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Scope Creep in Large-Scale Projects: Lessons from Denver International Airport

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Abstract: *Widely regarded as a project's boundary, project scope management is viewed as a critical knowledge area in project management (PMBOK). However, the complexity of scope management makes its definition complicated as it is influenced by various external factors, including political, technological, and organizational factors, which tend to significantly redefine a project's lifecycle. In the situation where there are shortcomings in the project's scope, these interferences could have adverse implications on the overall project, such as increased expenses and extended timelines. The Denver International Airport (DIA)project provides an intriguing case study in understanding the importance of scope management in the success or failure of a project. Hence, this study investigated the DIA's automated baggage project from the lens of scope management. Findings indicated factors such as project complexity, inadequate change control mechanisms, communication gap, and inconsistent strategy behind the project's collapse. The study has academic and practical implications for large-scale projects.*

Keywords: project management, scope creep, system failures, stakeholders' involvement, automation, baggage handling

INTRODUCTION

Understanding the Role of Project Scope Management: An Overview

A recipe for a successful project lies in its scope management (Khan, 2006). Likewise, a loophole or interference (e.g. external factors) in a project's scope can have an adverse effect in areas such as timing, costing, and overall quality (Lampa et al., 2017). The impact varies depending on the magnitude of a project, with larger-scale projects experiencing a greater impact (San Cristóbal et al., 2018). Project scope management is a multifaceted process that incorporates several other procedures in determining the feasibility of a project and completing the project's goals (Mirza, Pourzolfaghar &

Shahnazari, 2013). When a project has a clearly defined scope, the possibility of errors is minimal, and the project is likely to overcome unforeseen setbacks. A well-defined project scope can help avoid constantly changing requirements, unexpected outcomes, added costs, and failure to meet project deadlines (Williams 2016). A Work Breakdown Structure (WBS) is needed to depict the effort distribution needed to achieve the project objectives (Zecheru & Olaru, 2016). When documenting the project scope, a successful scope statement should detail all the boundaries of the project while also establishing the responsibilities of the team, define all the procedures that need to be followed for verifying and approving the finished work, and give team members a definitive guideline for making project-related decisions (Alexander & Beus-Dukic, 2009).

REVIEW OF LITERATURE

Overview of Case Study: Denver International Airport (DIA)

In the initial stages, the Denver International Airport (DIA) project aimed to build a new airport to replace Denver's existing Stapleton International Airport. The project was initiated in 1989 and was planned to open in late 1993. The airport was supposed to handle the growing number of passengers and airlines. To build a futuristic airport, DIA incorporated some innovative projects. The automated baggage handling system was one of these key projects. However, the project was plagued with several challenges that led to major setbacks (Calleamn Consulting, Ltd., 2008). In the practice of project management, the project's pitfalls were tied to the decision-making process (scope management). The resultant impact of poor planning and design flaws led to several critical issues and schedule delays. For example, the airport ended up costing way more than the original budget and delayed operation until early 1995 — more than a year and a half later than the original plan (as shown in Figure 1). Although the airport began operations successfully in 1995, the automated baggage handling system continued to be plagued by technical and operational faults, which led to customer dissatisfaction, pressure on the airlines, and increased cost of maintenance (Swartz, 1996; Calleamn Consulting, Ltd 2008).

	Projected Outcome	***Final Outcome***
Cost	Estimated construction cost was projected at $2.08 billion.	The final construction cost skyrocketed to almost $1 billion more than the projected cost.
Duration	Scheduled to open in October 1993.	Actual opening in February 1994 after four failed targeted openings.
Output	Designed to ease baggage management and increase turnaround time for aircraft using a fully automated process.	The project was scrapped in 2005 in place of a fully manual process.

Figure 1. Projected versus actual outcome of the DIA Project (Source: Author)

Changes in Project Scope

The scope of DIA from inception was to address growing traffic concerns and capacity limitations of the existing Stapleton International Airport (Goetz & Szyliowicz, 1997). Between 1991 and 1995, there were several significant changes in scope due to the introduction of the automated baggage system. The project schedule was extended two years to 1995 with a $4.8 billion cost (Calleam Consulting Ltd., 2008). Boeing Airport Equipment Automated Systems Incorporated (BAE) was contracted for the automated baggage system. Due to the functional failure of the system, the focus of the project shifted from developing infrastructures to solving the existing issues. The changes in deliverables, except for the airport-wide automated baggage system, also included additional runways, expanded parking lots and basements, the commuter building, and additional equipment and services (Calleam Consulting Ltd. 2008; GAO, 1996).

Rationale for Automation

Demand from United Airlines

In the preliminary planning phase, the DIA management provided airlines with the autonomy to design their baggage system. However, when United Airlines signed DIA as a hub in mid-1991, the airline approached BAE to design a futuristic baggage handling system with standards above existing airports with similar designs (e.g. San Francisco Airport). Following some deliberation, DIA management welcomed the idea of automated baggage handling for all its concourses. In justifying their decision, DIA management stressed the challenges of installing a manual system, pointing out that the conventional process will be labour-intensive and cost-consuming (Swartz, 1996; Calleamn Consulting Ltd., 2008).

Proximity

Based on the design of the airport, the nearest concourse is over a thousand feet away from the passenger terminal. The DIA management believes that distance would result in baggage delay, particularly when using baggage carts. To maintain an effective and efficient flight scheduling system, the speed of baggage delivery was a valid reason for choosing automation (de Neufville, 1994).

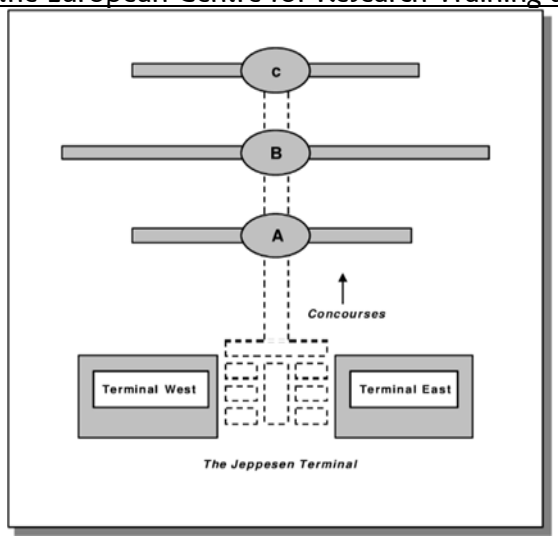

Figure 2. DIA Concourses and Terminal (Source: Donaldson, 2002).

Higher airline revenues

The DIA management posited that by improving aircraft turnaround time, the airline would record fewer ground delays and improve the number of flights. This, in turn, will lead to an increase in profit. Their argument was built on Stapleton International Airport's limitation in efficiently managing baggage handling, providing DIA more reason to embark on the automation project with BAE. (Calleamn Consulting Ltd, 2008; Schloh, 1996).

High capacity and reliability

Besides speed and profitability, DIA management favoured the automated process to be more dependable compared to the traditional systems of belts and conveyors. Moreover, the new system will be enhanced to manage higher carrying capacity, making it ideal for oversized baggage and sports equipment such as golf clubs. (Calleamn Consulting Ltd., 2008).

METHODOLOGY

This study adopted a literature review methodology in investigating the significance of scope management in PMBOK, and how it shapes large-scale projects. Snyder (2019) stressed that this research method helps to effectively synthesise research findings to provide "meta-level evidence" and identify gaps. The relevance of this research method to this study is further supported by Mengist et al. (2020) and Liberati et al. (2009). Key literature sources from scholarly journals, reports, policy-related documents, and online materials were identified. Keywords such as project management, scope creep, change management and stakeholder involvement were used in sourcing literature materials.

FINDINGS AND DISCUSSION

Scope Management Challenges

The subjectiveness and conflicting opinions on what is successful and what is not, make it difficult to define a successful or failed project (Belassi &Tuckel, 1996). Nonetheless, Hallgren and Wilson (2007) argued that a project that falls short of its estimated timeline and budget is not always considered a failure. As with any failure, analysing the issue can be viewed from different standpoints. Analysing the failed project of DIA can best be viewed from a decision-making (scope management) angle. Significant changes in project scope are always due to the poor scope definition. The inability to clearly define and adhere to the project's scope led the DIA management to make 'strategic blunders' that defined the future of the project. At the initial stage, the automated baggage system was excluded. The reversed decision on the airlines managing their baggage handling system and the integration of a full-scale automated project, despite the available timeframe, mounted additional pressure on the existing project. While the potential benefits appeared convincing, the timing of the decision was not strategic. Experts did not fully validate the performance of the DIA project. Despite earlier warnings from the Breier Neidle Patrone Associates about the complexities of the project feasibility given the allotted time, DIA management proceeded with redefining the scope to accommodate recent changes (de Neufville, 1994; Swartz, 1996). Many invites were sent out for the project, with only three bids returned. None of these bidders could meet the airport's initial opening date. Hence, the management team resorted to employing the services of BAE. This decision initiated a pattern of recurring failures, mounting costs, excessive delays, and the project's eventual termination (Calleam Consulting Ltd, 2008). Moreover, changing the project direction also included the risk of touching the interests of key stakeholders, which would further bring conflicts and disputes between the key stakeholders and the airport. The scope change comes with a ripple effect on the DIA project. The failure to control new features and requirements causes an increase in time, cost, and resources. The DIA management team was not aware of the potential scope creep. This led to the factors in the scope being out of control.

Time Scale

One of the biggest issues was the tight project schedule, which ultimately led to BAE's failure to deliver the project within the expected time. In exploring the DIA project, BAE promised to deliver the project within a fixed time, scope and cost. The decision to maintain a rigid timeframe created increased pressure to meet expectations. This decision also indicates BAE management's failure to assess the project's feasibility (Calleam Consulting Ltd., 2008). It is most likely that they would have to redefine the project scope to something more feasible based on the stipulated time. The automated baggage system was initiated two years after the airport construction began. From its inception, the mechanical and software complexity of the system was underestimated. The system was not able to pass the pre-test, and the modifications were time-

consuming. The project was under great schedule pressure, and as a result, the project ended up being delayed two years from the original schedule (Donaldson, 2002). Although BAE was committed to meeting the project timeline, correcting technical problems, and modifying the entire automated system was a challenge due to a lack of time.

Financial limit

Besides the schedule changes, the cost of the DIA project was also over budget. The budgetary crisis was due to the cost of installing and modifying the baggage system. It indicated that the management team failed to comply with the budget limit set when making the decision. To fix the system problems, Denver invested an additional $35 million for the modifications (GAO, 1996). In addition, an alternative conventional baggage system was taken into consideration with an estimated cost of $51 million. The project exceeded the budget by approximately 30 %, just for the construction of the automated baggage system. The total project budget greatly exceeded the initial estimate of $2.08 billion. The delayed opening not only resulted in cost escalation but also in operating deficits. To cover the deficits, the Denver Airport System had to use the surplus from Stapleton International Airport, airline contributions, bond proceeds, and reserved funds.

Stakeholder Issues

In the DIA case, DIA management and the BAE team made a lot of decision-making errors. One of such sidelining key stakeholders. The gap in communicating changes and certain decisions with key stakeholders significantly impacted the project. Key stakeholders such as Continental and United Airlines were not involved in the key decision-making. At the time these stakeholders are finally involved, they often demand significant changes that would impact the original scope. In addition, the conflicts between key stakeholders, especially with BAE and United Airlines, led to a continuous change in the project strategy. BAE was given over-ambitious tasks in a limited time. Airlines also questioned whether the launch of the alternative baggage system would be over-optimistic. However, interests from multiple stakeholders were not drawn to attention by DIA, and the associated investment risks were not made clear in the contract. To ensure its benefits, United Airlines made a direct contract with BAE with more complex requirements and put pressure on the system deadline. The new demands from the stakeholders made it more difficult to conduct the project (Calleam Consulting Ltd., 2008).

Resource Scope

The shift in scope for the baggage system project brought significant changes in human resources. With the pressure to meet pressing deadlines, more stakeholders and contractors were involved. The increase in labour would directly increase the operating costs of the project. For example, the additional employees needed for the alternative resulted in a consistent increase in costs in terms of employee training, wages, and insurance, thus driving the total cost of the project beyond the initial budget (de

Neufville 1994). To solve the underlying problems of the system, the management team also hired specialized engineers, consultants, and technical experts. However, their involvement was not part of the initial planning. The extra payment for these professionals undoubtedly increased the financial pressure on the project.

Risks of Scope Changes

The scope change brought several potential risks to the DIA project. One of the main risks is scope creep. The management team did not assess the potential negative impact of adding a new feature when the project had already been initiated. The potential of increasing cost, time, and resources was inevitable. However, there was no specific backup plan to respond to the changes. Another potential risk is the quality issue of deliverables. The automated baggage system ended up with poor performance. Significant mechanical issues could not be fixed or modified for a prolonged period. Scope creep also led to subsequent risks, such as resource and stakeholder issues. The DIA management team did not consider that scope changes may cause new resource requirements. Moreover, the potential risk is also shown in the demand for new outcomes from stakeholders. In this case, there is a high possibility of contract disputes and a series of disagreements between the DIA project team and stakeholders (Calleam Consulting Ltd., 2008).

Other contributing factors

Although factors such as inadequate planning, communication gap, and underestimating the scope and challenges of the project were reported to have caused the project to fail, the project suffered setbacks in other areas. Some of these setbacks were due to the project pressure; other factors cannot be controlled. For example, leadership change because of the demise of the project's sponsor caused a shortage in the engineering expertise needed for the project. Another factor is the defectiveness of the project architecture and design. The system's failure to identify jams led to blockage and piling of baggage. Furthermore, unreliable, and erratic power generation led to technical issues that prevented the smooth flow of the project's operation.

CONCLUSION

Despite innovative ideas, financial support, and availability of resources, some project still ends up unsuccessful. This study strongly indicates that project scope management is an important aspect of any project. Effective project scope management provides clear requirements for a project. The degree to which the project team prioritizes this area of PMBOK significantly determines the project's outcome. The case of DIA's Automated Baggage Handling System project highlights how a poorly scoped project can result in disastrous outcomes. The project's poor scope planning was reflected in the following areas: (a) the complexity of the project design was error-prone, (b) communication gaps between the project team and key stakeholders, (c) poor timing leading to delays, (d) budget underestimation, (e) inconsistent strategy, (f) power failure leading to a system collapse, (g) lack of project leadership, (h) failure to prepare for

uncertainties and risks, (i) inadequate change control mechanism leading to scope creep, and (j) failure in paying attention to experts concerns about the project's feasibility.

IMPLICATION TO RESEARCH AND PRACTICE

The findings documented in this study provide valuable insights for project managers, stakeholders, and scholars, particularly in decision-making and scope management. For airlines and airports embarking on a novel or relatively new project such as automated baggage handling systems, a scope verification in the form of a comprehensive design and performance analysis should be considered. When there are changes to a project scope or design, a thorough risk assessment and feasibility study should be conducted to determine how the changes impact the project outcome. Also, when a project scope suffers setbacks, short-term fixes for long-term problems would lead to further issues and complications. In providing lasting solutions, achieving efficiency requires a prolonged and detailed approach. Additionally, project control requires careful planning and a logical schedule. Preparing and utilizing a WBS will help allocate resources and communicate with members of the project and key stakeholders. Stakeholder management should be given attention in ensuring a successful project. An established system to effectively manage time and cost should be considered.

FUTURE RESEARCH

This study provided insight into scope creep concerning large-scale projects. With the rise of technology across several industries, future research could explore the application of artificial intelligence (AI) and predictive analytics in scope management and risk mitigation for mega projects. Moreover, comparative case studies of related project, including successful project recoveries despite initial project creep, would help in providing a broader perspective and offering best practices that may be relevant to future projects. Leadership style and organizational culture is an interesting area to explore under scope management. Project managers could benefit from research that identifies the best leadership practices and decision-making tools for addressing scope creep.

REFERENCE

Alexander, I., & Beus-Dukic, L. (2009). *Discovering requirements: How to specify products and services* (1st ed.). John Wiley & Sons.

Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International Journal of Project Management, 14*(3), 141–151.

Calleam Consulting Ltd. (2008). Case study – Denver International Airport baggage handling system – An illustration of ineffectual decision making. Retrieved February 22, 2025, from http://calleam.com/WTPF/?page_id=2086.

de Neufville, R. (1994). The baggage system at Denver: Prospects and lessons. *Journal of Air Transport Management, 1*(4), 229–236. https://doi.org/10.1016/0969-6997(94)90014-0.

Donaldson, A. J. M. (2002). A case narrative of the project problems with the Denver Airport baggage handling system (DABHS) (Software Forensics Centre Technical Report TR 2002-01). Middlesex University, School of Computing Science.

Goetz, A. R., & Szyliowicz, J. S. (1997). Revisiting transportation planning and decision-making theory: The case of Denver International Airport. *Transportation Research Part A: Policy and Practice, 31*(4), 263–280. https://doi.org/10.1016/S0965-8564(96)00033-X.

Hallgren, M., & Wilson, T. (2007). The nature and management of crises in construction projects: Projects-as-practice observations. *International Journal of Project Management, 26*, 830–838.

Khan, A. (2006). Project scope management. *Cost Engineering, 48*(6), 12–16.

Lampa, I. L., Contessoto, A. D., Amorim, A. R., Zafalon, G. F., Valêncio, C. R., & Souza, R. C. (2017). Project scope management: A strategy oriented to the requirements engineering. *ICEIS 2017 - Proceedings of the 19th International Conference on Enterprise Information Systems, 2*, 370–378.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., … Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Annals of Internal Medicine, 151*, W–65. https://doi.org/10.7326/0003-4819-151-4-200908180-00136.

Mengist, W., Soromessa, T., & Legese, G. (2020). Method for conducting systematic literature review and meta-analysis for environmental science research. *MethodsX, 7*, 100777. https://doi.org/10.1016/j.mex.2019.100777.

Mirza, M. N., Pourzolfaghar, Z., & Shahnazari, M. (2013). Significance of scope in project success. *Procedia Technology, 9*, 722–729. https://doi.org/10.1016/j.protcy.2013.12.080.

Project Management Institute (PMBOK) (2000). *A guide to the project management body of knowledge (PMBOK Guide)*. Project Management Institute.

San Cristóbal, J. R., Carral, L., Diaz, E., Fraguela, J. A., & Iglesias, G. (2018). Complexity and project management: A general overview. *Complexity, 2018*, 4891286. https://doi.org/10.1155/2018/4891286.

Schloh, M. (1996). Analysis of the Denver International Airport baggage system. http://www5.in.tum.de/~huckle/schloh_DIA.pdf.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039.

Swartz, A. J. (1996). Airport 95: Automated baggage system? *SIGSOFT Software Engineering Notes, 21*(2), 79–83. https://doi.org/10.1145/227531.227544

United States Government Accountability Office (GOA) (1996). *Denver Airport: Operating results*. https://doi.org/10.21949/1404008.

Williams, T. (2016). Identifying success factors in construction projects: A case study. *Project Management Journal, 47*(1), 97–112. https://doi.org/10.1002/pmj.21558.

Zecheru, V., & Olaru, B. G. (2016). Work breakdown structure (WBS) in project management. *Review of International Comparative Management, 17*(1), 61–69.