

Course4U

Build a Personalized Online Course Recommender System with Machine Learning

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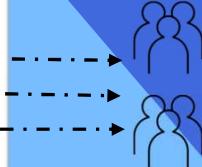
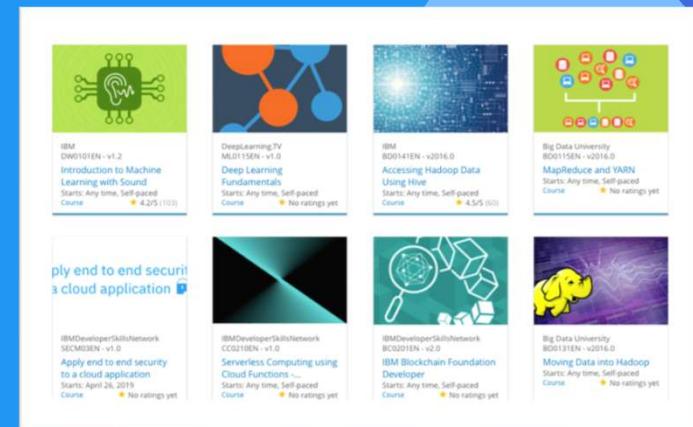


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Executive summary

➤ We use PACE framework

Data Analysis PACE Steps:

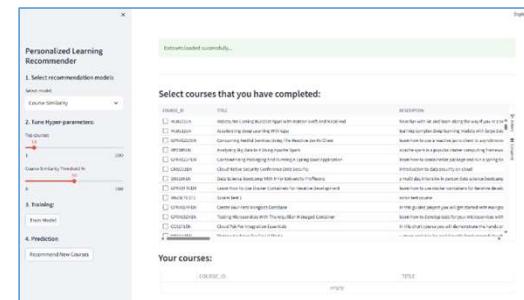
1.  Plan/Prepare - import the relevant libraries and data
Align project with business needs, requirements and contraints. Select an approriate machine learning model based on the problem and business context. KDD: Selection, Data Wrangling (Pre-processing and Transformation).
 2.  Analyze - Explaratory Data Analysis (EDA)
Understanding data for accurate predictions, focus on the response variable (what the model predicts) and leverage exploratory data analysis to uncover patterns and address irregularities. KDD: Data Mining.
 3.  Construct - model
Construct and evaluate model. KDD: Evaluation.
 4.  Execute - share
Interpret model and share the story. KDD: Communicate to stakeholders.

CO-V-FAST Principles: Clear/Clean/Communication/Collaboration/Correction, Objective, Valuable, Focus, Agile, Scientific and

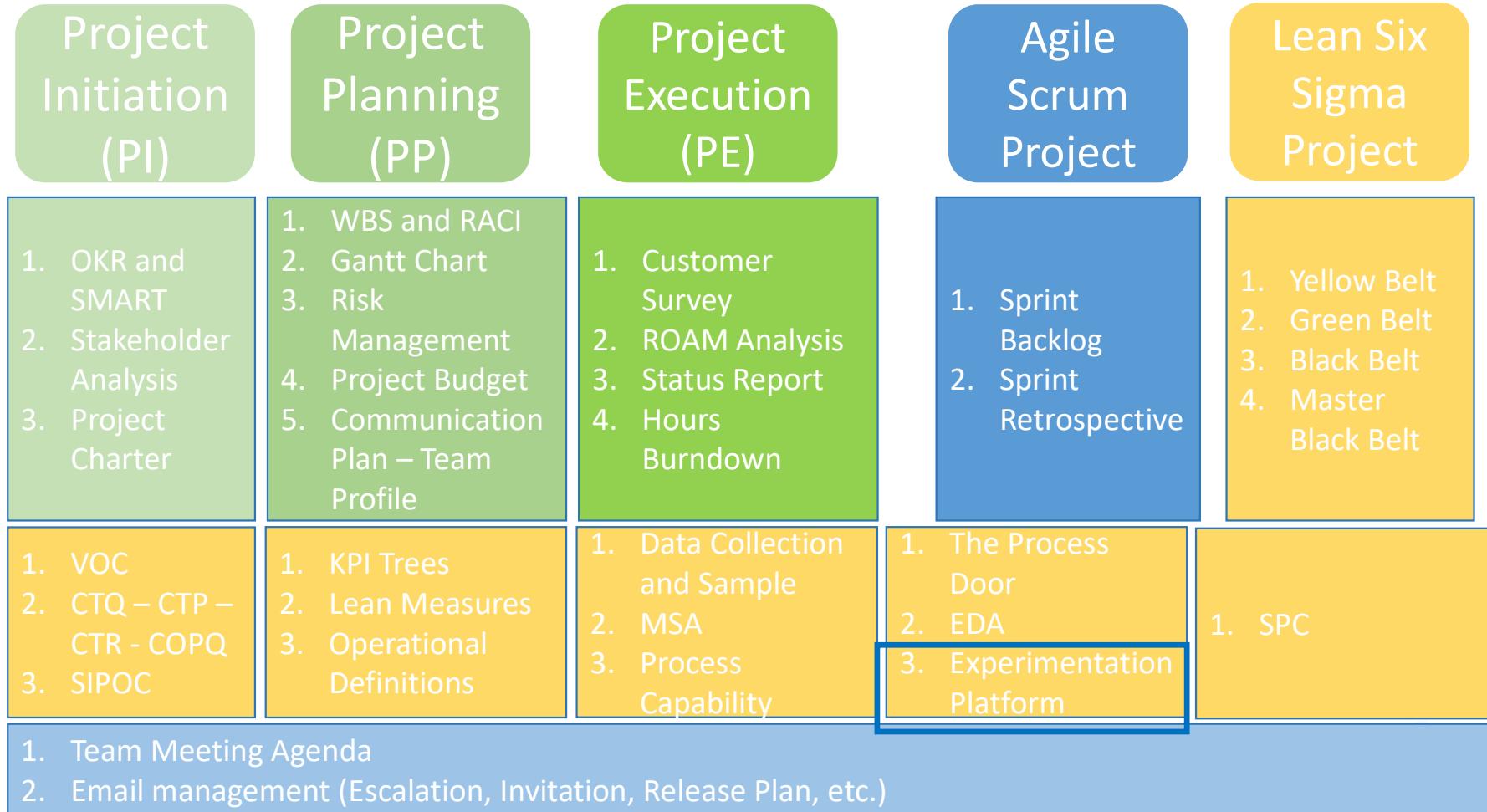
Time-bound/Trustworthiness

➤ The recommender system apps

- ## 1. Recommender system with supervised and unsupervised learning



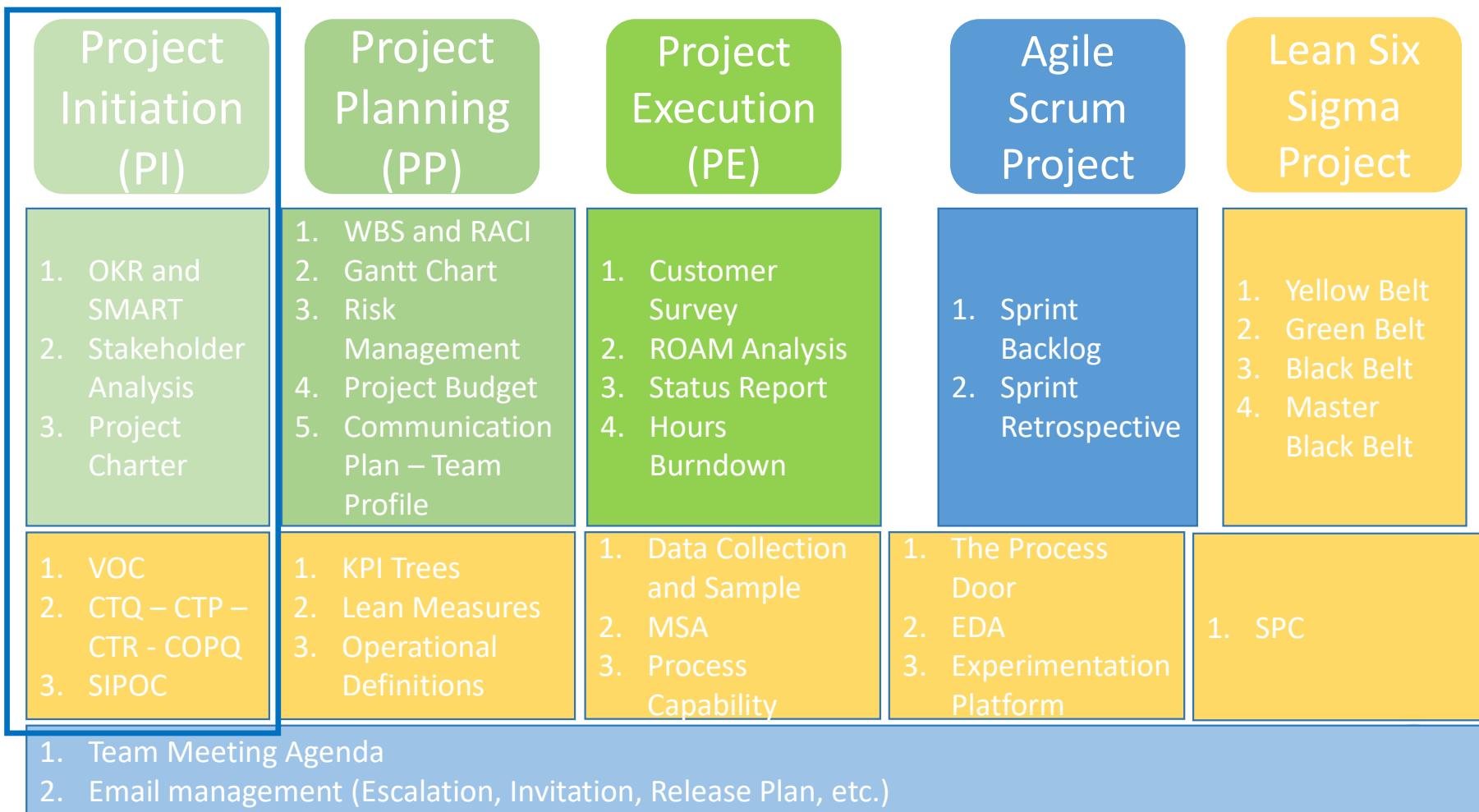
Project Management Flowchart



Plan

Project Initiation : Business case and Objective

Project Management Flowchart



Plan

Business Case

Course4U growing. having reached ~34.000 users and over 233.000 enrollments in a year.

Opportunity/Problem Statement:

- 25.000 users (**70%**) who have enrolled in fewer than **10 courses**.
- Among them. **8.000** users have enrolled in only a single course.
- Only less than **45%** of the total courses have been chosen by users.
- Encourage existing users to enroll in more than **10 courses**.
- Acquiring new users.

Goals

Maximize user engagement, increase revenue streams, and solidify Course4U's position in the online education market.
257.500 enrollments next year.

- **Campaign Objective:**
Conversion/Enrollments
- **KPI:**
Number of enrollments
(Tracked via online conversions and mobile - SDK)
- Primary metric:**
 - Increase course **enrollments** by 10% by identifying and offering more engaging and relevant courses to**learners**.
(courses enrolled in the list from 45% to > 50%)

Voice of Customer (VoC)

- What **features** are important to our customers (B2C, B2B)?
- How do our customers **prioritize** their courses selection?
- Reasons behind the courses selection?
- Reasons behind the payment selection?
- What courses are considered good quality and bad quality?

VoC :

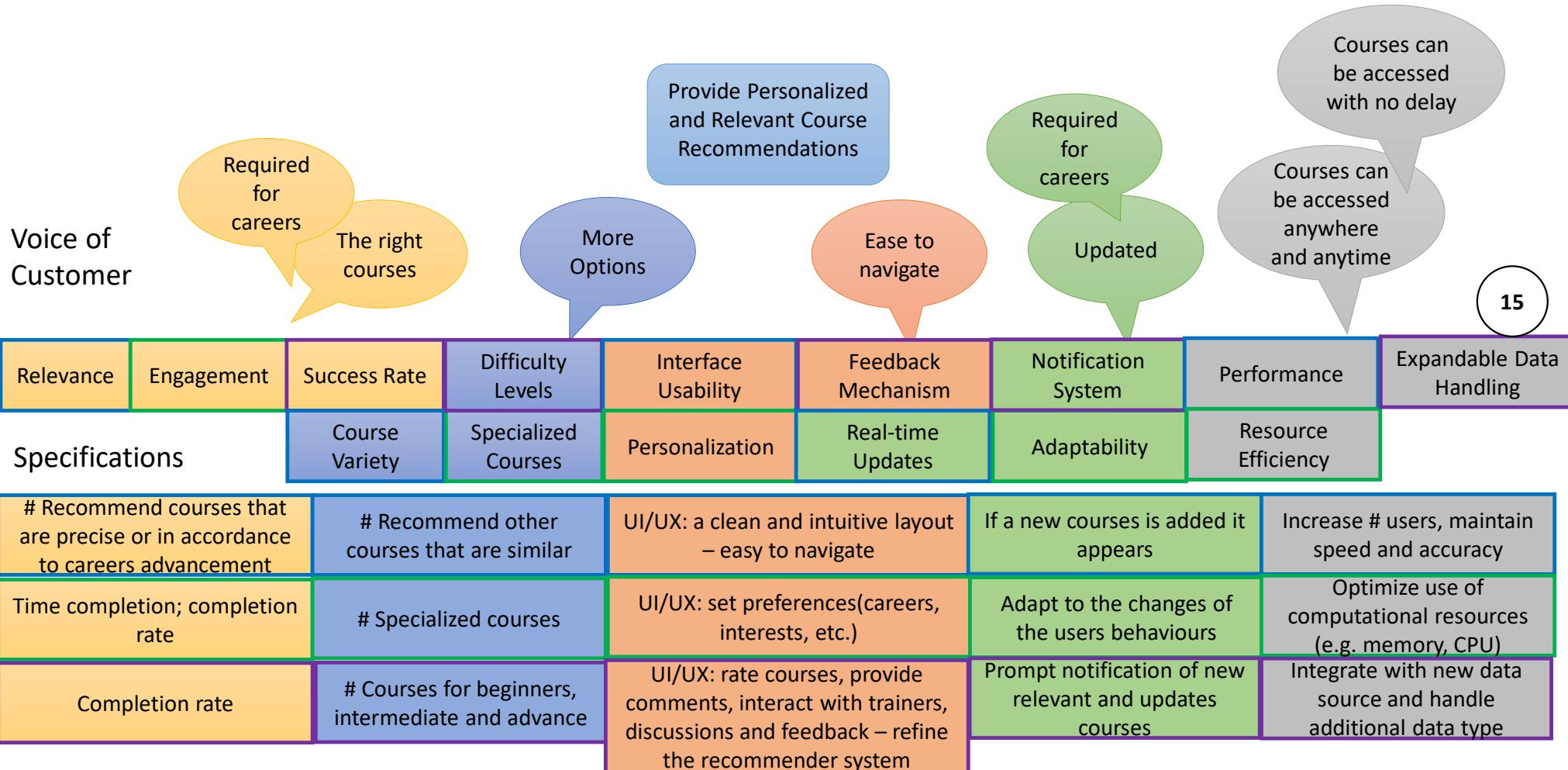
We do not have a formal budget for customer research, we utilize the customers feedbacks and the vast amounts of market research available in the internet.

Action Plan:

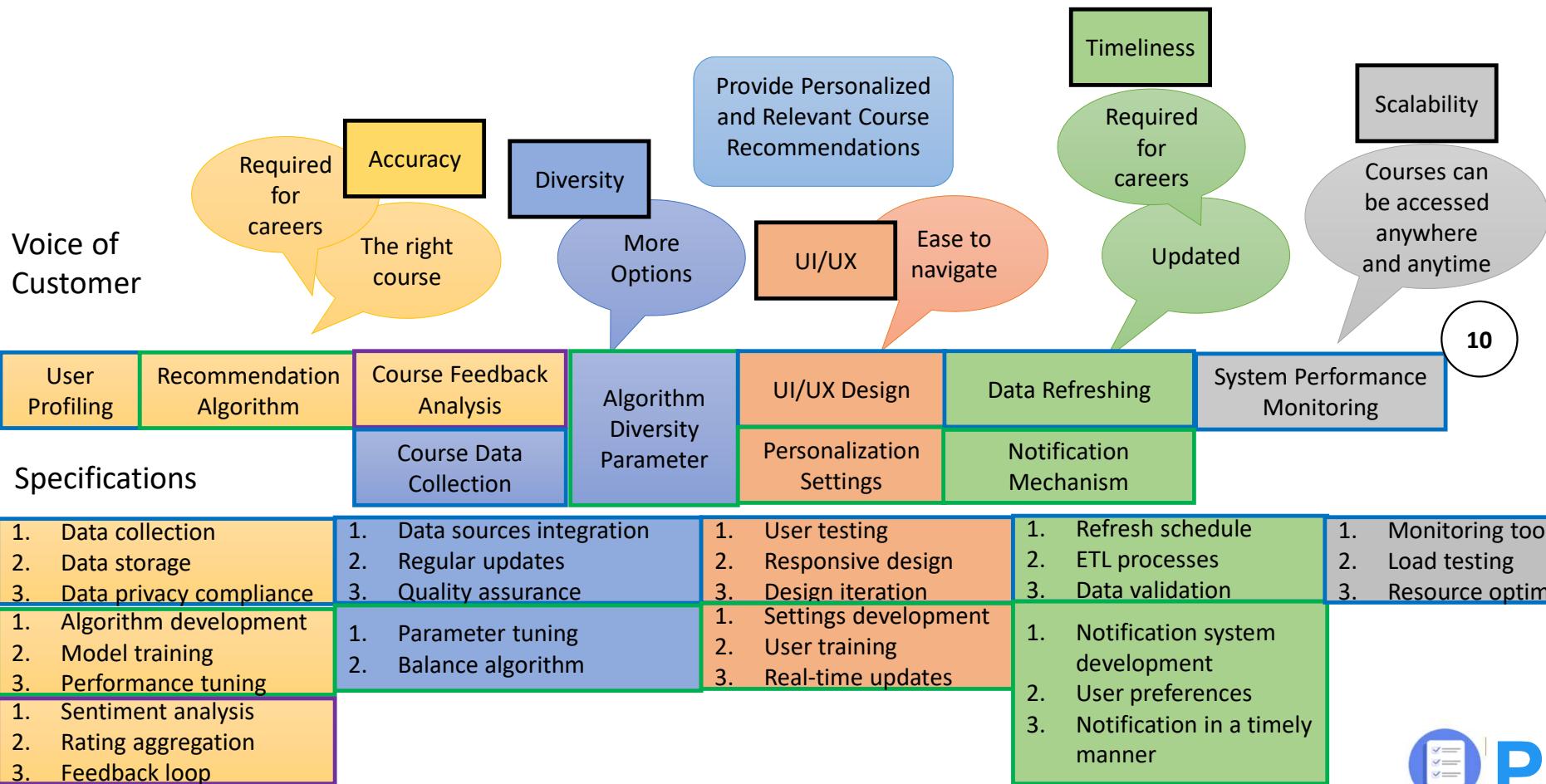
Meet the customers, generate insights from feedbacks (e.g. course reviews, course ratings) and online questionnaire.



Critical to Quality (CTQ)

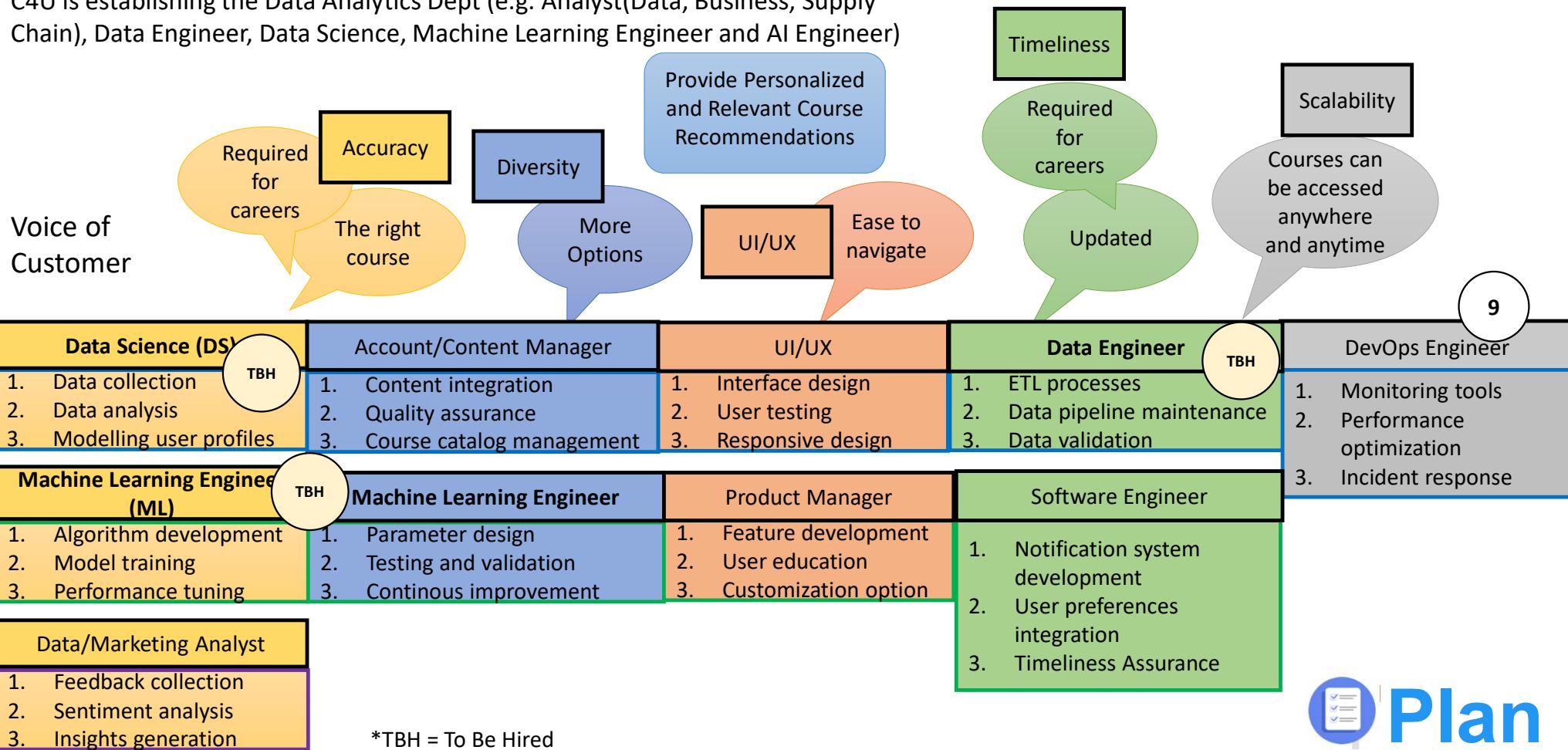


Critical to Process (CTP) – in Production



Critical to Resources (CTR) – in Production

C4U is establishing the Data Analytics Dept (e.g. Analyst(Data, Business, Supply Chain), Data Engineer, Data Science, Machine Learning Engineer and AI Engineer)





OKR – Strategic (QSCP)

O1 Make it easy to choose course in our C4U Web and Apps via course recommender system.	O3 Promote course recommender system as to assist user in their study journey.
KR1 Increase the enrolments from current users with more than 10 enrolments from 30% to 35%, from 25,000 users with fewer than 10 courses, 1,250 (5%) users have more than 10 courses.	KR1 Generate conversion from marketing ads, active users min. 2,250 user/month (average price \$125)
KR2 Revenue increase by 10% compare last year, min \$ 280,500/month (Q3). Active users from 2,040 to 2,250 users/month.	KR2 % click-through rate from banner ads on social media (A/B Testing) increase 2 times compared control group.
KR3 New users increase by 10%. By the end of this year we have 3,500 new users.	KR3 6 press pieces published in relevant print and online publications
O2 Provide a reliable and consistent course recommender system and its service.	KR4 Employ collaborative filtering or content-based filtering algorithms. Batch processing to provide recommendations. Later, upgrade to real-time from stream processing to continuously update recommendations based on the latest user behaviour when the users reach 100K.
KR1 90% of recommender system meet security standards at monthly audits	O4 Actively and meaningfully engage the user to generate buy-in and project support.
KR2 95% of integration with the web/app backend to serve recommendations to users.	KR1 Establish a YouTube channel, Total 400 attendees of 3 live YouTube focused on courses awareness and transit talks introducing recommendation system.
KR3 Wait times decrease by 10% within two months of launch	KR2 75% of Users surveyed before launch
	KR3 70% of top users participate in user outreach program (e.g. webinars, YouTube Live Sessions, etc.)

OKR - Prod



O1 Improve the relevance and engagement of course recommendations

KR1 Increase the **relevance score of recommendations to 90%** by the end of Q4.

KR2 Achieve a **15% increase in the average time users spend** on recommended courses by the end of Q3.

KR3 Boost the **course completion rate** for recommended courses to 75% by the end of Q3.

O2 Enhance the diversity of courses offered to users.



KR1 Increase the **Course Diversity Index** to an average of 6 distinct topics per user by Q3.

KR2 Ensure that **at least 25% of recommendations include niche courses** by the end of Q2.

KR3 Achieve a **balanced recommendation mix** with 30% beginner, 40% intermediate, and 30% advanced courses by Q4.

O3 Optimize the user experience of the course recommendation interface.

KR1 Increase the **User Satisfaction Score** to 4.7/5 by Q4.

KR2 Ensure **95% of recommendations align** with user preferences by Q3.

KR3 Utilize **80% of user feedback** to make **iterative improvements** to the system by the end of Q4.



O4 Improve the timeliness and adaptability of the recommendation system.

KR1 Reduce the **Recommendation Update Time** to under 30 minutes by Q2.

KR2 Achieve a **Notification Response Rate of 60%** within 24 hours by Q3.

KR3 Ensure **95% of user behaviour changes** are reflected in updated recommendations within 12 hours by Q4.

O5 Ensure the recommender system scales efficiently with growing demand.

KR1 Maintain 99.9% **System Uptime** as user base doubles by the end of Q3.

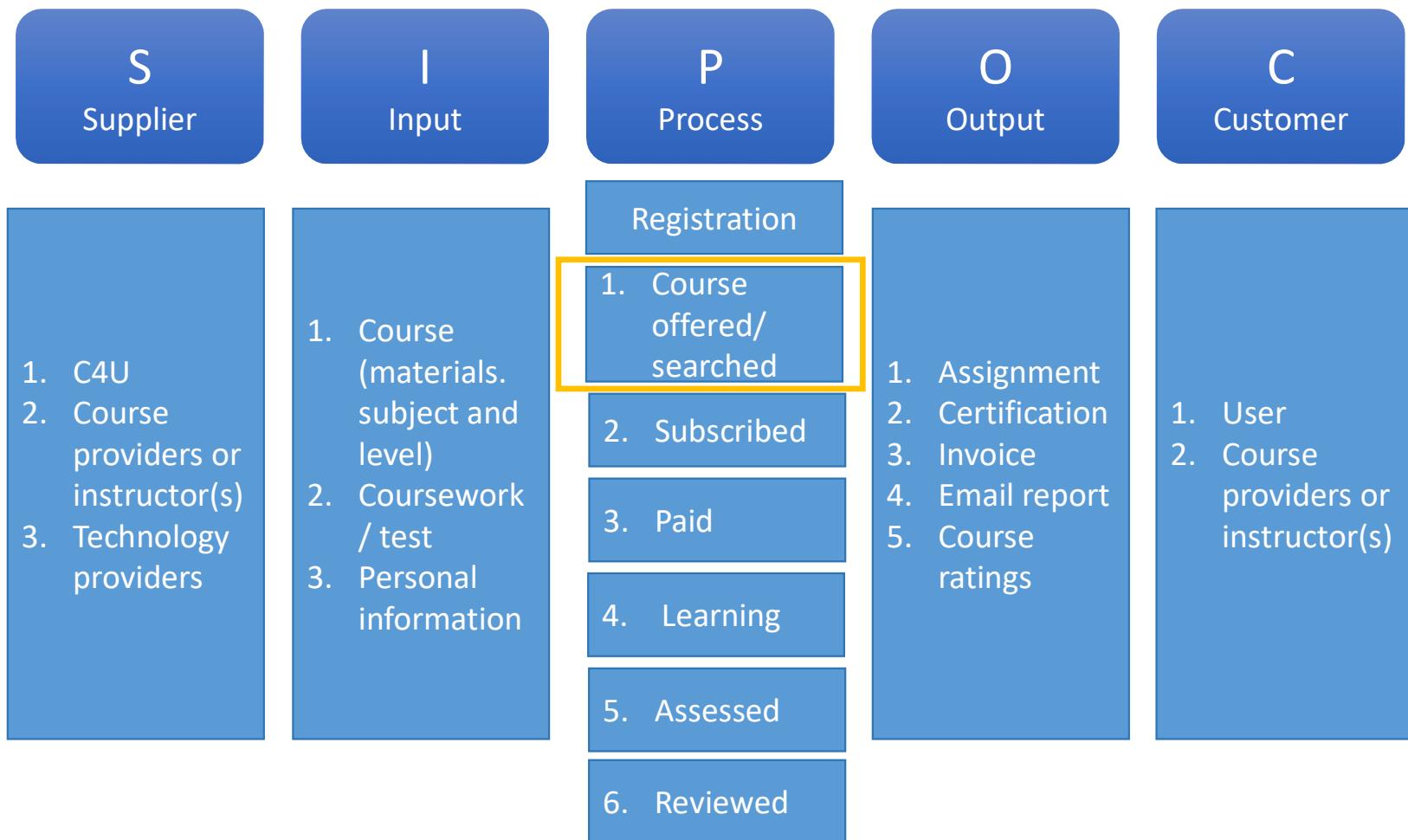
KR2 Keep **Latency** under 1.5 seconds per query even as the course library expands by 50% by Q4.

KR3 Successfully **support up to 40,000 users** with no performance degradation by the end of Q4.





SIPOC Analysis



Project Team



Project Team

Project Sponsor: Director of Customer Data

Project Lead: Head of Data Science and Machine Learning

Project Team: Director of Procurement, API Strategist, Data Warehousing Specialist, Data Governance Manager, Data Analyst, Director of IT, Project Manager, Product Manager, Marketing Promotion Manager, Financial Analyst, HR Recruitment and Training

Additional Stakeholders: Account Manager, Sales and Marketing Director, Investors

Account/Content Manager
1. Content integration
2. Quality assurance
3. Course catalog management

Machine Learning Engineer
1. Parameter design
2. Testing and validation
3. Continuous improvement

UI/UX
1. Interface design
2. User testing
3. Responsive design

Product Manager
1. Feature development
2. User education
3. Customization option

DevOps Engineer
1. Monitoring tools
2. Performance optimization
3. Incident response

Data Science
1. Data collection
2. Data analysis
3. Modelling user profiles
Machine Learning Engineer
1. Algorithm development
2. Model training
3. Performance tuning
Data/Marketing Analyst
1. Feedback collection
2. Sentiment analysis
3. Insights generation
Data Engineer
1. ETL processes
2. Data pipeline maintenance
3. Data validation
Software Engineer
1. Notification system development
2. User preferences integration
3. Timeliness Assurance

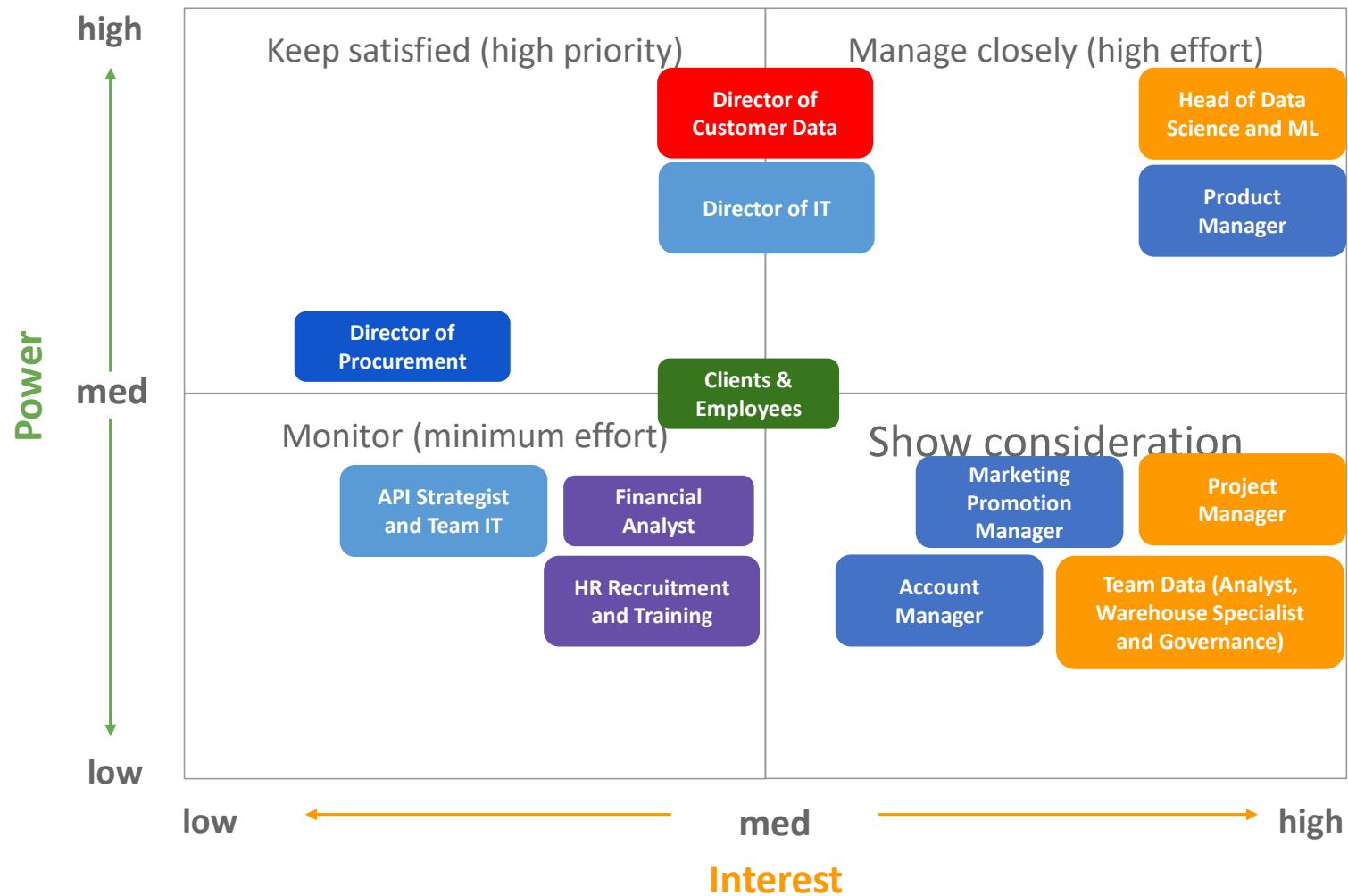
Understanding stakeholders (stakeholder analysis)

Stakeholder	Role (Related to project)	Involvement	Impact	Power or Influence (H/M/L)	Interest (H/M/L)	Engagement
Director of Customer Data	Project sponsor	Makes high-level decisions; serves as team resource	Wants the project to succeed. No resistance.	H	M	Communicate regularly, but not daily. Ask questions and give updates.
Head of Data Science and Machine Learning	Project leader	Knowledge of data science and machine learning	Invested in the project as a team leader. Possible resistance if data science and machine learning role is affected.	H	H	Communicate daily as project leader
Existing Clients and Employees	Office C4U customer	Can give feedback on the customer experience	Some highly interested; others less so. Resistance only if Plant Pals affects main product line.	M	M	Communicate as needed to inform and get feedback.
Director of Procurement	Project team member	Procurement support	Invested in the project as a team member. Little impact at present. Project could affect their investment budget allocation.	M	L	Communicate daily as project team member.
Director of IT	Project team member	IT support	Invested in the project as a team member. Little impact at present. Project could affect their IT infrastructure	H	M	Communicate daily as project team member.

Understanding stakeholders (stakeholder analysis)

Stakeholder	Role (Related to project)	Involvement	Impact	Power or Influence (H/M/L)	Interest (H/M/L)	Engagement
Product Manager	Project team member	Knowledge of website design and plants; strong relationships with OG employees	Invested in the project as a team member. Possible resistance if Product Manager role is affected.	H	H	Communicate daily as project team member.
Team Data	Project team member	Knowledge of Big Data; strong relationships with OG employees	Invested in the project as a team member. Possible resistance if Team Data role is affected.	H	H	Communicate daily as project team member.
Marketing Promotion Manager and Account Manager	Project team member	Knowledge of Big Data; Establish marketing plan and campaign for project	Invested in the project as a team member. Possible resistance if Marketing role is affected.	H	H	Communicate daily as project team member.
API Strategist and Team IT (UI/UX, DevOps and Software Engineer)	Project team member	API support	Invested in the project as a team member. Little impact at present. Project could affect the API management.	L	L	Not directly involved. Keep updated on progress and performance.
Financial Analyst	Project team member	Financial support	Invested in the project as a team member. Little impact at present.	L	L	Not directly involved. Keep updated on progress and performance.
HR Recruitment and Training	Project team member	Recruitment and Training support	Invested in the project as a team member. Little impact at present.	L	L	Not directly involved, but should be updated before launch

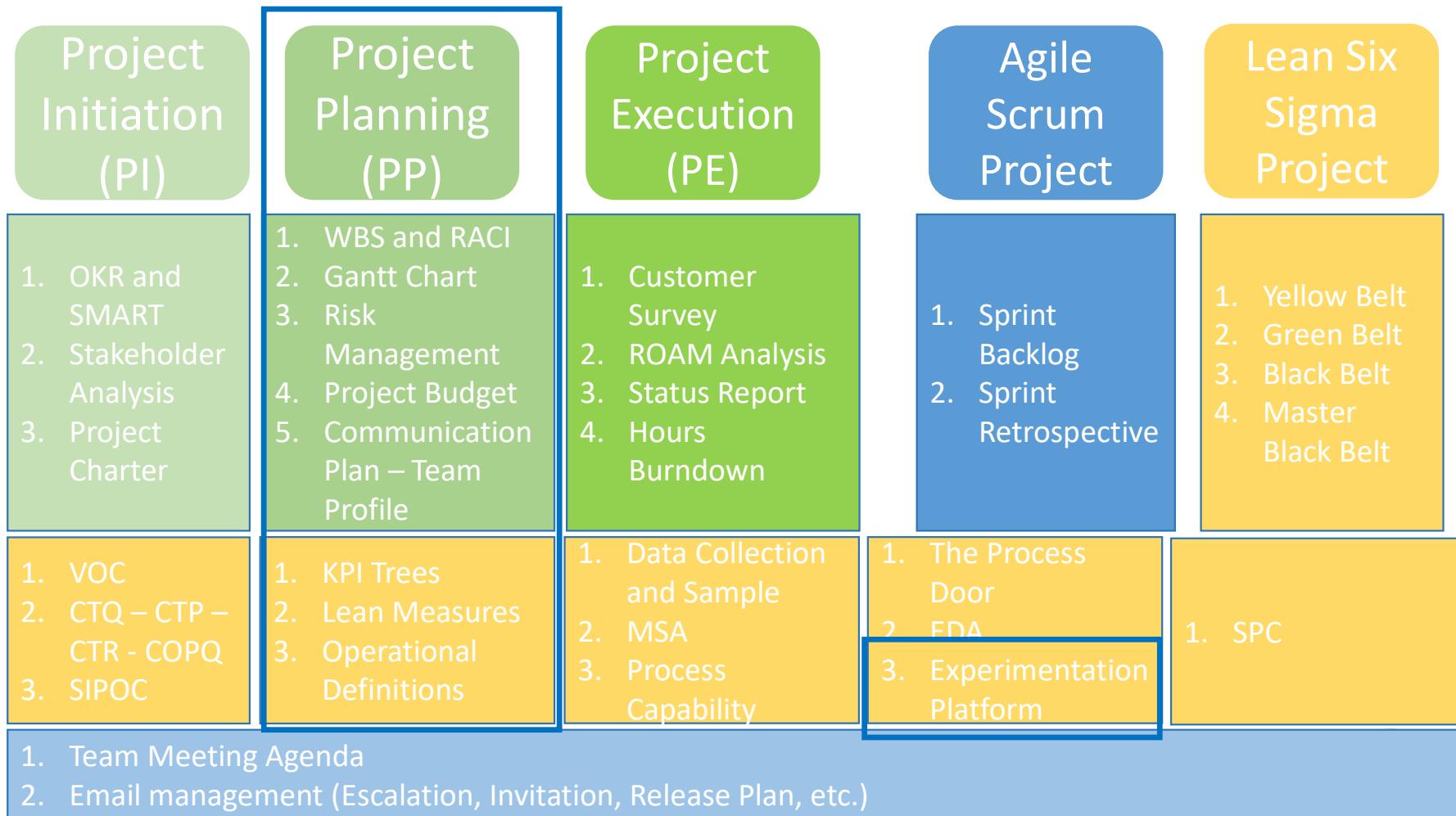
Prioritizing stakeholders (power grid)



Project Planning: Gantt Chart and Budget



Project Management Flowchart



Plan

Analysis and Experimentation Team Plan

Mission:

- Build a platform that is easy to integrate
- Foster a culture towards more data-driven decisions
- Accelerate innovation through trustworthy analysis and experimentation
- Empower the HiPPO (Highest Paid Person's Opinion) with valuable data

Team :

- Developers: Build the experimentation platform and the analysis tools
- Data Scientists – ML – Project (Program) Managers
- Admin



Analytics Objective

Explore and compare **various machine learning models** and **find one with the best performance** to improve learners' learning experience

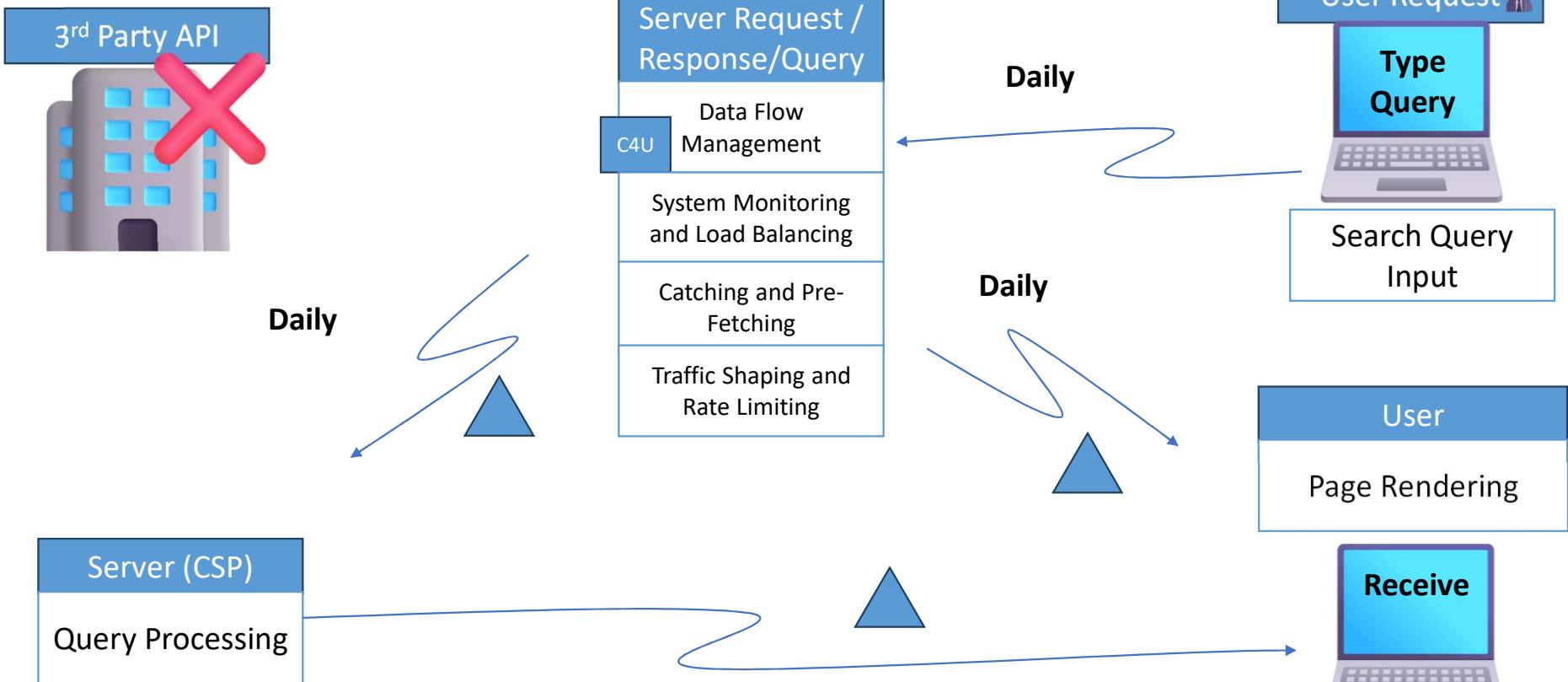
C4U Recommender Systems :

- Quickly find new interested courses
- Better paving learning paths
- More learners interacting with more courses

Hypothesis :

Recommender system delivers **more incremental value of enrollments relative to the current systems.**

VSM Analysis Current State



Key issues :

Inefficiency, Lack of personalization and
Bad user experience



The 7 Wastes Plus

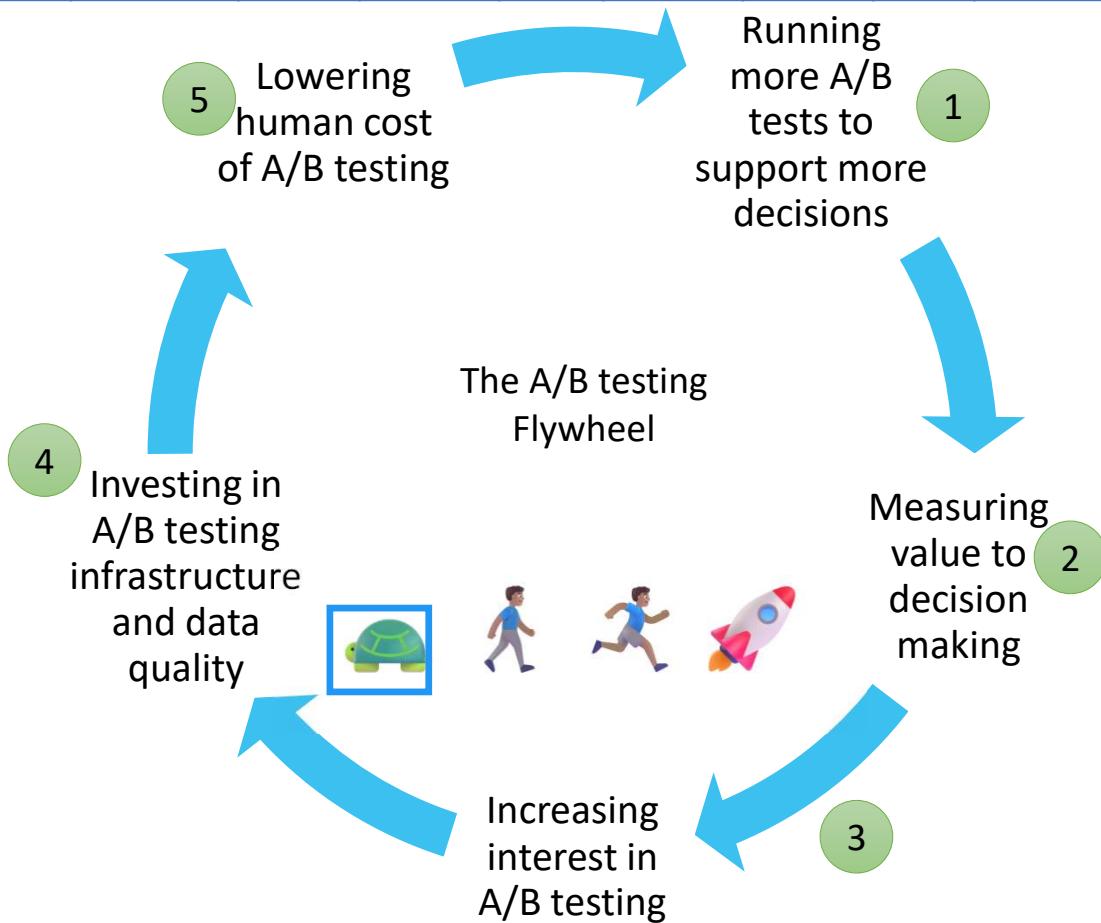
WIT MODE U

7 Waste + In Lean (Muda)	Findings	Mitigate Strategy
Waiting	Delays such as slow load times for course recommendations or search results frustrate users and hinder engagement	Optimizing system performance and using caching techniques
Inventory	Irrelevant or unused courses sitting in the system without aligning with user needs	Regular audits and clean-ups of course offerings
Transport	Inefficient data transfers between systems slow down processes, especially between course recommendation engines and user interface	Streamline data integration and ensure that communication between services is efficient through API optimization and faster data pipelines.
Motion	Excessive steps or clicks required by users to find the right course due to poor UI design	Improve UI/UX design to minimize user effort
Overproduction	Generate more content or features than users actually need	Regular user feedback surveys and data analysis
Defects	Errors in course recommendations or system bugs	Continuous testing and monitoring of the recommender system
Extra Processing	Overly complex algorithms or redundant steps that don't add value to the recommendations.	Simplify algorithms and focus on using only those processes that enhance recommendation relevance and user experience
Unused Talent	Underutilization of the team's expertise	Actively involve all team members in decision-making and problem-solving

Experimentations Life Cycle

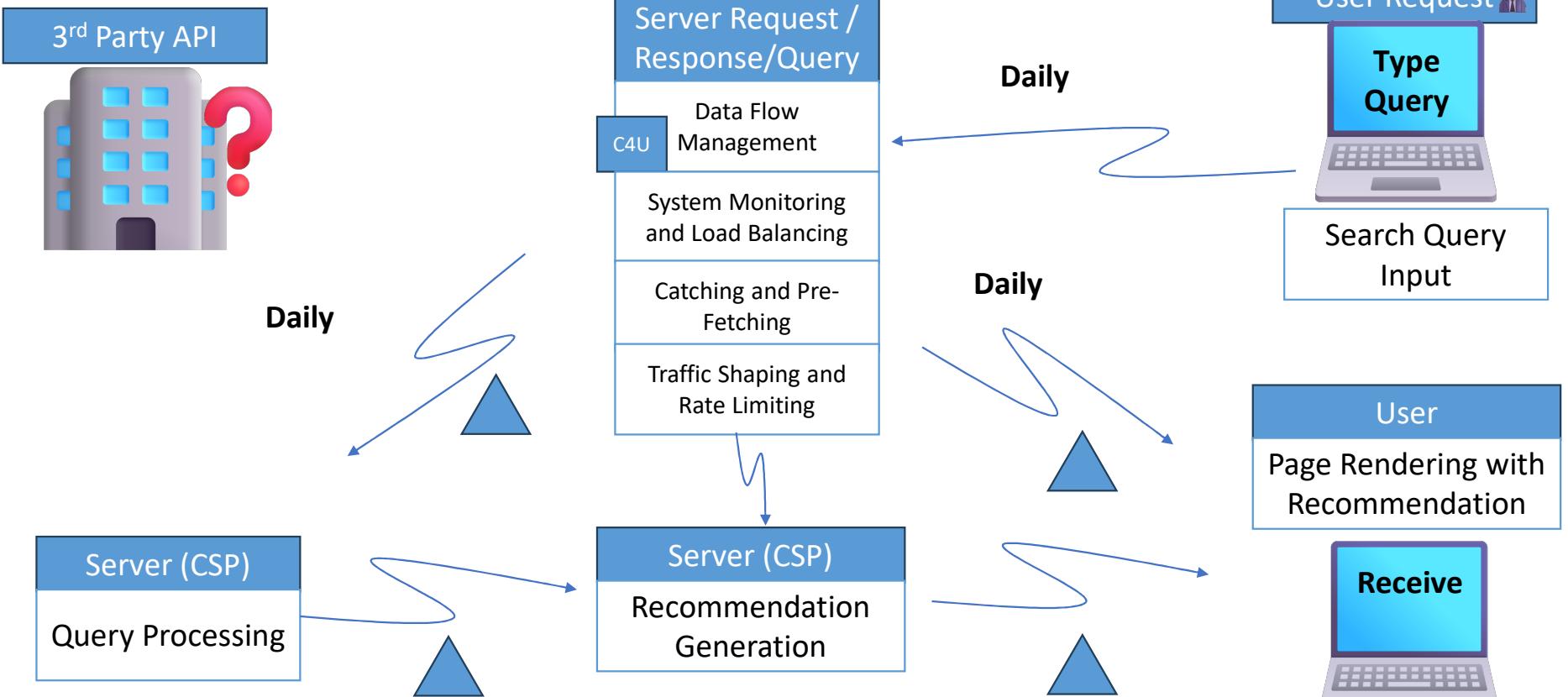


Monthly Revenue Forecast									
Revenue Y1	Increase Revenue Y1	Revenue Y2	Increase Revenue Y2	Revenue Y3	Increase Revenue Y3	Revenue Y4	Increase Revenue Y4	Revenue Y5	Increase Revenue Y5
\$ 280,500.00	\$ 25,500.00	\$ 308,550.00	\$ 28,050.00	\$ 339,405.00	\$ 30,855.00	\$ 373,345.50	\$ 33,940.50	\$ 410,680.05	\$ 37,334.55
User Y1	Increase User Y1	User Y2	Increase User Y2	User Y3	Increase User Y3	User Y4	Increase User Y4	User Y5	Increase User Y5
37,400	3,400	41,140	3,740	45,254	4,114	49,779	4,525	54,757	4,978



Key takeaways : C4U is a small company that has recently started generating monthly revenue in the six-figure range, exceeding a quarter of a million USD. The organization is still in the early stages, with a limited budget and resources..

VSM Analysis Future State



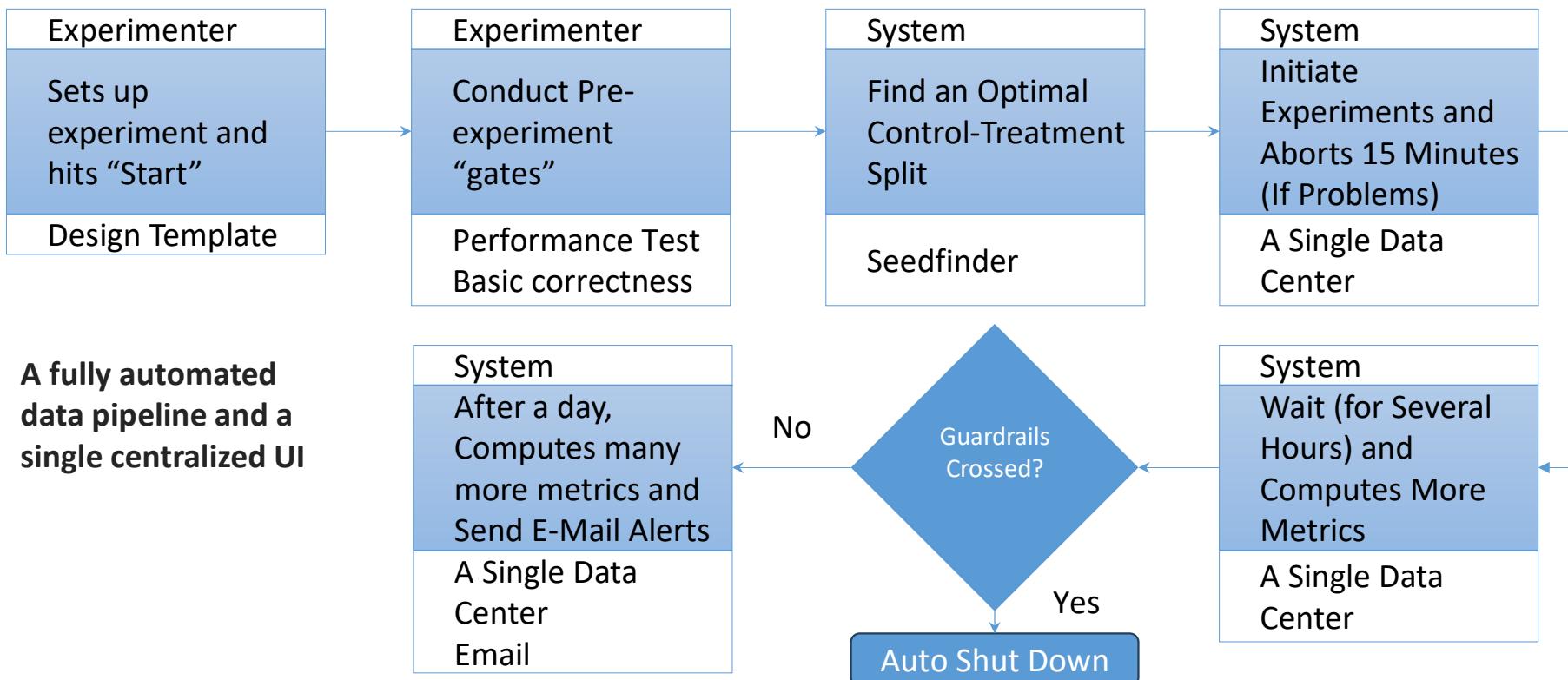
Key improvements :

Efficiency, Personalization and
Enhanced user experience

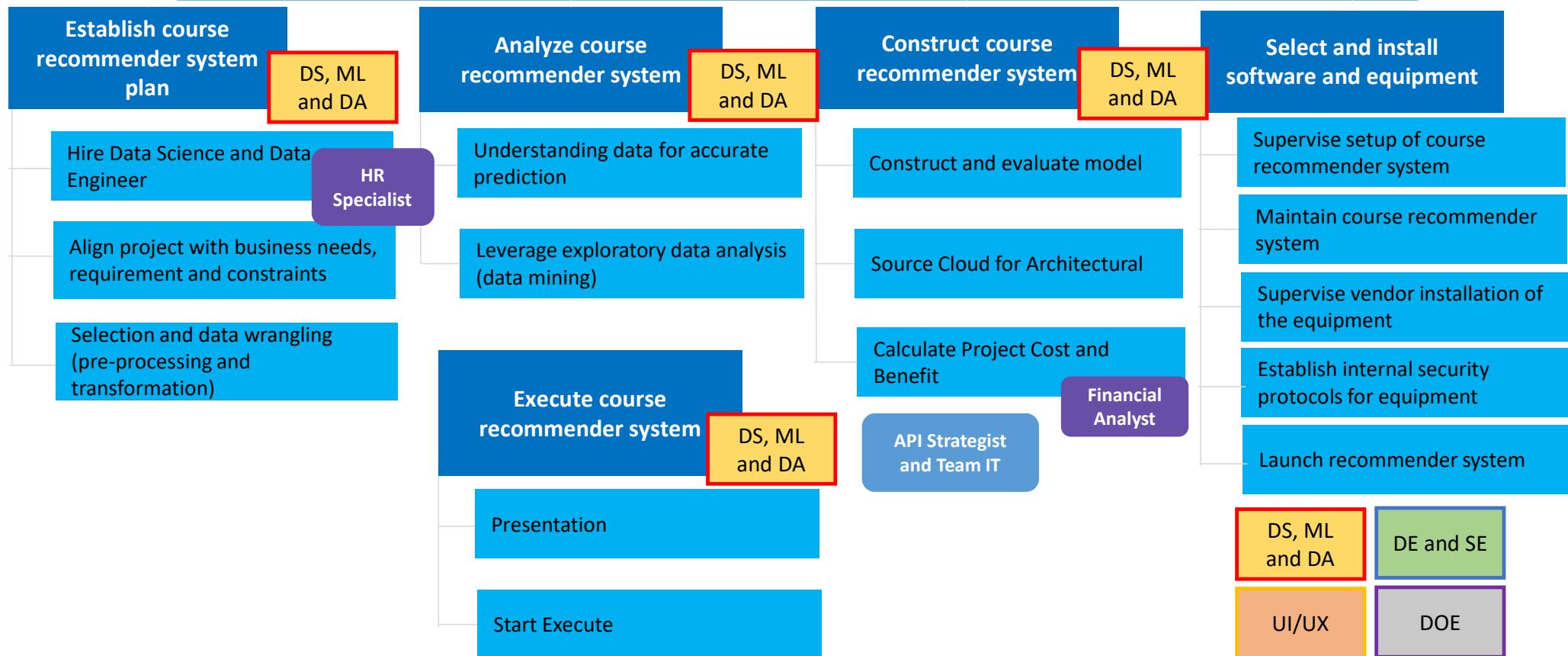


The Experimentation Platform (Future State)

- Experimentation Platform provides full experiment-lifecycle management



Project C4U: Course Recommender System



Project C4U: Course Recommender System

Promote course recommender system as to assist user in their study journey.

Banner Ads on social media

3 press pieces published in relevant print and online publications

Marketing Promotion Manager

Actively and meaningfully engage the user to generate buy-in and project support.

3 live YouTube focused on transit talks

75% of Users surveyed before launch

70% of top users participate in user outreach program

UI/UX and PM

Establish an experimentation platform - software

Implement A/B Testing

Apply Multiarmed Bandit and Bayesian Optimization

DS, ML and DA

Marketing and TV Ads Campaign

Marketing Ads

Television Ads

Marketing Promotion Manager

WBS and RACI

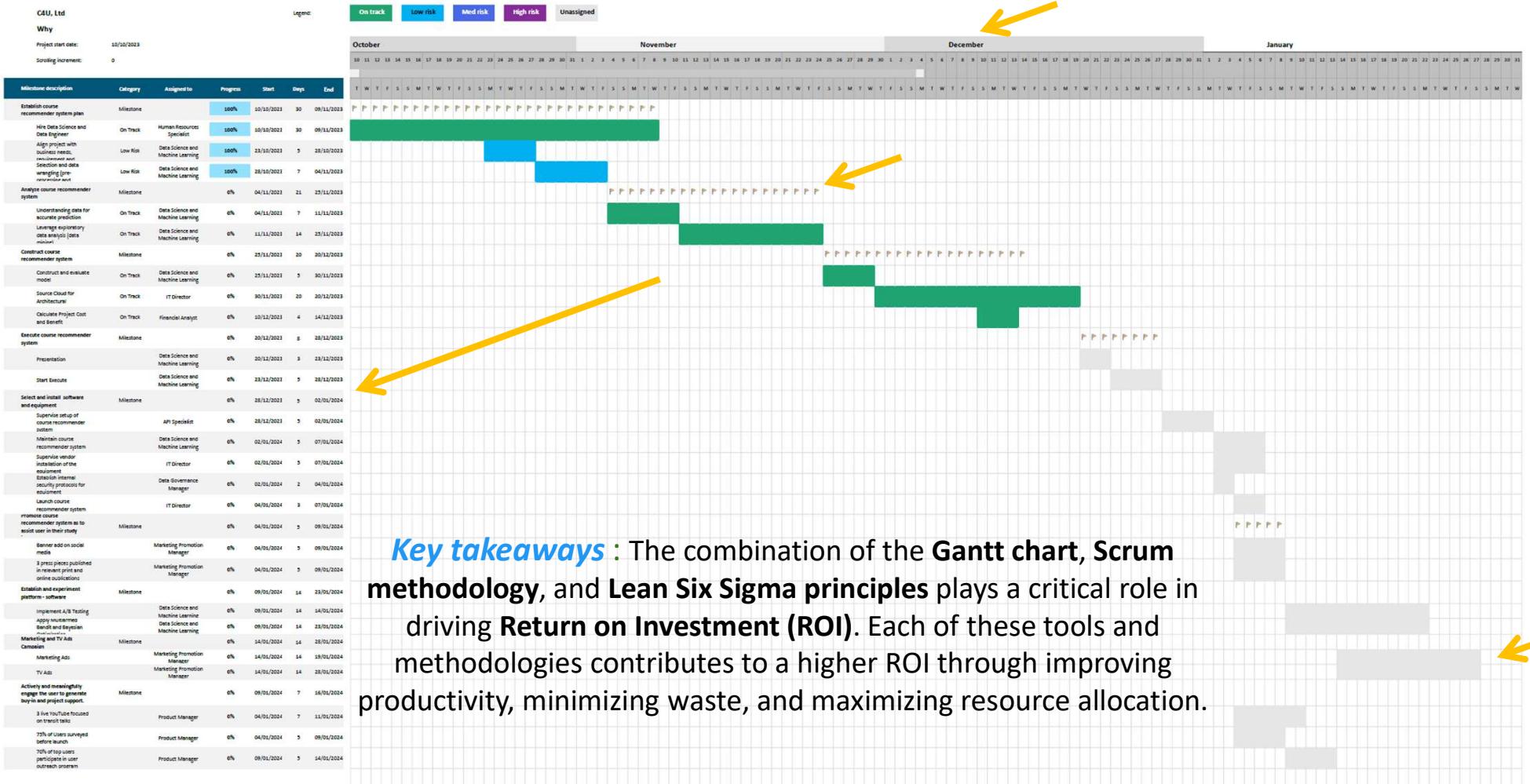


Course Rec Sys WBS Spreadsheet							R - Responsible	Completes the deliverable or task.		A - Accountable	Makes final decisions and signs off on task completion. Only 1 per task.		C - Consulted	An advisor, stakeholder, or subject matter expert who offers guidance before an action is taken.		I - Informed	Kept up to date on decisions made.	
Milestone	ID	Task	Owner	Duration (days)	Notes		Director of Customer Data	Head of Data Science and ML	Existing Clients and Employees	Director of Procurement	IT Director	Product Manager	Team Data	MPM and AM	Team IT	Financial Analyst	HR	
Establish course recommender system plan	1.1	Hire Data Science and Data Engineer	Human Resources Specialist	30	The Human Resource Specialist oversees hiring		I	A			I	I	C	I	I		R	
	1.2	Align project with business needs, requirement and constraints	Data Science and Machine Learning	5	The Data Science and Data Engineer collect data		A	R					R					
	1.3	Selection and data wrangling (pre-processing and transformation)	Data Science and Machine Learning	7	The Data Science and Machine Learning pre-process the data. Clean/Clear, objective and valuable data acquired.		C	A										
Analyze course recommender system	2.1	Understanding data for accurate prediction	Data Science and Machine Learning	7	The Data Science and Machine Learning focus and elaborate data statistically to understand more		A	R					C					
	2.2	Leverage exploratory data analysis (data mining)	Data Science and Machine Learning	14	The Data Science and Machine Learning focus and elaborate data statistically to uncover pattern and address irregularities (data mining)		A	R										
Construct course recommender system	3.1	Construct and evaluate model	Data Science and Machine Learning	5	The Data Science and Machine Learning choose the best model according to the metrics.		A	R					C					
	3.2	Source Cloud for Architectural	IT Director	20	The IT Director sources materials		I	C										
	3.3	Calculate Project Cost and Benefit	Financial Analyst	4	The Financial Analyst tracks costs and revenue		C	A										
Execute course recommender system	4.1	Presentation	Data Science and Machine Learning	3	Share and present project result to the project team		A	R										
	4.2	Start Execute	Data Science and Machine Learning	5	Initiate execution course recommender system after approval		A	R										
Select and install software and equipment	5.1	Supervise setup of course recommender system	API Specialist	5	The Data Science and Machine Learning setup fullstack with course recommender system and oversees software installation		I	C										
	5.2	Maintain course recommender system	Data Science and Machine Learning	5	The Data Science and Machine Learning maintain course recommender system		A	R										
	5.3	Supervise vendor installation of the equipment	IT Director	5	The IT Director ensure equipment is functional with the help of the Data Governance Manager/Quality Assurance Tester		I	C										
	5.4	Establish internal security protocols for equipment	Data Governance Manager	2	The Data Governance Manager/Quality Assurance Tester ensures product quality and determines security protocols and best practices		I	C										
Promote course recommender system as to assist user in their study journey.	6.1	Banner add on social media	Marketing Promotion Manager	5	The Marketing Promotion Manager develop click through banner add		A	C										
	6.2	3 press pieces published in relevant print and online publications	Marketing Promotion Manager	5	The Marketing Promotion Manager publish relevant print and online publication		A	C										
Establish and experiment platform - software	7.1	Implement A/B Testing	Data Science and Machine Learning	14	Test the Recommender System		I	C										
	7.2	Apply Multiarmed Bandit and Bayesian Optimization	Data Science and Machine Learning	14	Test the Recommender System		I	C										
Marketing and TV Ads Campaign	8.1	Marketing Ads	Marketing Promotion Manager	14	The Marketing Promotion Manager develop Product Service Announcement (PSA)		A	C										
	8.2	TV Ads	Marketing Promotion Manager	14	The Marketing Promotion Manager develop TV Ads Campaign		A	C										
Actively and meaningfully engage the user to generate buy-in and project support.	9.1	3 live YouTube focused on transit talks	Product Manager	7	The Product Manager develops the training sessions with the help of the Training Manager		I	C										
	9.2	75% of Users surveyed before launch	Product Manager	5	The Training Manager runs the training program on the established protocols		I	C										
	9.3	70% of top users participate in user outreach program	Product Manager	5	The Training Manager refines training processes		I	C										

Key takeaways : The **RACI Matrix** is a responsibility assignment chart that outlines key activities and designates who is Responsible (R), Accountable (A), Consulted (C), and Informed (I).

Project Gantt Chart

PROJECT: Course Recommender System



Key takeaways : The combination of the **Gantt chart**, **Scrum methodology**, and **Lean Six Sigma principles** plays a critical role in driving **Return on Investment (ROI)**. Each of these tools and methodologies contributes to a higher ROI through improving productivity, minimizing waste, and maximizing resource allocation.

Project Budget vs Cashflow

Monthly Revenue Forecast									
Revenue Y1	Increase Revenue Y1	Revenue Y2	Increase Revenue Y2	Revenue Y3	Increase Revenue Y3	Revenue Y4	Increase Revenue Y4	Revenue Y5	Increase Revenue Y5
\$ 280,500.00	\$ 25,500.00	\$ 308,550.00	\$ 28,050.00	\$ 339,405.00	\$ 30,855.00	\$ 373,345.50	\$ 33,940.50	\$ 410,680.05	\$ 37,334.55
User Y1	Increase User Y1	User Y2	Increase User Y2	User Y3	Increase User Y3	User Y4	Increase User Y4	User Y5	Increase User Y5
37,400	3,400	41,140	3,740	45,254	4,114	49,779	4,525	54,757	4,978

Increase Revenue

10%

\$280,500 per month

Budget: Project Course Recommender System Operations & Training

MILESTONES & TASKS	EMPLOYEE	HOURS	RATE	UNITS	\$ UNIT(S)	TRAVEL	EQUIPMENT / SPACE	OTHER	TARGET BUDGET	ACTUAL/FINAL SPEND	UNDER/ OVER
									BUDGET	ACTUAL	UNDER/OVER
Milestone 1: Establish course recommender system plan									\$ 154,936.00	\$ -	\$ 154,936.00
Task 1: Hire Data Science and Data Engineer	Human Resources Specialist	80	\$ 40.00		\$ -	\$ -	\$ -	\$ -	\$ 3,200.00	\$ (3,200.00)	
Task 2: Align project with business needs, requirement and constraints	Data Science and Machine Learning	20	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 1,300.00	\$ (1,300.00)	
Task 3: Selection and data wrangling (pre-processing and transformation)	Data Science and Machine Learning	28	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 1,820.00	\$ (1,820.00)	
								Total	\$ 6,329.00	\$ -	
Milestone 2: Analyze course recommender system											
Task 1: Understanding data for accurate prediction	Data Science and Machine Learning	28	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 1,820.00	\$ (1,820.00)	
Task 2: Leverage exploratory data analysis (data mining)	Data Science and Machine Learning	56	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 3,640.00	\$ (3,640.00)	
							Total	\$ 5,469.00	\$ -		
Milestone 3: Construct course recommender system											
Task 1: Construct and evaluate model	Data Science and Machine Learning	20	\$ 50.00		\$ -	\$ -	\$ -	\$ -	\$ 1,000.00	\$ (1,000.00)	
Task 2: Source Cloud for Architectural	IT Director	8	\$ 150.00		\$ -	\$ -	\$ -	\$ -	\$ 1,200.00	\$ (1,200.00)	
Task 3: Calculate Project Cost and Benefit	Financial Analyst	16	\$ 30.00		\$ -	\$ -	\$ -	\$ -	\$ 480.00	\$ (480.00)	
							Total	\$ 2,049.00	\$ -		
Milestone 4: Execute course recommender system											
Task 1: Presentation											
Task 2: Start Execute											
Milestone 5: Select and install software and equipment											
Task 1: Supervisor setup of course recommender system											
Task 2: Maintain course recommender system											
Task 3: Supervise vendor installation of the equipment											
Task 4: Establish internal security protocols for equipment											
Task 5: Launch course recommender system											
Milestone 6: Promote course recommender system as to assist											
Task 1: Banner add on social media											
Task 2: 3 press pieces published in relevant print and online publications											
Milestone 7: Establish and experiment platform - software											
Task 1: Implement A/B Testing	Data Science and Machine Learning	50	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 16,600.00	\$ (16,600.00)	
Task 2: Apply Multilevel Bandit and Bayesian Optimization	Data Science and Machine Learning	56	\$ 65.00		\$ -	\$ -	\$ -	\$ -	\$ 16,600.00	\$ (16,600.00)	
Milestone 8: Marketing and TV Ads Campaign											
Task 1: Marketing Ads											
Task 2: TV Ads											
Milestone 9: Actively and meaningfully engage the user to generate project support.											
Task 1: 3 live YouTube focused on transit talks											
Task 2: 75% of Users surveyed before launch											
Task 3: 70% of top users participate in user outreach program											
Reserve buffer											
TOTAL											
Launch recommender system									\$8,000		
Promote course recommender system									\$13,500		
Establish experiment platform									\$15,000		
Marketing and TV ads campaign									\$27,500		
Actively engage with users									\$37,500		
									\$155,000		

Monthly Expenses	Expenses	Percent per Revenue
Developer Salaries and Other Overheads	\$ 37,950.00	14.88%
Development and maintenance costs	\$ 10,000.00	3.92%
Frontend Cloud Cost	\$ 87.30	0.03%
Backend Framework Cost	\$ 59.95	0.02%
Backend Cloud Cost	\$ 173.95	0.07%
Backend Caching Cost	\$ 12.96	0.01%
Backend Message Queues Cost	\$ 50.00	0.02%

Baseline C4U Apps (Monthly)

\$50,000

Total Monthly Expenses

\$ 49,272.74

Additional Monthly Expenses

\$25,000

Total Additional Monthly Expenses from Recommender System

\$ 24,341.70

NPV Expected

\$12,000

Year 1 Cash Flow

\$ 12,000.00

IRR Expected

14%

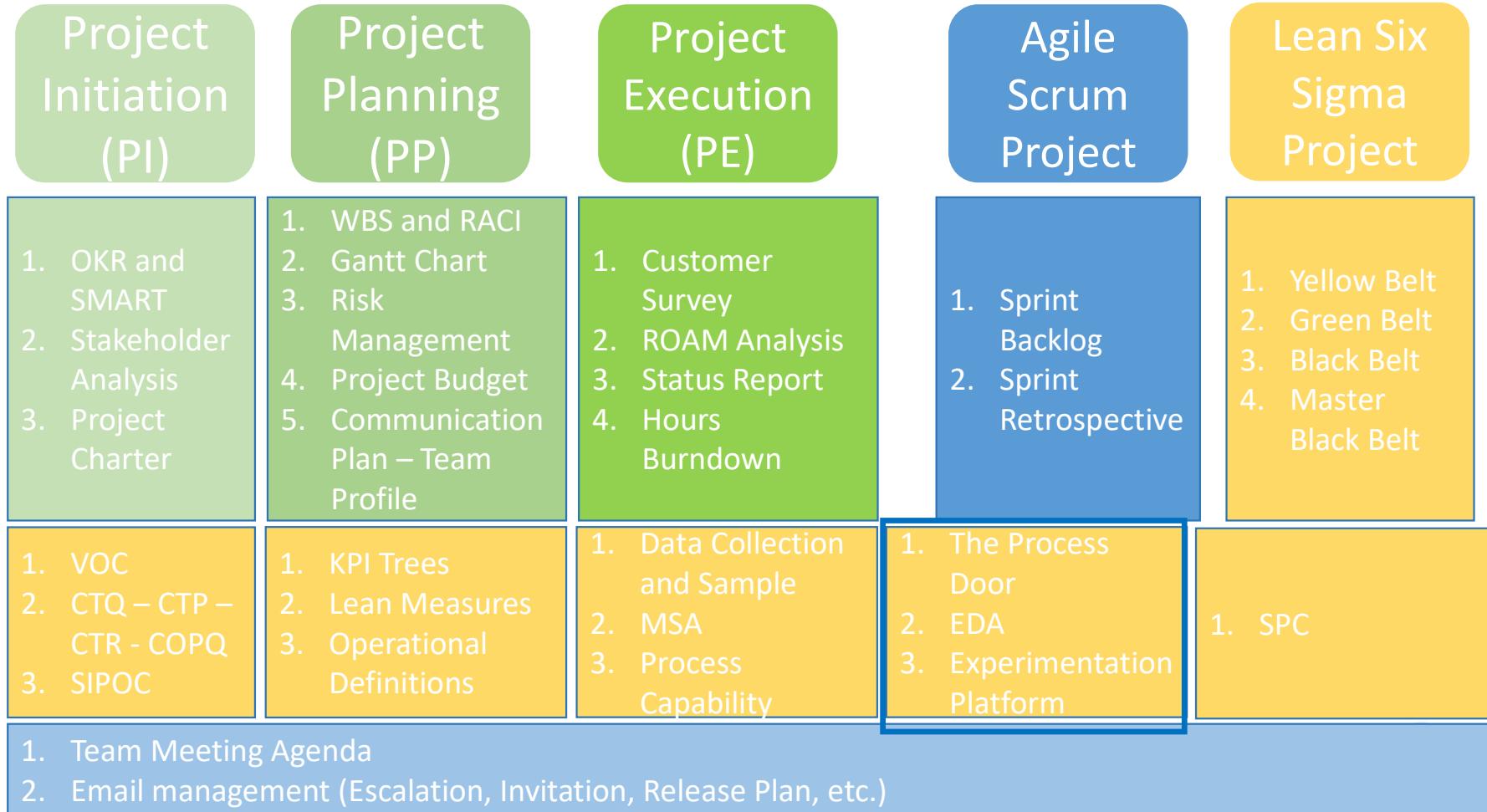
IRR

14.36%

Increase Expense All Year	10%
Discount Rate	10%
Initial Investment	\$ 87,833.40
Year 1 Cash Flow	\$ 12,000.00
NPV Expected	\$ 12,000
Year 4 Cash Flow	
IRR	14.36%

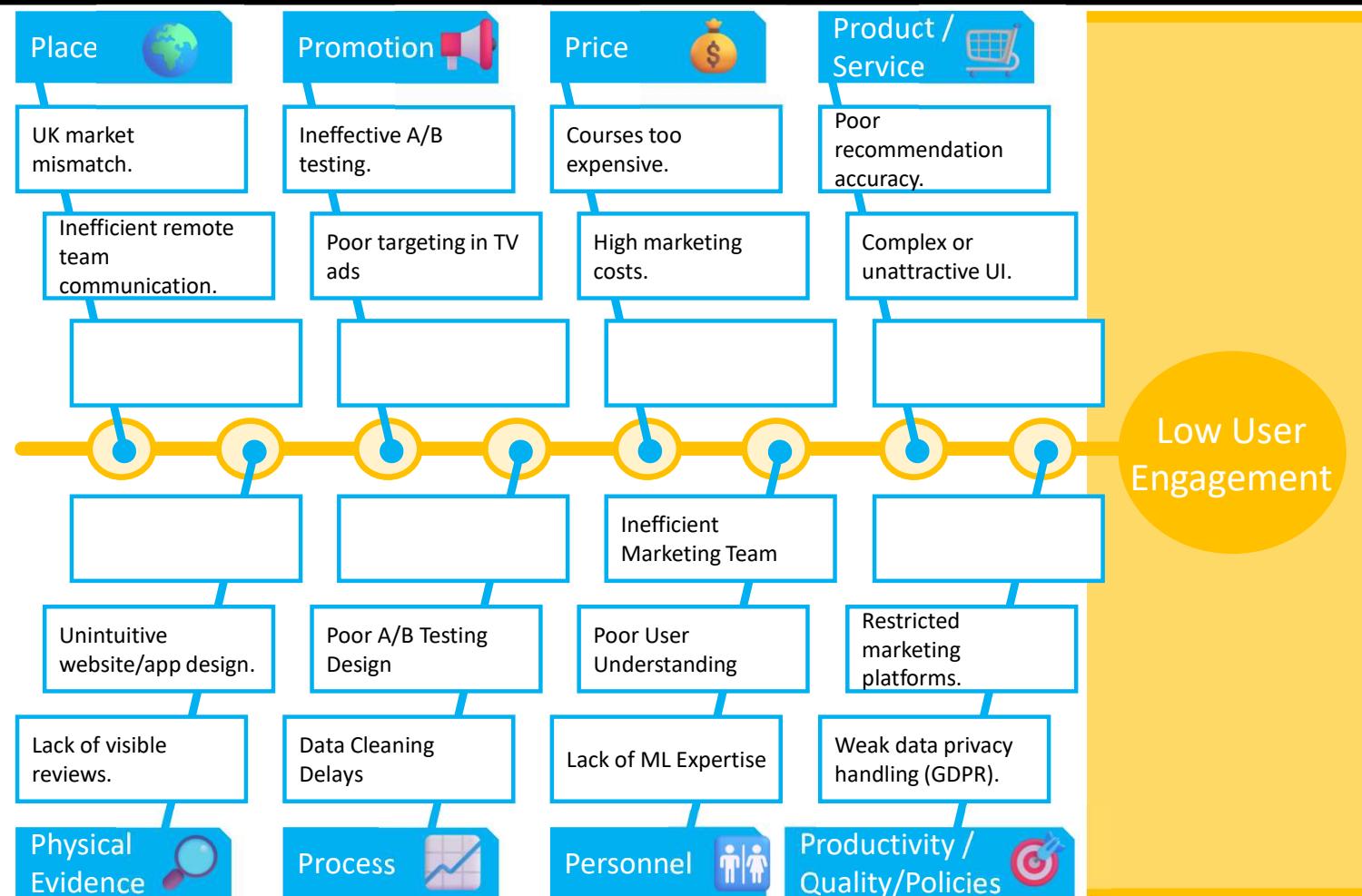
Root Causes and Risk Mitigation

Project Management Flowchart

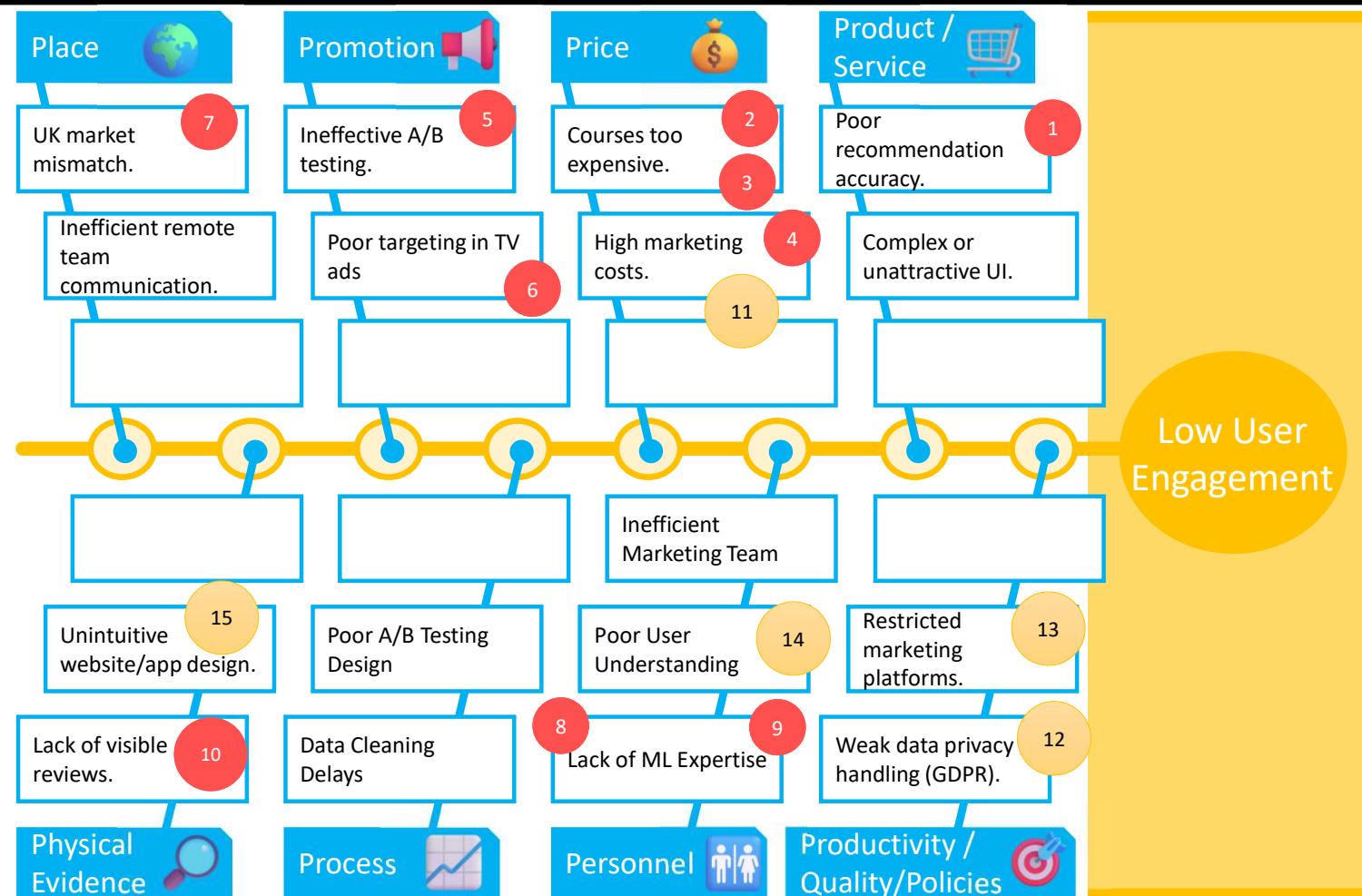


Plan

Potential Causes

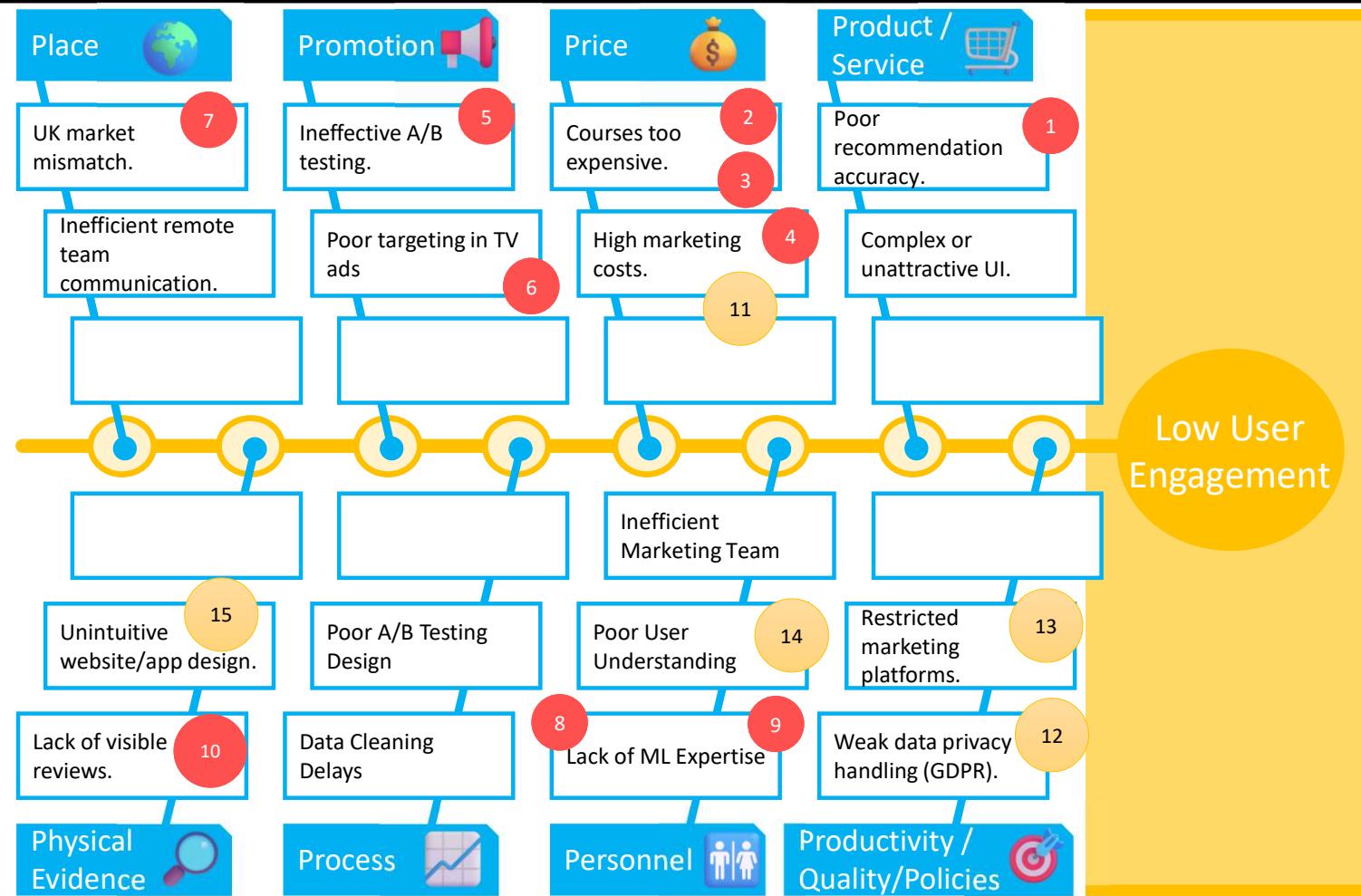


FMEA



Analyze

Data Science and Machine Learning



Analyze

Data Science and Machine Learning FMEA

FMEA									
Process/Product Name: Course Recommendation System Responsible: Data Science and Machine Learning				Prepared By: Wahyu FMEA Date (Orig.): _____					
Process Step/Input	Potential Failure Mode	Potential Failure Effects	Severity (1 - 10)	Potential Causes	Occurrence (1 - 10)	Current Controls	Detection (1 - 10)	RPN	Action Recommended
What is the process step, change or feature under investigation?	In what ways could the step, change or feature go wrong?	What is the impact on the customer if this failure is not prevented or corrected?		What causes the step, change or feature to go wrong? (how could it occur?)	What controls exist that either prevent or detect the failure?		What are the recommended actions for reducing the occurrence of the cause or improving detection?		
Data Collection & Processing	Missing or inaccurate data collected from users	Poor quality recommendations, leading to low engagement	8	Incomplete user profiles, faulty data sources	6	Data validation scripts that check for missing or malformed values; daily data integrity checks	4	192	Implement real-time data validation processes that flag and fix anomalies before they propagate into the system
Recommendation Algorithm	Algorithm fails to provide relevant course recommendations	Users may not find the courses they want, leading to churn	9	Poor algorithm tuning, lack of diversity in recommendations	6	Periodic retraining of the model using new data; recommendation model is tested with sample users before production	5	270	Regularly evaluate the algorithm with A/B testing on live users to ensure relevance, and introduce diversity in recommendation logic (e.g., collaborative filtering + content-based)
User Interface & Experience	Poor or confusing UI/UX makes it difficult for users to find recommendations	Frustration, drop-off in user engagement, and poor user retention	7	Unintuitive design, poorly placed recommendation widgets	4	Basic UI/UX testing during development; user focus groups conducted to get feedback	6	16	Perform extensive A/B testing on various UI designs; refine UI layout based on heatmaps to ensure ease of navigation for recommendation widgets
System Performance	System lags or crashes during high-traffic periods	Users will abandon the system, leading to dissatisfaction	10	Recommendations don't improve over time, leading to static system	4	Load testing is done periodically to simulate traffic spikes; basic server monitoring (CPU, RAM, disk space) is in place	6	240	Scale infrastructure automatically based on user traffic; implement load balancing across multiple servers to handle traffic surges
Feedback Loop	User feedback on recommendations is not incorporated	Late response to underperformance	6	Lack of a proper feedback mechanism, or ignoring feedback	6	User feedback is collected through star ratings, but this is not tied directly to algorithm improvement	4	144	Develop mechanisms for users to provide more granular feedback (e.g., thumbs up/down on specific courses); Use feedback to fine-tune the algorithm
Data Security & Privacy	User data is compromised or used inappropriately	Loss of user trust, legal issues, penalties	10	Inadequate data encryption, lack of compliance with regulations	3	Basic data encryption (SSL for transmission); periodic security audits	5	150	Ensure end-to-end encryption, perform more frequent security audits, and ensure compliance with GDPR, CCPA, and other data protection laws

Key takeaways & action items: To achieve 10% increase in revenue we regularly evaluate algorithm with A/B testing.

Key takeaways & action items: We also conduct A/B testing on various UI designs



Marketing FMEA

FMEA										
Process/Product Name: Marketing Campaign			Prepared By: Wahyu			FMEA Date (Org.)			(Rev):	
Process Step/Input	Potential Failure Mode	Potential Failure Effects	SERIOUSNESS (1 - 10)	Potential Causes	OCURRENCE (1 - 10)	Current Controls	DETECTION (1 - 10) RPN	Action Recommended	Responsible	Actions Taken
What is the process step, change or feature under investigation?	In what ways could the step, change or feature go wrong?	What is the impact on the customer if this failure is not prevented or corrected?	SERIOUSNESS (1 - 10)	What causes the step, change or feature to go wrong? How could it occur?	OCURRENCE (1 - 10)	What controls exist that either prevent or detect the failure?	DETECTION (1 - 10) RPN	What are the recommended actions for reducing the occurrence of the cause or improving detection?	Who is responsible for making sure the actions are completed?	What actions were completed (and when) with respect to the RPN?
Ad Design & Creation	Ad message is unclear or not compelling	Low engagement with the ads, low CTR (low customer interest, reduced clicks)	8	Poor copywriting, unclear messaging, lack of understanding of user needs or inaccurate audience segmentation	5	Initial audience research done using basic analytics tools; Marketing personas created based on existing users' data	4 160	Conduct in-depth surveys and interviews to refine personas. Use A/B testing to refine ad copies to see which messaging resonates best. Ensure clear, value-driven messaging that speaks to user pain points.	Marketing Promotions Manager	Conducted user surveys and interviews to understand needs. A/B testing of multiple ad copies led to optimized messaging that increased click-through rate (CTR) by 15% compared to the initial ad.
Audience Identification	Wrong target audience is selected	High bounce rate, low conversions	9	Inaccurate customer segmentation	6	Monthly review	5 270	Conduct thorough customer analysis, run small-scale A/B tests on different audience segments before full campaign.	Marketing Promotions Manager	Conducted user surveys and interviews to understand needs. A/B testing of multiple ad copies led to optimized messaging that increased click-through rate (CTR) by 15% compared to the initial ad.
Social Media Strategy	Social media posts are inconsistent or irrelevant	Reduced engagement, poor brand visibility	7	Poor content planning, mismatch with audience	4	Monthly review	5 140	Develop a social media content calendar aligned with target audience interests and campaign objectives.	Marketing Promotions Manager	Social media calendar - target audience interest - campaign objectives
Budget Allocation	Over-budget in one channel (e.g., TV)	Financial overspend, reduced ROI	8	Inaccurate budget forecasting or resource allocation	5	Tracking by monthly financial report	3 120	Use a marketing budget planner to allocate resources based on channel performance and ROI.	Marketing Promotions Manager	Project budget and project controller work with finance and accounting to monitor ROAS
Performance Monitoring	Campaign metrics are not tracked in real-time	Late response to underperformance	6	Inadequate use of tracking tools	6	Monthly review	4 144	Implement real-time campaign tracking tools; set up dashboards for key metrics (CTR, conversion rate).	Marketing Promotions Manager	Campaign tracking tools
Customer Engagement	Leads are not followed up promptly	Low conversion from leads to customers	9	Poor lead nurturing, slow response times	6	Manual follow-up leads	6 324	Schedule lead nurturing emails immediately after capturing leads using automation.	Course Manager	Implement automated lead follow-up through CRM
Ad Placement Strategy	Inefficient ad placement, missing key platforms	Reduced reach and visibility, lower conversion rates	7	Failure to choose the right platforms where the target audience is active	6	Ads placed on general platforms (Google, Facebook); basic analytics used to track impressions and clicks	5 210	Conduct audience behavior analysis to identify underperforming platforms (e.g., LinkedIn for professionals, YouTube for tutorials). Reallocate budget towards those platforms, improving overall reach by 20% and boosting conversions from professionals in particular.	Ads Manager	Analyzed user behavior and found underperforming platforms like LinkedIn and YouTube. Reallocated budget towards those platforms, improving overall reach by 20% and boosting conversions from professionals in particular.
Press Release & Media	Delayed or poorly distributed press releases	Reduced media coverage and brand awareness	6	Inefficient coordination with media outlets, delays in approval	4	Press releases sent to a few key outlets manually	7 168	Build relationships with a larger network of journalists, influencers, and bloggers; Use automated tools to schedule timely releases	PR Manager	Automated press release distribution and built a media relationship pipeline. Press coverage increased by 25%, and timely publication ensured visibility aligned with campaign
Social Media Ads	Low engagement rates on social media campaigns	Lower-than-expected ROI, wasted budget	8	Unattractive visuals, weak call-to-action (CTA)	6	Basic social media engagement tracking (likes, shares, and comments)	6 288	Enhance visuals and CTAs with A/B testing. Use interactive elements (e.g., polls and quizzes); Tailor ads for each platform (e.g., Instagram vs LinkedIn)	Ads Manager	Revamped visual and CTAs with A/B testing. Engagement on social media improved by 18% with polls and interactive quizzes increasing direct traffic by 10%. Ad performance on platforms like Instagram and Facebook.
Budget Management	Budget overrun due to poor cost tracking	Depletion of marketing funds, leading to campaign cutback	9	Inefficient allocation, unexpected expenses	3	Weekly budget reviews by the finance team, using basic expense tracking software	6 162	Implement real-time budget tracking and automated alerts for over-budget items. Forecasting dynamic spend analysis based on real-time ad performance	Marketing Promotions Manager	tracking software that sent real-time alerts when spending approached set limits. This led to a 10% reduction in unexpected expenses and better control of the budget.
User Conversion Rate	Low conversion rate from ad click to signing up for the course	Low ROI, fewer course sign-ups	8	Poor ad targeting, ineffective landing pages	7	Basic conversion tracking using Google Analytics; Weekly reviews of conversion data	4 224	Conduct A/B tests on landing pages to improve conversion rates; Optimize the user journey from ad click to course sign-up with personalized landing pages	Marketing Promotions Manager	A/B testing of landing pages resulted in a 12% improvement in conversion rates. Personalized landing pages for different user personas were created, aligning better with the audience's needs and journey.
Timing of Campaign	Campaign launched at a suboptimal time	Low user interest, low traffic	7	Lack of coordination with key seasonal trends or competing events	5	Ads are timed based on previous marketing schedules and intuition	6 210	Analyze user behavior and seasonality data to schedule campaigns during peak times (e.g., exam prep seasons for courses); Optimize ad frequency	Marketing Promotions Manager	Adjusted campaign schedules to (e.g., before exams). Increased sign-up rates by 20% during high-demand periods, compared to campaigns launched at random times in the past.
Competitor Activity	Competitor runs simultaneous campaigns	Marketing noise and reduced effectiveness of the course campaign	6	Lack of awareness of competitors' marketing schedules	4	Basic competitor monitoring using general tools like Google Alerts; React to competitor campaigns after they've been noticed	6 144	Set up proactive monitoring for competitor activities and market trends; Plan campaigns around or in anticipation of competitor launches	Competitive Intelligence Analyst	Implemented competitor activity monitoring using specialized tools. Planned the launch of our ads one week before a major competitor's campaign, leading to 10% higher engagement during that competitive period.

Key takeaways & action items: We apply prediction model on marketing campaign and TV ads.

Key takeaways & action items: A/B testing was apply in Ads copies, social media Ads and landing pages.

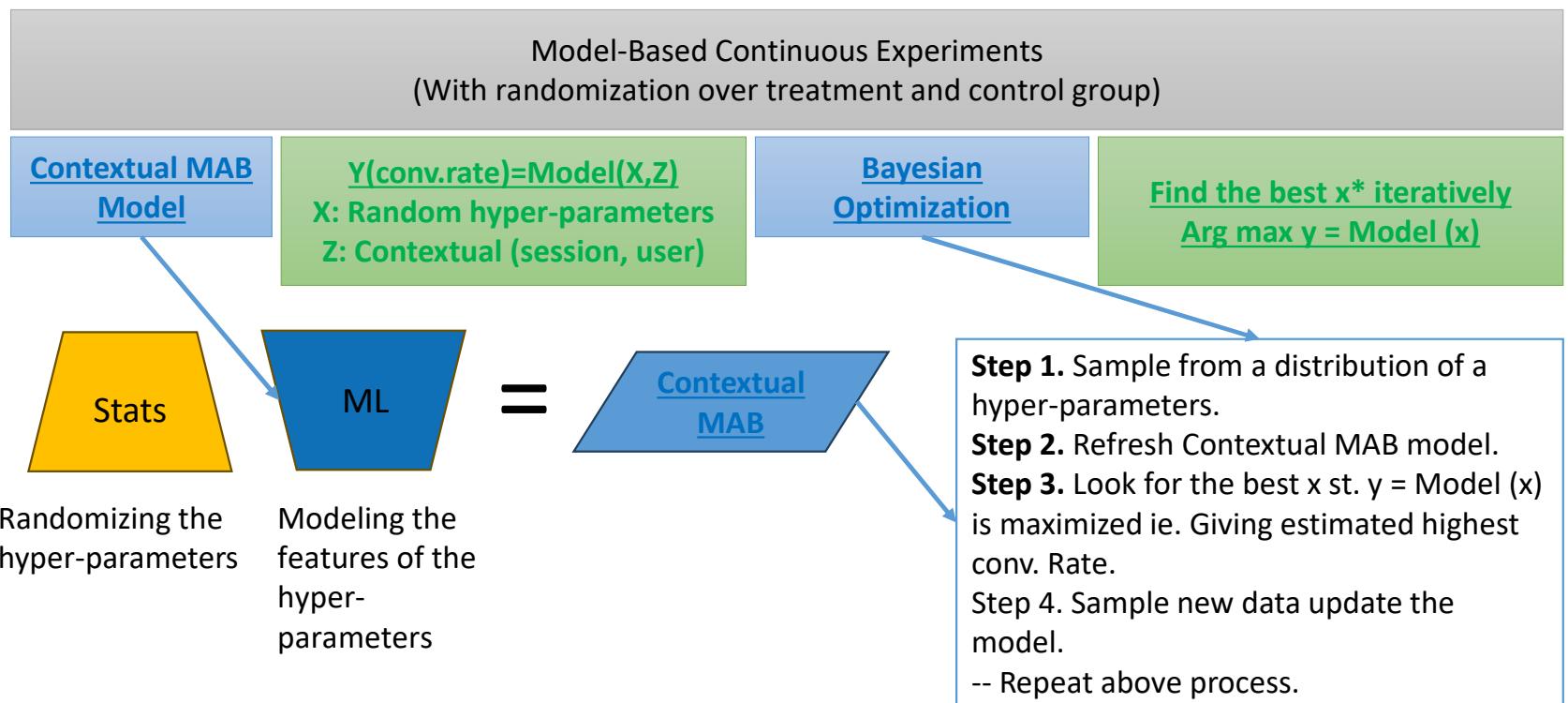


Experimentations at C4U

Randomized Experiments (With randomization over treatment and control group)		Observational Studies (Pure Observation with no randomization)	
Classic Experiments (Non-Recurring)	Continuous Experiments (Recurring)	Different Methods to Estimate Associated Lifts	
Univariate Tests	Statistical Techniques	Synthetic Control	A/B-like: How to construct a weighted “control” group
<u>A/B Tests</u>	<u>Allocation %</u> Eg. Thompson Sampling	<u>Rollout %</u> Eg. Power Based via Sequential Tests Eg. Risk Based	<u>Regression</u>
Model-Based Techniques			
<u>Contextual MAB</u>	<u>Bayesian Optimization</u>		



Experimentations at C4U



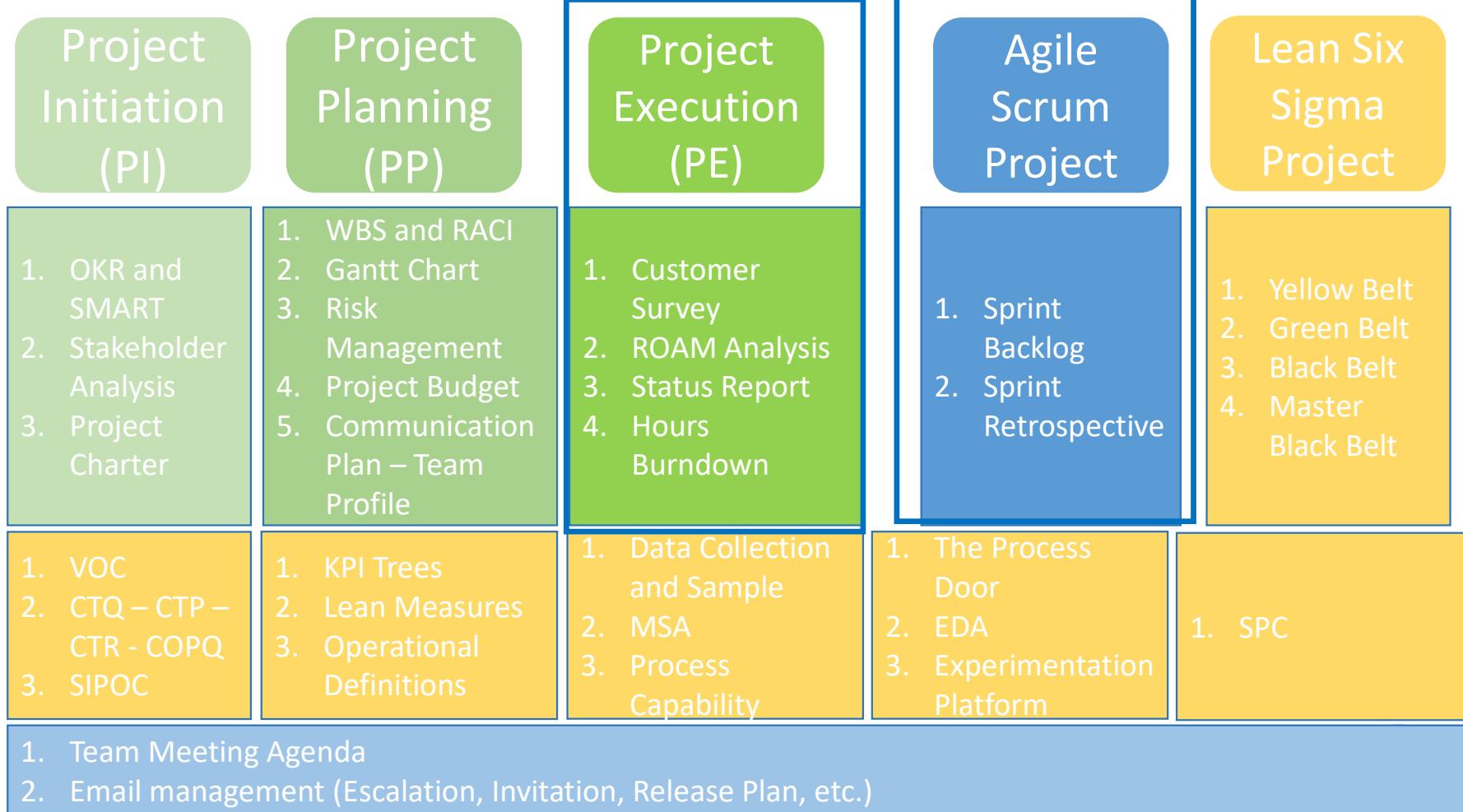
A/B Testing

- To get the probability that we need to apply Bayes Rule, which requires a prior $P(H_0)$
- FPR, or False Positive Risk/Rate, is a proxy: the probability that H_0 is true (no real effect) when the test was statistically significant
- Assuming the experiment was properly run with 80% power, here is a useful table relative to reported success rates by companies and p-value threshold (alpha) of 0.05 for statistical significance

Company/Source	Success Rate	FPR	Revenue/Benefit Estimate from A/B Testing
Microsoft	33%	5.9%	\$517 million increase in revenue (from various A/B tests improving features like Bing search speed and Office product optimization)
Bing	15%	15%	
Avinash Kaushnik	20%	11.1%	- (Revenue estimates not directly available)
Booking.com, Google Ads, Netflix	10%	22%	Booking.com: Reportedly added \$1 billion in annual revenue from continuous experimentation improvements Google generating over \$224 billion in ad revenue in 2022 Netflix increased its subscriber base by 30 million in 2022. The new user model, designed based on A/B test results, reduced churn and enhanced customer satisfaction, significantly contributing to its revenue and market value growth
Airbnb Search	8%	26.4%	In 2018, Airbnb's A/B testing on search algorithms reportedly resulted in \$80 million in additional revenue

Project Execution: Customer Survey, ROAM Analysis and Scrum

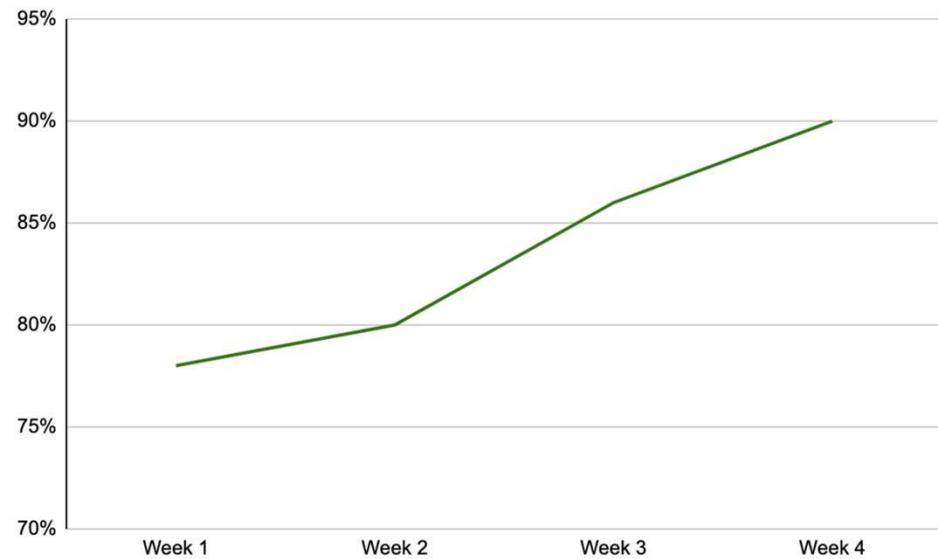
Project Management Flowchart



Plan

Customer Survey

We surveyed 50 C4U Pals test batch customers over a four-week period to learn about their satisfaction with the product, delivery process, and customer support.



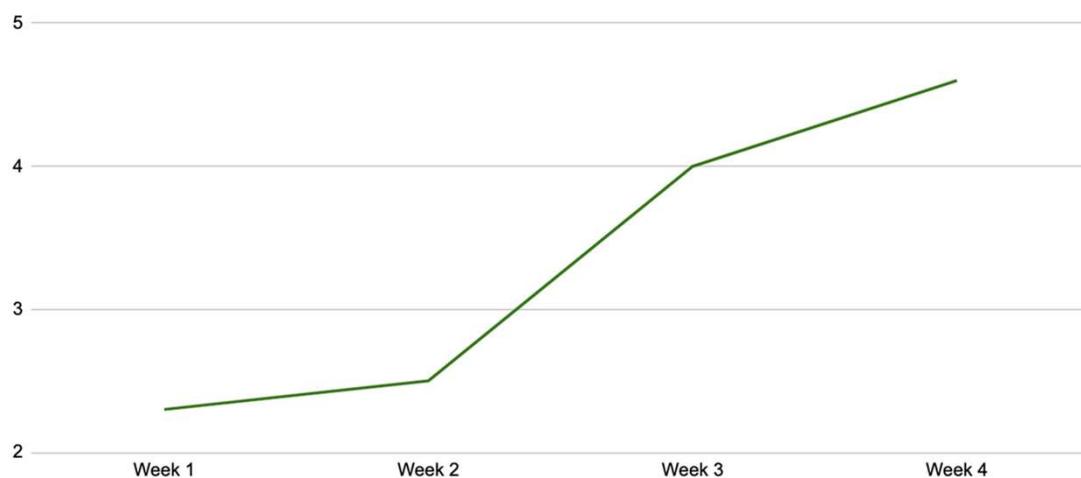
Did you participate in the course we recommend for you?

- O1** Improve the relevance and engagement of course recommendations
- KR1** Increase the **relevance score of recommendations to 90%** by the end of Q4.

- O3** Optimize the user experience of the course recommendation interface.
- KR2** Ensure **95%** of recommendations align with user preferences by Q4.

Key takeaways & action items: Users participate to 90% by the end of the survey—a solid improvement, but still short of our 95% target. Investigate additional reasons for courses participation.

Customer Survey



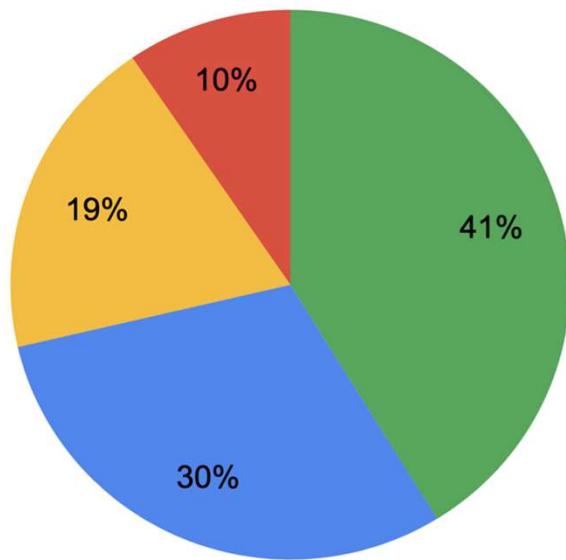
In general, how do you suggest we improve our customer support?

O3 Optimize the user experience of the course recommendation interface.

KR1 Increase the User Satisfaction Score to 4.7/5 by Q4.

Key takeaways & action items: Satisfaction with support increased once we fixed the customer service software problem. There is still room for improvement, so continue to monitor responses and solutions to support tickets.

Customer Survey



- Offer live chat support
- Share more step-by-step guides and tutorials
- Extend support hours
- Other

In general, how do you suggest we improve our customer support?

O3 Optimize the user experience of the course recommendation interface.

KR3 Utilize 80% of user feedback to make iterative improvements to the system by the end of Q4.

Key takeaways & action items: A number of customers volunteered that a live chat option would improve customer support. Also, many respondents found the guides and tutorials helpful. Research expanding these offerings for specific courses.

Data Science and Machine Learning FMEA

FMEA															
Process/Product Name: Course Recommendation System Responsible: Data Science and Machine Learning				Prepared By: Wahyu FMEA Date (Orig.): _____ (Rev.): _____											
Process Step/Input	Potential Failure Mode	Potential Failure Effects	Severity (1 - 10)	Potential Causes	Occurrence (1 - 10)	Current Controls	Detection (1 - 10)	RPN	Action Recommended	Resp.	Actions Taken	Severity (1 - 10)	Occurrence (1 - 10)	Detection (1 - 10)	RPN
What is the process step, change or feature under investigation?	In what ways could the step, change or feature go wrong?	What is the impact on the customer if this failure is not prevented or corrected?		What causes the step, change or feature to go wrong? (how could it occur?)		What controls exist that either prevent or detect the failure?			What are the recommended actions for reducing the occurrence of the cause or improving detection?		Who is responsible for making sure the actions are completed?				
Data Collection & Processing	Missing or inaccurate data collected from users	Poor quality recommendations, leading to low engagement	8	Incomplete user profiles, faulty data sources	6	Data validation scripts that check for missing or malformed values; daily data integrity checks	4	192	Implement real-time data validation processes that flag and fix anomalies before they propagate into the system	Data Science and Machine Learning	Implemented a real-time data validation pipeline, where missing or incorrect data is flagged and rectified within minutes, improving data accuracy and preventing downstream issues in recommendations.	8	4	2	64
Recommendation Algorithm	Algorithm fails to provide relevant course recommendations	Users may not find the courses they want, leading to churn	9	Poor algorithm tuning, lack of diversity in recommendations	6	Periodic retraining of the model using new data; recommendation model is tested with sample users before production	5	270	Regularly evaluate the algorithm with A/B testing on live users to ensure relevance, and introduce diversity in recommendation logic (e.g., collaborative filtering + content-based)	Data Science and Machine Learning	A/B testing was performed with 10% of users. Diversified the recommendations based on content preferences and collaborative filtering. Algorithm adjustments reduced churn by 15% for new users.	9	4	3	108
User Interface & Experience	Poor or confusing UI/UX makes it difficult for users to find recommendations	Frustration, drop-off in user engagement, and poor user retention	7	Unintuitive design, poorly placed recommendation widgets	4	Basic UI/UX testing during development; user focus groups conducted to get feedback	6	168	Perform extensive A/B testing on various UI designs; refine UI layout based on heatmaps to ensure ease of navigation for recommendation widgets	UI/UX	Implemented A/B tests for multiple UI designs and improved navigation based on click-tracking heatmaps, reducing bounce rates by 12% and increasing engagement with recommendations by 35%.	7	4	3	84
System Performance	System lags or crashes during high-traffic periods	Users will abandon the system, leading to dissatisfaction	10	Recommendations don't improve over time, leading to static system	4	Load testing is done periodically to simulate traffic spikes; basic server monitoring (CPU, RAM, disk space) is in place	6	240	Scale infrastructure automatically based on user traffic; implement load balancing across multiple servers to handle traffic surges	DevOps	Implemented auto-scaling on the cloud server infrastructure, which dynamically adjusts resources based on real-time demand. Load balancing reduced crash incidents by 90% during high-traffic periods.	10	4	3	120
Feedback Loop	User feedback on recommendations is not incorporated	Late response to underperformance	6	Lack of a proper feedback mechanism, or ignoring feedback	6	User feedback is collected through star ratings, but this is not tied directly to algorithm improvement	4	144	Develop mechanisms for users to provide more granular feedback (e.g., thumbs up/down on specific courses); Use feedback to fine-tune the algorithm	Software Engineers	Integrated a thumbs-up/down feature for individual courses, tied immediate algorithm adjustments. Feedback utilization increased relevance scores, and user satisfaction improved by 18%.	6	4	3	72
Data Security & Privacy	User data is compromised or used inappropriately	Loss of user trust, legal issues, penalties	10	Inadequate data encryption, lack of compliance with regulations	3	Basic data encryption (SSL for transmission); periodic security audits	5	150	Ensure end-to-end encryption, perform more frequent security audits, and ensure compliance with GDPR, CCPA, and other data protection laws	Data Govern	Enhanced security by implementing AES-256 encryption for data storage, and scheduled quarterly security audits. Compliance with GDPR and CCPA was improved, reducing potential legal risks by 85%.	10	3	4	120

lyze

Marketing FMEA

FMEA						
Process/Product Name: Marketing Campaign			Prepared By: Wahyu			
Process Step/Input	Potential Failure Mode	Potential Failure Effects	Severity (1 - 10)	Potential Causes	Occurrence (1 - 10)	Action Recommended
What is the process step, change or behavior under investigation?	In what ways could the step, change or behavior go wrong?	What is the impact on the customer if this failure is not prevented or corrected?	Severity (1 - 10)	What causes the step, change or feature to go wrong? How could it occur?	Occurrence (1 - 10)	What are the recommended actions for reducing the occurrence of the cause or improving detection?
Ad Design & Creation	Ad message is unclear or not compelling	Low engagement with the ads, low CTR (low customer interest, reduced clicks)	8	Poor copywriting, unclear message, lack of compelling value, user needs or inaccurate audience segmentation	5	Initial audience research done using basic analytics tools; Marketing personas created based on existing users' data
Audience Identification	Wrong target audience is selected	High bounce rate, low conversions	9	Inaccurate customer segmentation	6	Monthly review
Social Media Strategy	Social media posts are inconsistent or irrelevant	Reduced engagement, poor brand visibility	7	Poor content planning, mismatch with audience	4	Monthly review
Budget Allocation	Over-budget in one channel (e.g., TV)	Financial overspend, reduced ROI	8	Inaccurate budget forecasting or resource allocation	5	Tracking by monthly financial report
Performance Monitoring	Campaign metrics are not tracked in real-time	Late response to underperformance	6	Inadequate use of tracking tools	6	Monthly review
Customer Engagement	Leads are not followed up promptly	Low conversion from leads to customers	9	Poor lead nurturing, slow response time	6	Manual follow-up leads
Ad Placement Strategy	Inefficient ad placement, missing key platforms	Reduced reach and visibility, lower conversion rates	7	Failure to choose the right platforms where the target audience is active	6	Ads placed on general platforms (Google, Facebook); Basic analytics used to track impressions and clicks
Press Release & Media	Delayed or poorly distributed press releases	Reduced media coverage and brand awareness	6	Inefficient coordination with media outlets, delays in approval	4	Press releases sent to a few key outlets manually
Social Media Ads	Low engagement rates on social media campaigns	Lower-than-expected ROI, wasted budget	8	Unattractive visuals, weak call-to-action (CTA)	6	Basic social media engagement tracking (likes, shares, and comments)
Budget Management	Budget overrun due to poor cost tracking	Depletion of marketing funds, leading to campaign cutback	9	Inefficient allocation, unexpected expenses	3	Weekly budget reviews by the finance team, using basic expense tracking software
User Conversion Rate	Low conversion rate from ad click to signing up for the course	Low ROI, fewer course sign-ups	8	Poor ad targeting, ineffective landing pages	7	Basic conversion tracking using Google Analytics; Weekly reviews of conversion data
Timing of Campaign	Campaign launched at a suboptimal time	Low user interest, low traffic	7	Lack of coordination with key seasonal trends or competing events	5	Ads are timed based on previous marketing schedules and intuition
Competitor Activity	Competitor runs simultaneous campaigns	Marketing noise and reduced effectiveness of the course campaign	6	Lack of awareness of competitors' marketing schedules	4	Basic competitor monitoring using general tools like Google Alerts; React to competitor campaigns after they've been noticed

FMEA						
Process/Product Name: Marketing Campaign			Prepared By: Wahyu			
Process Step/Input	Potential Failure Mode	Potential Failure Effects	Severity (1 - 10)	Potential Causes	Occurrence (1 - 10)	Action Recommended
What is the process step, change or behavior under investigation?	In what ways could the step, change or behavior go wrong?	What is the impact on the customer if this failure is not prevented or corrected?	Severity (1 - 10)	What causes the step, change or feature to go wrong? How could it occur?	Occurrence (1 - 10)	What are the recommended actions for reducing the occurrence of the cause or improving detection?
Ad Design & Creation	Ad message is unclear or not compelling	Low engagement with the ads, low CTR (low customer interest, reduced clicks)	8	Poor copywriting, unclear message, lack of compelling value, user needs or inaccurate audience segmentation	5	Initial audience research done using basic analytics tools; Marketing personas created based on existing users' data
Audience Identification	Wrong target audience is selected	High bounce rate, low conversions	9	Inaccurate customer segmentation	6	Monthly review
Social Media Strategy	Social media posts are inconsistent or irrelevant	Reduced engagement, poor brand visibility	7	Poor content planning, mismatch with audience	4	Monthly review
Budget Allocation	Over-budget in one channel (e.g., TV)	Financial overspend, reduced ROI	8	Inaccurate budget forecasting or resource allocation	5	Tracking by monthly financial report
Performance Monitoring	Campaign metrics are not tracked in real-time	Late response to underperformance	6	Inadequate use of tracking tools	6	Monthly review
Customer Engagement	Leads are not followed up promptly	Low conversion from leads to customers	9	Poor lead nurturing, slow response time	6	Manual follow-up leads
Ad Placement Strategy	Inefficient ad placement, missing key platforms	Reduced reach and visibility, lower conversion rates	7	Failure to choose the right platforms where the target audience is active	6	Ads placed on general platforms (Google, Facebook); Basic analytics used to track impressions and clicks
Press Release & Media	Delayed or poorly distributed press releases	Reduced media coverage and brand awareness	6	Inefficient coordination with media outlets, delays in approval	4	Press releases sent to a few key outlets manually
Social Media Ads	Low engagement rates on social media campaigns	Lower-than-expected ROI, wasted budget	8	Unattractive visuals, weak call-to-action (CTA)	6	Basic social media engagement tracking (likes, shares, and comments)
Budget Management	Budget overrun due to poor cost tracking	Depletion of marketing funds, leading to campaign cutback	9	Inefficient allocation, unexpected expenses	3	Weekly budget reviews by the finance team, using basic expense tracking software
User Conversion Rate	Low conversion rate from ad click to signing up for the course	Low ROI, fewer course sign-ups	8	Poor ad targeting, ineffective landing pages	7	Basic conversion tracking using Google Analytics; Weekly reviews of conversion data
Timing of Campaign	Campaign launched at a suboptimal time	Low user interest, low traffic	7	Lack of coordination with key seasonal trends or competing events	5	Ads are timed based on previous marketing schedules and intuition
Competitor Activity	Competitor runs simultaneous campaigns	Marketing noise and reduced effectiveness of the course campaign	6	Lack of awareness of competitors' marketing schedules	4	Basic competitor monitoring using general tools like Google Alerts; React to competitor campaigns after they've been noticed

Key takeaways : Data science and machine learning will assist on providing the analysis and reporting results from the experimentation platform and the prediction model for the Marketing and Product Manager.



ROAM Analysis

ROAM Analysis

	Issues	Actions	ROAM designation
Issue 1	10% of courses are not being updated	Contacted the courses manager and have had no issues for two weeks.	Resolved
Issue 2	Customers are complaining.	Reached out to the customers, listened to their issues, and offered to send them a free coupon. Most customers were satisfied with this solution.	Mitigated
Issue 3	There is a software issue preventing your customer relations team receiving all requests and complaints.	Assign your IT Specialist to fix the problem as soon as possible.	Owned
Issue 4	Some customers are canceling their subscriptions.	Checks in with the customers and, despite offering them a subscription promotion, they still want to cancel. There is nothing you can do, but the impact is minimal.	Accepted
Issue 5	The cost HR per revenue ratio to recruit data engineer is above target (over budget)	Assign your HR Specialist to postpone hiring data engineer	Owned
Issue 6	Courses are being increasing.	Reassessed the model making it more relatable and importan for users.	Mitigated
Issue 7	Your budget is tightening.	Financial Analyst reassessed project spending and was able to increase the budget. The additional money was enough to offset recent losses.	Resolved

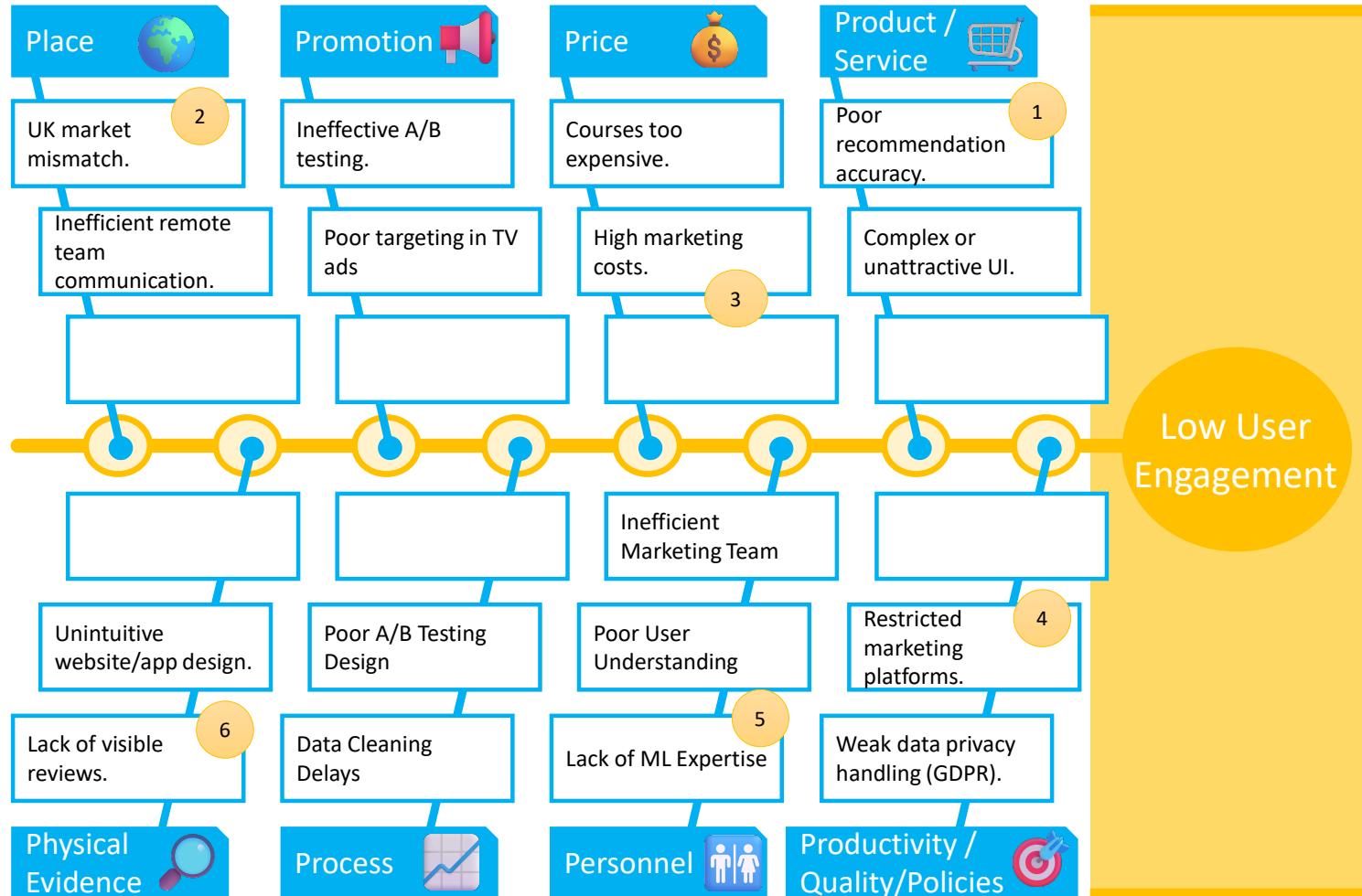
Status Report

Project Name: C4U Course Recommender System

Today's date: July 5

Summary		Overall Status (RAG)		
We have installed new course recommender system software to recommend a more personal courses and begun sending out the first test batch of c4U to customers. However, we have run into issues with product quality, customer communication, and the delivery process. Our next milestones include sending the test batch customers newsletters on plant upkeep and sending out the second batch of plants. This report also includes top risks and issues that have arisen and how we intend to take action.		Amber		
Completed Milestones and Tasks				
Description	Date	Status	Owner	Comments
Purchased and installed new software to keep track of incoming orders	June 15	Completed	IT Specialist	The installation took three days longer than expected.
Began sending test batches of C4U course recommender system	June 21	Completed	Head of Data Science and Machine Learning	The number of orders exceeded targets by 15%.
Upcoming Milestones and Tasks				
Description	Date	Status	Owner	Comments
Send the first batch customers e-newsletters with a product announcement on our improved search engine	July 7	Upcoming	Marketing Promotion Manager	The newsletter must C4U brand design guidelines.
Hit at least 95% of recommendation align with user preference	July 19	Upcoming	Head of Data Science and Machine Learning	The error rate should be under 5%
Top Risks and Issues				
Issue	Impact	Action		Owner
The data team reports that 10% of the courses were not available	Profit loss, complaints, and budget issues	Evaluate and adjusting the courses inventory and obsolete		Courses Manager
The customer relations team is receiving only 30% of requests and complaints	Customer dissatisfaction	Fix problems with new customer service software		IT Specialist
The course completion rate is only 60%	Cancelled subscriptions	Evaluate, selecting and adjusting the courses to tailor the demand of the customer preference		Courses Manager

FMEA Updated



Key takeaways :
Data science and machine learning has been applied not only to Recommendation System but also in our sales pipeline, TV ads and marketing campaign.

Sprint Backlog

Epic	User Story Title	Story	Acceptance Criteria	Value	Estimate (Story Points)	Sprint	Sprints		
Course Recommendations	Personalize Course Recommendations	As a user, I want to receive personalized course recommendations based on my previous activity and interests so that I can easily find relevant courses.	<ul style="list-style-type: none"> - Recommendations are shown based on user preferences (past purchases, ratings, and browsing history). - Recommendations are updated dynamically as user activity changes. 	\$\$\$	8	Current Sprint	Name	Current Sprint	Next Sprint
	Course Recommendations Algorithm	As a data scientist, I want to implement a recommendation algorithm that considers user demographics, past activity, and course ratings.	<ul style="list-style-type: none"> - Algorithm uses collaborative filtering and content-based filtering. - The recommendations are shown in less than 3 seconds. 	\$\$\$	13	Current Sprint		June 1	June 22
	Integrate Feedback Mechanism	As a user, I want to provide feedback on recommended courses so the system can improve future recommendations.	<ul style="list-style-type: none"> - Users can rate recommended courses (1-5 stars). - The system adjusts future recommendations based on user feedback. 	\$\$	5	Next Sprint		June 19	July 9
Course Search Functionality	Filter Courses by Category	As a user, I want to filter courses by category so I can easily find courses in specific areas of interest.	<ul style="list-style-type: none"> - Filters are available for categories (e.g., Technology, Business, Art). - Users can apply multiple filters. - Search results update in real-time based on the selected filters. 	\$\$	8	Current Sprint	Start date	57	34
	Search Courses by Keywords	As a user, I want to search courses by keywords to quickly find relevant content.	<ul style="list-style-type: none"> - Users can search by keywords. - Results are relevant to the entered keywords. - Search results are returned within 2 seconds. 	\$\$\$	5	Current Sprint		60	60
User Profiles	User Data Collection	As a product manager, I want to collect user profile data (age, preferences) so that the system can deliver more personalized experiences.	<ul style="list-style-type: none"> - User profile fields include age, education, and interests. - The data is stored securely and can be updated at any time by the user. 	\$\$\$	5	Current Sprint	Point Capacity	17	9
	Update User Profile	As a user, I want to update my profile information to reflect changes in my preferences or education.	<ul style="list-style-type: none"> - Users can update their personal information. - Changes are reflected in the system immediately and influence future recommendations. 	\$\$	3	Next Sprint			
Social Media Ads	Create Engaging Ad Copy	As a marketer, I want to create engaging ad copy to increase click-through rates (CTR) and conversions.	<ul style="list-style-type: none"> - Ad copy is tested and optimized using A/B testing. - The ad has a strong CTA. - CTR increases by at least 10% after optimization. 	\$\$\$	5	Current Sprint	End date		
	Design Visuals for Social Media	As a social media manager, I want to design eye-catching visuals for the campaign to attract more user attention.	<ul style="list-style-type: none"> - Visuals are platform-specific (Instagram, Facebook, LinkedIn). - Visuals lead to a 15% improvement in engagement (likes, comments, shares). 	\$\$	8	Next Sprint			
Email Marketing	Create Personalized Email Campaigns	As a user, I want to receive personalized emails about courses based on my previous interests so that I can easily find relevant content.	<ul style="list-style-type: none"> - Emails are personalized based on user profiles and past activity. - Email open rates increase by 12%. - Click-through rate increases by at least 10%. 	\$\$\$	8	Current Sprint	Point Capacity		
	A/B Testing for Email Subject Lines	As a marketer, I want to run A/B tests on email subject lines to see which ones generate the highest open rates.	<ul style="list-style-type: none"> - Two subject lines are tested in each campaign. - The winning subject line increases open rates by 15% compared to the control. 	\$\$	5	Current Sprint			
Influencer Partnerships	Partner with Industry Influencers	As a campaign manager, I want to collaborate with influencers in the education space to promote the new course recommender system.	<ul style="list-style-type: none"> - At least 3 influencers post about the campaign. - Influencer posts generate a 20% increase in user sign-ups. - Positive engagement on influencer posts is high (e.g., comments, likes). 	\$\$\$	13	Next Sprint	Points Assigned		
	Track Influencer Campaign Success	As a campaign manager, I want to track the success of influencer marketing to evaluate the ROI.	<ul style="list-style-type: none"> - Influencer posts are tracked using unique reference links. - ROI is calculated based on the conversion rate from the posts. - Campaign report is generated post-campaign. 	\$\$	5	Next Sprint			

Key takeaways : A project manager will help to ensure the ROI is healthy. 2-weeks to a month of projects are listed which related to C4U's course recommender system



Data Science and Machine Learning Scrum

*Please remove the filters before data entry.

KANBAN BOARD

RESEARCH	DESIGN	APPROVAL	DEVELOP	TEST	PUBLISH
0	0	0	2	1	6
PROJECT	Low Priority	Medium Priority	High Priority		
Data Analysis Data Engineer Supervised Models Unsupervised Models			Product - Recommender System - Ensure alternative models Unsupervised Models Wahyu DUE DATE - 27-Sep-24 HOURS - Not Estimated COST - \$\$	Product - Recommender System - Improve machine learning models by updating Supervised Models Wahyu DUE DATE - 27-Sep-24 HOURS - Not Estimated COST - Not Estimated	Product - Recommender System - Improve machine learning models by updating Supervised Models Wahyu DUE DATE - 27-Dec-23 HOURS - Not Estimated COST - \$
RESOURCE					
Wahyu (blank)					
PRIORITY					
High Medium (blank)			Process - Align the architecture with the revenue Data Engineer Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - \$\$	Price - Marketing Campaign - Follow up the analysis from Data Analysis Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - Not Estimated	Promotion - Marketing Campaign - Adjust targeting Data Analysis Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - Not Estimated
DUE MONTH					
Dec '23 Not Scheduled Sep '24					
WEEK					
4 6 Not Sche...					
STATUS					
COMPLE... OPEN (blank)			Place - Marketing Campaign - Market analysis Data Analysis Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - Not Estimated	Policies - Marketing Platform - Create model from the market Supervised Models Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - Not Estimated	Policies - Marketing Platform - Create model from the market Unsupervised Models Wahyu DUE DATE - Not Set HOURS - Not Estimated COST - Not Estimated

FILTER

- PROJECT: Data Analysis, Data Engineer, Supervised Models, Unsupervised Models
- RESOURCE: Wahyu, (blank)
- PRIORITY: High, Medium, (blank)
- DUE MONTH: Dec '23, Not Scheduled, Sep '24
- WEEK: 4, 6, Not Sche...
- STATUS: COMPLE..., OPEN, (blank)

Key takeaways : Kanban board is use to visualize the flow of tasks within the sprint.

Conclusion

Conclusion Part 1

- **Project Management:**
 - **Clear roadmap** and **defined milestones** ensured that project objectives were met on time and within scope.
 - **Resource allocation** and **risk management** enhanced decision-making, leading to optimized resource use.
- **Agile Scrum:**
 - **Iterative development** allowed for continuous improvements and faster delivery of working features.
 - **Customer feedback loops** were integrated, ensuring that user-centric features were prioritized, boosting system adoption.
- **Lean Six Sigma:**
 - **Process optimization** through Lean Six Sigma reduced waste and increased efficiency, particularly in data processing and model training phases.
 - **Quality improvements** minimized errors and bottlenecks, leading to smoother deployment and enhanced system performance.
- **Budgeted ROI (15.8%)** was exceeded by **actual ROI (18.2%)**, indicating higher-than-expected returns.

Points learn from Netflix's Story
(Credit)

Points from Netflix's Story

Business Case:

- In 2022, after a decade of remarkable growth, Netflix seemed to have reached a plateau.
- **Competition** from new streaming services was intensifying, particularly in the US.
- **Geopolitical conflicts** urged **the company's exit from certain regions**, where it had an expanding customer base.
- **Rising inflation** was making **users more price-sensitive**, restricting Netflix's capacity to raise its subscription fees.

Problem Statements:

- **Netflix went from adding over 165,000 new customers daily** in the first quarter of 2020, to reaching a plateau in 2021, when **out of 60 million subscribers, approximately 30 million more people were using shared accounts**.
- In the first half of 2022, **Netflix experienced the worst six-month period in its history**, losing customers and prompting the company to **fire hundreds of people** and **scale back its programming**.
- This downturn led to a significant drop in its share price, **wiping out approximately \$200 billion in market value**.

Points from Netflix's Story

Root Cause Analysis:

- Some users shared their accounts with partners or children they lived with, which was generally considered acceptable.
- Others shared with friends or relatives in different locations, a more problematic and common scenario.
- Additionally, there were instances of individuals sharing passwords with dozens of people, often reselling accounts to those unwilling or unable to pay through traditional means.
- This was Greg Peters approach, when the numbers **revealed untapped potential in how many subscribers would share their accounts - approximately 30 million more people were using shared accounts..**

Experimenting and Testing Possible Solutions:

- The company's management initiated two measures:
 - **Blocking Password Sharing:** aiming to curb the loss of potential revenue by ensuring that only paying subscribers could access Netflix's content.
 - **Introducing an Ad-Supported Version:** a new subscription tier designed to attract cost-sensitive customers who might be willing to endure advertisements in exchange for a lower subscription fee.
- Netflix developed a model to identify users who are traveling and differentiate them from those using someone else's password - **Blocking Password Sharing – The Experiment**



Points from Netflix's Story

- After identifying account sharers, **the next step was to decide how to make these users pay.**
 - On one side there was the belief that **Netflix should charge by residence**, similar to cable TV. This belief came from Reed Hastings, Netflix co-founder.
 - This would require users to pay per home and get another account for different locations.
 - The argument opposing this view was that **the residence model contradicted a core principle of Netflix: the ability to take the service anywhere.**
 - The alternative was **an individual user model**, allowing customers to access Netflix wherever they went, **with an additional fee for adding new users to their accounts.**

The Experimentation Roll Out:

- In 2022, Netflix introduced the **user model in Chile, Costa Rica, and Peru**, while **the residence model was deployed in five other Latin American countries.**
- This region, with its high incidence of password sharing, **served as an ideal testing ground due to common language (Spanish) and similar payment challenges**, as many residents lacked bank accounts.
- The results were clear-cut: **the subscriber-centric model was more successful.**

The Outcomes:

- Last year, **Netflix added 30 million new subscribers**, and in the first quarter of this year, **another 9.3 million.**
- According to Netflix, its **ad-supported plan now hosts 40 million monthly active users worldwide**, a significant **increase from 23 million in January.**
- This model not only increased the number of subscribers but also reduced churn rates (the rate at which customers unsubscribe) and minimized negative feedback on social media platforms.

Points from Netflix's Story

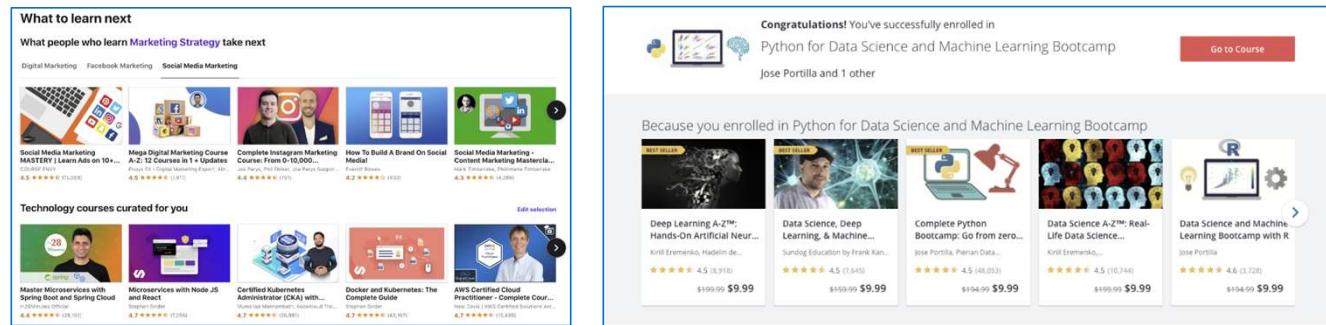
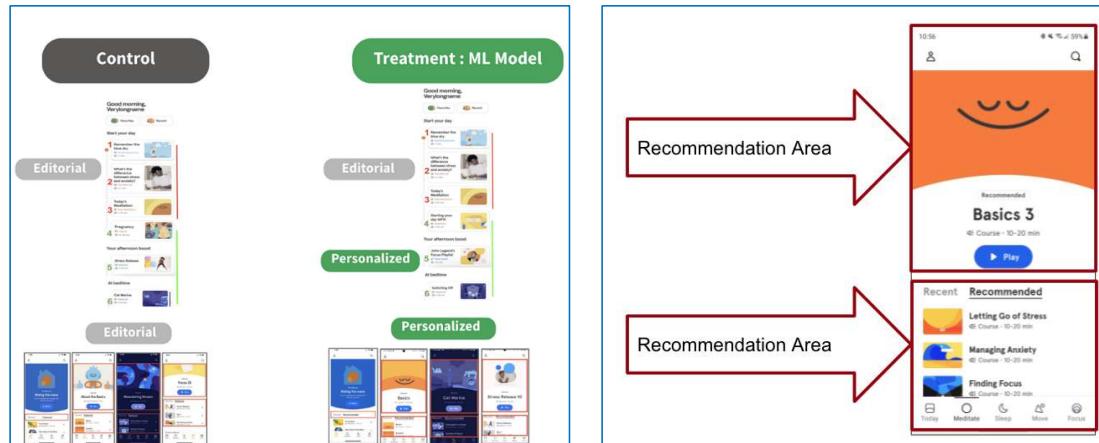
The subscriber-centric model's success can be attributed to several factors:

- **Flexibility:** users appreciated the ability to access Netflix from anywhere without being tied to a single household.
- **Cost-Effectiveness:** while there was an additional fee for adding new users, this was often seen as a better alternative than forcing each household member to have a separate subscription.
- **Reduced Friction:** the model minimised disruptions to the user experience, which could have led to dissatisfaction and cancellations.

Project Related – AB Testing, Marketing Campaign and TV Ads and Process Capability (Credit)

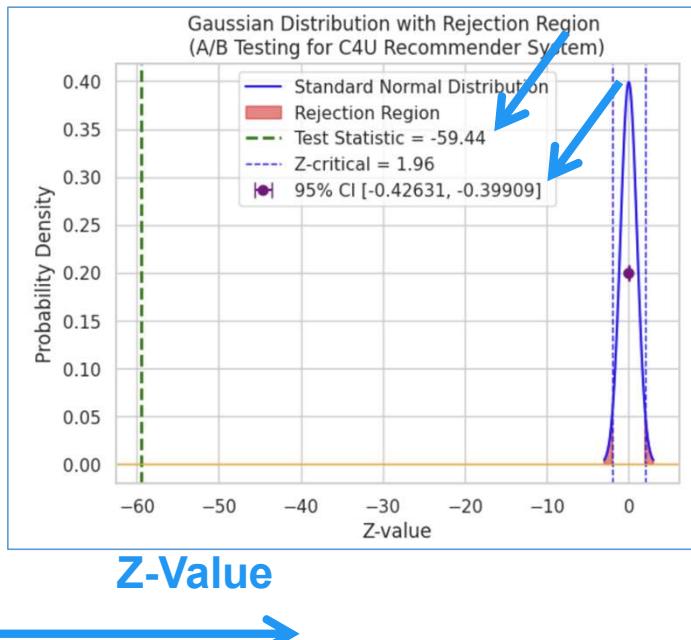
Recommender System

How many click from the control group and the experimental group?

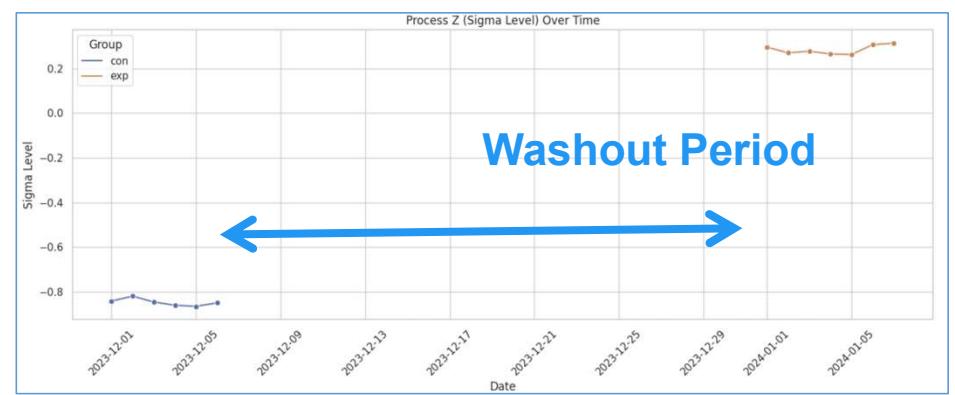
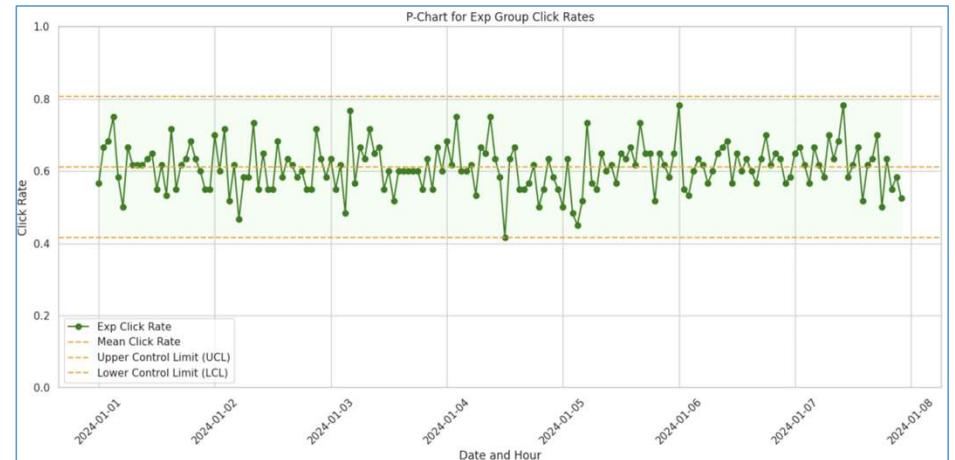


Recommender System

Probability ↑



Key takeaways : Will applying Control Chart and Process Capability add value to the Experimentation



Con (Baseline)



Recommender System

How many converted with our ads vs product service announcement?



Ads

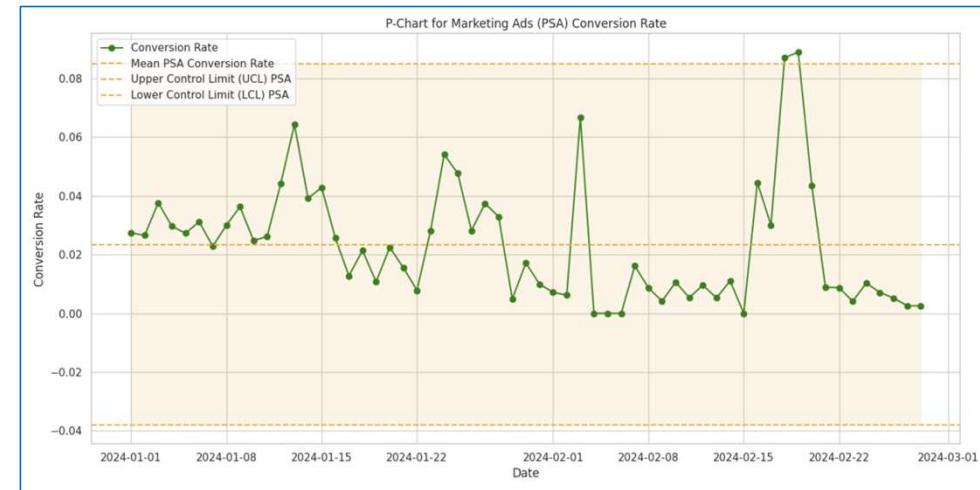


Products Service Announcement
(PSA)



Ads and PSA

How many converted with our ads vs product service announcement?



Key takeaways : Should we compare to different Ads and determine which one is the most effective one?



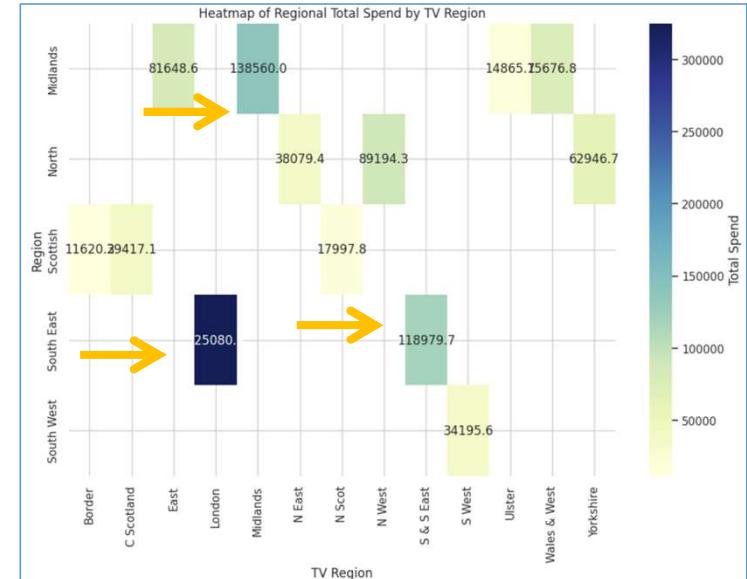
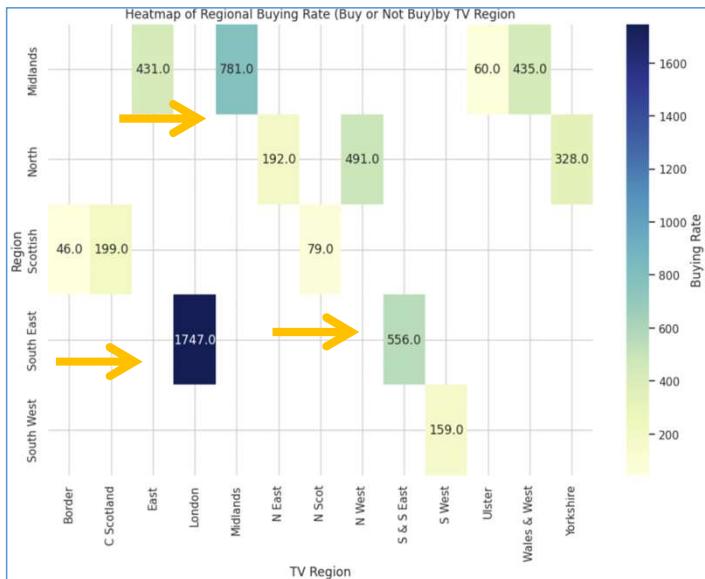
Recommender System

How many purchase with our tv campaign?



TV Campaign

Region and TV Region



- The highest buyers and total history spending are from London, South & South East, and Midlands.
- The middle range for both are from East, Wales & West, and Yorkshire.

Key takeaways : Is TV Ads still relevant? Which location is significant to our sales



Appendix

Appendix

Documents:

- <https://www.kaggle.com/code/wahyuardhitama/task003-p001-ml-dl-rec-sys-course-20231025>
- <https://www.kaggle.com/code/wahyuardhitama/task003-p002-ml-dl-rec-sys-course-20231029>
- <https://www.kaggle.com/code/wahyuardhitama/task003-p003-ml-dl-rec-sys-course-20231101>
- <https://github.com/whyzie/Task003-ML-DL-Rec-Sys-Course-20231201>