Implementation of Virtual Reality at TAUW

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Implementation of IT in Organizations

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1. Company Description

In this chapter of the report, the setting of TAUW is described together with the main motives of the VR implementation within the company.

1.1. Setting of the Company

TAUW is an environmental consultancy company located in Europe. The company focuses on creating a sustainable solution for their customers. TAUW is a medium sized enterprise with more than 1200 employees within six countries: The Netherlands, Belgium, Germany, France, Spain, and Italy. Within the company, there is a hierarchical structure. TAUW is a mature organization with a strong client base. The vision and mission of TAUW is to create a world in which nature and human activities co-exist in harmony, which requires environmental professionals with passion and expertise. As a leading environmental consultancy company, TAUW creates solutions, which make sustainability tangible and feasible. The consultancy themes TAUW primarily focuses on are sustainability, water, and soil groundwater. Other themes that the company focuses on are digital transformation, environmental monitoring, and infrastructure. Within TAUW, sharp decisions are made. They focus on clients that help the company to realize their vision and mission. Since TAUW is a participative company, the employees are involved in the decision-making process.

Within the company, there are three core values: care, connect, and improve. Care is one of the three core values since TAUW cares for their clients, colleagues, society, and the environment. The employees at the company are passionate and competent and they work in an open and participatory culture. Since TAUW believes in the power of teamwork and involves their stakeholders to realize a sustainable world for future generations, the second core value is ‘connect’. The last core value is ‘improve’, TAUW empowers their employees to improve the quality of the services they offer to make sustainable outcomes feasible and tangible.

1.2. Main Motives IT Implementation

Within the company, Virtual Reality (VR) is implemented. The implementation of VR is not urgent. However, the implementation is useful for the clients as well as for the company. Adding VR might result in a higher quality service and better customer experiences. For the client, they can see the progress of the project and they can give useful feedback. With this early feedback, the team of TAUW can adjust steps within the project development early and easier than later within the project. This will save the team time and it will improve the processes. The idea of the VR implementation came from employees of TAUW. They are curious what VR can bring them and there is a desire for improvement and innovation. The goal is not to increase the profit, but to increase the quality of service.

2. Problem Definition

2.1. Our Understanding of the Problem

Based on the interview with TAUW's company personnel the main problems arise on both client and employee sides. From the employee side, the main challenges that they are facing are that it's hard for them to interpret 3D models on the 2D screen, lack of understanding of the designs by the team members and some design mistakes are made frequently. From the client side, the challenges include lack of technical expertise, difficulty in visualizing the designs, and lack of awareness of work progression, inability to provide the necessary feedback are the main. The problems from both the client and employee side results in waste of time which leads to not meeting the deadlines of the project and also higher costs. So, we have done the SWOT analysis to further understand and get in-depth knowledge of the TAUW's problem in order to find the solutions.

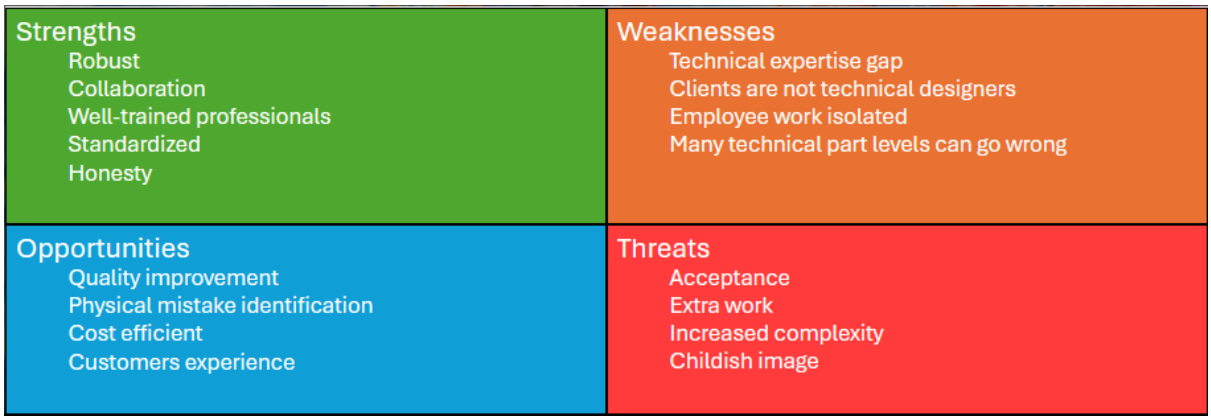

Figure 1: SWOT analysis of TAUW

Strengths:

TAUW illustrates steadiness and flexibility in its operations, reflecting a strong organizational structure. The company cultivates a collaborative culture, improving advancement and problem-solving capabilities. TAUW has a gifted workforce, contributing to the quality and viability of its administrations. Standardized forms guarantee consistency and productivity in benefit delivery. TAUW maintains integrity and transparency in its business dealings, building trust with clients and partners.

Weaknesses:

A gap in technical expertise poses challenges intending to raise in zones of environmental designing. Communication boundaries with non-technical clients may lead to misaligned desires and disappointment. The complexity of technically specialized ventures increases the risk of mistakes or disappointments, affecting project results.

Opportunities:

Continuous advancement activities can upgrade the quality of TAUW's administrations, driving client fulfillment. Implementing tools for distinguishing and rectifying mistakes can minimize mistakes and move forward to extend results. Optimizing costs through streamlining operations and leveraging innovation can improve productivity. Prioritizing client involvement can separate TAUW from competitors and cultivate long-term client connections.

Threats:
Resistance to change from clients or partners may ruin advancement and advance. Unexpected challenges or scope changes during projects may result in extra work and asset prerequisites. The complexity of environmental regulations poses challenges to TAUW's operations. Misinterpretations of TAUW's branding or communication endeavors may weaken its validity and professionalism.

TAUW's SWOT examination highlights its qualities in solidness, collaboration, a talented workforce, standardized forms, and judgment. However, it also identifies weaknesses, such as specialized technical ability and communication obstructions, that hinder the enhancement and advancement of the growth of the company. Tending to these components deliberately will be basic for TAUW to capitalize on its strengths, overcome shortcomings, and seize opportunities while moderating dangers within the environmental consultancy industry.

2.2. Challenges for the Implementation Project

The integration of Virtual Reality (VR) at TAUW presented a transformative opportunity but also introduced several challenges. VR's novel nature meant that many employees were anchored to traditional methods, finding the shift to this advanced technology overwhelming. The unfamiliarity led to a lack of serious engagement with VR, as habits ingrained by the old ways of working were hard to break. Moreover, the widespread lack of experience with VR technology exacerbated this resistance to change.

Addressing these challenges required a proactive and structured approach. Preventative actions included comprehensive VR workshops aimed at demystifying the technology, coupled with clear communication about its practical applications within the company. Showcasing the tangible benefits of VR, such as enhanced design comprehension and improved collaborative capabilities, helped in building a persuasive case for its adoption.

Recovery strategies focused on mitigating the impact of the slow adoption rate. HR management was pivotal, putting in place incentives to encourage collaboration and experimentation with VR. Training sessions were designed not only to educate but also to build confidence in using the technology, aiming to prevent the potential decrease in productivity and satisfaction. By taking these steps, TAUW aimed to smooth the transition to VR, ensuring its integration was both effective and beneficial to all stakeholders involved.

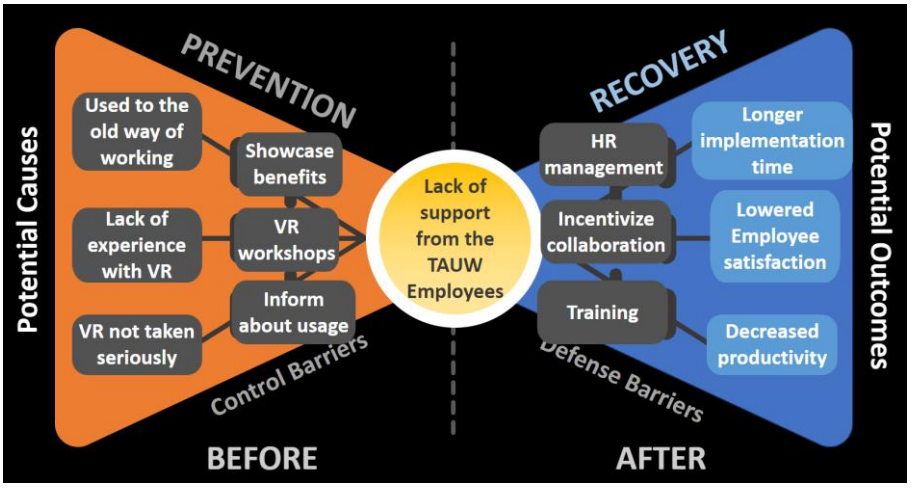

Figure 2: Bow Tie model showcasing the challenges and their mitigation techniques

3. Plan of Action

3.1. Business Strategy

TAUW is a driving environmental engineering consultancy company spread across all over Europe, works with a purpose-driven approach, prioritizing maintainability, advancement, and client fulfillment. In this section, we shall look into how TAUW's Business strategy adjusts with its center values which are Care, Connect, and Improve.

Mission and vision of TAUW

TAUW's mission is to form sustainable solutions that address complex environmental challenges. Their target is to be a leading environmental engineering consultancy, leveraging their enthusiasm and ability to advance harmony between nature and human exercises. TAUW is committed to making sustainability tangible and doable, endeavoring to form a world where natural contemplations are coordinated into each perspective of society. Their mission reflects a devotion to advancement, collaboration, and judgment in their interest of environmental direction. TAUW envisions a world where nature and human exercises coexist in balance. They try to be a driving environmental company, known for their skill, development, and commitment to maintainability. TAUW looks to make arrangements that not as it were moderate environmental impacts but to improve the well-being of ecosystems and environments. Their vision embodies a future where environmental considerations are coordinated into each angle of society, driving positive alter for eras to come.

Market analysis

The environmental engineering consultancy industry is encountering steady fast development driven by expanding mindfulness of natural issues and administrative weights. Requesting for environmental consultancy administrations is driven by an increase of awareness in many sectors like government, manufacturing, construction, energy, etc. TAUW works in a competitive scene, with various players advertising comparative administrations. In any case, TAUW separates itself through its center on sustainability, innovation, and client-centric solutions. TAUW's competitors incorporate both huge multinational firms and smaller specialty players. Key competitors may offer comparable administrations but TAUW's uniqueness lies in its vigorous operations, collaboration culture, and commitment to sustainability, which delivers a competitive edge. Clients are progressively looking for consultancy firms that can offer comprehensive arrangements to address a wide run of environmental challenges, from climate change mitigation to waste management and pollution prevention. TAUW serves a different run of clients over different divisions, including government offices, mechanical organizations etc. The company's administrations span different subjects, including supportability, water and soil groundwater management, sustainability, water and soil groundwater, digital transformation, environmental monitoring, and infrastructure development.

Business strategy conclusions

TAUW's business technique is built upon the establishment of purpose-driven values, counting Care, Connect, and Improve. Through a center on maintainability, collaboration, and advancement, TAUW has set itself up as a pioneer within the natural consultancy industry. The company's commitment to conveying high-quality, maintainable arrangements while prioritizing the well-being of its representatives and the environment sets it separated in a competitive market scene.

By leveraging its qualities, tending to strengths, addressing weaknesses, capitalizing on opportunities, and mitigating threats, TAUW is balanced for proceeded victory and development. The company's vigorous operations, collaborative culture, well-trained experts, standardized forms, and commitment to genuineness position it for sustainable profitability and client fulfillment. Moving forward, TAUW ought to stay watchful in tending to regions for advancement, such as upgrading specialized skills, moving forward client communication, advancing collaboration, relieving specialized dangers, protecting client involvement, and grasping nonstop change activities. By remaining genuine to its center values and adjusting to advancing showcase elements, TAUW can set its position as a trusted accomplice in making a more maintainable world for future eras.

3.2. Implementation Proposal

Within this part of the report, the implementation proposal is discussed based on Kotter's model of change. Also, the timeline for the implementation, the estimation of the budget, and the economic impact are discussed.

3.2.1. Kotter's Model of Change

Kotter's model of change (Kotter, 1996) is used for the implementation proposal. Kotter considers eight different steps for an implementation. Other models, for example, the model of Beckhard and Harris and Lewin's change model are also considered. However, these models consist of less steps and are less detailed. Because we want to consider all the important steps for the implementation, the model of Kotter is used.

Step 1: Creating urgency

In conducting an interview with our client from TAUW, we came across issues affecting both the company's employees and its clients, depicted in Figure 3. On the employee side, the primary challenge revolves around the creation of 3D models on computer screens. When these designs are shared among team members via 2D screens, it often results in misunderstandings of the intended concepts. This miscommunication can lead to errors when further work is based on these misconceptions, necessitating time-consuming corrections that elevate costs.

Furthermore, both current and former TAUW employees have voiced concerns over excessive workloads1. Such burdens may stem directly from an overwhelming number of assigned tasks or be perceived due to the additional time required to rectify errors. This not only detracts from the time available for project-critical tasks but also amplifies stress as deadlines loom, contributing to the sensation of an unbearable workload.

From the client's perspective, the lack of technical expertise complicates their ability to grasp the nuances of their own projects' designs. This gap in understanding impedes clients' ability to track project progress effectively and offer meaningful feedback on the designs presented by TAUW. Subsequent discovery of design flaws necessitates adjustments, further delaying progress and inflating project costs.

The 2020 financial annual report from TAUW highlights a positive trend, indicating an increase in customer satisfaction. This upward trajectory suggests that efforts to enhance the customer experience are resonating with the target audience. To sustain or even amplify this level of customer satisfaction, one effective strategy is the reduction of errors in the design process. By minimizing these errors, TAUW can ensure a smoother, more reliable service that meets or exceeds customer expectations. Furthermore, 'Care', being one of TAUW's core values, underscores the significance the company places on customer satisfaction. This

commitment to 'Care' not only reflects TAUW's dedication to its clientele but also serves as a guiding principle in its operational strategies, emphasizing the importance of maintaining high customer satisfaction as a reflection of the company's values and mission.
We believe that reducing the frequency of design errors could alleviate the perceived workload for employees and result in financial savings for TAUW. The question remains: how can we achieve this improvement?

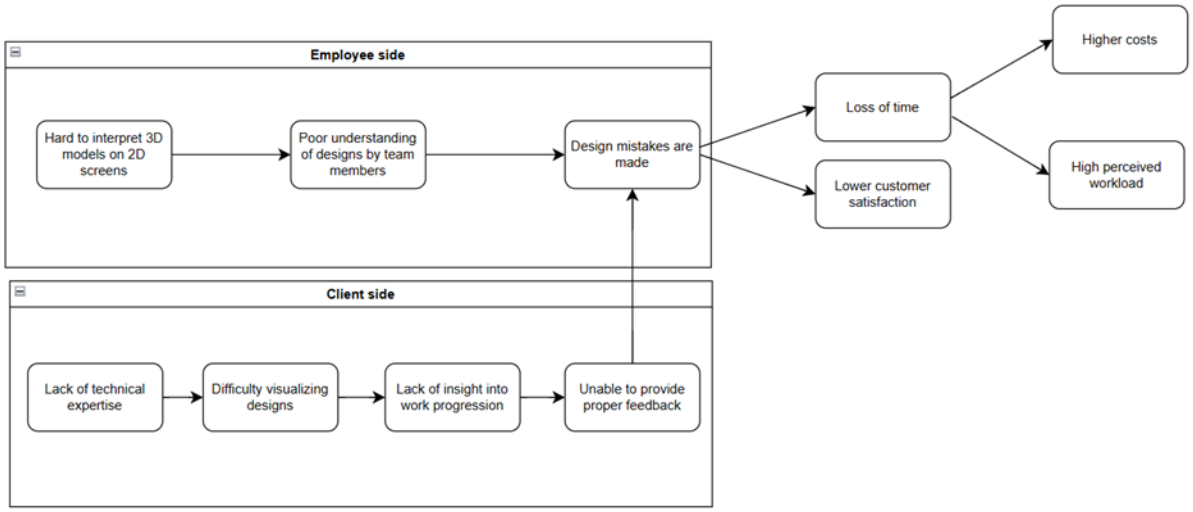

Figure 3: issues affecting both the company's employees and its clients

Step 2: Form a Powerful Coalition
In the bustling work environment of TAUW, a team of employees harnesses a sense of urgency, propelling the integration of Virtual Reality technology to the top of the company's priorities. They do not merely suggest, but rather articulate a narrative spotlighting the imminent need for VR. This urgency is bolstered by the tangible issues unearthed through interviews with TAUW's staff and clientele, revealing the high costs of misunderstandings and the stress of mounting workloads. The core of their argument zeroes in on the inefficiencies plaguing the design process—misinterpreted 3D models leading to costly, time-intensive revisions.

A coalition emerges, imbued with a shared sense of criticality, pitching not just the 'what' and 'how' of VR, but the 'why now'. The immediacy is echoed in every conversation they instigate, every demonstration they orchestrate, painting a vivid picture of a future where VR drastically reduces error rates, slashes project timelines, and enhances customer engagement.

The coalition approaches TAUW's influencers and decision-makers with a well-crafted presentation that is an appeal to action, an urgent call to pivot swiftly to VR solutions, emphasizing that delays could mean foregoing the vanguard of design innovation and, crucially, allowing competitors to seize the advantage.

This urgency is communicated with compelling clarity, the coalition outlining a timeline where early wins with VR can swiftly transition into long-term competitive edge and market leadership. They underscore the pressing need to embrace VR as a transformative tool, not tomorrow, but today, to alleviate the immediate pressures on employees and to fulfil the growing expectations of clients.

Their mission, underscored by a palpable sense of urgency, is to galvanize TAUW's management, ensuring that VR becomes not just a future consideration but an immediate action

point, integral to the company's evolution and vital in maintaining its reputation as a pioneer in leveraging technology for environmental consultancy and sustainable development.

Step 3: Create a vision for change

A vision for change is a clear, inspiring, and achievable picture of the future state of the organization. According to Kotter there are a few factors that are needed to create and define a good vision for chance. The vision should be easy to understand, solid and emotionally appealing. Change can be created in relation to processes, people, and technology. In the case of TAUW, VR is a technological change which has influence on the workflow process. As of now, models are made showing the 3D representation of a project via 2D communication. This means either printed versions of the 3D model or on a computer screen. An example is created to show how a vision can be created at TAUW:

"VR will change the way design projects can be approached, evaluated, and experienced. Soon it should be possible to invite stakeholders into a multidimensional VR world and guide them through a project. An interactive environment allows designers, developers, engineers, and stakeholders to look at the project as if it has already been realised. Simulations can be executed, bugs can be found earlier in the process and providing and processing feedback and evaluation can be done more effectively to make sure projects will align to customer expectations even better."

Step 4: Communicate the Vision

Once the vision is developed, it needs to be effectively communicated to all stakeholders. Leaders must articulate the vision in a way that resonates with employees at all levels of the organization. Communication should be frequent, transparent, and consistent to ensure everyone understands the purpose and importance of the change. Communicating TAUW's vision successfully includes utilizing different channels and strategies to lock in partners and strengthen core values.

- *Presentations & Meetings*: Deliver engaging presentations and encouraging discussions to internal teams, clients, and stakeholders, by emphasizing TAUW's vision and values.
- *Posters & Visual representations*: visually appealing posters featuring TAUW's vision statement and core values in office spaces to strengthen messaging.
- *Focus Groups & Workshops:* Organize focus groups and workshops to gather insights, foster dialogue, and deepen understanding of TAUW's vision and values among employees which helps in gathering unity all at once from within.
- *Workshops (Training & Development)*: Integrate TAUW's vision and values into training programs, providing chance for skill-building and personal development aligned with sustainability, collaboration, and innovation.

Step 5: Empower Action

Leaders play a fundamental role in change management. (Musaigwa, 2023) Leaders are the ones that empower action since they provide the vision and support necessary for the employees to embrace the change. There are many leadership styles. Goleman describes six of them.

Visionary	Motivates people towards a vision	*"Come with me"*	Self-confidence, empathy, change catalysts
Coaching	Developing people for the future	*"Try this"*	Developing others, self-awareness, empathy
Affiliative	Creates harmony and builds emotional bonds	*"People come first"*	Empathy, building relationships, communication
Democratic	Forges consensus through participation	*"What do you think?"*	Collaboration, team leadership, communication
Pacesetting	Sets high standards for performance	*"Do as I do now!"*	Conscientiousness, drive to achieve, initiative
Commanding	Demands immediate compliance	*"Do what I tell you"*	Drive to achieve, initiative, self-control

Table 1: Goleman leadership styles (Goleman, 2017)

Table 1 above shows an overview of the 6 leadership styles described by Goleman, and their characteristics. Each leadership style has different approaches. Therefore, a description will be given of how each approach can work for the VR implementation at TAUW.

Visionary
Motivating leadership involves inspiring and energizing employees towards a shared vision. A leader using this style can motivate TAUW's employees by emphasizing the potential benefits of VR technology, such as improved efficiency, enhanced client engagement, and opportunities for innovation. By highlighting the positive impact of VR on individual and team performance, a motivating leader can create enthusiasm and commitment towards the technology's adoption.

Coaching
Coaching leadership focuses on developing employees' skills and capabilities. In the context of VR implementation, a coaching leader can provide personalized guidance and training to employees to ensure they feel confident and competent in using VR tools. By offering constructive feedback, support, and ongoing development opportunities, a coaching leader helps employees embrace VR technology and maximize its potential within their roles.

Affiliative
Leadership that wants to achieve harmony emphasizes collaboration, empathy, and relationship-building. It relates to the core value "Care" of TAUW. A leader using this style can facilitate open communication and teamwork among employees during the VR implementation process. By creating a harmonious work environment where individuals feel valued and respected, this leader cultivates a positive atmosphere conducive to effective collaboration and successful adoption of new technologies like VR.

Democratic
Democratic leadership is about involving employees in decision-making and problem-solving processes. In the context of VR implementation, a democratic leader seeks input and feedback from employees at various stages, such as selecting VR applications, designing workflows, and addressing challenges. By empowering employees to participate in decision-making, a democratic leader fosters ownership and commitment to the VR integration efforts. This ties in with participative company TAUW claims to be.

Pacesetting
Leadership that sets high standards for performance focuses on driving excellence and continuous improvement. A leader using this style can establish clear performance expectations related to VR utilization, quality of work using VR tools, and adherence to project timelines. By promoting the core value “Improve”, this leader motivates employees to strive for high-quality outcomes in their VR-related tasks and responsibilities.

Commanding
Commanding leaders provide clear direction and decisiveness in decision-making. In the context of VR implementation, a commanding leader can set a clear vision and roadmap for how VR technology will be integrated into TAUW's workflow. By clearly stating what needs to be done and why it's important, a commanding leader helps everyone feel confident and stay on track with the VR implementation plan.

In conclusion, all six leadership styles could work in their own way for TAUW’s VR implementation. However, three of them stand out. The first one being affiliative leadership since it relates to the core value “Care”. The second one is democratic leadership, considering the participative culture of TAUW, and finally pacesetting leadership, which relates to the core value “Improve”.

Step 6: Create Quick Wins
Implementing VR into TAUW is a significant change that requires careful management to ensure success. One effective approach to facilitate this process is by generating "quick wins," as outlined in step 6 of the Kotter model of change. Quick wins are early successes that are achievable within a short timeframe and can significantly contribute to building momentum and gaining broader support for the VR initiative.

To achieve quick wins, TAUW should identify small goals that are achievable early in the implementation process. These could include completing a pilot VR program, achieving a target level of employee engagement with the VR system, or reaching specific learning outcomes through the initial set of VR modules. Focusing on projects with high visibility ensures that these successes are noticed throughout the organization, thus demonstrating the benefits of the VR implementation. Developing and deploying quick, easily completed VR training modules can serve as an immediate win, illustrating the potential of VR to enhance learning and training processes. Early and positive feedback from employees who have engaged with the VR system can also be highlighted as a quick win.

Furthermore, it is important to celebrate early wins within the organization, this can be through company-wide emails, meetings, or newsletters. Such recognition not only reinforces the value of the VR initiative but also encourages further participation and engagement from employees. This approach not only validates the change effort but also helps in convincing sceptics of the benefits of VR, thereby creating a positive and supportive environment for change.

Generating quick wins is an important strategy for the successful implementation of VR and is therefore important to TAUW to successfully implement VR. By setting and achieving short-term goals, publicizing successes, and continuously optimizing the process based on feedback, TAUW can build momentum and support to ensure the long-term success of its VR implementation.

Step 7: Build on the Change

The last two steps of Kotter's Change Model focus on making sure the new changes stick around and are therefore very important. Also, the new changes must become a part of the operations of TAUW. Step 7 of Kotter's Change Model focuses on building on the success of the change and drive further change. The key objective of this step is to build on the momentum from early VR successes and changes and to initiate more VR projects to make sure the changes become embedded in the organization's processes. To implement this, a few things can be done within the organization. Early wins with VR should be celebrated by TAUW to highlight the cases in which VR improved the outcome of projects and/or the customer satisfaction. Besides this, TAUW should learn from early VR experiences, they should assess the effectiveness and the feedback of the customers so they can learn from it and improve. Also, the use of VR should be expanded within the organization, employees should be encouraged to use VR and they should receive trainings so they can use VR in the right way.

Step 8: Make it stick

Step 8 of Kotter's Change Model focuses on ensuring that the changes stick within the organization. The changes considering VR implementation should become a part of TAUW's operations and social norms. To implement this, VR should be integrated within the company values and missions. The use of VR and feedback of the customers should be part of the core values of TAUW. Within TAUW, there should be VR leaders that show to importance of the VR implementation, and they should encourage the employees to use VR during projects, so it becomes part of the operational steps. As a part of encouraging employees to use VR within their projects, success stories should be shared within the company so employees know what they can achieve with VR. Besides this, TAUW should adjust the policies and systems to align with the new changes to make sure the changes stick within the organization.

3.2.2. Timeline

Step in Change Process	**Timeframe**	**Description**
Creating Urgency	Month 1-2	Highlight issues in current design processes causing costly errors and stress, leveraging financial data and employee testimonials.
Form a Powerful Coalition	Month 2-3	Employees rally supporters across departments to form a coalition advocating for VR, preparing a compelling pitch for management.
Create a Vision for Change	Month 3	Craft a clear vision for VR integration that addresses design process inefficiencies and enhances customer feedback mechanisms.
Communicate the Vision	Month 3-4	Disseminate the VR vision through presentations, meetings, and focused group sessions, ensuring alignment with TAUW's core values.
Empower Action	Month 4-5	Convince employees by leadership to embrace VR usage in design processes.
Create Quick Wins	Month 5-6	Identify and execute pilot VR projects to demonstrate immediate benefits, using successes to validate the VR initiative.
Build on the Change	Month 6-8	Expand VR usage based on pilot success, integrating feedback to refine the approach, and encouraging wider adoption within TAUW.
Make it Stick	Month 8-10	Cement VR integration into TAUW's culture, adjusting policies and systems to sustain the change, while promoting success stories.
Final Evaluation and Adjustment	Month 10-12	

Table 2: Kotter's model of change steps including a timeframe and description for TAUW.

Over time, the VR integration process should be reviewed, the outcomes should be evaluated against objectives, and necessary policy or operational adjustments should be made.

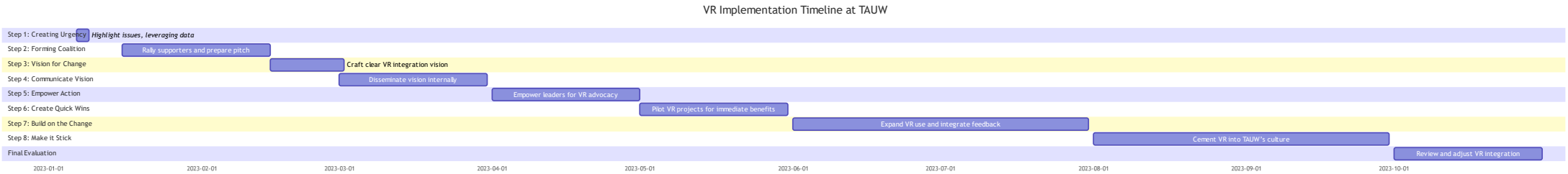

Figure 4: Visualized timeline of Table 2

3.2.3. Budget Estimation and Economic Impact

The budget estimation for the VR implementation within TAUW is based on the information provided by TAUW and common sense. At TAUW, they set a budget for this IT project, which was around 75K-80K euros. Furthermore, the total project turned out to cost between 100K-120K euros. To adopt VR effectively after the project was finished, they estimated the costs to be between 40K-55K euros on a yearly basis for 2-5 years. After successful adoption the costs would drop to just maintaining the hard-and software. If we run the numbers, the total cost for this implementation is between 180K-395K euros. The costs that are considered are hardware costs, software costs, development costs, training costs, maintenance and support, VR content creation costs, and legal costs.

Unfortunately, we cannot provide a Return on Investment or a Net Present Value for this implementation, as the potential profits of this IT implementation are hard to make tangible. As we have shown in our business strategy section, TAUW had a profit of €11 million in 2021. If we compare that number to the costs of the implementation of VR, the financial impact is, even in the worst-case scenario, very little. The benefit is hard to quantify, however, we can argue that the implementation of VR within the processes will increase the productivity and the customer satisfaction.

4. Change of Project Approach

In our efforts to investigate VR implementation at TAUW, we encountered a shift in our project approach due to unforeseen circumstances. Due to the cancellation of an interview with our contact person at TAUW, we needed to adapt the project in consultation with our lecturer. Originally, the project involved reflecting on the theoretical implementation approach designed by our team and comparing it to how TAUW implemented VR in practice and evaluating the impact of IT implementation on the organization's goals and motives. Instead of proceeding with the initial comparative analysis, we have chosen to elaborate on the plan of action and go in more detail. This revised approach focuses on the more technological aspects, including the integration of VR within TAUW's process workflow model, and elaborate on key stakeholders involved in the implementation process.

5. VR Technology and Implementation

In this section of the report the VR technology and its implementation will be discussed in more detail. First, a suggestion is done for VR implementation in the current workflow model. Second, the workflow model is enhanced using a feedback loop. Finally, some other useful technologies are discussed.

5.1. Implementing VR in TAUW's Workflow Model

In chapter 1.2 a brief motivation was given for the VR implementation. A reason for implementing VR is for higher quality of service and thus better customer experiences. Not only for employees, but also for client VR is useful, because they can see the progress of the project and they can give useful feedback. This feedback is crucial to improve a concept design.

The VR implementation should therefore be implemented at verify and validate, after the decision-making stage of TAUW's current process workflow model. Furthermore, the final VR model can be used as a demo for external reviewers. This results in the model in Figure 5.

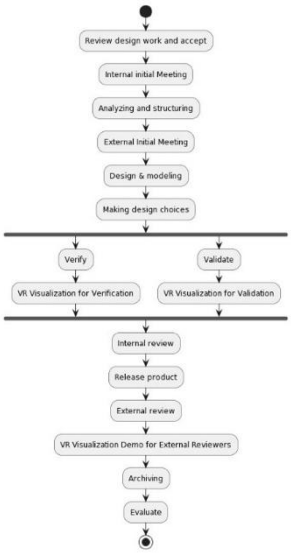

Figure 5: Process workflow model including VR implementation.

5.2. Enhancing the Workflow Model with a Feedback Loop

When delving deeper into TAUW's workflow process model, which incorporates Virtual Reality (VR) technology, we propose an enhanced version that integrates a feedback loop. This refinement aims to optimize the workflow by fostering continuous improvement and innovation, particularly focusing on the stages of making design choices, and verification/validation.

The updated workflow model builds upon the model introduced in Figure 5 and introduces a feedback loop between step 6 and step 7:

- **Step 6: Making Design Choices**
  In this phase, informed decisions are made regarding project designs based on VR-enhanced models and stakeholder input.
- **Step 7: Verify and Validate**
  The designs undergo verification and validation using VR (simulations) and assessments, ensuring accuracy and alignment with project objectives and client requirements.
- **Feedback Loop Integration**
  The feedback loop is used to transfer gathered insights and assessments from stakeholders (clients) and project members from the verification/validation stage (step 7) to the decision-making stage (step 6) and repeat this process for the desired quality.

The introduction of a feedback loop in the process workflow stages offers several benefits ((PDF) Clarifying the Feedback Loop Concept for Innovation Capability: A Literature Review, n.d.):

- **Holistic Perspective:** By capturing feedback at the design and decision-making stages, TAUW gains a comprehensive view of project progress and potential improvements.
- **Outcome Measurement:** The feedback loop facilitates the measurement of desired outcomes, ensuring that design choices align with project goals and client expectations.
- **Continuous Learning:** Insights gathered through the feedback loop promote continuous learning, enabling adaptive practices and iterative improvements.
- **Flexibility and Adaptability:** The feedback loop enhances the workflow's flexibility by providing real-time insights for adjusting designs and strategies as needed.

By integrating this feedback loop into the VR workflow model, we enhance operational efficiency, promote innovation, and ensure that projects are executed with precision and client satisfaction. This iterative approach demonstrates how TAUW's core values “Care”, “Connect” and “Improve” are met through leveraging technology to achieve better products and excellence in environmental consultancy with teamwork.

5.3. More Technologies

Augmented Reality (AR): AR overlays digital information onto the real world, enhancing the user's perception of their environment. (Ong et al., 2008) This technology can be valuable for fieldwork and site inspections, allowing TAUW’s engineers and consultants to visualize data and information directly on-site.

Geographic Information Systems (GIS): GIS integrates geographic data with analytical tools to visualize, interpret, and analyse patterns and relationships. TAUW could use GIS for spatial analysis, environmental mapping, and resource management. (Oh, 2001)

6. Key Stakeholders Involved in the Implementation Process

In this section of the report, the key stakeholders involved in the implementation process will be discussed in more detail. First, each stakeholder is identified, whereafter a stakeholder analysis is done regarding their roles and responsibilities.

6.1. Stakeholder Identification

Jane from TAUW told us that there are six key stakeholders:

1. Clients
2. Management of the design department
3. Coordinators of the designers
4. Designers
5. Project managers
6. Team managers

The model of Mitchell, Agle & Wood (1997) is used to identify the role and the importance of each stakeholder. Figure 6 shows the model. The model divides each stakeholder into their own category based on their power, legitimacy, and urgency in the implementation of VR. Figure 7 depicts the category that each stakeholder belongs to.

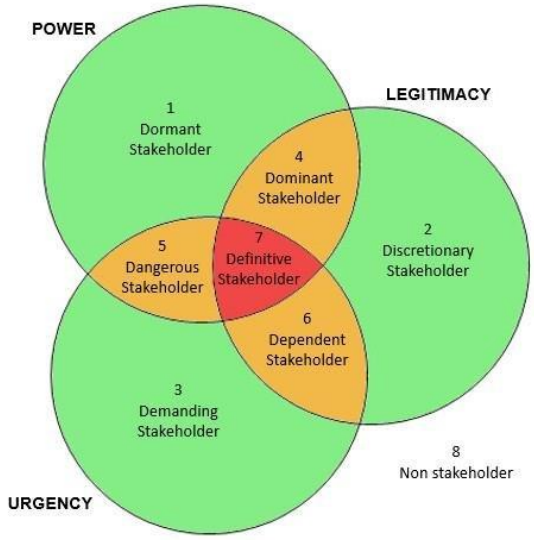

Figure 6: Model of Mitchell, Agle & Wood.

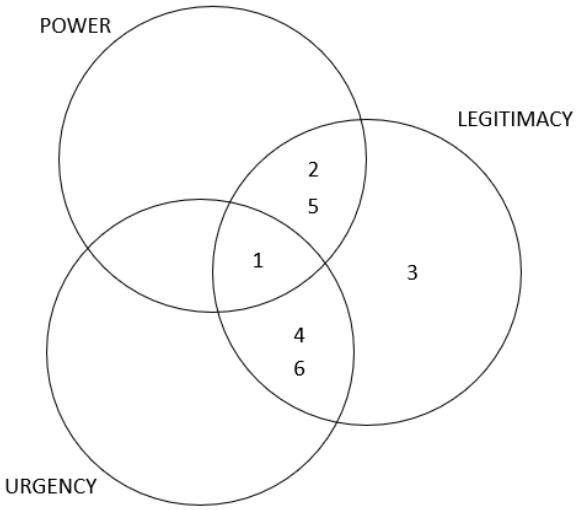

Figure 7: TAUW stakeholders positioned in the model.

6.2. Stakeholder Analysis

The client falls under the category 'dangerous stakeholder', they are the end-users of the VR and the ones that will pay in the end. However, they are not able to provide feedback during the implementation process, so they do not have a high legitimacy. That is what makes them dangerous stakeholders because TAUW does not fully understand their needs, and this might lead to a failed implementation if they do not like it.

The management of the design department has a lot of power, they have control over the resources and strategic directions. They also have high legitimacy and are responsible for the oversight and success of the design department. They do not see urgency for this

implementation because they are used to their way of working and do not want change. This is what makes them a dominant stakeholder.

The coordinators of the designers play a big role in managing and supporting design activities. That is what makes them legitimate players. They feel the same way over this implementation as the managers of the design department. However, they have less power than they have, that is why they are discretionary stakeholders.

The designers have high urgency for this implementation because they are the ones that came up with this idea. They want their 3D models to be viewable in 3D instead of 2D. They are also at the core of the operational process of design and therefore have a high legitimacy. They do have the least amount of power in TAUW, so they are dependent stakeholders.

Project managers have moderate to high power in TAUW, they manage the projects of clients and make sure that they are successful. They have high legitimacy and moderate urgency. That is why they are 'definitive stakeholders' in the VR implementation.

Team managers have authority within their teams and therefore have high legitimacy. They do not have a lot of power within TAUW and have a moderate interest in this project. They are therefore dependent stakeholders.

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