard basket”. This resulting in lost revenue for Totalspan.
- A franchise will complete an average of four quotes a week, averaging around three working hours per quote [1]. 35 percent of jobs quoted convert into sales. Reducing the time franchisees spend quoting Specific Design jobs would mean they could spend more time on value added activities such as sales.
- Currently in the final stages of developing new portal range (ADAPT). Engineering has already been completed, which opens up a larger range of standard designs than currently available (higher wind, increased building variability etc.). ADAPT will eliminate a high percentage of Specific Designs; however, the release date will not be until October at the earliest. Until then, Totalspan needs a

Proposed Solution:

- Develop preliminary quoting service through Totalspan Head office.
 - Franchise submits a request for quote through echo
 - Totalspan employee receives quote request and completes preliminary assessment using in-house tools; Checkwind, ADAPT (design spreadsheet), Microstan (if required), Sitaline (price). Average turnaround time on process test was 15 minutes (only when no modelling required).
 - Provide a guaranteed quote for the building kit-set within two working days (optimally one).
- Pricing service should be limited to the portal range pricing tools are readily available (ADAPT). Portal buildings make up a large percentage of all buildings sold (60%) [1]. Other ranges, i.e. Flat Roof Farm Building and Heritage Barn would be much more time consuming to price and the service would not be viable estimated price. Could potentially look into cruder pricing tools for those ranges, which could be provided to the franchisees.

Risk Considerations:

- Totalspan accepts risk in guaranteeing a price before final design is complete. Some designs will come back heavier than expected, and some designs will come back lighter. However, due to the volume of jobs going through the system, Totalspan can handle any swings and roundabouts better than individual franchisees. The process will require continual improvement and refinery to remove any systematic errors. Back-costing should be complete once final design is available.
- There is nothing stopping the franchisee ordering the building under a separate job number once the final design has been completed. This could result in the franchise picking and choosing based off which quote is cheaper. Totalspan need to lock the franchise into the quoted price, to avoid losing out.
- The service would be heavily reliant on one employee. There needs to be contingency plans in place in the event that this person is sick, on holiday or leaves the company. This would mean other people in the company that are capable of using the tools to provide quotes. There is also certain times of the year when the single employee may struggle to keep up with demand, i.e. promotional periods. Other staff should be available if required otherwise turnaround times on quotes will become unacceptable.
 - Risk providing uncompetitive quote due to price increase to cover service (see pricing strategy below). However, the safety factors franchisees apply to quotes are much more significant (30-40% kit-price).

PRICING STRATEGY

As explained in the previous section (BoM Creation Service) this service will need to be cost neutral at worst. Some services Spanbild is willing to take at a loss because they benefit the business as a whole, but this particular service will be disproportionately beneficial to the businesses that use it the most.

The main consideration when determining the pricing strategy for this service is that the job is in its early stages and may never go live. The client expects a free no-obligation quote within a couple days of making the enquiry [9]. Because of this, it is difficult to justify charging a fee for the service up front. However, there are other options for recuperating cost on the service:

- Reducing the amount of time the franchise spends providing quotes will give them more time to focus on sales. If each of the 26 franchisees can sell one more building a year it would neutralise the cost of the service. However, it would be good to retain this profit, to account for the additional risk accepted by Totalspan when providing a guaranteed quote.
- Adding a fee to the quoted price so that whenever a job is converted into a sale Totalspan recuperates the money. This fee needs to account for quotes that are not converted into sales (65%). It will therefore be almost three times higher than the break-even cost on a single job.
- Below is a brief summary of the estimate costs of the service and the appropriate cost to break even.
- The final selling price for the service will be \$35 per job, i.e. \$100 added to the quoted price.
- This price may will need to be re-evaluated if the volume numbers are still too high or usage of the service is low.

Table 22: Pricing Service Break-Even Analysis

Yearly Overhead Estimation	Price	Yearly Job Capacity	Units
Engineer	\$65,000	Working Hours in a Year	1920
Equipment (Laptop)	\$500	Chargeable Hours (67% Utilisation)	1286
Software	\$450	Quote Capacity (Jobs Per Hour)	2
Supervisor (5% Utilization)	\$5,000	Quote Conversion Rate (% Quotes Sold)	35%
Administration	\$250	Total Quotes Per Year	2572.8
Total	\$71,200		

Pricing Overview	Break-Even	Actual
Cost (Per Quote)	\$27.67	\$35
Service Fee (Price Added to Quote)	\$79.07	\$100
Required Job Volume (Weekly)	54	42

Assumptions:

- Optimal utilisation rate (percentage of chargeable work) in the engineering industry is 67 percent [43].
- Average time to complete a quote using in-house pricing tool is around 15 minutes [4]. However, some designs may take significantly longer and there additional time spent on administration. It is safe to assume the employee could complete two jobs and hour.
- On average, 35 percent of completed quotes will convert into a sale [4]. This was determined using a survey of the entire franchisee network data; however, there is no solid data on quote conversion. The conversion rate and pricing will therefore require monitoring and evaluation as process matures. For this to be achievable, echo reporting functionality must be improved (recommendation E.2).
- General fixed costs to the business will remain the same, i.e. rent, utilities, manufacturing overheads, and marketing.

APPENDIX G: DESIGN SERVICE – CONSTRUCTION DRAWINGS AND BOM

PROCESS OVERVIEW

Process Drivers:

- Franchisees spend a significant amount of their time processing BoM and factory orders – 1-2 hours per job depending on complexity. Reducing or removing this processing time will mean they have more time to focus on value added activities such as sales.
- Process involved a lot of hand calculations and manual data entry, which takes time, and care to avoid mistakes. Process could be automated using:
 - Improved transfer of information between the various project stages:
Engineering > BoM > Factory
 - Improved tools and spreadsheets for altering BoM's
- Drawings provided with engineers producer statement show insufficient detail for construction. Engineers tend to just take the standard design sketches and mark them up with red pen (generic building outline, no frame details or lengths). Can be extremely difficult to put together, especially for kit-set builders with limited experience with the product. Causes time delays and rework on site.

Proposed Solution:

- Expansion of Totalspan's in-house Design Service :
 - Full set of Construction Drawings – frame dimensions, member lengths, connection details etc.
 - Completed BoM – Modified list of materials ready for franchise to complete factory order.
- Totalspan already has a basic service it offers to a number of franchisees. However, expanding the service to the entire network will require more resources:
 - Additional full time employee, located in Auckland. Graduate Quantity Surveyor or someone with similar skillset (methodical thinking, construction knowledge, problem solving skills, financial and numeracy management skills, communication and negotiation skills).
 - Recruitment opportunities may come within the company, i.e. factory workers that can be upskilled. Knowledge of the Totalspan products, i.e. how the come together will be invaluable.
 - Process tools require optimisation. Currently using solidworks software, drawing process can be slow without a past job to base the design off. This will improve as the service builds up a database of previously completed designs.

Risk Considerations:

- Currently, after franchisees use the service they have to check over the BoM and make sure everything is correct, accepting responsibility for any mistakes. Franchisees using the service have suggested this is not right or fair [7]. If Totalspan are going to provide a complete service, the franchisees want them to take ownership over the final product. This means Totalspan could be liable for any wrong parts that arrive on site and the resulting costs to rectify. Totalspan will accept responsibility for any replacement parts, but not provide compensation for lost time or labour hours.
- Fluctuating demand due to promotional periods means the service will need to be able to bring on supporting staff as required. Management should also find ways for the employees to add value during down time, i.e. helping out with the pricing service, factory worksheet detailing.
- Another risk is that the new employee is not the right fit for the job. Complete adequate recruitment process and psychometric testing to confirm competency, background, skills and work ethic.

PRICING STRATEGY

Similar to the pricing strategy of the quoting service, the design service will only need to be cost neutral. However, the design service is simpler to charge out because the client has already signed and paid for the job. The service will provide quotes on a job-by-job basis. Price will be dependant on the size and complexity of the building. The quote will also take into account whether or not the service has a similar job on record to use as a base for the design.

Service fee set at \$60 hour. Requires four jobs a week at five hours per job to break-even.

Table 23: Design Service Break-Even Analysis

Yearly Overhead Estimation	Yearly	Hourly
Full Time QS	\$50,000	\$38.87
Equipment (Laptop)	\$500	\$0.39
Software	\$240	\$0.19
Supervisor (5% of their time)	\$5,000	\$3.89
Administration	\$250	\$0.19
Total	\$55,990	\$43.52

Pricing Overview	Break-Even	Actual
Cost (per hour)	\$44	\$60
Average Job Length (Hours)	5	5
Required Job Volume (Weekly)	5	4

Assumptions:

- Optimal utilisation rate (percentage of chargeable work) in the engineering industry is 67 percent [43].
- Average time to complete construction drawings and BoM is five hours [4] .
- General fixed costs to the business will remain the same, i.e. rent, utilities, manufacturing overheads, and marketing.

APPENDIX E: LITERATURE REVIEW

PROJECT OVERRUN: RISK

Risk can manifest itself in a number of ways (figure 1). Specific design projects are inherently risky because of their pace and novelty. The salesperson is asked to provide a quick quote without actually knowing what the final design will look like. They risk either overpricing the job and losing it to a competitor, or underselling the job and losing of their profit margin. More often than not they

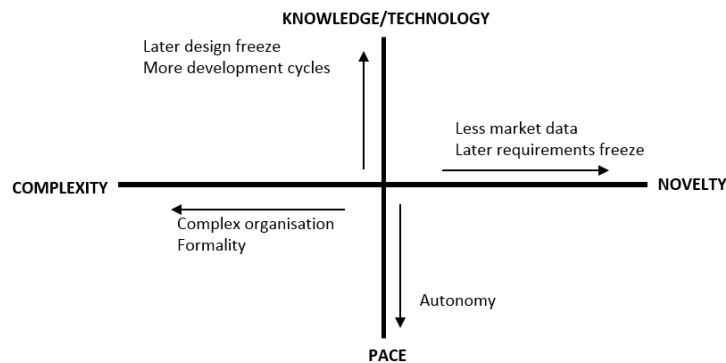


Figure 18: Shows the various causes of risk on each axis and potential mitigation strategies as their likelihood increases (Beukman 2017)

PROJECT OVERRUN: ROOT CAUSE

The following diagram below outlines the factors that contribute to project overrun. Some can be controlled and mitigated during the planning phase and others require action as they arise. Literature suggests that there are four main reasons project planners tend to underestimate (see below).

- Technical – Aspects surrounding the planning and execution of the project
- Psychological – Internal psychological factors that influence the decision making process
- Political-economic – Actions taken by the company or individual for political or economic gain
- Luck – Unforeseeable events that negatively influence the outcome of the project

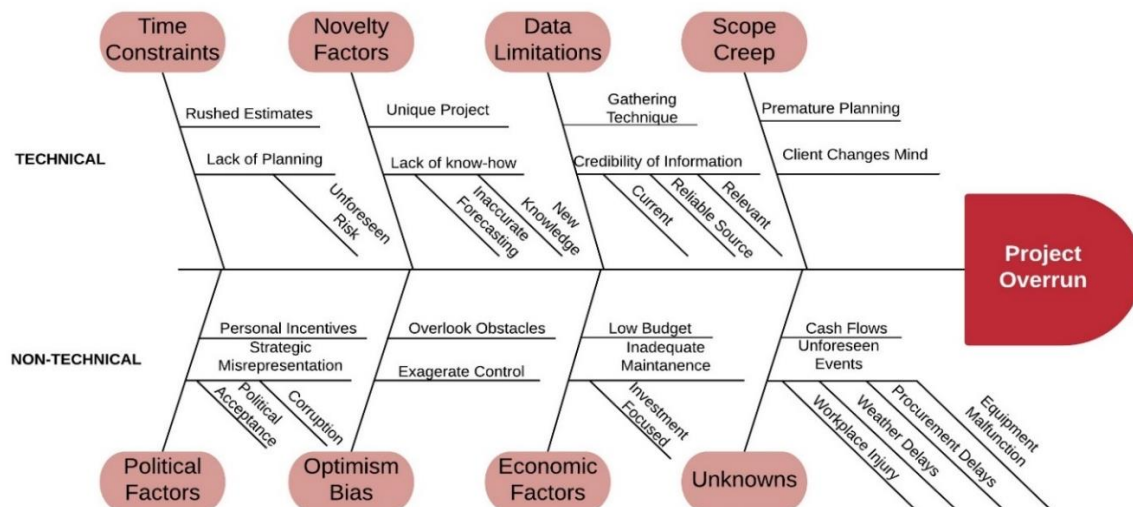


Figure 19: Root cause analysis diagram detailing the reasons projects overrun on time and money.

PROJECT OVERRUN: COUNTERMEASURES

Table 24: Potential countermeasures to project underestimation during quote phase

Category	Mitigation	Implementation	Priority
Time constraints	Thorough Planning Process.	Appropriate time for planning to ensure risks and contingencies plans are identified. By anticipating unforeseen events, the potential consequence can be reduced. [44]. Performance data should be recorded for future projects.	Medium
Scope creep	Monitoring of scope and progress	Document control and engagement of stakeholders will ensure that progress does not defer from the brief and everyone understands the requirements. It will also ensure that all modifications are approved before being implemented [45].	High
Data Limitations	Using appropriate costing technique	Select the appropriate costing technique for the information available. Understand cost drivers and market conditions, use appropriate benchmarks (expert experience and similar projects). Follow a strategic method so decisions can be made in an objective manner [46].	High
Optimism Bias	Establish optimism- bias uplifts	Adding established uplifts will pave the way for more accurate forecasting and increase the estimated budget based on the amount of risks clients are willing to accept for going over budget [47].	High
Economic	Budget Comparisons or Reference Class Budgeting	Projects can be grouped into certain classes based on the scale (size or time) of the project. By comparing to references and projects of similar scope or scale, a more realistic budget can be determined [48].	Medium
Unknowns	Vendor capability checks	Supply chain failures can add cost or time delays to a project. Just-in-time deliveries may not be suitable for certain critical components as it can cause knock-on delays. Question contractors or vendors on previous projects to gauge an understanding of their capabilities and expertise [49].	High
Novelty Factors	Avoid overly complex design specifications	Overly complex project designs result in long preparation and implementation periods and overwhelmed project teams. Moreover, specifications are often technical rather than performance based which stifles innovation and drives up costs [50].	High

COMMUNICATION AND SUCCESSFUL PROJECT OUTCOMES - [51]

A study conducted by the Project Management Institute (PMI) concluded that ineffective communication is the primary contributor to project failure. Research found that one out of five projects is unsuccessful due to ineffective communication. Effective project communication involves sharing information, problems and ideas throughout a project team. It is particularly important when dealing with design changes or rework. Workers on site need to communicate any issues efficiently and effectively. They should bring up any minor areas of concern before they manifest into something bigger.

Totalspan franchisees plays a critical role in project communications because they are the only link between the client, contractors, and consultants. They need to be able to transfer the right information, to the right people, at the right time. The more collaboration and discussion between the groups, the fewer disputes or discrepancies arise. A key barrier to communication is that engineers cannot physically visit the site to complete inspections. The employees on site need to be proficient with smartphone technology so they can communicate issues through pictures and email.

OPEN COMMUNICATION SUPPORTS INNOVATION - [52]

Innovation tends to flourish through ambiguity and open discussion rather than well-defined methods or processes. Ambiguity creates room for experimentation and the solutions become far less predictable. Insights occur when managers need to bring people together from various backgrounds (e.g., engineers, product designers, marketing and sales people), to engage in open-ended discussion, and not shy away from ambiguity and the unknown. Innovation occurs because each of the parties has their own way of interpreting ambiguity.

Remote working locations creates communication and collaboration issues for the franchisee network. The head office and factory departments are also quite separate in their work patterns. This gives limited opportunity to reuse the knowledge gained from projects. Collaboration software such as SharePoint will enable employees to connect in an open and accepting environment.

BUILD A CULTURE THAT SUPPORTS STRATEGY IMPLEMENTATION - [53]

A company strategy that conflicts with the core values of its employees will never succeed. Employees need to believe that what they are doing adds true value for its customers and the organisation. A lack of company culture will result in cut-corners and compromised values. Developing a company culture requires time, commitment, planning and execution. Management needs to develop a detailed understanding of what drives and motivates their employees the most. They also need to understand the current attitudes and practices that hinder strategic execution the most. For Totalspan, this is likely a resistance to change and a tendency to be more re-active in thinking than proactive.

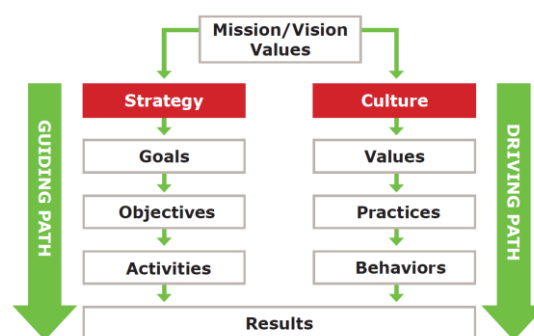


Figure 20: Strategy guides change, culture drives it.

KNOWLEDGE MANAGEMENT: INTRODUCTION

Knowledge: “Knowledge is what we perceive to be real and true” [54]. Knowledge is subjective; it depends significantly on an individual’s perceptions and the context of the situation [13]. Knowledge is a familiarity or understanding of someone or something. It can manifest itself in a number of different ways:

- **Implicit Knowledge** – informal processes, practical skills, expertise
- **Explicit Knowledge** – facts, information, policies, records, data, guidelines

Knowledge Management: “KM is the explicit and systematic management of vital knowledge - and its associated processes of creation, organization, diffusion, use and exploitation - in pursuit of business objectives” [55]. It highlights the need to capture knowledge and experience in order to improve decision-making and stimulate innovation [56]. Insufficient KM systems will increase of time and money in searching for relevant knowledge, reinventing the wheel, slow and wrong decision-making and repeating similar mistakes that can affect time and cost performance [57].

KM has four key stages [13]:

- **Generation** – the creation, acquisition or development of new knowledge
- **Storage** - the selective retention of existing, acquired and created knowledge
- **Transfer** – the distribution and dissemination of information throughout the organisation
- **Application** – Utilising the knowledge to support decisions, actions and training

Effective KM requires clearly defined processes and responsibilities. The first thing to consider when developing the system is how knowledge flows through the organisation. It is important to understand the activities that lead to new learnings and any barriers that impede the information flow to the point of use [14]. The main barrier within the Totalspan network is an appropriate platform to share and discuss project learnings. The franchisees have access to a shared network drive; however, they are unable to upload anything themselves. The drive has a lot of useful information but employees only tend to visit it when they are looking for something specific. The business needs to explore ways to make it more accessible to franchisees and give them reasons to visit and engage on a regular basis.

The Organisation Loop outline is a general framework for KM (figure 1) [13]. Organisation artefacts create formal workplace routines, whilst individual attributes results in informal working practices. KM systems should identify the individual attributes (also referred to as tactics) that enhance working practice to formalise the process of informal learning.

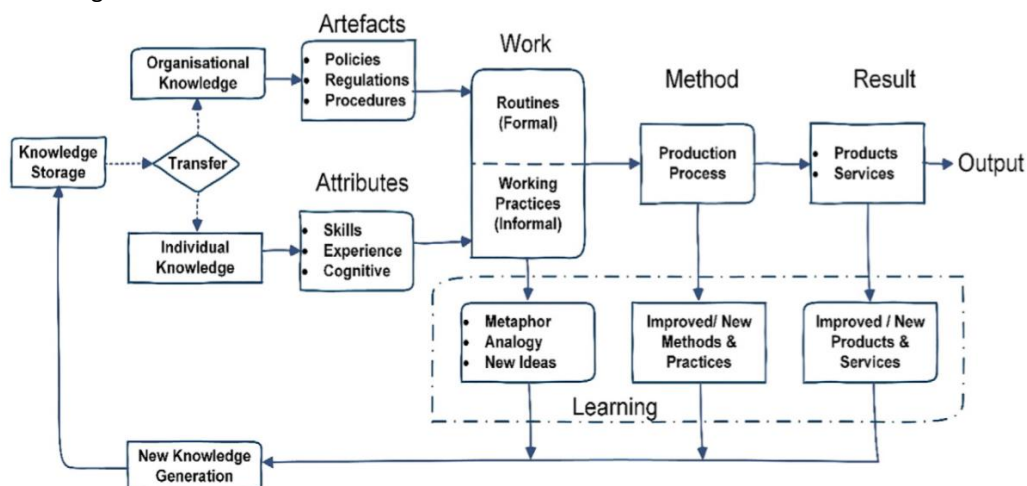


Figure 21: Organisational Knowledge Loop

KNOWLEDGE MANAGEMENT: INTEGRATED KM MODEL - [58]

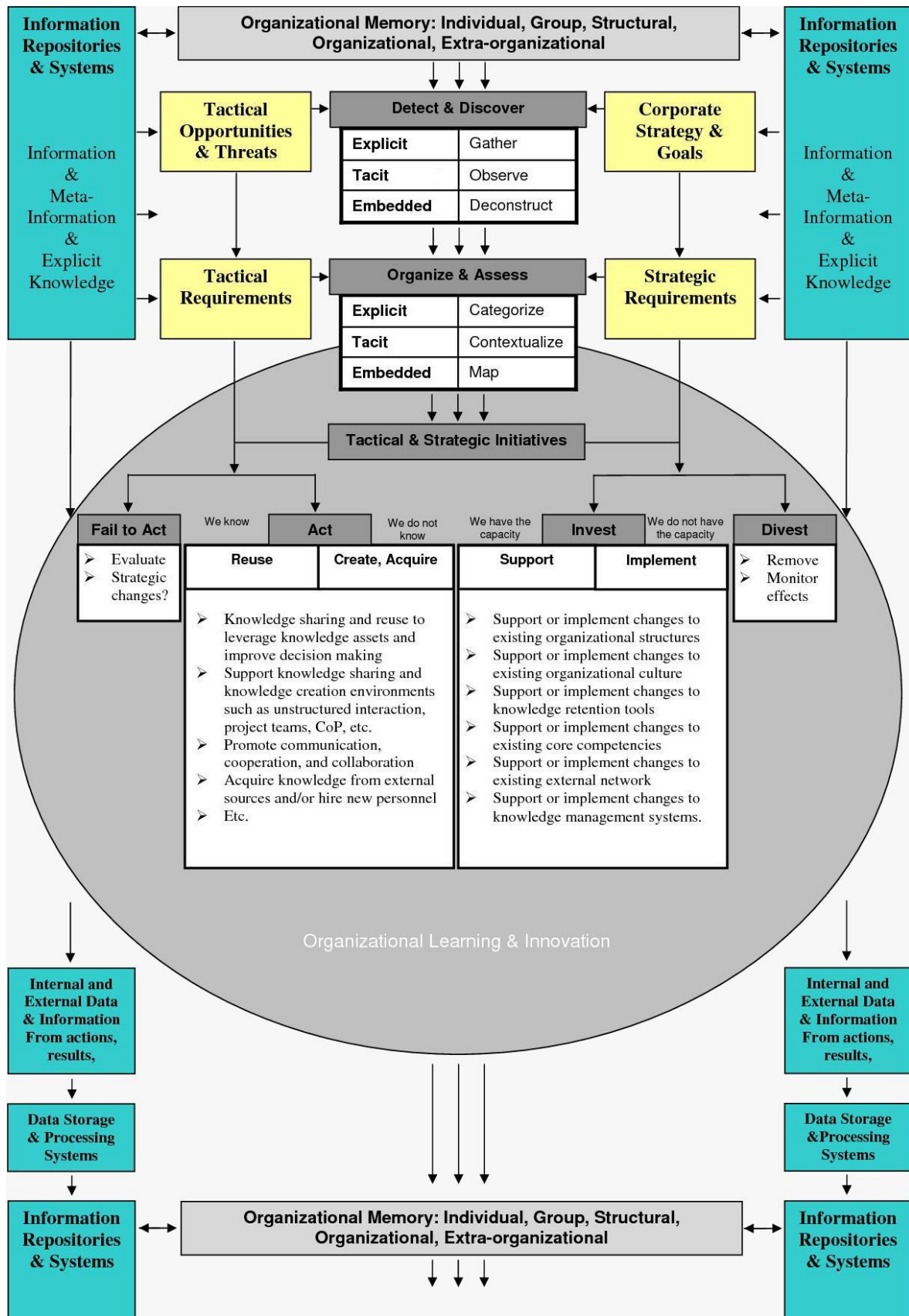


Figure 22: Integrated KM model links process and strategy, while offering specific KM initiatives [58].

DESIGN CHANGE: ROOT CAUSE CLASSIFICATION - [57]

Design change is detrimental to time and cost performance. The following diagram outlines the primary causes of design changes in construction.

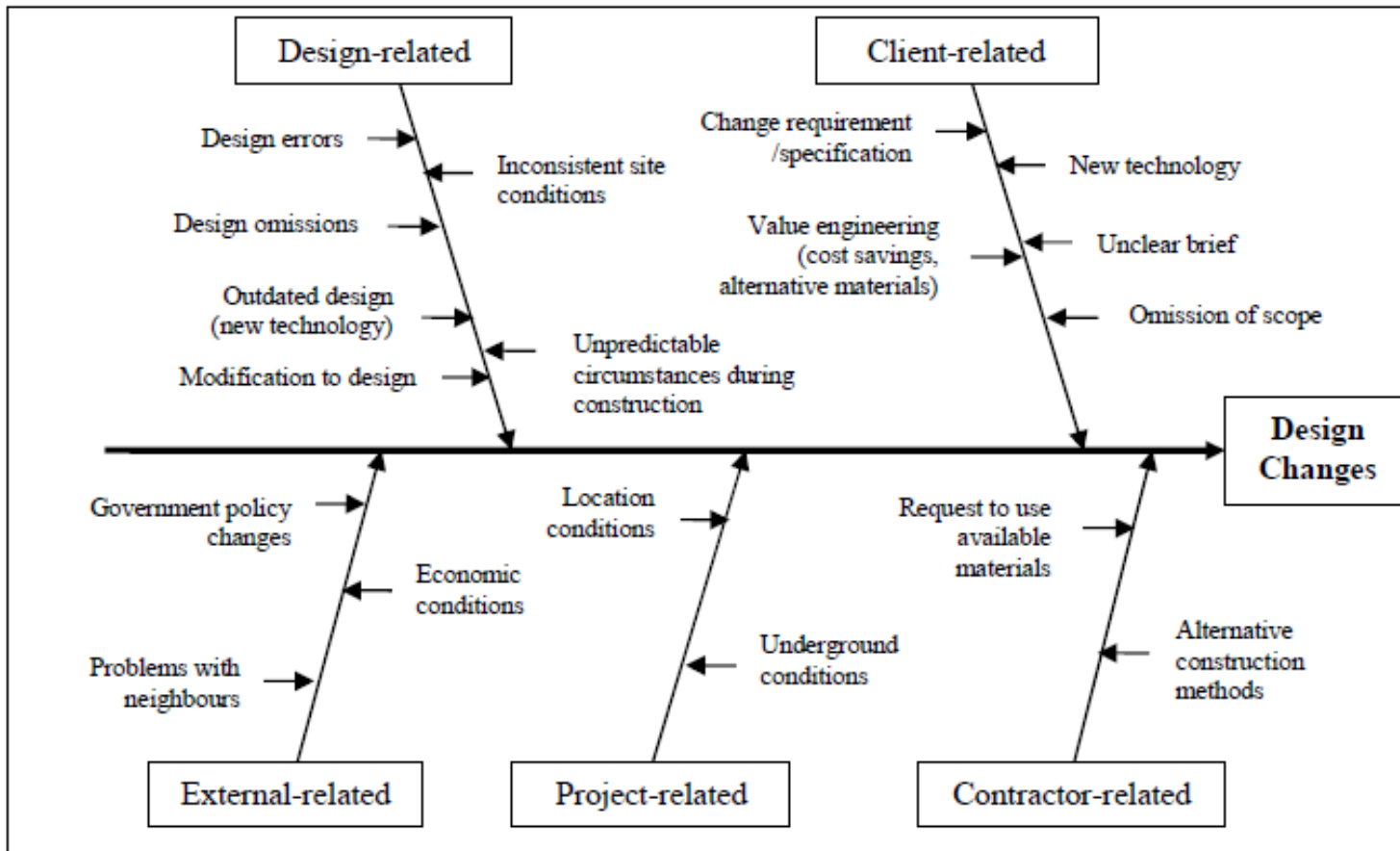


Figure 23: Cause and effect diagram for design change [57]

DESIGN CHANGE: COLLABORATION MODEL - [57]

Researchers propose that the cause and effect of design changes can be mitigated through effective communication and project learning. Effective communication within the project team creates a cohesive working environment, which promotes a collaborative culture for project learning.

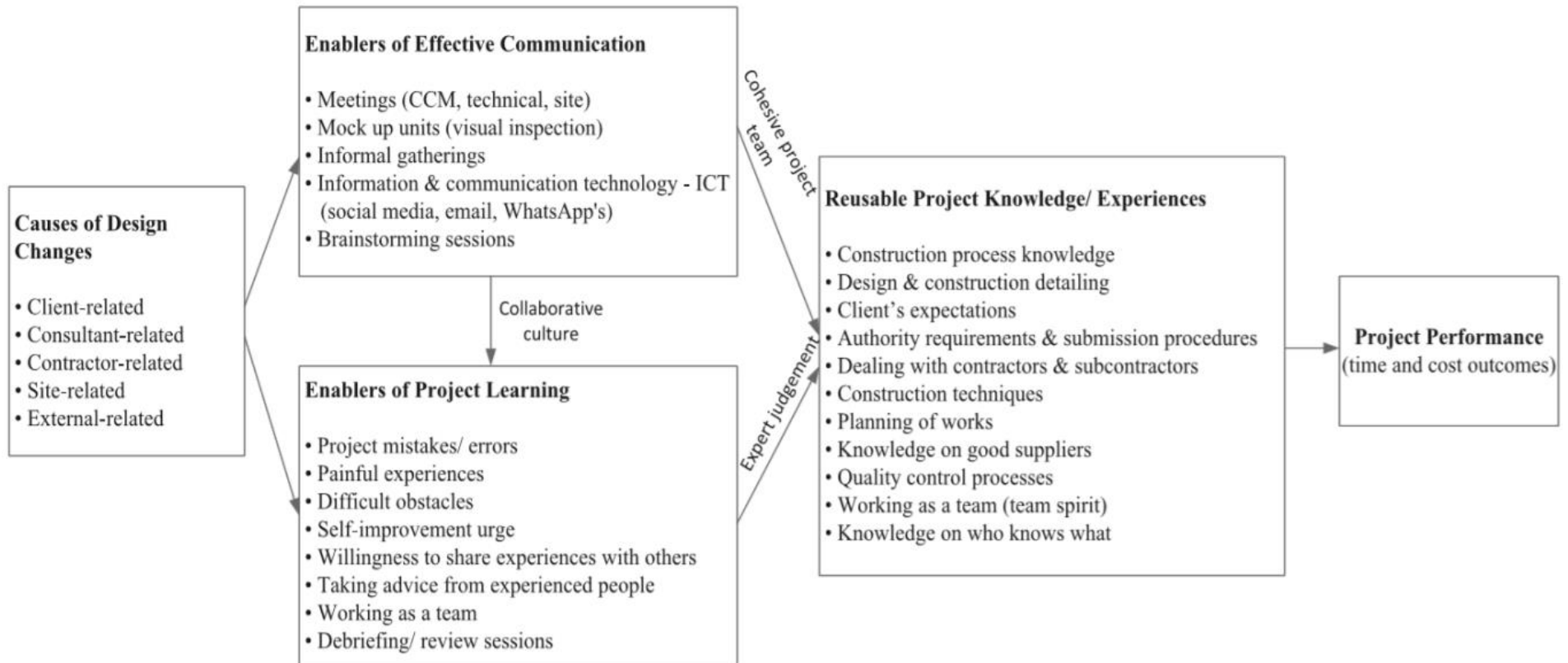


Figure 24: Collaboration model for effective design change management [57]

REWORK: ROOT CAUSE AND EFFECT [21]

Rework: “Activities in the field that have to be done more than once in the field, or activities which remove work previously installed as part of the project regardless of source, where no change order has been issued and no change of scope has been identified by the owner” [21].

Average rework on projects can cost between 7.3 and 10.9 percent of the total construction costs (when both direct and indirect costs are included) [59]. The Construction Owners Association of Alberta (COAA) develop the following industry standards relating to rework classification. They proposed that standardizing rework classification would enable them to identify trends and formulate strategies to deal with the most significant causes of rework.

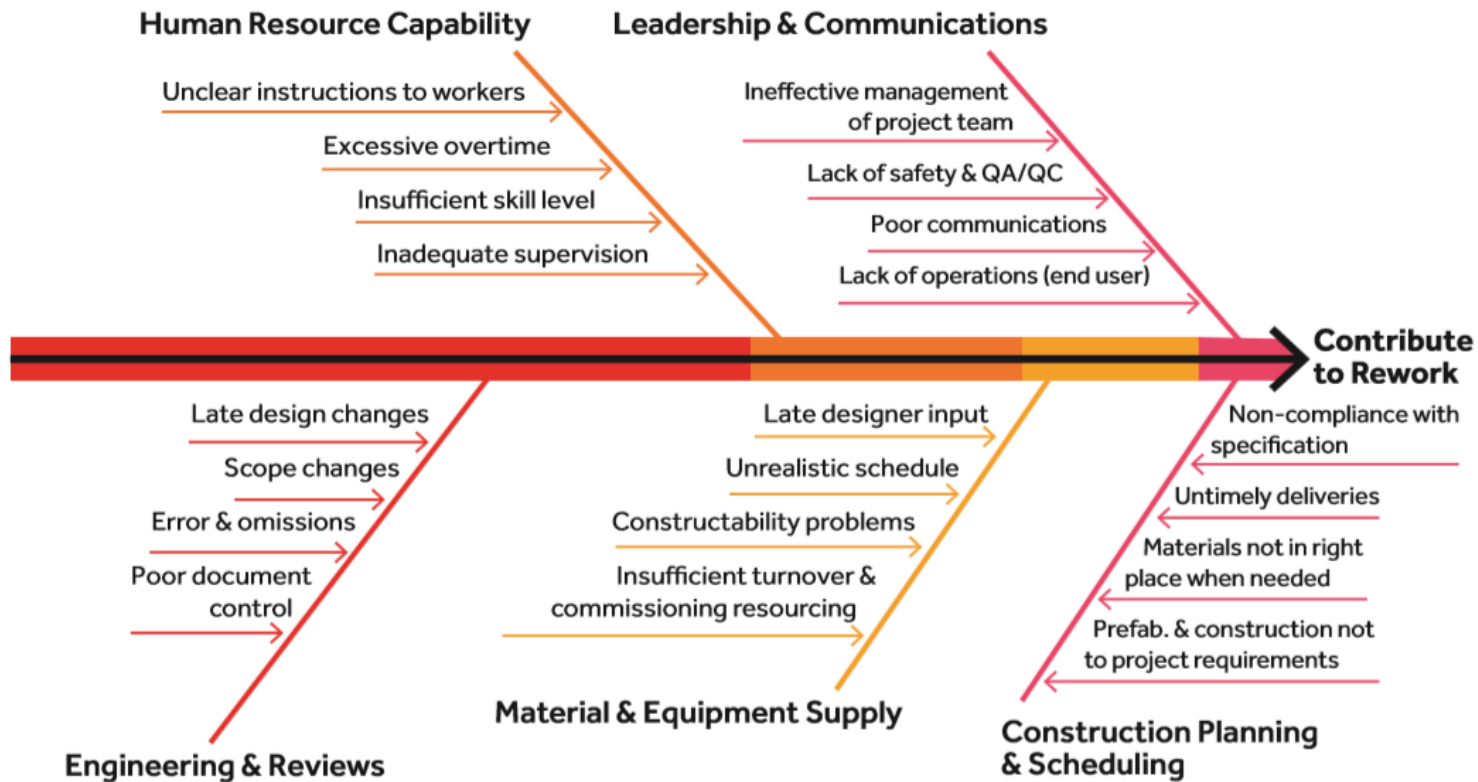


Figure 25: Cause and Effect Diagram - Model of the Root Causes of Rework [21]