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Introduction

The present study evolves around the Smart City OS project as it looks to achieve a purpose-built, smart operating system (OS) for Hull City in the UK. The Smart City OS project is developed to provide the residents of Hull to receive better information to make choices about transport, traffic and parking. The local government such as the Hull City Council (HCC), and the central government such as Department for Environment, Food and Rural Affairs (DEFRA) would be playing a vital role in the project developments. Apart from this, Connexin's LoRaWAN and investment of £85m from KCOM in the city's full-fibre network structures the area-wide connectivity initiative in the project. The study objective is to manage the project developments and look after the resources and risks while addressing the ways to tackle people and team collaborations in the Smart City OS project. In doing so, there would be several areas under focus such as stakeholder management, project iron triangle, costing, risk management, change management, conflict and negotiation management, and building effective teamwork.

1 – MANAGING PROJECTS

1.1 Project Manager

The project manager leads the project decisions and distributes the work processes with each stage of the project to the team members and project associates. As per the views of Tam *et al.* (2020), key skills needed for a project manager to see through the project proceedings in a better way are resource management, leadership, decision-making, collaborative working, and the formation of diverse teams. As seen for the project of Smart City OS, the personal skills required by the project manager will be leadership, analytical thinking, adaptability, and organised nature. On the other end, interpersonal skills such as negotiation, communication, problem-solving, and relationship management among the stakeholders should be present within the project manager. Apart from this, group skills in the form of team building and conflict management remain vital for the project manager to succeed with the developments in the Smart City OS project. According to the study by Oraee *et al.* (2019), there are several knowledge areas a project manager has to deal with in a project such as integration, quality, risk, scope, cost, schedule, procurement, communication, resource, and stakeholder management. Hence, to meet all these project knowledge areas a project manager needs to be well-equipped with a wide array of skills and have the necessary experience to deal with complex project processes. As per the project of Smart City OS, the project manager needs to plan the project systematically such as by following the project life cycle, which comprises the stages such as initiation, planning, executing, monitoring and controlling, and closure. This will assist the project manager to lead the project successfully and keep the project scope intact. The project manager also needs to carry an ample degree of emotional intelligence as the idea is to learn from the project processes and hone existing skills while learning new ones

to make the project a grand success. As discussed by Zhang *et al.* (2020), diligent planning, clear stakeholder communication, proper monitoring of the project stages, setting definitive project scope, and managing risks are seen as the major success factors for a project. While project initiation document (PID) creation is ideally the success initiator of a project as this outlines the project deliverables, project scope, project budget, timeline, and assumptions for the project. Smart City OS project manager should therefore invest in the idea of developing PID to guide the project with an ample degree of merit. For example, a similar kind of project can be seen in the form of London Garden Bridge as it proposed a footbridge and public garden over the River Thames,²⁶ but due to inactivity from the project manager to clearly outline the project scope, deliverables and lack of planning skills, resulted in a massive failure of the project (Walker, 2019). Therefore, to avoid disastrous outings such as this, the project success factors should be followed by the project manager.

1.2 Stakeholder Engagement and Management

Internal stakeholders	External stakeholders
Hull University, Environment Agency, Connexin, KCOM, Cisco, and HCC Department, and HCC ICT, Hull Fire & Rescue, and DEFRA.	Public, and System Developers

Table 1: Stakeholders in project

(Source: Self-developed)

¹¹ There are two types of stakeholders involved in a project such as internal and external stakeholders. For a project to meet the deliverables, adequate management of both these stakeholder groups are essential. Stakeholders in a project could be assigned their respective tasks with the help of a work breakdown structure (WBS). As per the study by Silvius and Schipper (2019), using WBS allocation of tasks to the internal stakeholders of the project becomes easier as tasks are allocated based on the respective skillset of project participants. It also authorises the project manager to navigate through the project activities in a better way.
⁴ According to the project of Smart City OS, the major stakeholders in the business are identified as Hull University, EA, Hull Fire & Rescue, System Developers, Public, DEFRA, Connexin, KCOM, Cisco, and HCC Department, and HCC information and communication technology (ICT) team (APM, 2021). Therefore, a handful of stakeholders are going to require a seamless engagement with the project and the project manager to develop positive outcomes in the project. Among these stakeholders, the internal stakeholder is Hull University, Environment Agency, Connexin, KCOM, Cisco, and HCC Department, and HCC ICT, Hull Fire & Rescue, DEFRA, whereas the external stakeholders are the Public, and System Developers. As viewed

by Kivits *et al.* (2021), Mendelow's stakeholder mapping matrix assists in the process of predicting the decision-making capabilities of the stakeholders based on the level of power and interest in a specific project. Depending on the degree of stakeholder power and stakeholder interests across projects, there could be four stakeholder groups such as key players, keep informed, minimal effort, and keep satisfied.

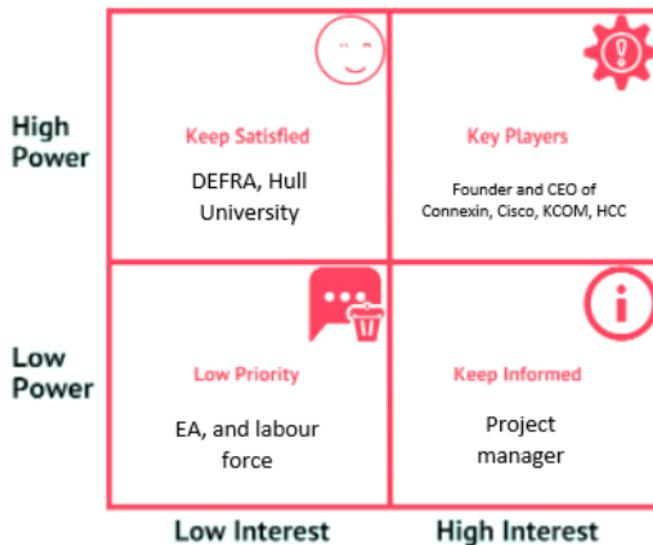


Figure 1: Stakeholder mapping

(Source: Developed from Kivits *et al.* 2021)

Mendelow's stakeholder mapping matrix helps place the respective stakeholders in a project across these groups to assist the stakeholder management in a better manner and ensure lesser conflicts of interest. The stakeholder groups sharing the highest level of power and interest should be placed as key players. Here, the key players are the Founder and CEO of Connexin, Cisco, KCOM, and HCC. As per the views of Bernstein *et al.* (2020), low-power and low-interest-centric stakeholders should be placed in the minimal effort grid according to Mendelow's stakeholder mapping matrix. Therefore, EA and the labour force should be placed here. Additionally, DEFRA, Hull University should be kept satisfied and the project manager shall be kept informed to ensure higher stakeholder engagement and productive outcomes in the project. For example, in the case of another similar project such as the Crossrail project in the UK, Tony Bryan as the project manager exercised effective stakeholder meetings to keep everyone thoroughly involved in the project. This helped the Crossrail project to share lesser

concerns in regard to stakeholder management, much of which is expected in the Smart City OS project. According to ²³ the study by Bahadorestani *et al.* (2020), a specific stakeholder engagement technique that is identified to be effective is the communication plan for stakeholders. The stakeholder communication plan assists in the process of transferring information across the project team effectively and saves time. Hence, a sense of collaboration tends to form between the different stakeholders as they get to interact and share progress about the project to make project functions operate with excellence and meet the project scope. As seen for the project of Smart City OS, the internal and external stakeholders would be sharing varied methods of communication to remain engaged with the project and promote successful outcomes. On the other end, the approach of the HCC to use the 'one council' approach to keep stakeholders engaged thoroughly in the project activities also adds a certain value to stakeholder management.

Stakeholder	Role	Category	Interest	Influence	Method of communication	Frequency
1	System Developers	External stakeholders	High	Medium	Meetings	One week
2	Project manager	Internal stakeholders	High	High	Meetings	Two weeks
3	HCC	Internal stakeholders	High	High	Email	Three weeks
4	Labour force	External stakeholders	Medium	Low	Meetings	One week
5	CEO of Connexion	Internal stakeholders	High	High	Email	2 weeks

Table 2: Stakeholder communication

(Source: Self-developed)

1.3 The Project Triangle

Managing the project constraints becomes necessary for a project manager. As a project consultant, it could be suggested that a large-scale project with a longer duration faces a bigger potential of facing project constraints. In many ways, the constraints within the project take the shape of risks going forward and act as a detrimental association. As per the views of Kabirifar and Mojtabaei (2019), the iron triangle theory outlines the major constraints within a project that impact the quality of the project. These three constraints are recognised as time,

² cost, and scope. As witnessed from the project of Smart City OS, the presence of these three constraints remain to be there as all of these collectively and on an independent level impact the quality of the project. Since networking and infrastructure for data-driven decision-making is a key part of the quality of the current project, the constraints are required to be managed efficiently or else networking issues could collapse the success of the Smart City OS project in Hull. The scope is not clear from the project developments thus far. Considering the scope factor, it becomes difficult to review the projected date of completion for the project and the cumulative budget required to deliver the project. Hence, the project manager should be aware of this and make way for a defined scope to avoid disaster with the Smart City OS project in Hull.

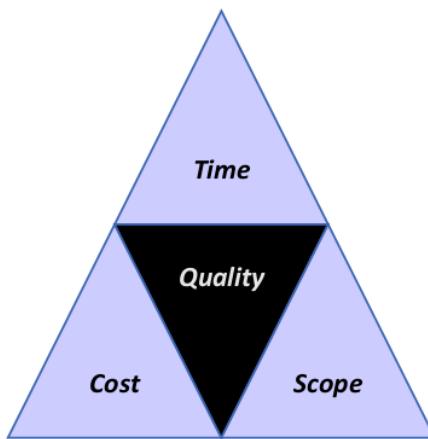


Figure 2: Iron triangle theory

(Source: Developed from Kabirifar and Mojtabahedi, 2019)

There is an interdependent nature shared by the three constraints within the iron triangle as making a change in any one of them would lead to changes in the other. According to the study by Mac Donald *et al.* (2020), balancing the three constraints within the iron triangle is essential to avoid risks such as scope creep, over budget, and delays. In terms of the time factor, the 12 separate council information technology (IT) systems being applied to the project could cause time management issues and bring delays. Hence, to avoid this and keep cost and scope tied up, the project could use Gantt charts for scheduling work. On the other end, the budget factor is a major concern for the project as it seeks funds from different stakeholders. In case poor forecasting is done and scope is constructed ineffectively, there shall be excessive budget requirements, which would cause delays and scope creep. Arguments could be made that the project field goes through changing dynamics that might cause either of these variables to shift, but the degree has to be low to make the overall project a success. For instance, in another project such as this one where the duration stood to be high, the project completely failed as it kept on dragging dates. This project was the Denver

International Airport project that tried to make use of sophisticated technology and handle passenger luggage but failed miserably with a delay of 16 months and a \$560 million budget in 2005. As per the study by Goldsmith and Boeuf (2019), the iron triangle solely focuses on the success degree of a project but skips aspects such as the impact of the project upon the stakeholders and investment risks in the project. Therefore, with finely tuned project scope and control measures, the constraints are required to be handled alongside several other key activities to keep the project on track for success.

2 – MANAGING RESOURCES AND MITIGATING RISKS

2.1 Managing Finances

Enhancing data sharing and decision-making remains to be one of the fundamental aspects of the project. This requires an ample degree of financial and technological resource support. As per the study by Elghaish *et al.* (2021), a dedicated cost estimation technique and approach needs to be figured out for a project as that gives a forecast of the project budget and possible return on investments (ROI) once the project is finished. The four key resources required to be properly reviewed are seen as human resources, material resources, equipment, and financial resources. The infrastructural work in the project is seen to be immense as setting the network connectivity to automate decisions and make a smarter living is a challenge for the project. Hence, there are possibilities that the raw material usage and different forms of equipment would make it difficult to predict the costs for each. Apart from this, the cost of the labour force and system developers in the project would also vary periodically due to the economic fluctuations in the UK. According to the views of Fazeli *et al.* (2021), direct costs, indirect costs, fixed costs, variable costs, normal costs, recurring costs, non-recurring costs, and expedited costs are known as the different types of costs affecting projects. On the other end, the Association for Project Management (APM) indicate two forms of costing, one as bottom-up and the other as top-down. The bottom-up estimation suggests that the total costs should equal the finished project as the project managers accounted for each expected cost. In contrast, taking a pot of funds and allocating it across each sub-process of a project defines the top-down approach. In this case, the major elements of the work are separated from that of the entire project based on the project scope. The top-down cost estimation method is done to generate a rough estimate for the critical tasks in the project. This helps secure enough funds for the project to progress sequentially across the project life cycle. In terms of comparison with the bottom-up costing method, the top-down cost estimation method is faster as it does not depend on extensive analysis of the project processes as evident for the bottom-up costing method. As seen for the project of Smart City OS, the top-down costing method is a better fit as it boosts the chances of securing higher ROI.

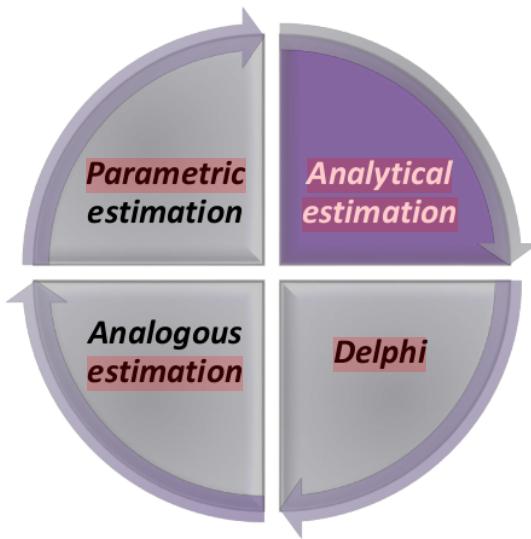


Figure 3: Cost estimation techniques

(Source: Developed from Elmousalami, 2020)

Cost estimation makes a project scope more relevant, thereby assisting the project manager to face minimal pressure from the project constraints. As viewed by Elmousalami (2020), parametric estimation, analogous estimation, analytical estimation, and Delphi are recognised to be the most popular cost estimation techniques. These techniques are applied in a project depending on the required budget and cost variations. The statistical relationship between the historical data and another set of variables can be used to estimate the cost of operations, which is referred to be a parametric estimation. The technique could be addressed as an assumption-driven one based on historical data. The analogous estimation technique is where costs of similar projects are required to compare and estimate costs for the project. On the contrary, the analogous estimation cannot be applied as the bulk of the smart city projects are under development, and without a final budget error driven, estimations would be formed. However, the detailed forecasting of the non-labour and labour resources required for a project can be done using the analytical estimation technique. This assists the activities to be finished within the set project scope. Furthermore, there remain higher chances for the current project to be influenced by external factors. According to the project of Smart City OS, the analytical estimation technique will be a good fit for the project in terms of estimating the costs for the project completion within a set time. As an example, the Garden Bridge project in London came across to be a disaster as it did not rely on the idea of estimating costs. Eventually, the Garden Bridge charity spent £53.5m with no construction project out of which £43m was public money (Walker, 2019).

2.2 Risk Management within the Project

Risk management is a vital knowledge area of a project as it assists in the handling of project constraints and assure that the project is moving forward without any issues. For effective monitoring and controlling, risk management has become a major part of projects of any size or domain. As stated by George (2020), initiating, identifying, assessing, planning a response, and implementing refer to the stages that enable the assessment of risks in a project and effectively categorise them. In the current project, the five main operations are setting up the infrastructure, installing the sensors of control in Hull City where the 12 systems will be integrated, applying of Smart City OS platform, gathering insights from networks, and relying on outcomes from insights to generate active systems capable of meeting the programmable city concept.



Figure 4: Risk management process

(Source: Developed from Buganová and Šimíčková, 2019)

Risk management enables a project to develop a lesser possibility of becoming a complete failure as minor adjustments based on the risks can be made to promote successful project actions. According to the views of Buganová and Šimíčková (2019), a risk register functions as a vital tool in a project as it manages to verify the impact of risks and prioritise the risks based on their likelihood of reappearing and severity. Similarly, the risk register also helps predict the possible mitigation strategies that could be applied to nullify the risks in a project and monitor the project effectively. As witnessed from the project of Smart City OS, the rating of risks based on the risk register should help gain better resilience against the risks and negate those to proceed safely with the project. As mentioned by Willumsen *et al.* (2019), there could be various risk categories such as operational, financial, reputational, technological, environmental, and legal for a project. Among these risk types, a wide host of

risks could be there for a project. Hence, to accurately find out the actual project risks, the presence of a risk register is imminent. According to the project of Smart City OS, there are ten actual risks identified across the six risk areas operational, financial, reputational, technological, environmental, and legal. The application of a risk register has helped score the risks and address mitigation solutions. (**Refer to Appendix**)

The risk register is indicative of the fact that the operational risk such as Increased time for project processes due to testing measures shared a score of 9, being the most concerning risk. As stated by Galli (2020), the use of the Gantt chart is done in a wide variety of manners as it can help generate the critical path for the completion of the project in a resource-efficient way. Similarly, several financial tools such as the cost-benefit analysis and earned value analysis can be applied as mitigation measures to avoid risking the funds of the project investors and ensure better ROI from the project. According to the project of Smart City OS, the risks are possible to be mitigated based on the solutions drawn and the degree of priority given for each risk. However, similar projects such as the London Garden Bridge project represented a sustainable new infrastructure that suffered from legal, financial, and scheduling risks resulting in the collapse of the project before it began (Walker, 2019). Therefore, risk analysis of the project environment and internal factors remain pivotal for a successful project.

2.3 Change Management

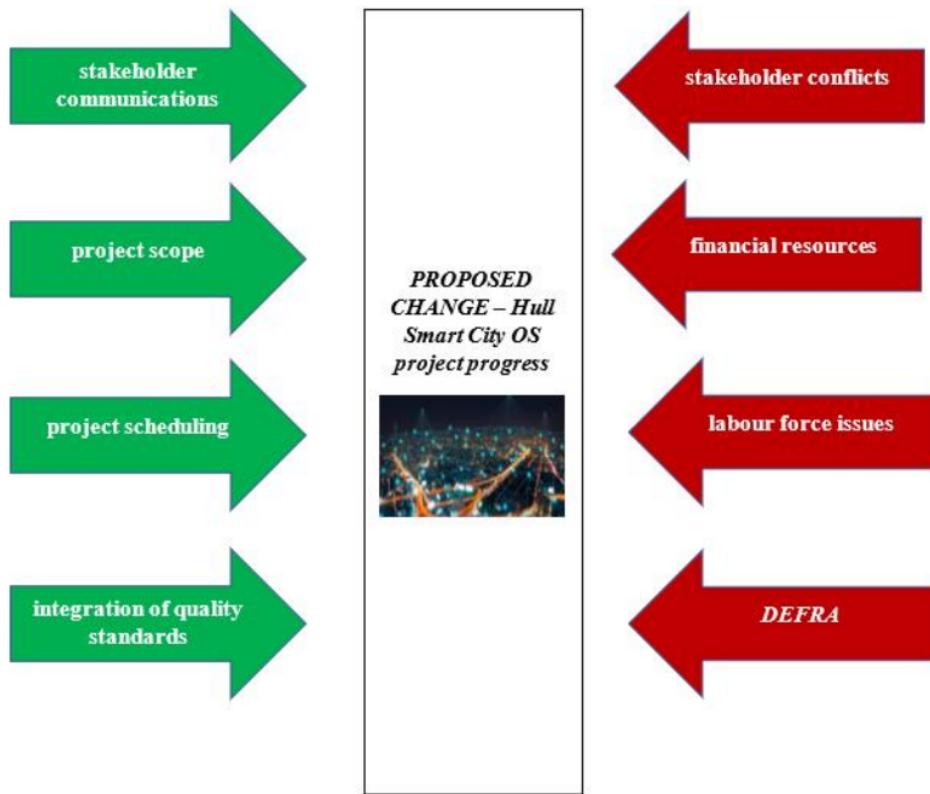


Figure 5: Force field change analysis of Lewin

(Source: Developed from Yang *et al.* 2021)

The change is an emergent one as seen in the project of Smart City OS as it tries to use modern technological solutions and infrastructural strength to make living for society. Changes developed from the project need to be controlled in an attempt to ensure that the stakeholders involved in the project can reap benefits from the executed project actions. Since the project is structured around the theme of digital transformation and smarter solutions for the public, the forces for change and forces against change stood there in numbers. As discussed by Yang *et al.* (2021), Lewin's force field analysis of change suggests that a project change is dependent on the forces that are accepting the change and the forces that are resisting the change. Therefore, the idea is to prove that the forces for change have greater power as compared to the forces against change to shape the project developments sincerely and follow change management with effectiveness. In a current project, the forces for change are stakeholder communications, project scope, project scheduling, and integration of quality standards. In contrast, the forces against change are stakeholder conflicts, financial resources, labour force issues, and DEFRA. On the other end, a similar project where there

remained similar change management measures stands as the Crossrail project in the UK, as over the years plenty of changes were required to establish successful outcomes.

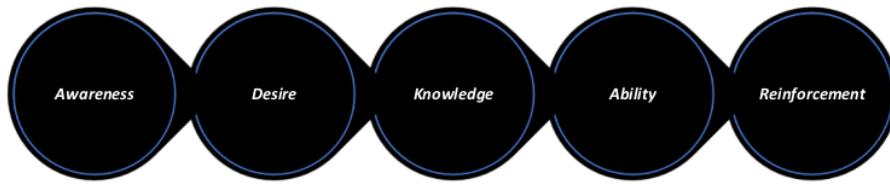


Figure 6: ADKAR change management model

(Source: Developed from Galli, 2019)

The acceptance level for the changes during the project needs to be systematically addressed. According to the study by Galli (2019), changes could be controlled and managed successfully with the help of change management frameworks such as the ADKAR model. This change management model gives the opportunity to systematically initiate and control the change events to meet successful project outcomes. ¹³ ADKAR is the acronym for awareness, desire, knowledge, ability, and reinforcement as these stages systematically aid in the process of shifting from the current to the transition to the future. Smart City OS project manager needs to successfully communicate the project changes to the respective stakeholder groups in an attempt to generate awareness. Information distribution to the stakeholders based on required changes after monitoring and controlling should be apt to ensure stakeholders are knowledgeable about the developments. This would allow for promoting the desire and ability to move forward with the project changes such as adding funds to the project or securing sponsorship to make the project deliver strong performance. As stated by Niayeshnia *et al.* (2020), the reasons for the change in a project should be visible in the project scope. Similarly, the long-term duration of the current project persists for changes in the future that can be better managed and controlled by keeping stakeholders and HCC notified about the updated schedule and budget for the project. Reinforcement can be done during the phase of project

execution depending on short-term gains such as the completion of the wide-scale data network in some areas within Hull, and thereafter remaining motivated to see the application in all areas within Hull could be achieved.

3 – MANAGING PEOPLE AND TEAMS

3.1 Conflict and Negotiation

Conflicts could occur at any point in time ²¹ in a project and disrupt the project's progress. This could also result in poor scope management of a project as stakeholders would be busy clearing doubts as compared to focusing on project tasks when conflicts arise. As per the views of Ahmadi Ettekhari *et al.* (2022), personal differences, role incompatibility, informational deficiencies, and environmental stress are the ideal reasons for conflict. On the other end, ²² there could be goal-oriented, interpersonal, and administrative conflicts. As seen for ¹ the project of Smart City OS, the association ² of different stakeholders such as Hull City Council, Connexin, Siemens, Bartec, Datek, Pitney Bowes, Defra, Teletrac Navman, and EA are concerned about the chances of extensive conflicts. According to the study by Rao and Lakshmi (2021), forcing, accommodating, avoiding, compromising, and collaborating are the five main conflict management approaches applied in different situations. *As per the project of Smart City OS, the six major conflicts are seen as a disagreement between the HCC and the project manager, a mistake from the project manager, an error from the project team, improper estimation due to conflict between HCC and system developers, quarrel between the project manager and CEO of Connexin, and questioning the path of the project from the end of HCC ICT to project manager.* The sources for the respective conflicts are witnessed to be project scope, resource allocation, scheduling, budget, personal differences, and priorities set in the project. These conflicts can be managed based on forcing, accommodating, avoiding, compromising, and collaborating techniques.

Types of Conflict	Sources of conflict	Resolution techniques
Disagreement between the HCC and project manager	Project scope	Collaborating
A mistake from the project manager	Resource allocation	Avoiding
Error from the project team	Scheduling	Forcing
Improper estimation due to conflict between HCC and system developers	Budget	Forcing
The quarrel between the project manager and CEO of Connexin	Personal differences	Accommodating

22	Questioning the path of the project from the end of HCC ICT to the project manager	Priorities set in the project	Collaborating
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Table 3: Types of Conflict during project management

(Source: Self-developed)

Negotiation refers to the invention of new options for mutual gains without voiding the complete interest of the opposing party. In a project, a strong degree of negotiation skills becomes useful as dealings occur between different stakeholders with variable inputs in the project. As per the views of Omene (2021), exchanging information and bargaining are crucial variables when one is looking to negotiate solutions in a project setting. The common interest, conflicting interest, compromise, and conditions are required to be addressed with diligence in negotiating project developments within the Smart City OS project.

3.2 Leadership

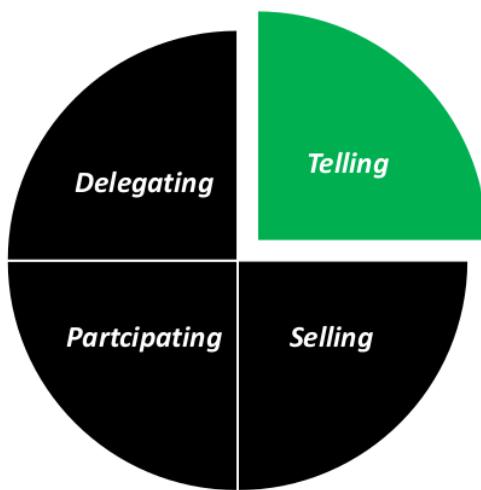


Figure 7: Situational leadership model of Hersey-Blanchard

(Source: Developed from Bhasin, 2019)

Leadership styles and management behaviour help construct the project developments with merit as the decisions made by project leaders go to influence the project actions, and thereafter the project outcomes are successfully achieved. As per the study by Bhasin (2019), the situational leadership model addresses the need for changing leadership practices based on situational demands as this helps a leader become flexible and resilient. In relation, self-efficacy, self-determination, personal consequences, meaning, and trust generation assures the empowerment of the project team which is achieved by following situational leadership. The Hersey-Blanchard Model of situational leadership outlines four forms of leadership styles

such as delegating, participating, selling, and telling style. As witnessed from the project of Smart City OS, APM highlights the application of situational leadership to be suitable to deal with shifts in the external and internal environmental factors, thereby influencing the project manager to observe it. According to the views of Henkel *et al.* (2019), communicating effectively and setting a common goal during the initiation phase of a project yields better performance in the projects as project leaders. The management of project knowledge areas becomes a success formula for projects that share an ample degree of complexity.³ It is the role of a project manager to systematically structure the project activities and lay the foundation for a successful project. As witnessed in the project of Smart City OS, the project manager as the leader should be willing to make situational adjustments to run the project successfully. It can be therefore recommended that situational leadership, specifically the telling style of leadership should be followed as it permits high-task and low relationship-based operations. However, in a similar sort of project where complex processes remained a major theme, the construction of the FIFA 2022 World Cup Stadiums was done efficiently as the project leaders set clear scope and deliverables with a flexible budget and slack time.

3.3 Teamwork

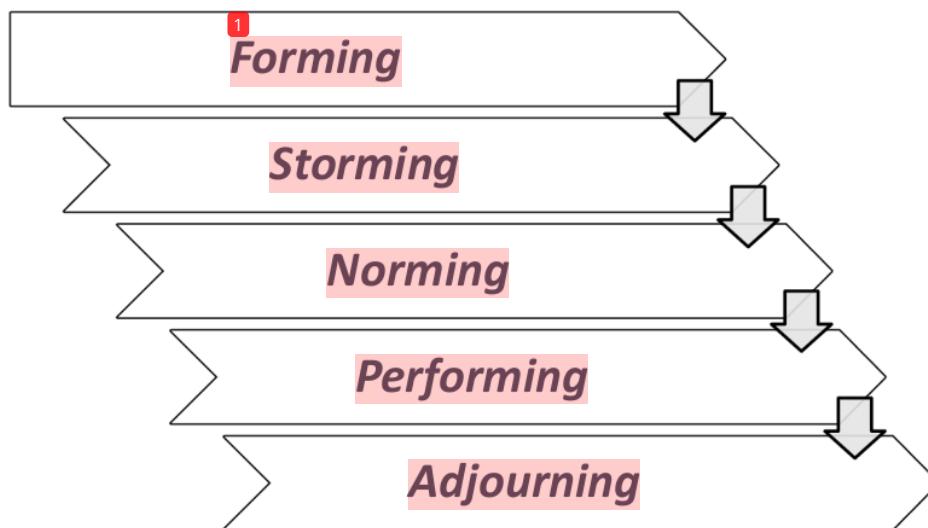


Figure 8: Tuckman Group Dynamics model

(Source: Developed from Nawi *et al.* 2022)

Diverse and inclusive teams are essential for modern-day project as better idea generation for complex problems are quickly sourced. As mentioned by Nawi *et al.* (2022), the Tuckman Group Dynamics model comprises five stages to help dynamically build teamwork and ensure better outcomes from the teamwork. These stages are represented by forming, storming, norming, performing, and adjourning. In case, there are a wide variety of team members in a

project, the model will help reduce conflicts and encourage teamwork. As discussed by von Ameln *et al.* (2020), brainstorming sessions are promoted with the objective of making teamwork better as everyone in the team gets to share their personal views and get recognition in the team. Brainstorming is also used in the Tuckman Group Dynamics model to form the team and keep aside personal differences. A collective focus on the team goal enables flexible workload distribution, whereas after performing assigned duties, in the adjourning phase, the team members are released. As witnessed from the project of Smart City OS, the Tuckman Group Dynamics model could be applied to promote Equality, Diversity & Inclusion in the project. On the other end, to form effective diversity in the project team, acceptance of opinions from different cultural backgrounds should be boosted with similar brainstorming sessions. Allowing empathetic views and making everyone in the team feel valued accelerates the pace of diversity in the project team.

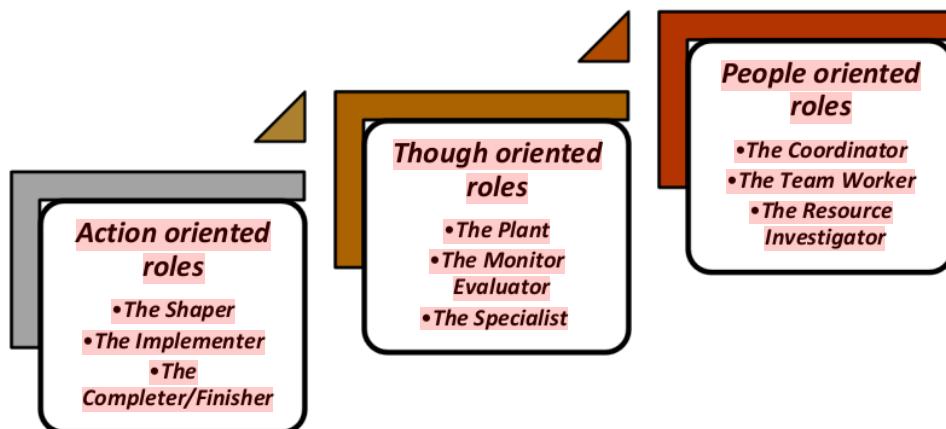


Figure 9: Belbin's team role

(Source: Developed from Rahmani *et al.* 2022)

Belbin's team role suggests the need for a team lead such as a project manager to position the project team members in respective categories to work flawlessly as a team. According to the views of Rahmani *et al.* (2022), Belbin's team role holds nine roles distributed across three categories action-oriented, people-oriented, and thought-oriented. The nine roles are shaper, implementer, resource investigator, team worker, coordinator, plant, monitor-evaluator, completer-finisher and specialist. According to the project of Smart City OS, the project manager needs to ensure each of these roles is covered by individuals in the project team to amplify the scope of a diverse team. Sharing possibilities for creative ideas and innovations is a result of a diversified team. According to the views of Scott-Young *et al.* (2019), diversity

improves team performance because it allows individuals from different backgrounds to be a part of them while holding different skills and expertise. Hence, the probability to generate solutions for problems becomes easier and time management is effectively dealt with alongside problem-solving. As seen for the project of Smart City OS, a diverse team shall catalyse the flow of processes in the project with superior expertise appointed for each project processes becoming available. As mentioned by Bernstein *et al.* (2020), EDI (Equality, Diversity & Inclusion) enables deeper trust and more commitment from the workforce, thereby making teamwork sustainable and value-driven. However, there are certain challenges of working in an EDI environment as communication language, slower decision-making, discrimination, and lower acceptance of different views might be present. To some extent, the project of Smart City OS includes EDI based structure as several stakeholders are collectively looking to transform Hull City into a smart one.

Conclusion

The current study has helped summarise that the Smart City OS could be a success with the effective management of project knowledge areas such as stakeholders, risks, costs, conflict, and teamwork. The availability of diverse stakeholders Hull University, EA, Hull Fire & Rescue, DEFRA, System Developers, Public, KCOM, Cisco, Connexin, HCC Department, and HCC ICT team gives chances to be efficient with the project processes. Iron Triangle has been helpful to declare that the cost, scope, and time require effective management to secure quality outcomes in the project. However, several other knowledge areas, especially stakeholder management has been also touted to carry immense value in the project. Smart City OS project shares plenty of possible risks such as overbudgeting, delays, and lack of skilled human resources. Smart City OS project faces conflicts from the sources such as project scope, resource allocation, scheduling, budget, personal differences, and priorities set in the project. EDI has been recognised to add value to team-based project work. Tuckman Group Dynamics model and Belbin's team role should collectively promote EDI for the coming project to make it a success.

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Appendix: Risk register

Sca le 1- 3	Severity - Red-High, Amber - Medium, Green - Low																				
Type (Ex am ples)	What is the actual risk?	Whic h will result in?	Pr ob abi lity	I m pli ct ed)	Total	Response	Action	Mit igat ion	Mit igat ion	Total	Risk	St at us (O pen or Cl osed)	D ate	Proj ect ma na ge r	Oper ation	Proj ect ma na ge r	Oper ation	Proj ect ma na ge r	Oper ation	Proj ect ma na ge r	Oper ation
	Supplier may go out of business	Delayed delivery	2	1	2	Find other suppliers as a back up		2	1	2	Open	Project manager	Open	Project manager	Open	Project manager	Open	Project manager	Open	Project manager	Open
Operational	Increased time for project processes due to testing measures	Delayed delivery	3	3	9	Use more system developers		3	2	6	Open	Project manager	Open	Project manager	Open	Project manager	Open	Project manager	Open	Project manager	Open

Financial issues	Budget overrun	Delayed delivery	2	3	6	Better resource allocation to critical tasks with Gantt chart	3	3	9	Project manager	Open	
	Unable to fund system developer	Delayed delivery	3	2	6	Using CBA or EVA	3	3	9	Project manager	Open	
Reputational issues	Software and infrastructure	Flawed Smart City	2	1	2	Using multichannel communications for better damage control	1	1	1	HC	Open	
	Poor network	Data loss	3	2	6	Following ISO standards	2	3	6	Connection	Open	
Technological	Cyber Securities	Data theft	2	3	6	Use of blockchain	2	3	6	System developers	Open	
	Loss of signals for environmental reporting	Data management	1	2	2	Following ISO standards	2	1	2	DEFRA	Open	

	Land issues for new infrastructure	Delayed delivery	2	1	2	Compliance with local and international law	1	2	2	Project manager	Open		
Legal	Ethical public acceptance	Delayed delivery	1	2	2	Public awareness campaign	2	1	2	Project manager	Open		

(Source: Self-developed)



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