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1 – Task 1: Ideation and Innovation

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The following task summarises theories about the role of innovation and value creation, details project ideas, and identifies resources to support the development of the chosen project.

1.1 – Question 1: Innovation

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The following summaries of Unit 1 Topic 1 'How Innovation Shapes the World' detail the role creativity and innovation play in the development of society and self.

1.1.1 – Section 1: Innovation is Everywhere

Innovations are constantly improving people's lives, and they have "marked several key turning points in human history" [1]. Innovation has become widely accessible because the current age values aptitudes which emphasise combining "seemingly unrelated ideas" and going beyond standard routines "in pursuit of purpose and meaning" [2].

Scientific discoveries also drive innovation and these "help solve some of the world's biggest challenges", and one of the best ways that the public can ensure continued innovation is "to support leaders that recognise the importance of public research programs" to change the world for the better [3].

1.1.2 – Section 2: The Onward March of Technology

Economist Klaus Schwab identified "four distinct periods of industrial revolution throughout history" where society moved from mechanisation to electricity, then digital automation and communication, and now integrated physical-virtual technologies [1].

Economist Nikolai Kondratieff further developed this idea by demonstrating cycles where "certain innovations cause spikes of prosperity before they return back to normal" [1]. The financial crisis of 2009 can be considered "an indication that the 5th Kondratieff cycle has ended" and society's challenge is to determine what could trigger the next cycle [1].

1.1.3 – Section 3: Creativity and You

"Creativity drives innovation" by enabling people to use "different perspective[s] without the restrictions of rules and norms", it is "inherent within every single human" and functions as a mindset and an identity "that we hold about ourselves" [1]. It is "not limited to classical ways in which we view creativity" as an outcome, it "can also be within the process of getting to that desired outcome" [1].

Educationalist Ken Robinson defines creativity as "the process of having original ideas that have value" [4] and reminds students that mistakes are an essential component of the creative process [1].

1.2 – Question 2: Ideation

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The following are project ideas of personal interest related to the Computing (Data & Information Systems) programme of study.

1.2.1 – Project Idea 1

Title: Workforce Absence and Population Health Geographic Model

Aim: To analyse the relationships between workforce absence and geographic population health indicators.

Pro: Provides focus for targeted interventions of employees who are at higher risk of absence, if correlation can be identified with geographic patient profile.

Con: Findings may show correlation rather than causation, making it difficult to translate insights into actionable interventions.

1.2.2 – Project Idea 2

Title: Service Reconfiguration and Workforce Impact Model

Aim: To simulate workforce impacts (in terms of staffing levels and cost) from service and site reconfigurations.

Pros: Provides insight into both workforce and financial implications of service changes.

Con: High level of complexity and may require significant simplification for completion of proof-of-concept within 10 weeks.

1.2.3 – Project Idea 3 (Chosen Project)

Title: Recruitment Scenario and Workforce Forecasting Model

Aim: To model and forecast NHS workforce levels under various recruitment scenarios.

Description: The focus of this project will be the development of a modelling tool that simulates how changes in recruitment would impact workforce levels. The model will allow for scenario testing and forecast the resulting workforce levels over time. With these forecasts, it will be possible to identify areas which would result in low staff retention, enabling the redeployment of staff into those areas.

Pro: The project would provide a clear and valuable impact on decision-making and the associated risks involved with staffing levels.

Con: Large datasets would be required to improve forecasting accuracy which could be difficult to find as publicly available and/or time consuming to prepare.

Justification for chosen project idea: It aligns closely with the directorate's five-year objectives and would provide a valuable resource to determine the impact of various workforce level scenarios across services and drive decision-based change.

SMART Objectives:

1. Source appropriate workforce datasets then clean and validate them.
2. Learn and practice basic statistical modelling in Python.
3. Develop a prototype model that forecasts workforce levels using historical trends.
4. Extend the model to simulate different recruitment scenarios.
5. Deliver a proof-of-concept model and supporting documentation.

1.3 – Question 3: Research

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The following resources will support the achievement of the project's aim and objectives:

1. 'Learn Time Series Forecasting in Python' by Marco Peixeiro, hosted by freecodecamp: introductory video to ensure basic understanding [5].
2. 'Python for Time Series Forecasting' by Jesus Lopez, hosted by LinkedIn Learning: in-depth course providing a practical guide to forecasting and visualisation [6].
3. *Forecasting: Principles and Practice, the Pythonic Way* by Rob Hyndman: textbook covering different forecasting models and assumptions [7].

2 – Task 2: Project Management

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The following task answer provides the proposed solution to the project aim, identifies required resources, outlines a project timeline, identifies risks and considers mitigation strategies.

2.1 – Question 1: Project Scope

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2.1.1 – Proposed Solution

The proposed solution is to design and implement a workforce forecasting and scenario-modelling tool that enables Senior Managers to simulate how different recruitment strategies affect NHS workforce levels over time. The tool will integrate historic rates of recruitment with projected rates of leavers to generate staffing forecasts.

2.1.2 – Required Resources

The following resources have been identified for the design and implementation of this proposed solution:

1. **Workforce Dataset:** publicly available workforce dataset from an NHS organisation that contains staffing levels, hires, and leavers data.
2. **Power Query (Excel):** to prepare the data for modelling.
3. **Visual Studio Code:** code editor to create statistical models in Python.
4. **Data Visualisation:** user interface where the staffing levels can be manipulated with slicers and output the resulting forecast.

2.1.3 – Project Timeline & Task Schedule

The following project timeline provides a structured schedule for the tasks required to take the project from initial ideation to final evaluation:

Project Stage & Key Tasks	Start Date	End Date
Ideation: explore several project ideas and select a suitable candidate.	19/05/2026	26/05/2026
Aim and Objectives: detail the aim and several SMART objectives for the chosen project.	26/05/2026	02/06/2026
Project Outline: clearly define the solution to the project's aim.	02/06/2026	09/06/2026
Project Scope: create a project timeline, identifying project stages and key tasks.	09/06/2026	16/06/2026
Project Planning: use a Gantt chart to visualise a schedule for the project's tasks.	09/06/2026	16/06/2026
Risk Analysis: identify potential risks and contingencies.	09/06/2026	16/06/2026
Development Methodology: research and select a suitable development methodology.	16/06/2026	23/06/2026
Design Phase: document two pieces of project design work.	16/06/2026	23/06/2026
Prototype Development: prepare the data then test different forecasting models for accuracy.	23/06/2026	07/07/2026
Implementation: create a visual solution which allows users to interact with the forecast and test various recruitment scenarios.	07/07/2026	14/07/2026
User Testing & Feedback: design a data collection	14/07/2026	17/07/2026

method and acquire feedback on project design and implementation.		
Finish Development Work: make final amendments based on user feedback.	14/07/2026	21/07/2026
Deployment Planning: evaluate deployment of forecasting tool.	14/07/2026	21/07/2026
Reflection and Report Writing: reflect on weekly progress sheets, evaluate what could have be done differently, and consider positive social impact of the project.	21/07/2026	28/07/2026

2.2 – Question 2: Project Planning

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The Gantt chart is “one of the most used planning and controlling tools in projects today” [8]. They provide “a quick and easily understood means for describing project activities” and are a “powerful method for implementing interactive approaches to scheduling” [9].

A Gantt chart was utilised to visually represent the project’s task schedule. As seen in Figure 1, the project was separated into five main tasks (yellow) and sub-tasks were identified under each main task (blue). This approach provides a high-level view of the project’s progression whilst affording granularity when specific sub-tasks require scrutiny.

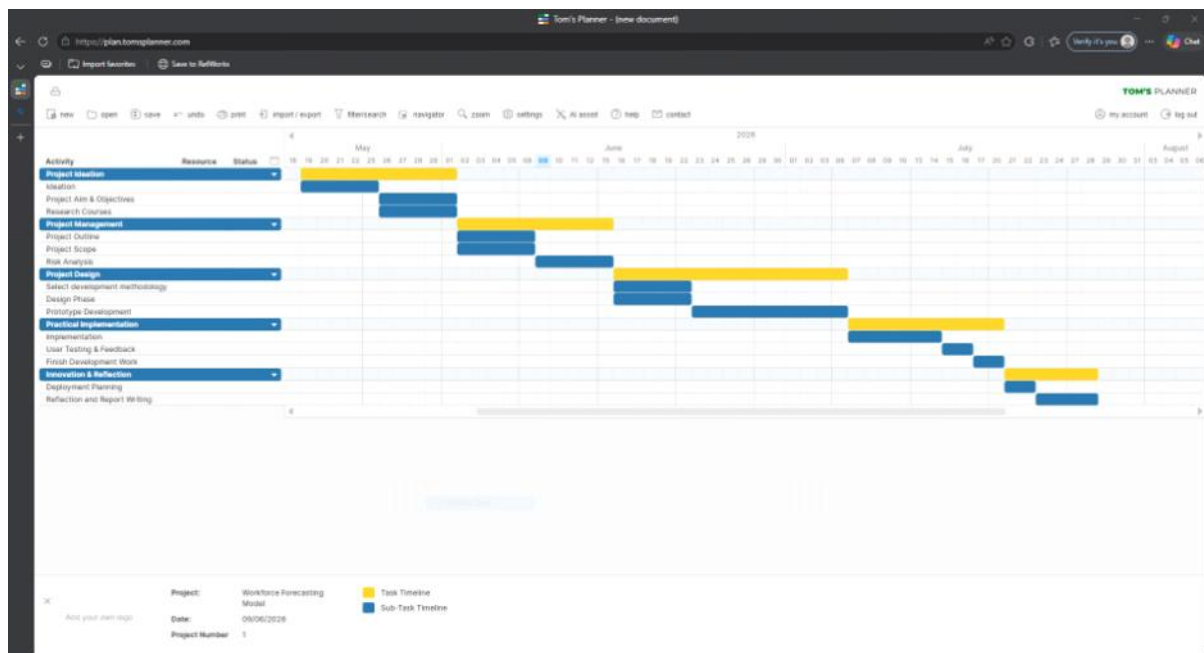


Figure 1: screenshot of Gantt chart of Project Timeline and Tasks.

2.3 – Question 3: Risk Analysis

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Risk Analysis is an essential tool for project managers to “identify, evaluate, and mitigate potential risks” and importantly it forms part of “an ongoing process that requires continuous monitoring and adaptation” [10]. Risk Analysis should occur “during the initiation phase of the project life cycle” to ensure proactive risk prevention and mitigation [11].

Risk No.	Risk	Impact	Contingencies
1	Data Quality & Accuracy	High	Data will be drawn from a publicly available NHS dataset submitted to and published by a government body, so a high level of accuracy can be inferred. Checking dataset for any fragmentation or errors.
2	Inaccurate Representations of Data	Medium	Adjustments could be made to normalise anomalies and flag periods of non-typical activity.
3	Bias Modelling of Workforce Behaviour	Medium	Modelling will be conducted separately for each staff group, recognising that they may exhibit seasonality (e.g. clinical streamlining).
4	Skill Set	High	The project requires statistical and data-modelling expertise, so review by other data analysts will ensure appropriate validation and interpretation.
5	Data Security	Low	The tool will use publicly available anonymised NHS data, so no sensitive information will be handled.
6	Incorrect Assumptions	High	Assumptions will be validated against historic trends and insights will be sought from subject-matter experts.
7	Overreliance on or Misuse of the Tool	Medium	Clear documentation and training will accompany the tool to ensure users interpret forecasting results correctly.

3 – Task 3: Project Development Method & Design Work

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The following task shows how the project was developed with an appropriate development methodology and includes supporting evidence from design work and initial implementation.

3.1 – Question 1: Project Development Method

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The System Development Life Cycle (SDLC) is a methodology that separates software development “into seven distinct phases”, from Planning to Maintenance [12]. “Agile software development approaches have transformed traditional systems engineering” and SDLC is recognised for its “alignment with agile principles, [and] practical applicability” [13]. The Agile methodology is “a flexible framework with several approaches, each suited for different project needs”, allowing “teams to adapt to changes quickly and provide customer value faster” [14].

The project will use a hybrid methodology of SDLC and Agile methods, specifically MoSCoW prioritisation and Kanban task management (see Section 3.2.1 and Appendix 1). SDLC will provide the formal project framework while an Agile approach will be adopted within each stage as new requirements and insights emerge. This hybrid methodology will ensure the project remains both structured and adaptable, which is essential when working with complex workforce data and predictive modelling.

3.2 – Question 2: Project Design Work

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The following sections document two pieces of design work for the project.

3.2.1 – Design Work 1: Project Requirements Specification

The following tables outline the requirements of the project, separating them into three-tiers based on the “well-established software application architecture that organizes applications into three logical and physical tiers” [15]. This approach aligns with the chosen development methodology because “each tier can be developed simultaneously [...] and can be updated and scaled as needed without impacting the other tiers” [15].

MoSCoW is one of “the most cited and utilized prioritization methods” and is “suitable for iterative development such as agile software development” [16]. In line with the chosen SDLC-agile hybrid methodology, the requirements specification utilises MoSCoW to prioritise project requirements as follows:

- M = Must Have
- S = Should Have
- C = Could Have
- W = Won't Have (This Time)

3.2.1.1 – Data Tier

This tier is concerned with where the project's data is stored and managed [15].

ID	Title	Priority	Description
PR-001	Data Input	M	Create a clear, accessible location for raw datasets to be manually added.
PR-002	Data Quality	M	Use Power Query to clean the datasets by removing inconsistencies (such as duplicate values) and merging separate reports into one unified table for modelling.
PR-003	Data Security	M	Apply appropriate file and folder access controls to prevent unauthorised modification of datasets.

3.2.1.2 - Application Tier

This tier is “the heart of the application” where information collected at the presentation tier is processed using business logic and data is manipulated in the data tier [15].

ID	Title	Priority	Description
PR-004	Forecasting Calculations	M	Build the statistical forecasting model that calculates future workforce levels over time using historic staffing levels, hires, and leavers data.
PR-005	Forecasting Assumptions	S	Incorporate key assumptions into the model (e.g. Retire & Returns) and any known staff

			group seasonality.
PR-006	Forecasting Accuracy Check	M	Use various methods to test the ongoing accuracy of the model (such as MAE) to determine how close the forecast is to known historical values and added values over time.

3.2.1.3 – Presentation Tier

This tier is “the user interface and communication layer of the application”, the main purpose of which is to “display information and collect information from the user” [15].

ID	Title	Priority	Description
PR-007	Dashboard Visualisation	M	Create a clear visual presentation of results with interactive charts, enabling Senior Managers to view staffing levels based on historic data.
PR-008	Scenario Modelling	M	Develop an intuitive user interface for scenario modelling, allowing users to adjust recruitment percentages for staff groups and immediately generate forecasts of staffing levels over time.
PR-009	Reporting Function	S	Provide a function that allows users to export forecast summaries for wider organisational use.
PR-010	Deficient/Excessive Staffing Levels Alert	C	Alert users when their recruitment scenario is forecast to produce deficient/excessive staffing levels and return a list of departments where this would occur.

3.2.2 – Design Work 2: Wireframe Design

The following is a wireframe design for the user-interface dashboard which will display the forecasting model’s output and provide the ability to test recruitment scenarios.

The wireframe shows a dashboard titled "Workforce Forecasting & Scenario Modelling Tool". It includes a header with a logo placeholder and an "Export as..." button. The main content area is divided into several sections:

- Scenario Controls:** Contains input fields for "Date Selections" (Historic Data Range and Projected Date), a "Staff Group Selection" dropdown, "Recruitment Settings" (Average Recruitment and Adjusted Projected Recruitment slider), and "Attrition & Mobility Rates" (Leavers, Retire & Returns, and Contract Changes).
- Workforce Levels Forecast:** A large central area, currently marked with a large 'X'.
- Projected Staffing Levels Matrix:** A table with columns: Department, Staff Group, Baseline Projected Level, and Adjusted Projected Level.
- Scenario Alerts:** Two sub-sections: "Deficient Staffing Levels" and "Excessive Staffing Levels", each with a table showing Department and Deficit/Excess.

The footer contains detailed guidance documents, support contact information, and the last updated date.

Figure 2: Wireframe Design for user-interface dashboard.

The user-interface dashboard will contain the following sections:

1. **Header:** Health Board logo, dashboard title, and export function.
2. **Scenario Controls:** user inputs for historic data range and model's projected date, staff group selection to populate Average Recruitment and Attrition & Mobility Rates, and user-adjustable projected recruitment based on average recruitment rate.
3. **Workforce Levels Forecast:** illustrative output of historic staffing levels and forecast based on Recruitment Settings.
4. **Projected Staffing Levels Matrix:** projected staffing levels with baseline/unadjusted and adjusted recruitment levels.
5. **Scenario Alerts:** departments with excess and deficit staff based on user-input scenario parameters.
6. **Footer:** guidance document including forecasting model details, further support contact details, and date last updated.

Below is considered the viability of different data visualisation tools:

- **Power BI:** widely available in the Health Board, however Python output is rendered as static images that cannot be manipulated by the user [17].
- **TabPy:** a framework in Tableau with full Python support, however not currently available within the Health Board [18].
- **Excel:** while more rudimentary, it is accessible to all staff within the Health Board and supports open-source Python libraries [19].

3.3 – Question 3: Evidence of Initial Practical Implementation

The following screenshots document some initial practical implementation work.

3.3.1 – Screenshots of ARIMA and SARIMA forecasting models in Jupyter notebook

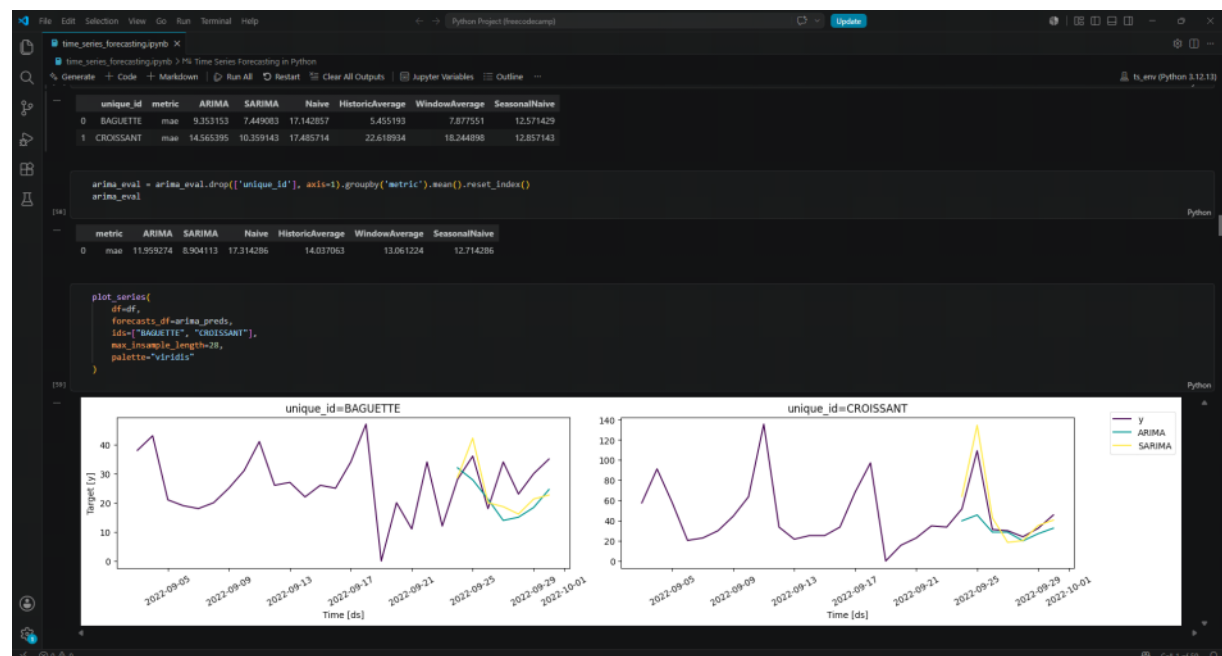


Figure 3: screenshot of Jupyter notebook in Visual Studio Code (VSC) where mock data was used to generate ARIMA and SARIMA models in Python [5].

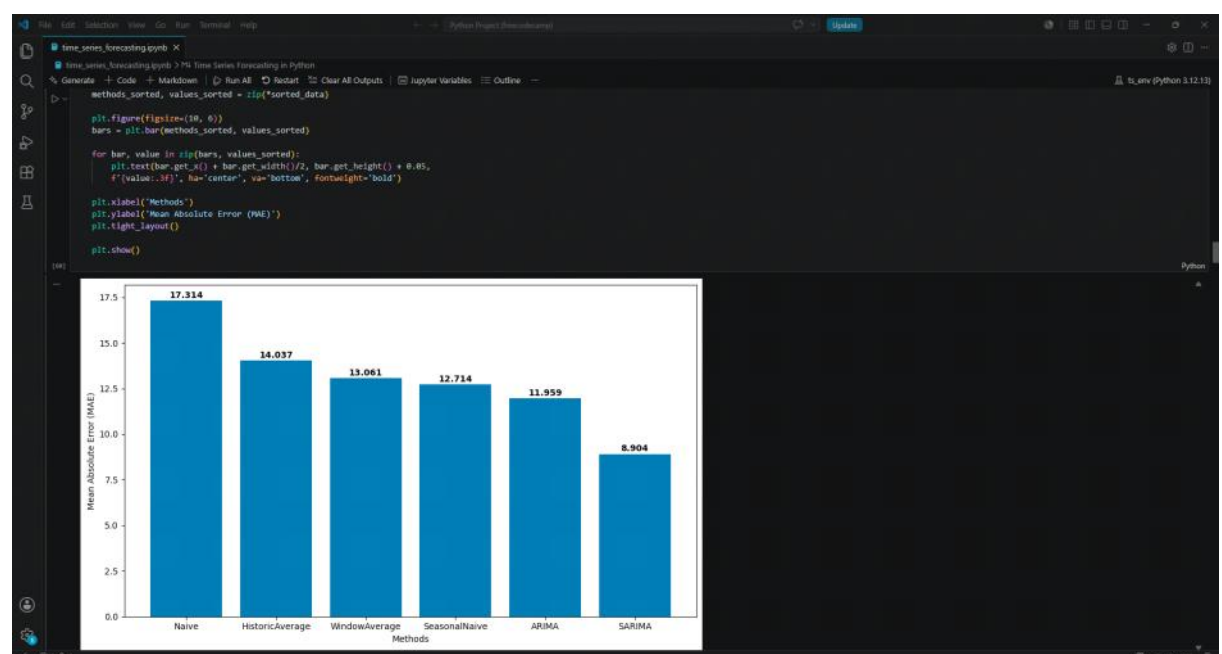


Figure 4: screenshot of Jupyter notebook in VSC where Mean Absolute Error (MAE) was used to test the accuracy of different forecasting models in Python [5].

3.3.2 – Screenshots of Excel Power Query's editor where dataset is cleaned and transformed for modelling

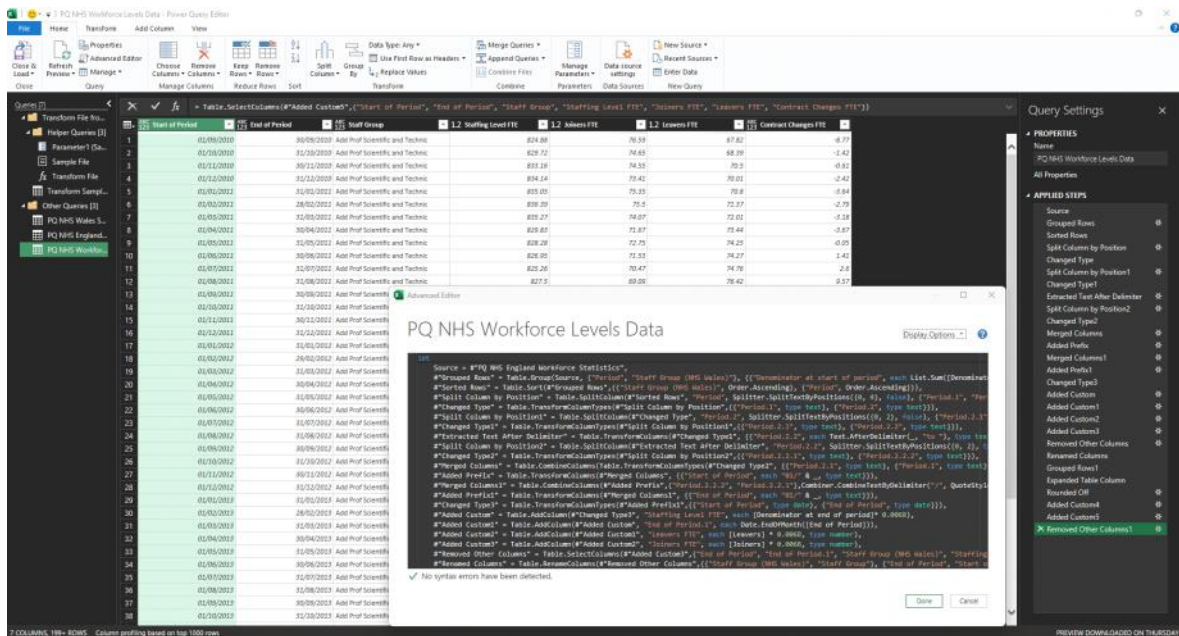


Figure 7: screenshot of Excel Power Query's editor where workforce dataset is transformed and prepared for modelling.

3.3.3 – Screenshot of Excel Power Query's Dependencies demonstrating links between datasets

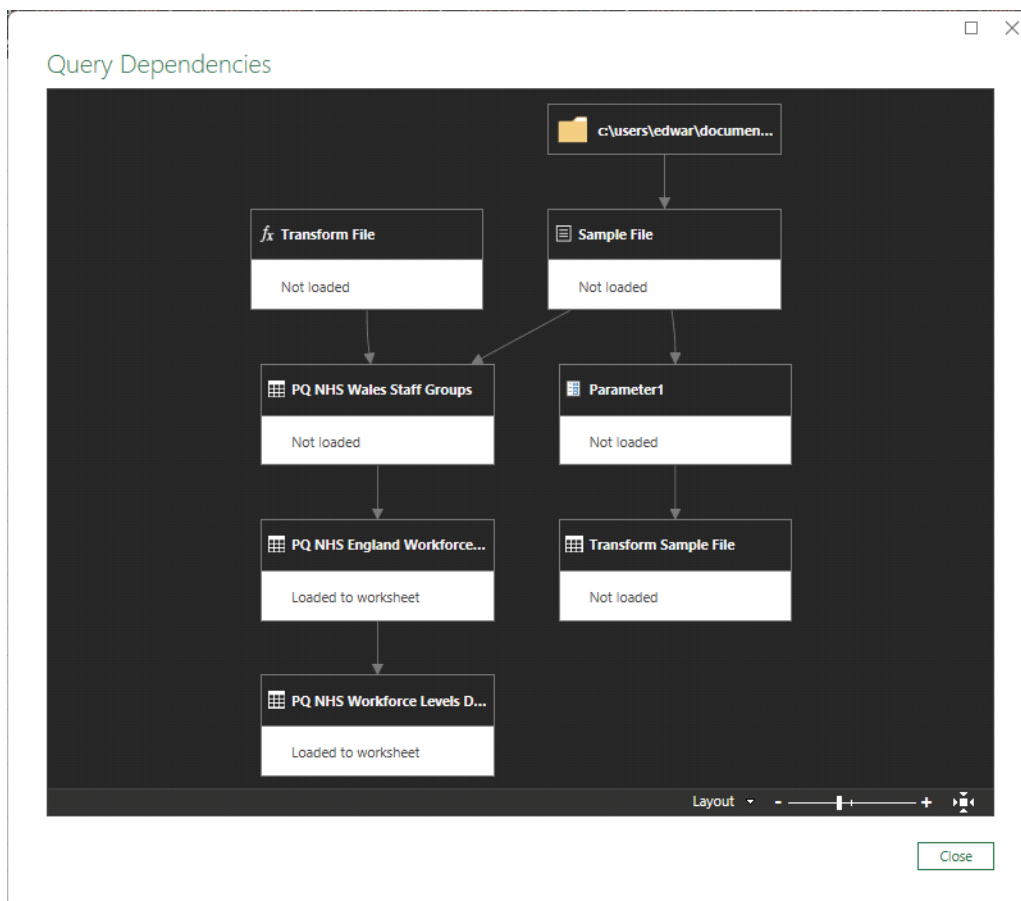


Figure 8: screenshot of the data dependencies in Excel Power Query.

3.3.4 – Screenshots of testing ARIMAX and user-adjustable variables with Excel's integrated Python libraries

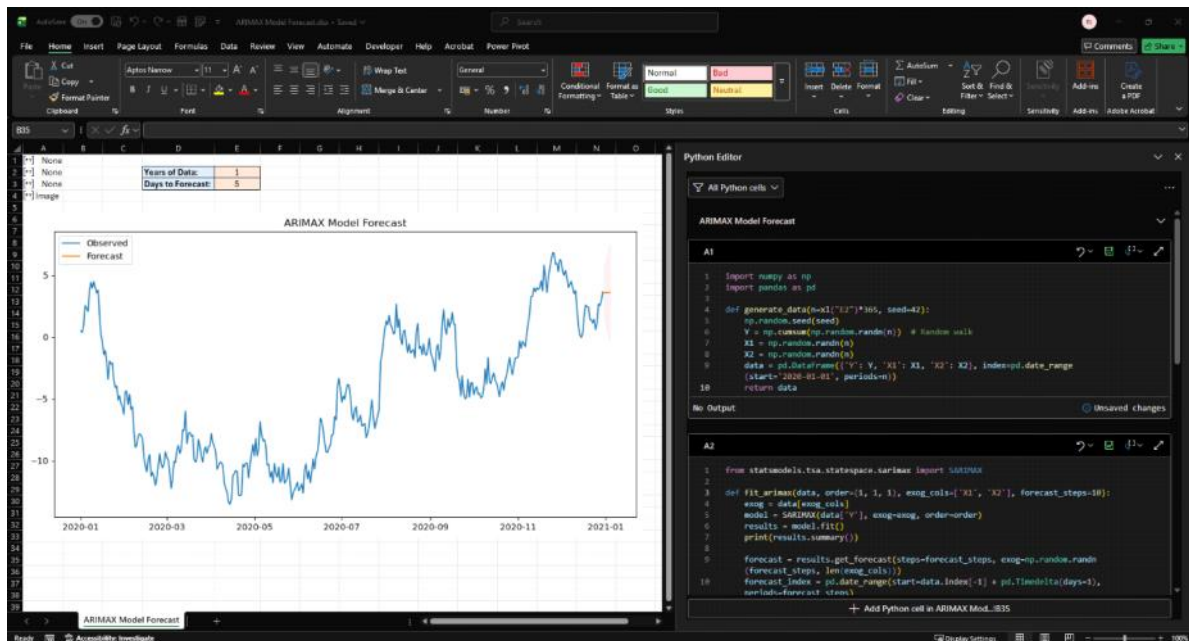


Figure 9: screenshot demonstrating the use of Python libraries in Excel to produce ARIMAX forecasting results using randomly generated data values [20].

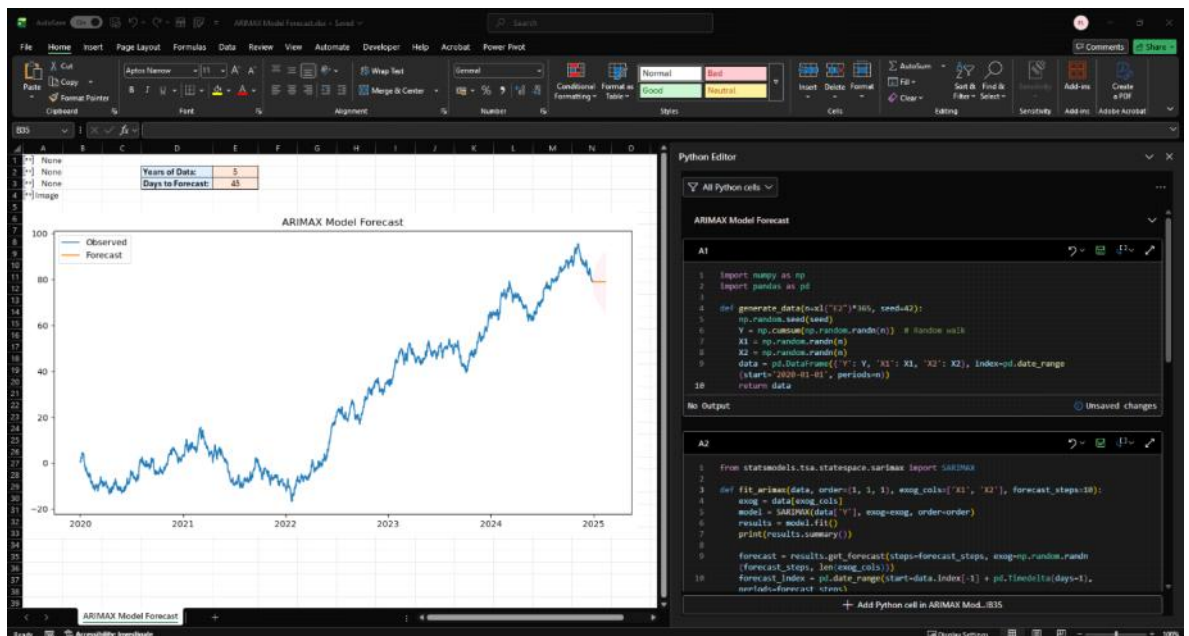


Figure 10: screenshot demonstrating user-adjustable variables (amount of historic data and number of days to forecast) in Excel.

References

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Appendix 1

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Below is evidence of use of a Project Management tool, specifically Kanban boards on Trello.com [21].

Kanban boards are a suitable addition to the project because the required tasks are not all known at the beginning, and new tasks will undoubtedly emerge as further knowledge is gained. Kanban boards provide the necessary flexibility whilst providing visibility of the project's progress, and this could be completed at a high level for the entire project:

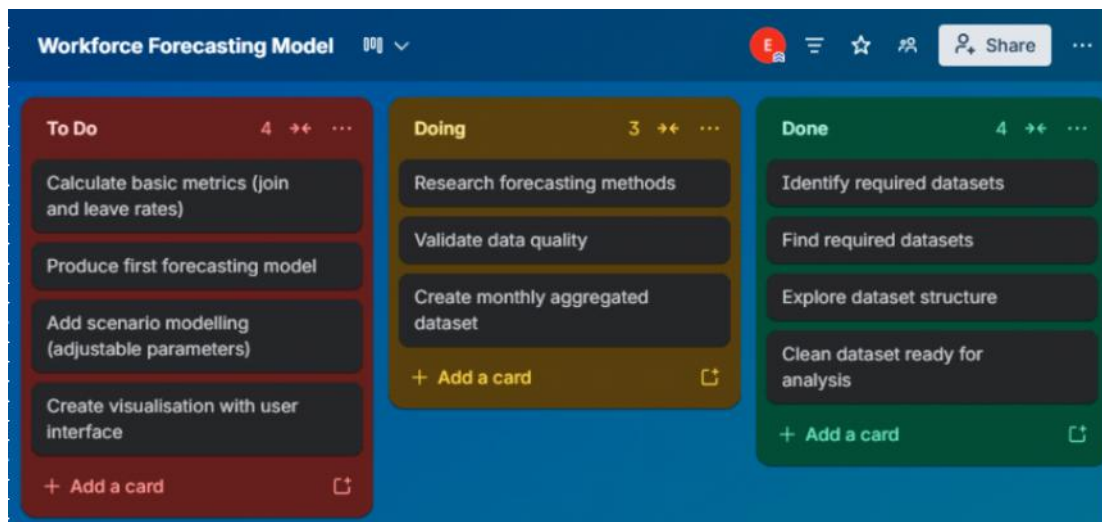


Figure 11: screenshot of populated Kanban board.

Kanban was originally created by Toyota “to control inventory levels, [and] the production and supply of components” and is referred to as a “Material Flow Control mechanism” because it controls the quantity and time of the “production of necessary products” [22]. However, variations of the Kanban system have been created to adapt it to the specific realities of companies and projects “in line with modern production logic” [22].

An adaptation that could be made for this project would be to use a Kanban board for each stage of the chosen SDLC framework which would allow the tasks to be separated into the following categories (see 3.1 – Question 1: Project Development Method):

1. Planning
2. Analysis
3. Design
4. Development
5. Testing
6. Deployment
7. Maintenance

For example, at the Analysis stage, the tasks of the below Kanban board clearly identify that the focus of this stage is to find, prepare, and understand data for modelling requirements:

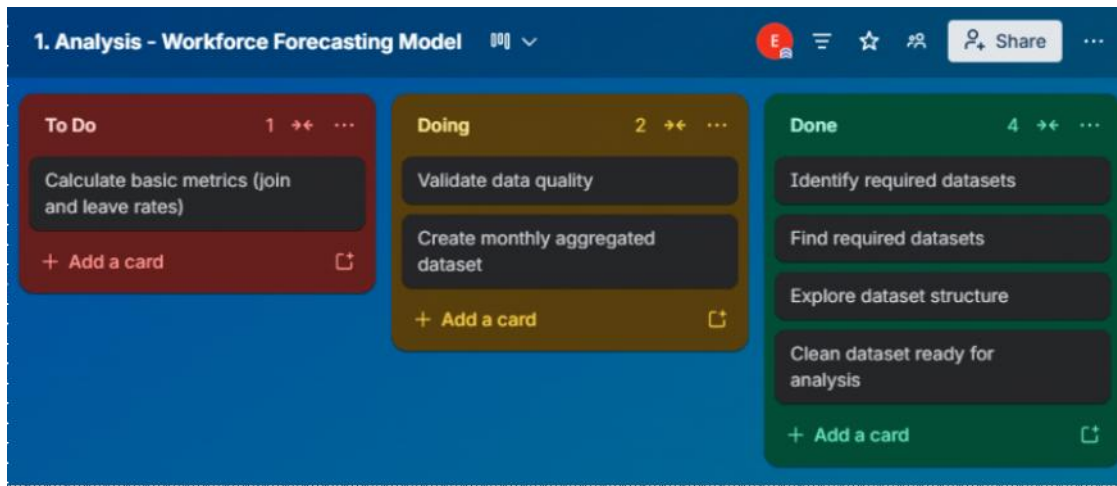


Figure 12: screenshot of Kanban board adapted with SDLC development methodology.

Appendix 2

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Below is Continuing Professional Development (CPD) evidence of engagement with an online certified course related to the assignment.

freecodecamp

'Learn Time Series Forecasting in Python' by Marco Peixeiro, hosted by freecodecamp [5].



Figure 13: screenshot of title page for online course 'Learn Time Series Forecasting in Python'.

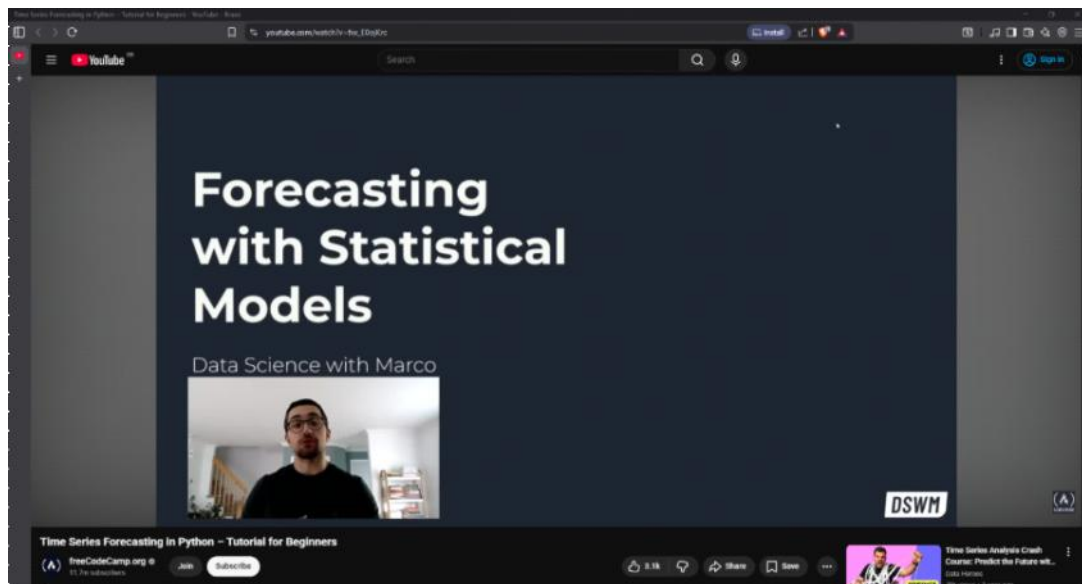


Figure 14: screenshot of video from online course 'Learn Time Series Forecasting in Python'.

LinkedIn Learning

'Python for Time Series Forecasting' by Jesus Lopez, hosted by LinkedIn Learning [6].

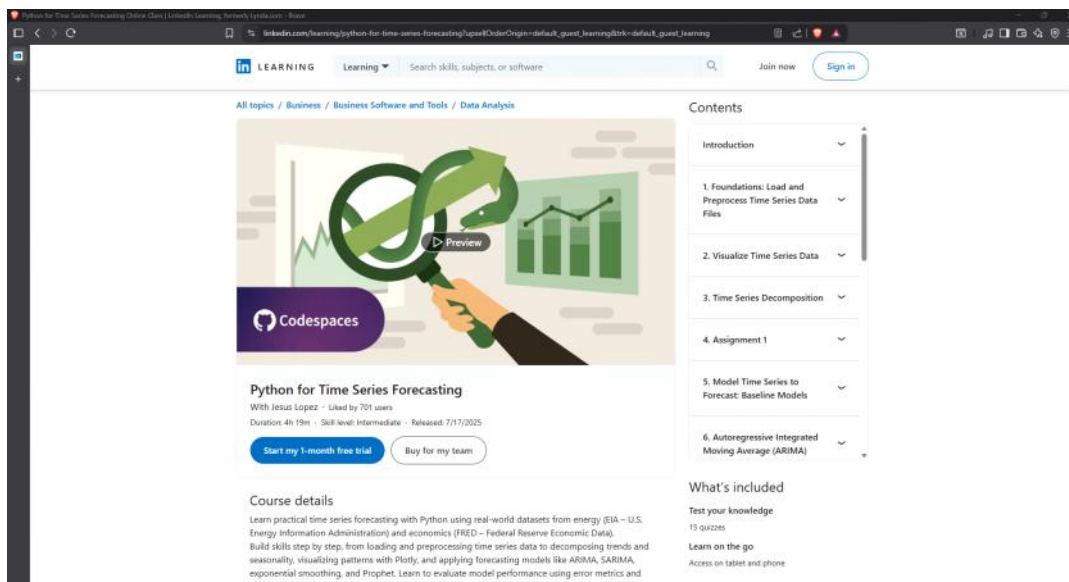


Figure 15: screenshot of title page for online course 'Python for Time Series Forecasting'.

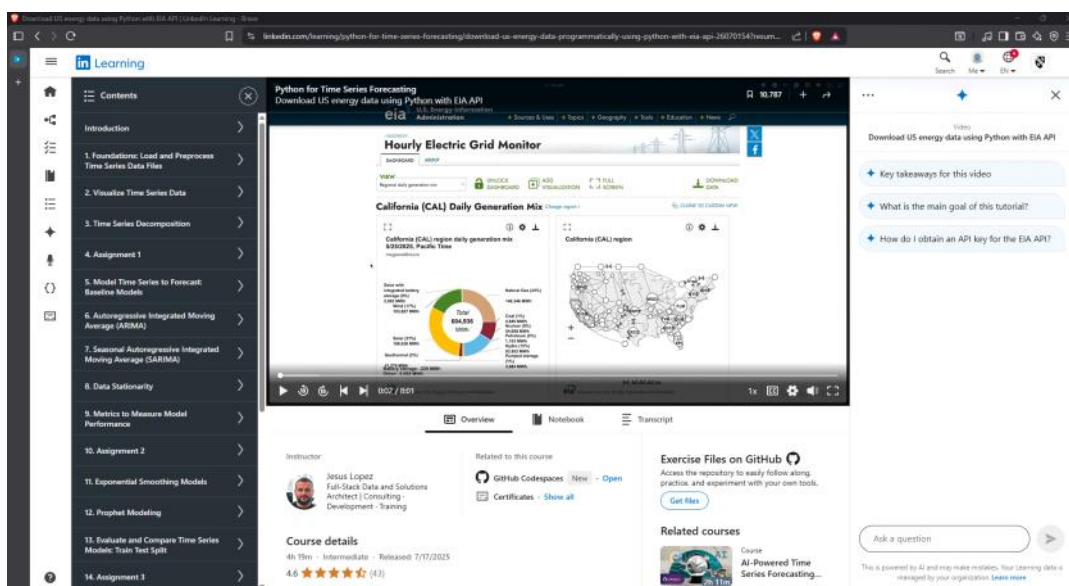


Figure 16: screenshot of example module from online course 'Python for Time Series Forecasting'.

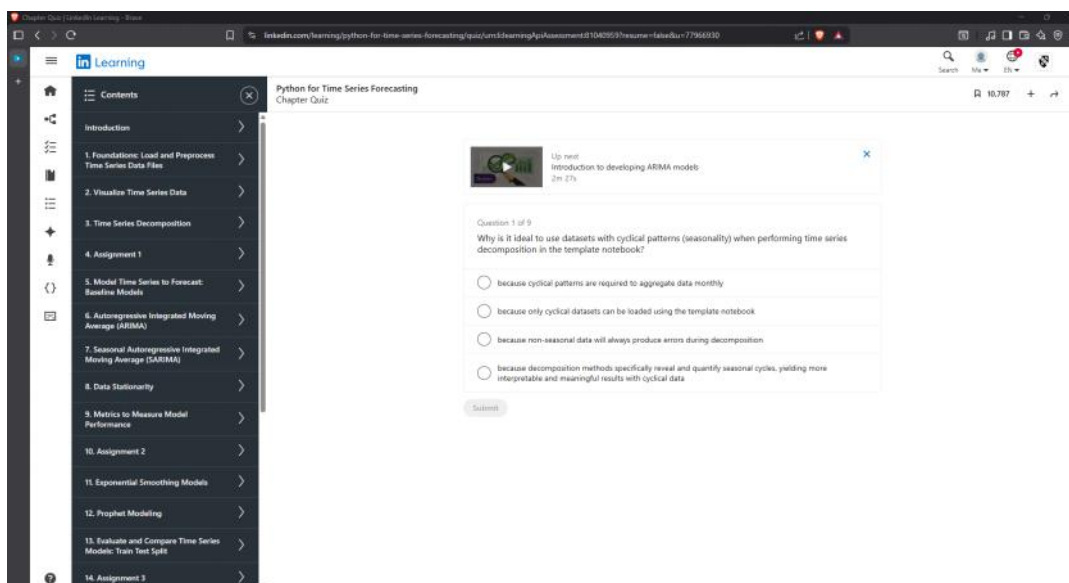


Figure 17: screenshot of example quiz to test knowledge in online course 'Python for Time Series Forecasting'.