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**QA LIMITED and University of Roehampton**

**Business Process Change Management for Propel Tech**

**Analysing and implementing change to Propel Tech’s Service Delivery process**

**Joshua Morton**

**Business Systems and Processes – QAC020N225K**

**25/06/2024**

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# Introduction

This essay aims to employ a variety of analytical techniques for Propel Tech, a software consultancy, to expose inefficiencies with their service delivery process. The goal is to identify and model solutions for re-designing the process to address its weaknesses, later discussing how adoption of machine learning can benefit the organisation.

This process was selected as it has the largest impact on profitability and client retention within the organisation.

# Analysing Propel Tech’s Service Delivery Process

Before analysing a specific process, the wider organisation must first be understood to establish the scope of the process. Shown below, a value chain analysis is a means of evaluation on a company-wide basis (Stobierski, 2020).

Porter (1985, p.33) states that value chain analysis, shown in Figure 1, helps “understand competitive position and improve their performance”. The purpose of this analysis is to identify value-generating activities for customers, these contribute to the organisation’s competitive advantage and potential for profit.

Figure 1 helps outline Propel’s primary activities, as a software consultancy, these include pushing their market awareness to attract new clients and provide value to them through expert software development, support and testing resources. This diagram does not yet fully identify high-level processes of the organisation.

A diagram of a company

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Figure 2 Propel Tech’s Primary Activity Map

Figure 2 displays the relationships between each primary activity outlined in the value chain analysis, displaying a high-level process map, which Harmon (2019, p.86) states “helps to understand the overall process flow and the relationships between major process components”. This analysis is useful as it helps understand which processes are essential to stakeholders.

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Figure 3 - Harmon's Organisation Chart

Figure 3 illustrates Propel Tech’s organisation diagram. Harmon describes this as displaying the “relationship of the organization to its external environment”.

This format is excellent at establishing the boundaries of what a business can control but can also help guide changes to process by identifying external factors that can be beneficial to the process, as it exposes opportunities for change and allows an organisation to consider external risks when making decisions for process change.

Looking externally, it is apparent high-level processes have emerged, indicating our earlier primary activities are more accurately mid-level processes.

Service delivery appears to have a large impact both internally and externally, proving the importance of highlighting inefficiencies through further analysis.

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Figure 4 Service Delivery Business Process Scope Diagram

Figure 4 depicts a process scope diagram, at a high level, for service delivery. This diagram helps to understand the inputs and outputs of the service, as well as the controls that regulate it and enablers that support it and finally identifies key stakeholders.

Harmon (2019, p.139) advises that “when you are just starting to try to figure out what might be wrong with a process a scope diagram is much more powerful than a flow diagram”.

With figure 3 indicating influences that are directly related to the process, it can be confidently asserted the entities modelled in the diagram are critical to its efficiency.

Examining figure 4 shows evidence that the process has many factors that show potential for profitability. The process does not require physical resources to produce goods or services, like a typical manufacturing chain. This allows increased demand to be met by scaling up engineer capacity through recruitment and training.

Also, the use of free open-source software and premium cloud service providers boost development speed and efficiency. While cloud services are typically expensive, these can be expensed to customers as a service charge.

However, there are also potential weaknesses in this chain. As engineer time is the primary resource used to generate revenue, it must be leveraged effectively, otherwise services may be provided that cannot be charged for. Poor time estimation and invoicing can lead to irrecoverable losses.

These potentials can be analysed deeper by mapping out the process hierarchy.

A diagram of a process

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Figure 5 Service Delivery Process Hierarchy Diagram

Figure 5 displays multiple levels of processes contained within service delivery, Propel’s major processes directly influence each other, showing a link between them. This diagram focuses directly on child-processes of service delivery.

Šaulinskas-et-al (2013, p.62) describes middle processes as being “directed towards fulfilling the company’s major aims”. The displayed mid-level processes encapsulate each of Propel’s departments; Project Management, Engineering, Testing and Infrastructure, all working together to fulfil the requirements of the higher-level process.

Next, low-level processes demonstrate how each department operates internally, depending on the size of Propel’s client, an individual or team would be required. These have sub-processes (procedures) which describe the explicit steps required to achieve each process, however, in the case of a large project an additional layer may be required to divide the large procedures further.

While these processes appear linear, departments operate in synchrony to ensure efficient service delivery, shown below.

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Figure 6 – Process Swim-Lane Flowchart

Figure 6 expands on the process hierarchy diagram; using more realistic low-level processes, divided into swim-lanes to represent each department responsible for service delivery at Propel. Harmon (2019, pg. 127) describes complex processes as “involving multiple steps, departments and continuous co-ordination”, figure 6 clearly demonstrates these characteristics.

The diagram highlights areas of efficiency, notably; the higher-level service allows for multiple lower-level processes to run simultaneously, allowing multiple departments to work asynchronously, with project management re-aligning departments at key stages. A visual representation of this in the diagram is when a process triggers multiple processes across swim-lanes before feeding back into the project managers swim-lane.

Conversely, it shows that all swim-lanes are involved before the client has agreed to pay for work. This is a risk to Propel as several employees could invest time with no revenue generated.

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Figure 7 - Fishbone Diagram of potential causes for delivery over budget.

Cause and effect diagrams, known as fishbone diagrams, use the frontal node to identify a problem, then supporting nodes represent categories of causal factors, each with their own branches to represent individual factors. (George et al., 2005, p. 146)

Figure 7 illustrates a map of internal and external factors that can impact the effectiveness of Propel’s service delivery. As this is the profit centre of the business, effectiveness would be measured by profitability. Engineers’ hours not being billable is typically a result of work being delivered over budget (under-estimate).

A clear trend can be observed, most risk factors surround the depth of understanding of Propel’s clients’ systems, needs and technical demands. In summary, these risk factors, coupled with estimation being done by test and software engineers, can lead to missed requirements and under-estimation of task difficulty, due to the additional layers of communication they must pass through. The engineers’ varying levels of expertise can make these issues unpredictable.

# Suggesting Process Improvement for Propel Tech

Firstly, below is a list of the core problems discovered through analysis the following suggestions will aim to resolve.

* All department layers being involved in estimation exposes Propel to risk of time investment without revenue.
* Engineers’ hours not being billable due to under-estimated work, caused by inconsistencies in engineer skill & ability.
* Misunderstanding clients’ systems technical demands & requirements leads to task underestimation.

## Identifying process outcomes

Before modelling and justifying suggestions for change, Propel needs to identify people who influence the process as well as an effective way to measure process performance. Without considering these elements, it isn’t possible to objectively measure the outcomes of process change.

A diagram of a company's project

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Figure 8 - Stakeholder Power/Interest Grid

A stakeholder power/interest grid allows a business to discover stakeholders who have the most influence over process change. Change of business process should be targeting the interests of the stakeholders in the higher quadrants. This is important, as typically business process change occurs only at the management level, Kotter (1996) argues all levels of the organisation must be involved for successful change.

A diagram of service delivery

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Figure 9 - Primary Stakeholders

The primary stakeholders to keep involved, based on figure 8, are displayed in figure 9.

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Figure 10 - Stakeholder Interest Table

Using Harmon’s method (p.96, 2019), figure 10 describes performance indicators and objectives of key stakeholders, this information is vital in understanding the desired outcomes of process change modelling.

## Process measurement.

Furthermore, to understand measurable factors of Propel’s service delivery, the following section details internal and external points, categorised by Harmon’s (2019, p.85) lagging and leading data analytical tools.

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Figure 11 - Billable Hours Lagging & Leading measurements.

Propel measure internal billable hours as the primary indicator of revenue, historical average hours logged is a lagging metric to compare to for year-on-year progression, whereas the number of hours scheduled is a leading metric to judge how work Propel is acquiring. Both can be used to create targeted outcomes for business process change, illustrated in figure 11. A process change that enables Propel to increase both engineer utilization (billable percentage) and increase their backlog is required to meet their main goal of profitability.

A graph of a graph showing a graph of a client proposal

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Figure 12 – Client Headcount Lagging & Leading Measures.

Externally, client acquisition and retention rates are a metric of projected success, as they indirectly contribute to total billable potential through new projects and support work. Lagging measures for this metric are the trend of client headcount over time and percentage scores from client feedback surveys, whereas leading measures are the number of leads and proposals sent to clients, as these create opportunities for Propel to win new clients. Figure 12 displays an example of how these metrics would be tracked.

## Options for process change.

Propel require a change to increase engineer billable hours by minimising variance in estimates and quotes, and the inefficiencies discovered in the requirements analysis phase of their service delivery process.

Rather than relying on individual skill and experience, Propel could invest resources into training programmes and mentorship workshops, aimed at establishing a standardised process for estimation. Upskilling the existing team minimises process change but requires additional processes. This can lead to short term losses during training but still risks variance.

Propel could reshape the earlier stages of service delivery (see Figure 6), leaving requirements analysis and quotation to a Solution Architect (SA). Having an expert with a specific skillset allows consistent estimates across all solutions, this proses a higher risk, with a much greater reward as engineers are left solely for implementation and delivery.

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Figure 13 - Architect vs Training costs

Considering the methods of measurement in earlier analysis, the profitability of both options must be weighed against each other. Training engineers is both an upfront and recurring cost when recruiting, additionally, this is a skill that not all engineers will have experience with, exposing additional risk. Contradictory the salary invested in an architect can provide immediate return on investment through additional billable capacity. Figure 13 illustrates an example projection.

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Figure 14 - Human Performance Analysis

Harmon (2019, pg. 166) advocates for analysing human performance, as both options involve human factors, Figure 14 adapts Rummler’s (1990) “Human Performance Analysis” to show considerations for quality of estimation.

The “Software Estimation Activity” encapsulates all sub-processes displayed in Figure 6, until the “Project Kick-Off” procedure. This activity is the primary location process change for Propel Tech is proposed. This flowchart is adapted in Figure 15 to illustrate the proposal changes under this activity.

The analysis shown in Figure 14 reveals that implementation of training programmes could introduce friction, as each of the factors shown in the human performance analysis would have to be considered for each engineer, this could expose Propel to further challenges including managing human performance across all departments, requiring a greater effort and potentially recruitment of human resources staff.

Despite higher initial risk, recruiting a Solution Architect and re-structuring the estimation/quotation stage of the process best aligns with the interests, KPIs and objectives identified for key stakeholders in Figure 10 and measures in Figure 11. This approach ensures accurate estimates, satisfies client interests, and increases engineer billable potential.

All analysis conclusively suggests that recruiting a Solution Architect has the best outcomes for Propel Tech’s service delivery process.

## Modelling process change

A diagram of a flowchart

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Figure 15 - Left: Existing Process Swimlane Flowchart. Right: Process Swimlane Flowchart. Adapted for Solution Architects.

The flowchart above, adapted from Figure 6, proposes the change to the process, showing how engineer’s responsibilities are reduced to project implementation and support resolution. The departmental overlap described earlier is removed from the earlier phase of service delivery entirely. The new structure of this flowchart closely resembles the waterfall project management methodology, which is uniquely beneficial in consulting, as billable work is tied to a previously agreed upon scope.

# Implementation details of service delivery process change

This section builds on goals and metrics observed through stakeholder analysis, discussed earlier in this report. It will discuss implementation techniques, scheduling, methods of ongoing monitoring and evaluation. Additionally, the role of machine learning, a technology that has existing since the 1950s (Foote, 2021), but is currently re-shaping how we incorporate technology into business processes.

Harmon (p.184-187) discusses management of business process change activities as requiring an organised plan for implementing change to ensure a smooth transition between the existing and proposed process. This also involves cross-department communication and monitoring process metrics during and after change - these metrics were displayed in Figure 10.

Harmon (p.124-126, p.184), discussing Business Process Management (BPM), also advises that a process owner oversees the implementation. He suggests that process owners are typically managers of higher-level processes and monitor performance, while process managers are responsible for general process activities.

## Scheduling and measuring implementation

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Figure 16 - Schedule of Process Implementation

Due to this process requiring recruitment of a new department, the best approach is to prepare process stakeholders during the recruitment phase, the duration of this phase is indeterminable due to employment notice periods, however it is estimated to take between three to six months.

Once recruitment has concluded, clients can be prepared while the solution architect is onboarded. As this is a high-risk high-reward change, it should be trialled with a few appropriate clients first, with later clients integrated depending on metrics measured during the trial period. This approach will greatly mitigate the impact if the process change fails. Finally, Propel will monitor the capacity of the solution architect, deciding whether another is required to cover the requirements of all clients.

As Propel is a small sized company, the role of process owner falls to the Operations Director, they will refer to the example measurements illustrated in Figure 11, analysing the trend of billable targets for engineers allocated to clients in the trial, compared against lagging data.

Specifically, data from the existing process and trial process clients will be compared for the timesheet billable percentages and accuracy and consistency of estimates for engineers allocated in each group. Figure 18 displays an example of these metrics that indicate outcomes aligning with KPIs and objectives.

A diagram of a process

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Figure 17 - Plan Do Check Act cycle

A style of business process change management that aligns with the implementation plan covered above is the “Plan Do Check Act cycle”, Vargas (2023) states that “PDCA is a continuous improvement model involving planning, doing, checking, and acting to enhance processes”. As this change to Propel’s service delivery process is critical to the business’s profitability, clearly defined phases of implementation must be established to give Propel decision points to allow them pivot away from the change if metrics indicate failure.

## Machine learning for process change management

Mitchell (1997) describes Machine Learning (ML) as “the study of computer science algorithms that improve automatically through experience”. It is a subset of artificial intelligence (AI), which uses machine learning to train models on monumental datasets (Caltech, n.d).

Open-source platforms like Tensorflow offer a set of tools and pipelines to create bespoke neural networks (Mattman, 2019), a model that makes decisions in a manner like the human brain (IBM, n.d), using individual datasets.

Propel can leverage Tensorflow to translate their process measurement metrics into a custom model, trained on their leading and lagging data, to create custom dashboards for evaluating both the performance of business process change and guidelines on project estimation tailored to each client and system that Propel support.

As Propel already use Atlassian’s Jira platform for task tracking, estimation and time logging, they can leverage internal resources to integrate with Tensorflow (Chola, 2021), creating a custom dashboard that automates analysis of the KPIs and metrics discovered in Figures 10, 11 and 12.

A diagram and chart of a pie chart

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Figure 18 - Cloud Dashboard Example

Figure 17 shows an example of a collection of measurement tools that can be made available in a dashboard, presenting data an easily digestible format to process owners. The example shows how impact of process changes on billable percentages, estimation accuracy and client standing numbers can be presented.

The real benefit of ML is these metrics can be fed into a bespoke algorithm, tuned with Propel’s goal of increased profitability and accuracy, to analyse current and historical data. This will identify patterns and correlations in data that suggest outcomes supporting these goals, enabling significant advancements in understanding (Murphy, 2012). Additionally, the continuous learning capabilities of ML enables it to provide feedback of the impact of business process change without manual intervention, including insights from correlated data that process owners had not considered (Damsten, 2023).

In summary, ML models trained on Propel Tech’s timesheet and estimation data, tuned to target profitability and accuracy, can streamline tracking the impact of business process change and recognise previously unconsidered patterns that align with business goals while reacting to change.

A potential challenge with integration ML could be the complex implementation of a bespoke model, (CorebrandAI, 2023) Propel has an advantage in this area as their speciality is software engineering, however they may have to specifically recruit for an engineer with expertise in ML which would incur the cost of an employee’s salary. Additionally, as they’re a smaller company, their pre-existing dataset may not be large enough to effectively train a bespoke model.

# Conclusion

While challenging and costly to implement, a bespoke model has the potential to streamline the PDCA cycle with critical insights to steer decision making in the “Act” phase. Long-term, ML could enable Propel to make continuous successful business process management decisions, increasing their profitability. Additionally, it sets the foundation for continuous integration of analytics and AI technologies in other areas of the business.

# Appendix A

A diagram of activities with different colored squares

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Figure 1 Porter's Value Chain Analysis of Propel Tech

### Figure 1: Porter’s Value Chain Analysis for Propel Tech

This figure illustrates the value chain analysis for Propel Tech, it identifies the primary and secondary activities involved in the company's operations.

### Figure 2: Propel Tech’s Primary Activity Map

This figure builds on Figure 1’s value chain analysis, taking each of the primary activities, mapped as high-level processes displays the relationship between the processes.

### Figure 3: Harmon’s Organisation Diagram of Propel Tech

This figure highlights the central (high-level) processes of Propel Tech’s organisation, and how the interact within the environment external to the business.

### Figure 4: Service Delivery Process Scope Diagram

This figure takes the high-level Service Delivery process and displays the scope of all impacting factors, including Inputs, Outputs, Controls and Enablers. It aims to display where inefficiencies can exist within the process.

### Figure 5: Service Delivery Process Hierarchy Diagram

This figure displays a hierarchy of Propel Tech’s Service Delivery. While traditionally each branch would have multiple lower-level child processes, only one branch is displayed per tier here.

### Figure 6: Process Swim-Lane Flowchart

This represents a flowchart with swim-lanes for each major stakeholder group that make up the high-level service delivery process of Propel Tech. The purpose of this diagram is to illustrate how lower-level processes in a hierarchy diagram can intersect with each other.

### Figure 7: Fishbone Diagram of Risk Factors to Service Delivery

This chart illustrates the problem (work delivered over-budget) and then several risks that contribute to this problem, organised into categories.

### Figure 8: Stakeholder Interest / Grid Ratio Chart

This chart maps internal & external stakeholders that can influence change within the service delivery process of Propel Tech.

### Figure 9: Primary Stakeholders

This diagram displayed the 4 most important stakeholders, adapted from figure 8.

### Figure 10: Stakeholder Interest Table

This table lists the key stakeholders identified from earlier analysis to involve in process change management. It details their interests, key performance indicators and objectives set to achieve them.

### Figure 11: Billable Hours Lagging & Leading measurements.

This bar chart displays examples of measuring lagging and leading data for mapping billable hour percentages over time. It shows how a target goal can be modelled for the future.

### Figure 12: Client Headcount Lagging & Leading measurements.

This plotted line graph shows both lagging and leading data for client headcount and acquisition. This graph is effective as it identifies the impact of the leading metric and the resultant lagging data trends.

### Figure 13: Architect vs Training expenses.

This graph represents an example measurement of how cost scaling can differ between a single architect and training of an entire engineering team, which is an ongoing process.

### Figure 14: Human Performance Analysis.

Adapted from Rummler (1990), this illustration documents items to measure the human factors of software task estimation.

### Figure 15: Left: Existing Process Swimlane Flowchart. Right: Process Swimlane Flowchart. Adapted for Solution Architects.

This illustrates an updated Service Delivery flowchart, with the recommendations in place utilizing a solution architect, rather than cross-department estimation, paired against the existing estimation process.

### Figure 16: Schedule of Process Implementation

This illustration displays actions for process change management over a 12-month period.

### Figure 17: Plan Do Check Act Cycle

This demonstrates a cyclic approach to process change management. In which you set out a plan, implement it, analyse the results and act on them.

### Figure 18: Cloud Dashboard Example

This image of graphs and charts shows how Propel’s metrics can be tracked with Atlassian Jira integrations. The purpose of this is to display what data can be made available to power machine learning models.

# References

Caltech Science Exchange. (n.d). *Machine Learning Defined: How Do Computers Learn?* Available at: <https://scienceexchange.caltech.edu/topics/artificial-intelligence-research/artificial-intelligence-vs-machine-learning> [Accessed 21 June 2024].

Chola, A. (2024) *‘Jira Python Integration: 2 Easy Methods’, Hevo,* 29th November. Available at: <https://hevodata.com/learn/jira-python-integration/> [Accessed 23 June 2024]

CorebrandAI. (2023) *‘The advantages of “bespoke” machine learning vs “off-the-shelf” models’,* 27th July. Available at: <https://www.linkedin.com/pulse/advantages-off-the-shelf-machine-learning-models-vs-bespoke/> [Accessed 25 June 2024]

Damsten, E. (2023) ‘*Incorporating Machine Learning in Business Process Automation’, Omnitas.* 29th December. Available at: <https://www.omnitas.com/incorporating-machine-learning-in-business-process-automation/> [Accessed 24 June 2024].

Foote, D.K. (2021) *‘A Brief History of Machine Learning’, DataVersity,* 3rd December. Available at: <https://www.dataversity.net/a-brief-history-of-machine-learning/> [Accessed 15 June 2024]

George, M. et al. (2005) The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to 100 Tools for Improving Quality and Speed. 1st Edition, New York, McGraw-Hill.

Géron, A. (2019) *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems.* 2nd edition. Sebastopol, California: O'Reilly Media.

Harmon, P. (2019) *Business Process Change: A Business Process Management Guide for Managers and Process Professionals*. 4th edition. Burlington, Massachusetts: Morgan Kaufmann.

Harry (2023) *'10 Value Chain Analysis Examples for Beginners', BoardMix*, 25th June. Updated on 22 April 2024. Available at: <https://boardmix.com/examples/value-chain-analysis/> [Accessed 21 May 2024]

IBM (n.d). *What is a neural network?* Available at: <https://www.ibm.com/topics/neural-networks> [Accessed 22/06/2024]

Kotter, J.P., 1996. *Leading Change*. 1st Edition. Boston, Massachusetts: Harvard Business School Press.

Lewis, S. (n.d.) *'Fishbone Diagram', TechTarget*. Available at: <https://www.techtarget.com/whatis/definition/fishbone-diagram> [Accessed: 28 May 2024].

Mattmann, C., 2019. *Machine Learning with TensorFlow.* 2nd Edition. Shelter Island, New York: Manning Publications.

Mitchell, T.M., 1997. *Machine Learning.* 1st Edition. New York: McGraw-Hill.

Murphy, K. P., 2012. *Machine Learning: A Probabilistic Perspective*. 1st Edition. Cambridge, Massachusetts: MIT Press.

Muzyka, B., 2021. Top 5 risks in software development estimation. *TechMagic Blog*, 1st October. Available at: https://www.techmagic.co/blog/risks-in-product-cost-estimation-and-how-to-avoid-them/ [Accessed 14 May 2024].

Porter, M.E. (1998) *Competitive Advantage: Creating and Sustaining Superior Performance.* 1st edition. New York: Free Press.

Reintech, 2023. Navigating the challenges of software development project estimation and forecasting. *Reintech Blog*, 16 June. Available at: https://reintech.io/blog/navigating-challenges-software-development-estimation-forecasting [Accessed 14 May 2024].

Rummler, G.A., 1990. **Improving Performance: How to Manage the White Space on the Organization Chart**. 1st Edition, San Francisco, Jossey-Bass.

Šaulinskas, L., Paliulis, N. & Meidute-Kavaliauskiene, I., 2013. Theoretical and Practical Aspects of Logistic Quality Management System Documentation Development Process. Contemporary Economics, 7, pp.57-72. 10.5709/ce.1897-9254.123.

Stobierski, T. (2020) 'What is a Value Chain Analysis? 3 Steps', *Harvard Business School Online Blog*, 3 December. Available at: https://online.hbs.edu/blog/post/what-is-value-chain-analysis [Accessed: 13 May 2024].

Technology Ally. (2023) ‘Solutions Architect: Role, Responsibilities and Required Skills. *Intellectsoft Online Blog, 8th September* [online] Available at: <https://www.intellectsoft.net/blog/what-is-solutions-architect/> [Accessed 03/06/2024]

Tensorflow. (n.d) *Introduction to Tensorflow.* Available at: <https://www.tensorflow.org/learn> [Accessed 22/06/2024]

Tensorflow. (n.d) *Get started with Tensorboard.* Available at: <https://www.tensorflow.org/tensorboard/get_started> [Accessed 22/06/2024]

Vargas, A.R. Alcaraz, G., and Díaz-Reza, J.R., 2023. *The PDCA Cycle for Industrial Improvement: Applied Case Studies*. 1st Edition. Springer Nature Switzerland.

Vention Teams, 2023. Software development estimation 101: Costs, time, tactics. *Vention Teams Blog*. Available at: https://ventionteams.com/software-development-estimation-101-costs-time-tactics [Accessed 14 May 2024].

Watts, S., 2019. Leading vs Lagging Indicators: What’s The Difference? *BMC Blogs,* [online] 1 Nov. Available at: https://www.bmc.com/blogs/leading-vs-lagging-indicators/ [Accessed 2 June 2024].

Wysocki, R. K. (2019) Effective Project Management: Traditional, Agile, Extreme, Hybrid. 8th Edition. Hoboken, NJ: Wiley.