

# Rethinking Event Systems and Sustainability in the Arctic

A Design Perspective on the Levi Alpine Ski World Cup



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## Abstract

This thesis examines how design can improve sustainability and spectator experience at Arctic winter sports events. Using the Levi Alpine Ski World Cup in Finland as a case study, it analyses event operations in environmentally sensitive conditions influenced by climate variability, spatial organization, and infrastructure. The research draws on sustainability and climate resilience theories, supported by strategic design and socio-ecological systems thinking. An arts-based action research (ABAR) methodology is used, combining field observation, visual documentation, and spatial analysis. Data collection includes on-site observations, photographs, videos, and informal discussions with event staff and organizers, focusing on mobility systems, spectator areas, accessibility, temporary infrastructure, and material practices.

The findings identify gaps between operational efficiency and broader sustainability and experiential objectives. These include limited spectator visibility and engagement, a lack of immersive experiences, weak community participation, and mobility systems that do not fully support sustainable participation. Although the event is well organized, these gaps indicate missed opportunities for more inclusive and adaptive design strategies. In response, the thesis proposes spatial and systemic design interventions: snow-based spectator terraces to improve visibility using existing materials, reconfigured spectator zoning and circulation for greater clarity and accessibility, and incentive-based ticketing systems to promote sustainable travel. These interventions position design as a means to align environmental responsibility with user experience and participation.

A socio-ecological perspective identifies design as a key driver of more adaptive, inclusive, and sustainable winter sports events. This perspective was further explored through an artistic exhibition at the University of Lapland, Gallery Puoti (7–23 April 2026), which translated the research into visual and spatial formats through site analysis, identified gaps, and proposed interventions.

Keywords: Sustainable event design, Arctic event systems, winter sports events, spectator experience, socio-ecological systems, climate resilience, strategic design, arts-based action research (ABAR), Event Sustainability, Experience Design.

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# Introduction

## Why This Research Matters: Rationale and Motivation

Winter sports events have shaped the identity and economy of northern regions (Pohja, 2025). In Lapland, events such as the Levi Alpine Ski World Cup drive tourism, local businesses, and regional visibility. However, these events occur in sensitive settings and depend on stable weather and snow, as well as complex operational planning (Moore, 2026). As a result, they are especially vulnerable to uncertainties from climate variability and shifting weather patterns. (Moore, 2026)

These circumstances make winter sports events both complex and significant subjects for academic research. While these events contribute considerable economic and cultural value, their long-term sustainability is increasingly influenced by environmental pressures (Lintumäki et al., 2020). Investigating how these events function, adapt, and develop in response to these challenges is therefore both academically relevant and practically significant.

The growing global emphasis on sustainability within the sports and events industry has intensified scrutiny of environmental impact, resource management, and social responsibility. Despite this, existing research predominantly focuses on large-scale global events such as the Olympic Games and FIFA tournaments (Breitbarth et al., 2023). This emphasis creates a gap in the literature regarding smaller, regionally significant events, such as the Levi Alpine Ski World Cup, which operate under unique environmental, spatial, and logistical constraints (Santos & Miragaia, 2025).

Winter sports events rely on fragile ecosystems, limited infrastructure, and marked seasonal change (Zhang, 2025). Studying these events reveals insights into adaptation, resilience, and the impact of design on experience and sustainability (Hulkkonen, 2025). Extending activities beyond winter is possible, but this research focuses on reimagining events as adaptive, integrated systems rather than just expanding the season.

My motivation comes from my design background and event production experience. Working in different contexts has shown me how complex it is to organize events that meet operational, social, and aesthetic expectations. Unlike stable climates where weather has little impact, Lapland poses unique challenges (Strauss-Mazzullo, 2025). Its unpredictable climate, combined with winter activity demands, raises key questions about designing effective events for such environments.

Living and studying in Lapland has further shaped my perspective. I have experienced the sharp contrast between busy winters and quiet summers. These differences highlight environmental opportunities to rethink event structure and experience (Strauss-Mazzullo & Tennberg, 2023). Instead of adding more events, this research aims to improve experience quality, participant engagement, and sustainability in existing event systems.

Arctic regions are increasingly affected by environmental change. This requires a new look at how large events work in these areas (Knowles et al., 2024). By studying spatial design, event systems, and sustainability together, this research hopes to inform wider discussions on resilience, adaptation, and responsible development in fragile environments.

This research aims to bridge the gap between operational efficiency and experiential quality in winter sports. It shows how design shapes space, influences events, engages participants, and supports sustainable participation.

## Environment for Winter Sports and Tourism

Skiing began in northern regions as an ecocultural practice, serving as a means of transportation and hunting and reflecting the relationship between people and their environment (Skille & Skille, 2025). Although it is now mainly recreational, skiing continues to demonstrate this connection; furthermore, it remains economically vital in remote and rural areas (Kiashemshaki, 2026).

Recent literature shows that ski tourism in the Arctic is a possible strategy for regional development as the climate changes, especially in the far north, where snow may last longer, even as lower resorts struggle (Demiroğlu et al., 2020). The main physical and environmental factors influencing ski tourism include snow depth, snow duration, and

topography. Socioeconomic and operational factors, such as accessibility, infrastructure, and regional adaptation, are also critical. Research by Scott et al. (2020) highlights that northern regions face additional challenges, including limited daylight in winter, higher snowmaking costs, and transportation constraints.

Finland has built modern ski sports facilities in the Northern and Alpine regions. About 80 downhill ski resorts exist, with most in Lapland. Levi, Ruka, and Ylläs made up roughly 40% of national skier days in 2017-2018 (Suomen Hiihtokeskusyhdistys ry, 2018). These resorts currently lead Finnish skiing but face risks to long-term viability due to climate change. Warmer temperatures and less snow are likely to hurt Finnish ski for the sector's sustainability.

## Research Context and Implementation

This thesis examines the spectator experience and sustainability at the Levi Alpine Ski World Cup. Specifically, it asks: How do operational, environmental, and spatial factors shape spectator experience and event sustainability in Arctic winter sports? The research investigates how these factors influence event outcomes within the fragile northern context.

I analyze the gap between functional efficiency and experiential quality in event systems, focusing on limitations in visibility, engagement, and participation. The study examines how spatial reconfiguration, interactive elements, and behavioural nudges can address these challenges. The goal is to propose design-driven solutions that enhance engagement and sustainable participation, considering mobility and access within the event system.

This study adopts a qualitative approach, grounded in arts-based action research (ABAR) and design-oriented inquiry. I analyze spatial, environmental, and experiential factors in the Levi Alpine Ski World Cup, incorporating quantitative data only as necessary. Research is conducted at the Levi Alpine Ski World Cup, where climate, infrastructure, and spectator experience intersect.

A design-oriented approach connects analysis, speculation, and proposal-making with a focus on evolving the Levi Alpine Ski World Cup event system through spatial, experiential, and behavioural strategies. Scenario-based exploration (Go & Carroll,

2004) is employed to identify and address specific user activities and overlooked issues within this Arctic event, ensuring that theory directly informs experiential design and applied solutions.

## Researcher's Position and Access

My expertise in event design, creative direction, and strategic thinking inform this research. This experience is reflected in my design portfolio (see Appendix F). I frame this research through a unique lens that merges hands-on experience with analytical rigor. My background in designing and managing event environments provides direct insight into the conception, construction, and lived experience of event spaces. This perspective enables a comprehensive analysis of the Levi Alpine Ski World Cup as both a sports event and a spatial system defined by temporary structures, logistical challenges, and user interactions.

This research examines how design enhances sustainability and spectator experience in Arctic winter sports events using a qualitative, design-oriented approach. Rather than focusing solely on technical or policy aspects, I analyze how spatial design, infrastructure planning, and material selection influence environmental performance and user experience, aligning with the MA Sustainable Art and Design program's multidisciplinary, creative, and sustainability-driven practices.

This study was completed as an independent master's thesis at the University of Lapland. Levi Ski Resort provided access for direct observation of the event's spatial organization, infrastructure, and spectator experience. Additional information on event operations and sustainability practices was gathered from public and institutional sources. There was no formal collaboration with external organizations. Field observations provided essential insights and served as the basis for this qualitative, design-oriented investigation.

This research examines event systems, sustainability, and the designer's changing role. It positions the designer as a systems thinker, mediator, and strategist who shapes physical environments and influences experience, participation, and behaviour within complex event systems.

## Literature Review

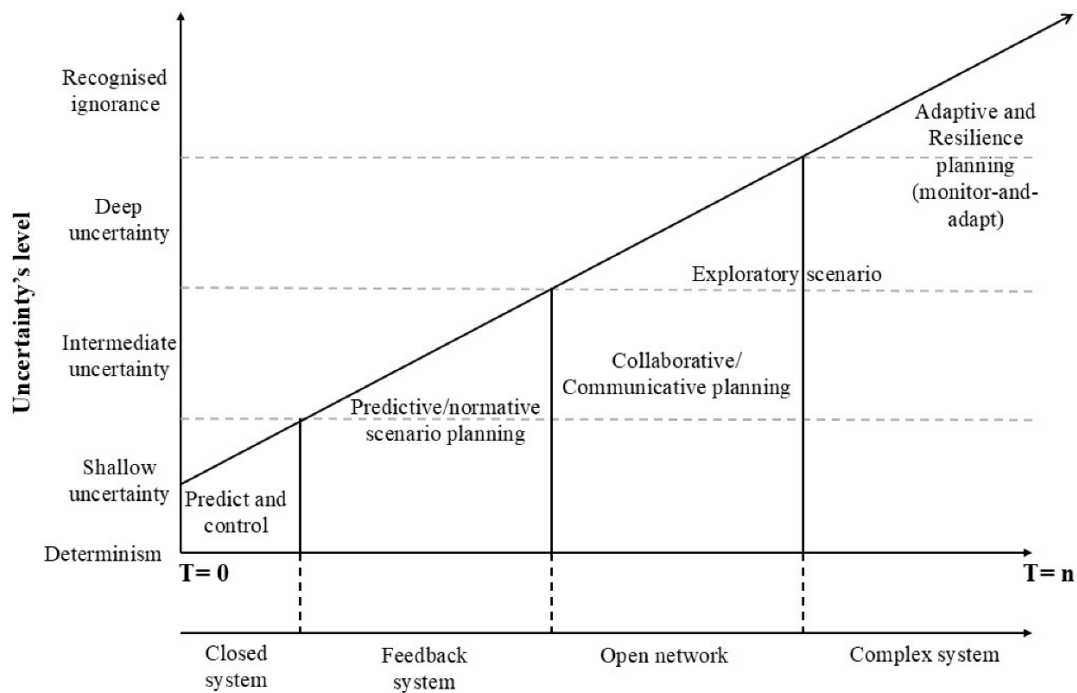
### Climate and Operational Challenges in Winter Sports Events

This discussion clarifies how climate change affects winter sports and ski tourism, focusing on the sector's reliance on stable conditions and low temperatures (Environmental and Energy Study Institute, 2026). Steiger et al. (2019) note that ski tourism is highly climate-sensitive, with even small changes in temperature or precipitation affecting season length, snow reliability, and planning. These vulnerabilities pose challenges, including unpredictable weather, infrastructure constraints, and rising financial pressures. Perechuda (2025) notes that these problems often create a gap between broad sustainability policies and what local organizers actually experience, especially at smaller events.

Snow reliability is key to ski tourism (Steiger et al., 2019). Climate change shortens seasons and creates unstable snow. This increases operational risks, especially for time-sensitive events such as international ski competitions, which require predictable conditions for scheduling, preparation, and meeting visitor expectations (Tsilogianni et al., 2023). Higher-altitude or northern destinations may fare better, but uncertainty remains everywhere (Steiger et al., 2022). Increasing uncertainty requires a shift from predictive planning to adaptive, resilience-based approaches (see Figure 1).

Deterministic models work well in stable conditions, but greater uncertainty calls for more flexible and responsive planning.

Figure 1 shows how uncertainty levels, system categories, and planning methods relate to each other. The vertical axis shows increasing uncertainty, from determinism to recognized ignorance. The horizontal axis displays system types, from closed to complex adaptive systems. As uncertainty rises, planning shifts from predict-and-control models to adaptive and resilience-based strategies. This shift underscores the need for flexible, responsive planning, especially for winter sports events, where environmental unpredictability demands dynamic event design and management.



**Figure 1.** Uncertainty levels, system categories, and corresponding planning approaches.

Source: Mannucci (2025, p. 9), *Urban Science*.

Artificial snowmaking is a key adaptation strategy in ski tourism. It addresses short-term variability, but research highlights its limits. Snowmaking requires substantial financial investment, energy, and water. This raises both economic and environmental costs (Steiger & Mayer, 2008; Morin et al., 2021). Rising temperatures further reduce its effectiveness, making it a limited solution for future climate scenarios (Steiger et al., 2019). Snowmaking should be seen as a short-term operational tool, not a long-term sustainability solution. This trend shows that snowmaking not only adapts to climate pressures but also supports business goals, such as timely season openings, protection of infrastructure investments, and maintenance of the destination's reputation for global events (Wolfsegger et al., 2008).

Scott et al. (2019) state that rising winter temperatures and variable snowfall reduce ski season lengths and raise operational costs, especially for low-elevation resorts. In addition to environmental challenges, winter sports events face significant operational constraints. Staffing, logistics, and transportation are highly sensitive to weather variability, requiring ongoing adjustment and coordination (Rice et al., 2022). These factors complicate stakeholder management and raise operational costs, especially for

large international events (Moore, 2026; Orr et al., 2022). The growing reliance on the increasing-term forecasting and real-time decision-making reflects a shift toward more flexible, responsive event management. These interconnected challenges make winter sports destinations fragile socio-environmental systems, with climatic, economic, and organizational factors closely linked (Kiashemshaki, 2026). In this context, resilience is a key strategic objective that requires destinations to shift from reactive adaptation to long-term transformation.

Beaudin and Huang (2014) observe that even minor weather fluctuations, such as unexpected warm periods, rain, and strong winds, disrupt ski operations and event planning, directly reducing visitor numbers and revenue. Climate change amplifies this uncertainty, making planning and risk management for ski resorts more difficult. This vulnerability is particularly critical for regions where winter tourism is central to the economy, such as Lapland (Leal Filho et al., 2024). Elsasser and Bürki (2002) describe that ski tourism in the Alps is highly vulnerable to climate change and therefore increasingly dependent on adaptation measures.

A widely discussed long-term strategy is diversification through year-round tourism development. Expanding activities beyond winter helps stabilize local economies. It also reduces reliance on climate-sensitive operations (World Tourism Organization [UNWTO], 2014). In Arctic and mountainous regions, these strategies include developing summer and shoulder-season activities like hiking, cycling, cultural events, and nature-based tourism (Pröbstl-Haider et al., 2021; Rico et al., 2021). These approaches build more resilient tourism systems and address the challenge of seasonality. In addition, ecological research has shown that ski management and artificial snow can affect ground temperatures and slope environments, highlighting the importance of combining technical and environmental approaches in slope management (Rixen et al., 2004). Broader, year-round tourism offerings are crucial (Varnajot & Makopoulou, 2025).

Research highlights the growing importance of creative tourism and design-led practices in sustainable regional development. Creative tourism centers on participatory, place-based experiences that draw on local knowledge, cultural practices, and environmental awareness (Duxbury et al., 2020). In Arctic contexts, these

approaches create value and strengthen connections among communities, environments, and visitors (Jokela et al., 2021; Huhmarniemi et al., 2021). By combining cultural engagement and environmental sensitivity, these models support meaningful, sustainable tourism experiences.

These studies show that winter sporting events involve intertwined operational and economic challenges (Spandre et al., 2019). The main takeaway is the need for destinations like Levi to adopt flexible strategies, diverse services, and long-term planning to sustain both sports and year-round event development (Levi Ski Resort's Evolving Environmental Program, 2025). The University of Lapland-led "Seasonality of Arctic Tourism" project emphasizes the importance of addressing seasonality by promoting year-round tourism development and diversifying Arctic tourism experiences beyond the winter season (Rantala et al., 2019). Research in this field demonstrates that design and artistic practices play a significant role in fostering transformation, as creative tourism initiatives have evolved over the past two decades to promote cultural engagement and responsible tourism (Benhaida et al., 2024).

Sarantou et al. (2021) describe context-sensitive design approaches that systematically map local conditions, cultural practices, and environmental characteristics. Through such methods, tourism becomes not just an economic activity, but also a means for fostering cultural interaction and environmental awareness (Briassoulis & Straaten, 2000).

In summary, year-round tourism development in Lapland should prioritize the quality and significance of visitor experiences rather than quantity alone (Briassoulis & Straaten, 2000). Winter sports events operate within complex, climate-sensitive systems. These systems are shaped by environmental uncertainty, operational constraints, and changing socio-economic conditions. Addressing these challenges needs integrated strategies. This includes technical adaptation, systemic thinking, and experiential design. These provide the foundation for more resilient and sustainable event systems in Arctic environments.

## Theoretical Foundation for Sustainable Event Systems

**Sustainability theory:** The theory establishes a framework for understanding how social, environmental, and economic systems interact, as well as how human actions may support or undermine long-term ecological equilibrium. The concept evolved significantly in the late twentieth century, particularly with the publication of the Brundtland Report (WCED, 1987), which defined sustainable development as the ability to 'meet the needs of the present without jeopardizing the ability of future generations to meet their own needs'. This concept remains highly influential in environmental policy, tourism development, and design studies, with sustainability research emphasizing the need to integrate governance, social systems, and ecological considerations in long-term development strategies (Bramwell & Lane, 2011)

In design and event management, sustainability theory emphasizes the need to incorporate environmental protection, social well-being, and economic stability into decision-making processes (Elkington, 1997). Elkington's Triple Bottom Line (TBL) redefines organizational success beyond profit to include "people" and "planet," providing a comprehensive framework that is widely used in tourism, sports events, and regional development.

According to Victor Papanek's (1971) critical approach, design may shape systems as well as products. Similarly, Ezio Manzini (2015) broadens this concept by presenting sustainable design as a catalyst for systemic reform. According to Manzini, sustainability necessitates reconsidering entire networks of production, participation, and consumption, prioritizing long-term resilience over short-term efficiency.

In addition, sustainability emphasizes the importance of social inclusion and equity in development processes. In the context of tourism and sports, sustainable development must benefit local communities, protect cultural identity, and create appropriate economic opportunities (Saarinen, 2006). This perspective aligns with broader sustainability frameworks that highlight the integration of social, economic, and environmental dimensions in long-term development (Bramwell & Lane, 2011).

**Strategic Design Theory:** According to Manzini (2015), strategic design operates at the level of relationships, processes, and networks, enabling designers to influence

evolving systems over time. Strategic design theory highlights design's capacity to shape systems, structures, and long-term decision-making, extending its influence beyond physical objects. Unlike traditional design, which typically addresses isolated problems, strategic design addresses complex, multidimensional challenges through planning, coordination, and systemic thinking.

In the context of events, strategic design helps create comprehensive planning models that address logistics, infrastructure, user experience, sustainability, and long-term socio-economic effects (Organisation for Economic Co-operation and Development, 2021). As Buchanan (1992) notes, design is increasingly used to address “wicked problems”, issues marked by the absence of a single solution, involvement of multiple stakeholders, and evolving constraints.

Strategic design theory revolves around Tony Fry's (2009) concept of "defuturing," which emphasizes how current behaviours might jeopardize future viability if they neglect long-term environmental consequences. According to Fry, design needs to move away from short-term results and toward long-term sustainability.

**Resilience Theory:** Resilience relates not to the ability to resist change, but to the capacity to absorb shocks, restructure, and operate under new circumstances (Folke, 2006). As natural variability and unexpected weather patterns increasingly affect operations, resilience theory becomes particularly useful in climate-sensitive winter sports.

Resilience in social–ecological systems is commonly understood through the capacities of persistence, adaptability, and transformability (Walker et al., 2004). Folke (2006) further expands this perspective by emphasizing resilience as the ability of systems to absorb disturbances while maintaining essential functions and adapting to change. In the context of winter tourism, Scott et al. (2019) argue that climate change has introduced “non-linear risk,” suggesting that even minor environmental changes can lead to significant operational consequences.

Within event preparation, resilience involves both organizational and community capacities, reflecting the interconnected nature of social and operational systems. Adger (2000) argues that resilience is partly social, shaped by networks, shared

knowledge, institutional collaboration, and the ability of communities to coordinate responses to change. Furthermore, contingency planning and scenario-based preparation enhance the ability of event systems to anticipate and respond to disruptions (Jariwala, 2024).

**Socio-ecological systems (SES) theory:** The theory builds on resilience thinking by emphasizing the interdependence between natural processes and human social systems. Berkes and Folke (1998) describe SES as integrated systems in which human activities and environmental dynamics continuously interact and co-evolve. This perspective challenges the separation of nature and society, instead positioning them as mutually dependent components of a single system.

This approach is particularly relevant for winter sports destinations such as Levi, where climatic conditions, tourism operations, local livelihoods, community identity, and infrastructure are closely interconnected. Environmental change directly influences economic stability, while economic activities can, in turn, impact environmental conditions. As Saarinen (2006) highlights, tourism in northern regions is both dependent on and a driver of environmental change, creating complex feedback relationships within the system.

Applying the SES theory to winter sports reveals several essential dynamics. Firstly, snow conditions affect tourist numbers, local economies, investment choices, and land use (Xiao et al., 2020). Feedback loops, such as increased snowmaking requiring more energy and water, impact the system as a whole (Institute for Environmental Research and Education, 2025). Additionally, SES theory examines thresholds and tipping points, noting that even small increases in winter temperatures can reduce snow reliability and shorten the season (Moore, 2026). Adaptability is an important part of resilience. It means that systems and communities can adjust to changing environmental conditions while still keeping their main functions (Walker et al., 2004). In winter tourism, this means destinations can handle climate changes by planning flexibly and offering a variety of activities. Socio-ecological systems thinking also shows that when stakeholders work together, share information, and use adaptive management, tourism systems become more resilient (Folke, 2006).

# Sustainability Frameworks in Sports Event Design

## Sustainability as a Multi-Dimensional Framework

In the last twenty years, sustainable event design has become a key research topic, especially in sports, where both environmental and social impacts are significant. Elkington's (1997) Triple Bottom Line (TBL) framework, which defines sustainability through three connected dimensions: environmental, social, and economic, provides a core theoretical base. This model is often used to analyze sporting events because it shows that focusing only on environmental sustainability is not enough; events should also benefit communities and remain economically viable. Mair and Whitford (2013) point out that research on events now covers environmental, social, and economic issues, highlighting the importance of integrated planning for long-term success.

## Triple Bottom Line (TBL) in the Context of Winter Sports Events

Elkington's (1997) Triple Bottom Line (TBL) framework is often used to measure how sustainable sports events and tourism systems are by looking at environmental, social, and economic factors (see Figure 2; Nevada Sustainability Alliance, n.d.). In winter sports, achieving environmental sustainability is especially difficult because running these events uses a lot of resources. Tourism linked to winter sports adds to greenhouse gas emissions, mainly from transport, energy use, and infrastructure (Gössling & Scott, 2018). Ski tourism also relies heavily on artificial snowmaking to keep conditions reliable, which uses more energy and water and shows how vulnerable the sector is to climate change (Wolfsegger et al., 2008). All these issues show the environmental challenges winter sports events face and highlight why better planning and management for sustainability are needed.

The economic side of the TBL framework shows that while winter sports events can bring in a lot of money, they are still at risk from changing weather, shorter seasons, and unpredictable visitor numbers. Studies on Arctic tourism point out that areas relying on winter tourism face major economic risks as snow becomes less dependable and seasonality remains a challenge (Rantala et al., 2019). Because of this, many experts recommend offering tourism activities outside the winter season to keep income steady and avoid relying too much on activities affected by the climate (Saarinen, 2006).

The social dimension looks at how communities get involved, how cultural identity is shaped, and the well-being of both residents and visitors. Winter sports events can strengthen regional identity and help local development, but these benefits rely on active community participation and careful management of tourism growth (Saarinen, 2006). In Arctic areas, it is also important to address seasonality and create year-round opportunities to support community well-being and long-term social sustainability (Rantala et al., 2019).



Figure 2. Triple Bottom Line framework

Source: Nevada Sustainability Alliance (n.d.), *Our impact* [Infographic], available at: <https://impact-nv.org/our-impact/>

## Environmental Management Systems and the Role of ISO 20121

Beyond the Triple Bottom Line framework, scholars highlight the importance of environmental management systems (EMS) in the context of sporting events. Collins and Cooper (2017) report that professional sports organizations are increasingly adopting EMS to monitor energy consumption, waste generation, carbon emissions, and water usage. In this context, ISO 20121 offers a structured framework for managing event sustainability (International Organization for Standardization, 2012). Research underscores the need to measure and evaluate environmental performance, as poorly managed events can result in substantial environmental impacts (Boggia et al., 2018). Furthermore, studies indicate that event organizers are increasingly integrating sustainability practices into planning and operations, although practical implementation challenges persist (Laing & Frost, 2010).

## Circular Economy Strategies in Sports Event Design

The circular economy (CE) model is increasingly used in event design. It challenges the traditional “produce–use–waste” approach common in tourism and event management. Geissdoerfer et al. (2017) define the circular economy as a system that minimizes waste and keeps materials in use. Strategies include reuse, repair, recycling, and regeneration. In sports events, these principles enable more resource-efficient practices and help reduce environmental impacts from event operations.

Multiple studies show that event organizers can adopt circular strategies, such as reusing infrastructure, improving energy efficiency, and designing modular or multi-purpose facilities, to curb resource consumption and waste (Geissdoerfer et al., 2017; Renfors, 2022). In tourism and winter sports, circular economy practices focus on conserving resources, reducing waste, and optimizing water and energy use, thus enabling more sustainable and resilient event management.

## Adaptation and Resilience Frameworks for Climate-Sensitive Sports

Folke (2006) defines resilience as the capacity of a system to absorb disturbances while preserving essential functions. In winter tourism, resilience frameworks advocate for diversification of activities, flexible scheduling, improved infrastructure, and increased stakeholder collaboration.

Climate adaptation measures such as artificial snowmaking, slope grooming, high-altitude relocation, and hydrological management are increasingly examined in recent research. However, experts argue that these adaptations possess inherent limitations and may only delay, rather than resolve, climate vulnerability (Rice et al., 2022).

Resilience thinking emphasizes the need for collaboration and coordination among diverse stakeholders, including regional tourism authorities defining visitor strategies, municipal officials managing infrastructure, environmental agency staff overseeing conservation, and representatives from local communities. Within social–ecological systems, resilience depends on actors' capacity to share knowledge, respond collectively to change, and adapt to evolving conditions (Folke, 2006; Walker et al., 2004). In regions like Lapland, where tourism represents a significant economic sector,

these strategies are crucial for managing environmental uncertainty and promoting long-term community well-being (Saarinen, 2006).

Mannucci (2025) describes built environments and tourism systems as complex adaptive systems shaped by environmental, spatial, and socio-economic interactions. In winter sports, climate variability affects both conditions and operations, impacting visitor experiences. Therefore, sustainable development in these contexts requires integrated, long-term strategies that emphasize resilience, adaptability, and systemic change over short-term solutions. Resilience in these systems involves not only recovery but also the ability to adapt and transform in response to environmental pressures (see Figure 3).

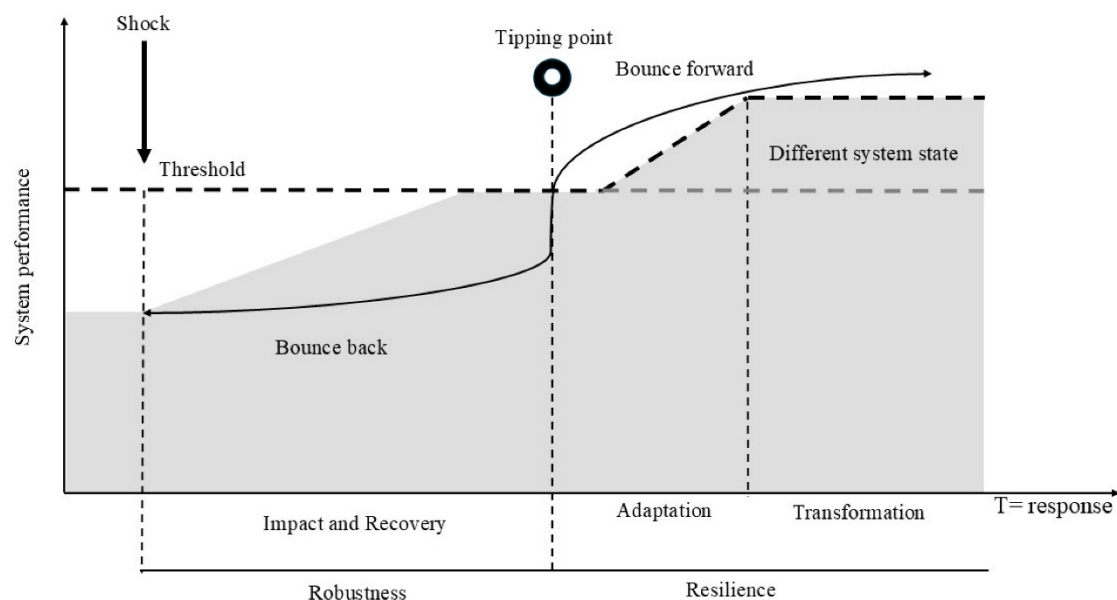


Figure 3. System response to disturbance: from recovery to adaptation and transformation.

Source: Mannucci (2025, p. 13), *Urban Science*.

Figure 3 illustrates that systems first respond to disruption by recovering, or “bouncing back,” to a previous state. As pressures intensify and thresholds are crossed, systems shift toward adaptation and transformation, or “bounce forward,” creating a new state. This distinction is especially important for winter sports events, where climate change threatens the long-term viability of traditional models and calls for more adaptive, forward-looking strategies.

## Sustainable Event Management (SEM) Models

Sustainable Event Management (SEM) puts sustainability ideas into action. Studies in event management highlight important SEM ideas, such as checking environmental impact, choosing supplies responsibly, tracking carbon footprints, handling waste, using energy and water wisely, and involving stakeholders through clear communication and reporting (Mair & Whitford, 2013).

The literature on Sustainable Event Management (SEM) stresses the need for context-specific strategies, especially for outdoor events highly susceptible to climate variability (Laing & Frost, 2010). In this context, tourism destinations that use systematic evaluation methods can better assess environmental impacts and respond to new challenges. Using impact assessment tools enables event organizers to quantify environmental impacts, track resource use, and make informed decisions to improve sustainability performance over time (Boggia et al., 2018).

Building on these frameworks, international governing bodies have established structured sustainability strategies for winter sports events. The International Ski and Snowboard Federation (FIS) focus on cutting carbon emissions, promoting sustainable travel, managing snow resources, and reducing waste.

The International Ski and Snowboard Federation (FIS) has set key sustainability goals for ski events: reducing carbon emissions, improving energy efficiency, supporting sustainable travel, managing snow resources, and minimizing waste (International Ski and Snowboard Federation, 2024). Environmental impacts stem from infrastructure, visitor mobility, logistics, and energy use. As a World Cup host, Levi meets sustainability targets through measurable operational criteria. However, these efforts are often technical and not visible to spectators.

This distinction highlights a gap between performance-based and experiential sustainability. Technical measures reduce environmental impact but are often invisible to spectators. Design can make sustainability visible through space, materials, and communication, encouraging awareness and sustainable behaviour. As host of the Alpine Ski World Cup, Levi translates these principles into context-specific practices.

## The Role of the Designer in Climate-Adaptive Event Systems

Drawing from the previously discussed theoretical foundations, this section synthesizes these perspectives to articulate the role of designers within climate-adaptive winter event systems.

Designers play an increasingly important role in adapting winter sports events to fragile social and environmental conditions. Markkula et al. (2024) highlight that reliable snow, managing temperature fluctuations, coordinating logistics, and handling visitor traffic must all harmonise within a limited climatic timeframe. In these situations, sustainability is essential for long-term success and resilience. Designers now do more than focus on looks or branding; their work has become strategic, involving complex systems and many stakeholders. They need to adapt to changing conditions and use approaches that fit the specific context (Leone & Tersigni, 2023).

A designer can serve as a systems thinker when planning events that need to adapt to climate challenges. (Mannucci, 2025) This approach views the event as interconnected parts: snow production, transportation, athlete facilities, volunteer coordination, media operations, accessibility services, and spectator experience. (Twible, 2025) According to systems thinking (Meadows, 2008), it is most effective to understand how these parts interact rather than treat them separately. In Levi, for instance, snowmaking choices affect energy use, scheduling, workforce planning, and environmental impact simultaneously. When designers adopt a systems perspective, they can see how these factors are interconnected and develop more integrated and flexible solutions (Jones & Kijima, 2018).

Designers mediate among many people in large events: event managers, snow technicians, city officials, athletes, sponsors, volunteers, and local residents. Strategic design theory (Manzini, 2015) highlights that designers help these groups communicate, especially when their priorities differ. In winter events affected by climate change, this role becomes even more important (White Winters - Ski Sport Finland, n.d.). For example, making transport systems and pathways wheelchair-accessible shows that inclusive design requires coordination between operational planning and social

sustainability goals. These interventions highlight that accessibility is not only a design outcome but also a result of collaboration across multiple systems and stakeholders.

Most people think of sustainability in winter sports as technical factors, like energy efficiency, snow storage, transportation emissions, and waste reduction. However, sustainable design theory (Papanek, 1971; Fry, 2009) shows that design also influences cultural values and behaviours. Designers can enhance sustainability by using clear signs to reduce traffic, choosing eco-friendly materials, planning spaces to limit unnecessary movement, and encouraging sustainable spectator behaviour through communication (Deng, 2014).

Levi shows how much designers can influence an event. Sustainability is reflected in things like accessible infrastructure, efficient transportation, and integrated service systems. While these may seem like simple logistics, they are actually design choices that take both environmental and social impacts into account (Liu, 2018). Empathy is important in this process because it helps designers think about the needs, experiences, and interactions of different users. As Kravtsov et al. (2022) point out, empathy-driven design helps visitors and local communities connect, making events more inclusive and socially sustainable.

Looking forward, resilience theory emphasizes the importance of systems adapting to climate change and uncertainty (Folke, 2006; Walker et al., 2004). In this context, winter sports events must remain flexible in scheduling, snow management, and contingency planning to respond effectively to changing environmental conditions. Designers help by creating flexible layouts, modular infrastructure, and planning tools that let events adjust to unpredictable weather (Battaglia et al., 2023). Instead of just reacting to issues, they plan ahead and build in flexibility from the start. This strategic approach is key for winter events to succeed in a changing climate.

Building on the perspectives discussed above, this study sees the designer's role in winter sports events as more than isolated spatial or aesthetic interventions. Instead, the designer engages with the event as a complex, interconnected system shaped by environmental conditions, operational structures, stakeholder relationships, and spectator experience. Here, design is not limited to form-making. It becomes a process

of understanding and influencing how multiple elements interact and evolve over time. Arctic environments come with uncertainty, climate sensitivity, and logistical challenges. In these settings, the designer's role is even more important. Designers work on many levels, connecting physical spaces with people's experiences. They turn technical sustainability ideas into clear, actionable steps and help diverse stakeholders find common ground. Importantly, this work leads to strategies that move away from fixed solutions and instead rely on adaptive, relationship-based, context-aware approaches. These better fit the changing environmental and social needs.

As shown in Figure 4, designers in this context also focus on how people behave and experience the event. Choices about movement, visibility, accessibility, and participation do more than shape the space; they influence how spectators see, interact with, and react to the event. Design becomes a way to shape both the environment and how people participate, helping create more sustainable engagement. The framework below brings these ideas together by combining systems thinking, stakeholder mediation, sustainability, and climate adaptation. It sees the designer as an active part of the event, able to blend environmental awareness, practical needs, and user experience into a clear and flexible design.

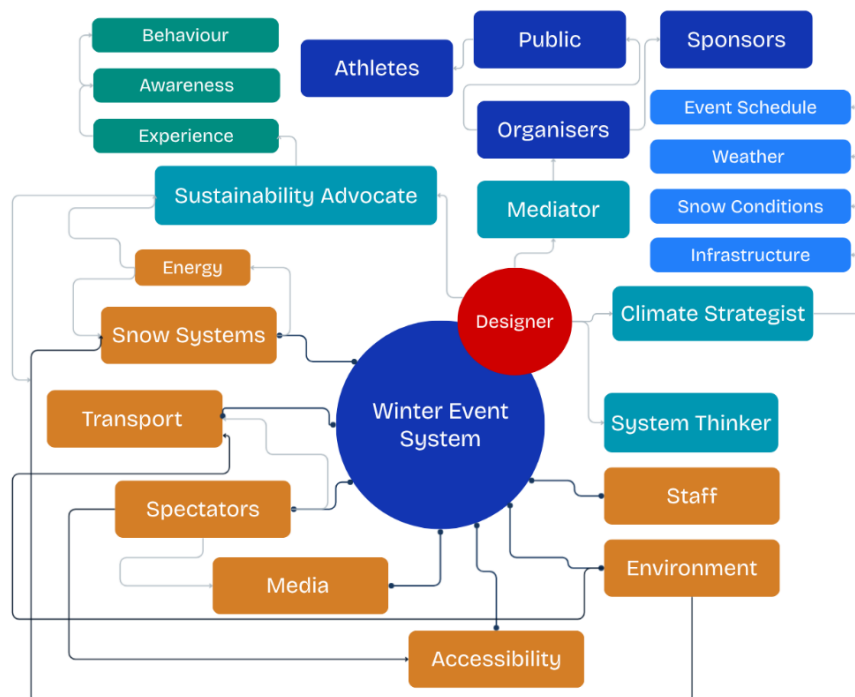


Figure 4: Explaining Winter Event Systems and role of Designer

## Art and Design Practices in Fragile Event Environments

This section explores how artistic and design practices can inform sustainable approaches within fragile event environments. It situates Arctic art and design as a lens for understanding how environmental conditions, materiality, and human experience interact in winter sports contexts.

Artistic and creative methods that engage with fragile environments help us understand sustainability in winter sports. Instead of treating landscapes as passive settings, many artists and designers view ecological environments as active players shaped by climate, material cycles, and human actions. In Arctic and snow-dependent regions, where conditions are changing and becoming less stable due to climate change, these approaches demonstrate how spatial design can adapt to forces rather than resist them. To demonstrate how artists and designers who work with land, time, materials, and ecological systems, this section provides examples of Levi's approach to planning sustainable winter events.

Arctic art and design offer a more relevant framework for this thesis than general environmental art. This is because they come from northern conditions, seasonal changes, and local ways of knowing. Jokela and Huhmarniemi (2022) argue that Arctic art education is closely tied to ecoculture. In ecoculture, ecological and cultural life are connected and shaped by local and environmental knowledge. From this view, winter is an active force that influences artistic practice, learning, and ideas about sustainability. Their research shows that art projects in the Arctic can support sustainability, renew northern knowledge, and strengthen connections between people, places, and changing environments.

Stöckell's (2025) study of sustainable resilience in winter art supports this view. Stöckell examines how experimental winter art helps people process environmental change and build resilience. He says that winter art seeks flexible ways of working that can adapt to changing winter conditions. Using snow as a material creates hands-on artistic experiences and links to science. Collaborative winter art projects also give people a chance to reflect on why winter is changing and to encourage responsible actions.

Together, these studies suggest that Arctic winter art and design are more than visual responses; they are adaptive strategies to connect with environmental change, local knowledge, and culture. For this thesis, these ideas offer a stronger view of how Lapland's design can respond to fragile winter conditions while staying tied to experience, sustainability, and place.

This broader approach flows into the design of winter sports venues, where the focus shifts to movement, flow, and physical experience. A ski event becomes like a dance between competitors, spectators, and snow across the landscape. In this context, Long's method suggests that spatial design can highlight these movements, turning the event into a conversation between people and nature instead of just a technical competition.

Contemporary festival and temporary architecture prioritize modularity, reusability, and minimal material impact (Kahvecioğlu & Selçuk, 2025). In the context of outdoor events, designers increasingly select lightweight systems, adaptive structures, and circular material strategies to minimize waste and reduce environmental impact (Comitti et al., n.d.).

These principles are particularly relevant for winter sporting events, where infrastructure is constructed and dismantled annually. Implementing modular design principles and circular material management may enhance the long-term viability of recurring events such as the Levi Alpine Ski World Cup.

## Research Methodology

This study uses an art-based action research (ABAR) approach to investigate how design processes and direct experience can inform winter sports event planning in Arctic contexts. The main argument is that ABAR uniquely enables the emergence of context-specific, practice-led knowledge essential for designing effective events in complex environments. Art-based action research has been extensively developed within Arctic art and design research as a method that connects practice, participation, and context-sensitive inquiry (Jokela & Huhmarniemi, 2018). Within this framework, the designer is positioned as both an observer of the event system and a contributor who engages with the environment and proposes interventions. This dual role fosters a more situated and experiential understanding of complex environments.

The approach is defined by its iterative, process-oriented nature, in which understanding develops through cycles of observation, reflection, and creative response (Jokela, Huhmarniemi, & Hiltunen, 2019). This makes ABAR well-suited for investigating dynamic, interconnected environments, such as large-scale winter sports events, where spatial, environmental, and social conditions interact continuously. Rather than pursuing detached or purely objective analysis, the method supports situated knowledge derived from direct experience and engagement.

Within this framework, qualitative inquiry is used to examine complex environmental, geographical, and cultural contexts that quantitative data alone cannot illuminate (Leavy, 2017). In this study, qualitative methods deeply explore intersections of sustainability, infrastructure, and spatial design within winter sports events. By integrating qualitative research with art-based action research, the study advances a methodology that not only observes but actively engages and reflects on event environments. This integrated approach fosters critical interactions and generates design-oriented insights, enabling the analysis of existing conditions and the identification of opportunities for change through design.

In this study, ABAR principles guide the investigation by facilitating a practice-oriented approach in which field observations, visual recordings, and reflective analysis help produce conceptual spatial ideas aimed at enhancing sustainability in winter sports

events. The project aims not just to examine the Levi event, but also to investigate how design thinking might lead to better sustainable event practices. The project aims to improve understanding of sustainability concerns in winter sports events by combining qualitative case study analysis and design-oriented inquiry, and by exploring options for environmentally responsive event design.

## Data Collection (Primary and Secondary)

I used several qualitative data sources to build a thorough understanding of the Levi event and its impact on sustainability. The sources include field observations, visual records, institutional documents, and relevant literature. Primary data came from observing the event in person, with careful attention to spatial layout, infrastructure, spectator experience, and sustainability practices. The observation covered important parts of the event, such as spectator zones and viewing areas, ski slopes and race infrastructure, temporary event structures, service and logistical spaces, transport routes and access, and spectator amenities like sanitation facilities and wheelchair-accessible viewing areas.

I documented my observations with notes, photos, and videos. This method allows a thorough review of how infrastructure interacts with the landscape and how sustainability is managed during the event. and I gathered additional data from documents provided by event organizers, including sustainability and carbon emissions reports. These documents helped me understand their environmental strategies and monitoring systems.

I reviewed research on climate change, winter sports sustainability, snowmaking technology, and event management. These sources provide a theoretical foundation and situate the Levi event within a broader discussion of sustainability. By combining field observations, documents, and literature, I developed a broad perspective on the Levi Alpine Ski World Cup. I see it as both a competitive event and an environmental system.

## Data analysis

I used thematic analysis to study the data. This approach, often used in qualitative research, helps identify patterns and themes in observations and documents (Leavy,

2017). I reviewed field notes, photos, and reports to find main themes related to sustainability and infrastructure. I looked for patterns in spatial structure, environmental effects, resource use, accessibility, and spectator experience. This analysis highlighted several key topics, such as the environmental impact of temporary event infrastructure, how spectator areas are arranged, accessibility and inclusiveness in event spaces, sustainable operational practices, and opportunities for design improvements.

These topics shaped the later design analysis in this thesis. The following sections explore possible improvements in spatial and organizational areas.

## Integration of Visual Documentation and Exhibition Practice

Photographs were presented in an exhibition associated with the thesis as part of the research process. In addition to documenting the existing event infrastructure, the exhibition featured design proposals, including drawings, renders, and technical visuals produced during the study. Exhibitions represent a significant method in sustainable art and design by facilitating the visual communication of spatial and environmental findings. In this project, the exhibition functioned as the creative component of the research, transforming analytical insights into a tangible and experiential format. (See Appendix G)

## Research Ethics and Limitations

I considered ethical issues throughout my research. I only observed the public parts of the event and received permission from the organizers to study and document the site. I used photos and videos only for research and spatial analysis. Spectators were anonymous unless they agreed to be identified. I handled organizers' records with care for scholarly research. These practices follow Leavy's (2017) ethical criteria for qualitative and design research. They help ensure transparency, careful recordkeeping, and respect for participants and organizations.

This study has important limitations. First, it examines only the Levi Alpine Ski World Cup, so conclusions relate to its specific context. Levi is a relevant example from a climate-sensitive Arctic region. However, insights might not apply to other events or locations. Second, I observed only one event period. The study provides a snapshot

rather than a long view across seasons. Some sustainability practices or challenges may change over time or in different climate conditions.

Finally, my design concepts and spatial ideas in this study are conceptual and exploratory. They highlight areas for improving sustainability in event design, not full solutions. Still, the study gives valuable insights into event infrastructure, environmental factors, and design-led sustainability in winter sports.

## Case Study: The Levi Alpine Ski World Cup

The Levi Alpine Ski World Cup was selected because of its unique timing on the global winter sports calendar. Its location in the Arctic region of northern Finland also makes it particularly significant for environmental studies. Levi hosts one of the first Alpine Ski World Cup events each year. This early timing makes it vulnerable to climate change, which affects snow reliability and winter tourism. As snow and temperature patterns shift, northern ski resorts and events face new challenges in operating sustainably.

The Levi event provides a strong case for study. It combines elite competition with large event infrastructure, including temporary spectator facilities, service areas, transit systems, and other operations. These physical and organizational aspects create environmental impacts beyond the ski slopes. I received direct access to the event after an invitation from the organizers. This allowed me to analyze the site and gather insights on spatial structure and sustainability policies. Such involvement adds relevance to my case study and helps me understand how sustainability is applied within a major winter sports event.

This study examines sustainability challenges at the Levi Alpine Ski World Cup and investigates how design-led approaches enhance environmental responsiveness in winter sports contexts. To support this analysis, the event is conceptualized as an interconnected system of environmental, spatial, and experiential components (see Figure 5).

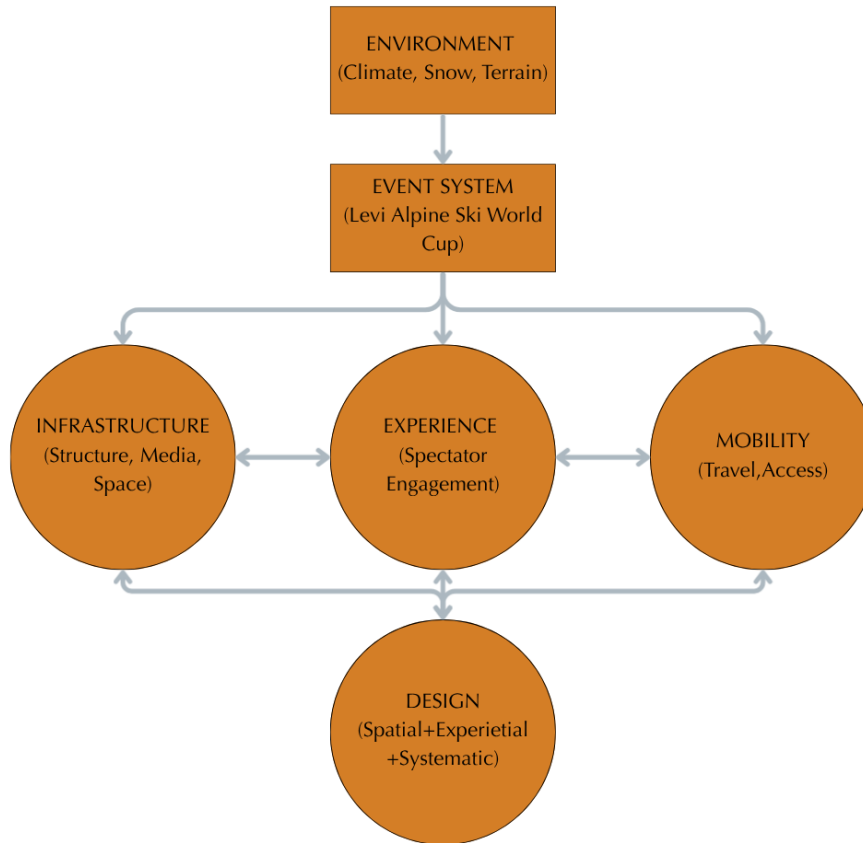


Figure 5: Conceptual framework of the Levi Alpine Ski World Cup as an interconnected event system.

Source: Author's own illustration.

## Field Observation: Levi Alpine Ski World Cup (16 November 2025)

The researcher conducted field observations as a central component of this study, yielding firsthand data on operational aspects (such as event management and logistics), geographical characteristics (such as location and layout), and experiential dimensions (including participant and spectator experiences) of the Levi Alpine Ski World Cup. By engaging directly with the event setting and its supporting infrastructure (facilities, technology, and services), the researcher gained deeper insights through on-site participant observation. The organizers gave the researcher unrestricted access to spectator zones, temporary structures, circulation routes, and key infrastructural points. This enabled a comprehensive understanding of spatial interrelationships and spectator engagement with the environment.

Data collection used visual documentation and real-time notetaking. Numerous photographs documented the venue's spatial configurations, material use, infrastructure, and human interactions. Selective video recordings captured dynamic aspects like crowd movement, slope maintenance, and the event's atmosphere. The researcher digitally recorded most written material with a camera and a mobile device. Low temperatures (-24°C) challenged me to manage device battery life. To ensure real-time documentation, I took observational notes during and immediately after encounters with spatial or operational factors. Photographs and video recordings helped me remember details, supporting later reflection and analysis.

In addition to observations, the researcher had informal conversations with selected event staff and organizers. These interactions were brief due to the event's operational demands but offered valuable insight into management practices and logistics. However, the research focused mainly on systematic observation rather than structured interviews. By combining direct observation of participants, systematic photo or video recording (visual documentation), and casual conversations or spontaneous interactions (informal engagement), the researcher developed a detailed, multi-layered understanding of the event environment. This approach aligns with qualitative and design-oriented research methods, which focus on in-depth descriptions and field-based study. Field immersion helps identify spatial arrangements, typical actions or

routines (operational behaviours), and opportunities to propose or implement design changes (design intervention).

The collected visual and observational materials form the basis for later analysis. They may also support the sharing of findings through visual or exhibition-based formats, as described in the methodology chapter.

## Event Spatial System and Infrastructure Analysis

The spatial organization of the Levi Alpine Ski World Cup is designed to manage circulation, viewing areas, infrastructure, and service areas for large audiences in the Arctic. This event features a sequence of spatial transitions. It begins at the arrival points and ends in the central competition zone. This study uses field observations from November 16, 2025, during the FIS Alpine Ski World Cup in Levi, Finland. Levi is an established ski resort in Lapland, known for hosting early-season World Cup races.

The observed event was a slalom race on the Levi Black slope. This course is considered among the most technically demanding because of its steep gradients (sharp inclines), icy surfaces (hard, slippery snow), and closely spaced gates (poles that define the ski path). The event environment comprises both permanent and temporary structures. This creates a layered spatial system that accommodates athletes, media, and spectators. As shown in figure 6, finish area serves as the central hub, integrating competition, media infrastructure, and spectator engagement into a single concentrated zone. Large digital screens, mobile display units, and sponsor installations are distributed throughout the site to extend visibility and enhance the spectator experience.



Figure 6: Frontal View of Black Slope and Finish Line Arch.

The spectator journey begins at designated parking areas situated away from the main event site. Visitors arriving by private vehicle are directed to organized parking zones managed by event staff. From these locations, shuttle buses transport visitors to the ski area, thereby reducing congestion. After the shuttle transfer, visitors walk along a designated route to the event entrance. This segment includes a steep pathway, creating a physical and experiential transition into the event. Ticket verification and on-site purchases occur near the entrance. This controlled access point allows entry into the main arena. The sequence of parking, shuttle, and walking forms a tiered mobility system. This process efficiently manages high visitor volumes and addresses topographical constraints' visitor volumes while addressing the site's topographical constraints.

The event offers diverse spectator experiences, structured through temporary viewing infrastructures (structures built for the duration of the event). A premium viewing experience is provided by a temporary VIP building with interior spaces and terrace areas featuring extensive glass facades (large panes of glass forming walls). These transparent surfaces provide unobstructed views of the slope, creating a visually immersive and comfortable environment. Additionally, a temporary scaffold-based spectator pavilion (temporary raised platform for viewing) is located near the finish

area, providing elevated seating and a central perspective of the race. This structure serves as a key viewing node within the spatial layout as shown in figure 7.



Figure 7: Scaffolding Based Temporary Spectator Pavilion

General spectators are primarily positioned along the sides of the slope, behind safety netting (protective mesh barriers) that provide a buffer between the audience and the racecourse. Although these areas allow close proximity to the athletes, visibility is limited by flat standing conditions and crowd density. Compared with elevated structures, these zones offer reduced sightlines (unobstructed views). The finish area is the focal point where competition, media, and spectators meet. A prominent finish-line structure, marked by a large arch, defines the race endpoint and serves as a visual anchor. A deceleration zone for athletes is nearby and closely linked to media and broadcasting infrastructure. Cameras, production equipment, and media staff are placed strategically, (As shown in figure 8). Barriers separate operational areas from spectators to ensure safety and efficiency.

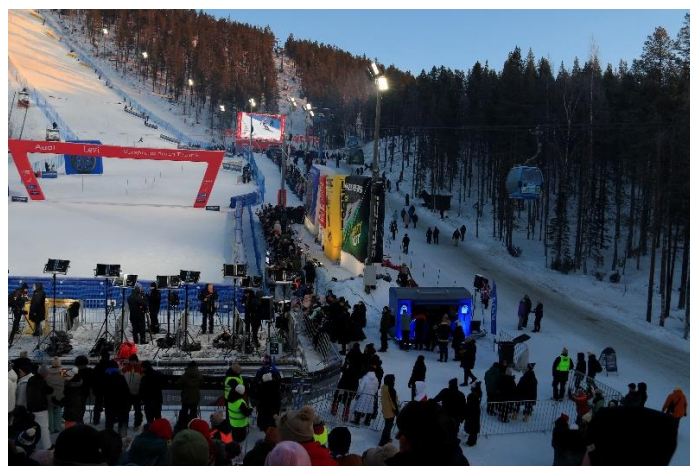


Figure 8: Deceleration Zone Between the Finish Arch and Media Zone

The spatial organization incorporates symbolic elements, such as the “leader’s seat,” which contribute to the event's narrative and management. Large digital screens and mobile display units extend visibility across the site, particularly for sections of the slope that are not directly visible. Sponsor installations, including inflatable structures and branded elements, are prominently positioned along the course, reinforcing the event's commercial and visual identity, (see figure 9, 10). Most temporary structures, such as scaffold systems and seating, are modular and reusable, indicating material efficiency and adaptability within the construction strategy.



Figure 9, 10: Large Screen and mobile display unit | Sponsor Installations along slope

Accessibility and spectator services are integrated into the event's spatial organization. Sanitation facilities are distributed throughout the site, including both standard portable units and systems adapted for Arctic conditions (such as weather-resistant structures).

Some facilities employ dry composting methods with wood-based materials (eco-friendly waste disposal without water), reflecting environmentally responsive practices suitable for cold climates. (As shown in figures 11, 12)



### Figure 11, 12: Event Area Accessibility and Amenities

Dedicated viewing areas for spectators with reduced mobility are located in positions with visibility. Access to these areas is facilitated by utility terrain vehicles, (UTV and ATV) that help individuals traverse the steep terrain between entry points and viewing zones. (As shown in figure 13) This approach demonstrates inclusivity in event design within a challenging landscape. Food and service areas are situated behind the scaffolding structure down the hill consisting of temporary vendor tents that provide food, beverages, and unformal sheltered spaces. (See Figure 14, 15)



Figure 13: UTV for the mobility of people with special needs

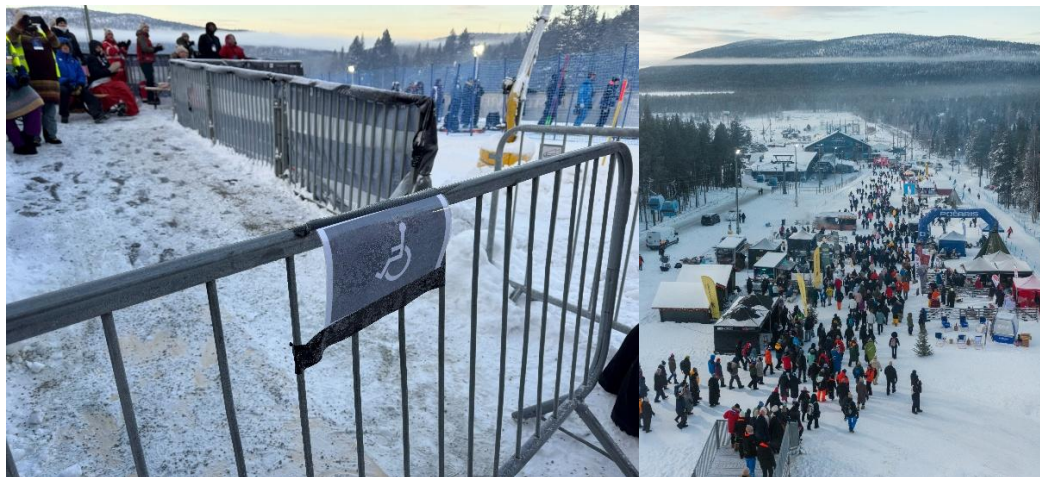


Figure 14, 15: Dedicated Area for People with Special Needs | Food Area behind the Spectators Pavilion

Overall, the Levi Alpine Ski World Cup functions as a multi-layered spatial system that integrates transportation, infrastructure, amenities, and viewing within a constrained natural environment. By employing both permanent and temporary structures, the event effectively manages large-scale visitor movement and delivers diverse spectator experiences.

## Event Sustainability Practices and Strategies

Field observations at the Levi Alpine Ski World Cup identify sustainability-oriented strategies in both spatial and operational facets. Though organizers do not always explicitly name these as sustainability measures, these initiatives demonstrate a holistic approach that integrates environmental, social, and cultural priorities.

A key sustainability feature of the event is the use of modular, reusable structures. Crews build temporary spectator areas, notably scaffold-based platforms and stairs, primarily from metal, engineering them for repeated assembly and disassembly. This approach highlights a material strategy that emphasizes reuse and flexibility over single-use construction.

Food vendors use non-plastic serving materials such as cardboard containers and packaging. Although limited in scope, this reduction in single-use plastics marks a shift toward more environmentally responsible consumption. Together, these observations mirror broader event design trends emphasizing circular material principles.

The transportation system employs a systematic approach to reducing environmental impact. By placing parking areas farther apart and providing shuttle bus access, the event reduces congestion near the core and streamlines vehicle traffic. This managed mobility system improves visitor flow and reduces the spatial footprint of private vehicles within the event area. Such tactics are standard in sustainable event planning, where transportation management is essential to reducing environmental impact.

Snow reliability underpins the sustainability of winter sports events. At Levi, snowmaking infrastructure, including installed snow cannons, enables organizers to sustain optimal conditions during early winter, demonstrating the technical reliance necessary.

Simultaneously, the resort implements adaptive strategies, such as snow farming, in which snow from previous seasons is stored and reused for early-season slope preparation. (See Figure 16). This approach reduces reliance on energy and water intensive artificial snow production while maintaining stable conditions despite climate variability. These practices situate the event within a broader framework of climate adaptation in winter sports.

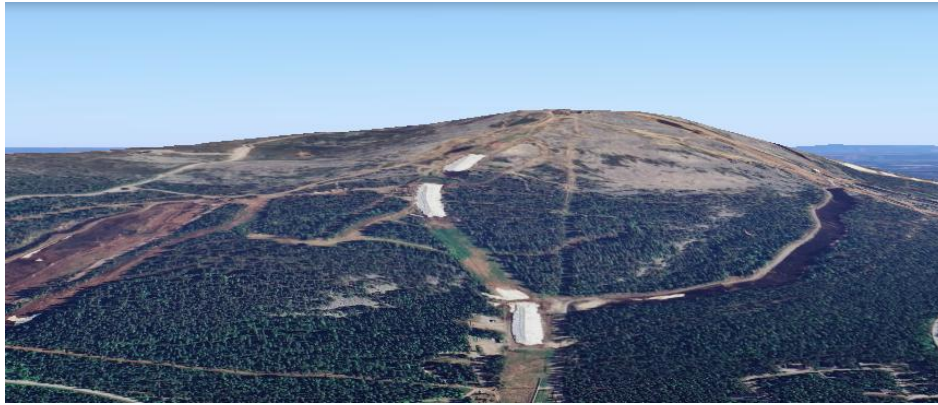


Figure 16: Piles of Snow Stored on the slope, for the next season

The event includes extensive media and broadcast infrastructure, such as large digital displays and lighting arrays, to support both live and international audiences. Though these systems increase energy consumption, initiatives such as energy-efficient LED lighting and optimized scheduling help minimize total energy demand. Event planners continuously balance the need to enhance the spectator experience through technology with the need to maintain energy efficiency at large-scale events.

Accessibility and inclusion are embedded in event design. Specific viewing areas for wheelchair users are strategically positioned for clear race visibility. Transport vehicles support mobility, assisting individuals in navigating challenging terrain. Accessible sanitation facilities are located nearby, ensuring infrastructure meets varied user needs. These provisions illustrate an inclusive design, positioning accessibility as central to sustainability alongside environmental priorities.

Integration of local cultural elements enriches the event's sustainability profile. Material choices such as wood and symbolic ties to the reindeer traditions of the race winners reflect a close connection to Lapland's identity (See Figure 17). Food options emphasize locally sourced products, supporting regional economies and reducing the environmental impact of distant supply chains. This highlights the event's dual role as both a sports platform and a venue for cultural and local engagement.

The Levi Alpine Ski World Cup exemplifies a comprehensive approach to sustainability spanning environmental, social, and cultural spheres. Practices such as reusable infrastructure, organized transportation, adaptive snow strategies, inclusive design, and local materials support a more sustainable event model. Nonetheless, sustainability is

an ongoing process. The coexistence of energy-intensive media systems with environmental measures underscores the challenge of achieving sustainability in large-scale, internationally broadcast sporting events. These observations establish a foundation for identifying opportunities to further enhance the sustainability of the winter sports event environment through design interventions.



Figure 17: Men's Slalom Winner Got a Reindeer as Prize

## Analysis of Observational Findings

Field observations at the Levi Alpine Ski World Cup reveal a highly organized and operationally efficient event environment. The infrastructure, accessibility measures, and coordination demonstrate comprehensive planning. Nevertheless, several spatial and experiential conditions present opportunities for further development through targeted design interventions. The following analysis explores these aspects in detail, beginning with the critical issue of spectator visibility.

Spectator visibility emerges as a significant concern. Central viewing platforms offer clear sightlines, but spectators along the slope often experience partially obstructed views. These obstructions result primarily from sponsor installations, such as large inflatable structures, and the height and placement of safety barriers, including

protective netting. Consequently, many spectators depend on digital screens instead of engaging directly with the live race, which diminishes the immediacy of the experience. The impact of visibility sets the stage for considering how spatial organization and flow further shape the event experience.

The event uses a zoning system that effectively manages arrival, transport, entry, and movement. These transitions are functional, not focused on experience. The trip from the parking to the event is controlled, but it does not build anticipation or connection. These elements of movement and atmosphere influence the effectiveness of accessibility measures, which are considered next.

Accessibility represents a notable strength of the event. Dedicated viewing areas and assisted mobility solutions facilitate participation for individuals with reduced mobility. These interventions illustrate how targeted design can enhance access without disrupting the overall system. However, accessibility remains concentrated in specific zones rather than being integrated throughout the entire spatial experience. Consideration of accessibility naturally extends into an evaluation of the event's environmental practices, as both are essential for holistic design.

Environmental practices at the event reflect a hybrid relationship between natural conditions and technological systems. Snow management, reusable infrastructure, and material choices demonstrate environmental awareness. However, these practices remain primarily operational and are not clearly communicated to or experienced by visitors. The gap between operational excellence and visitor experience is further examined in the broader context of engagement and social interaction.

Beyond these aspects, the analysis identifies a broader experiential gap. Although the event offers a high-quality sporting spectacle, spectator engagement remains largely passive. Opportunities for interaction, social exchange, and prolonged engagement within the event environment are limited. While some areas provide shelter and basic amenities, there is a lack of well-integrated social spaces where spectators can gather, rest, and engage with the event in a more informal and immersive manner.

In summary, the findings indicate that while the event excels in organization and infrastructure, there is considerable potential to enhance spatial experience,

engagement, and participation. To maximize the impact of future events, it is crucial to implement design-led strategies that transform these opportunities into actionable improvements.

## Spectator Experience and Visibility

Spectator experience at alpine ski events depends on visibility, location, and proximity to the slope. At the Levi Alpine Ski World Cup, visibility differs greatly by location.

Central platforms offer clear views, while slope-side areas have limited sightlines. (As shown in figure 18, 19). Variations in visibility underscore the influence of spatial and infrastructural elements on spectator experience. Safety barriers, such as protective netting, and large sponsor installations, including inflatable advertising structures, create visual obstructions that limit direct engagement with the live event.

Consequently, spectators in obstructed areas depend more on digital screens to follow the race, shifting their experience from direct observation to mediated viewing.

This situation illustrates a broader tension between functional requirements and experiential quality. While safety infrastructure and sponsor visibility are essential for large-scale sporting events, their spatial integration can affect audience perception and engagement. Reliance on screens in certain areas weakens the physical connection between spectators and athletes, diminishing the immediacy and intensity of the live experience. From a design perspective, visibility depends not only on placement but also on the construction of spatial hierarchies within the event environment. Elevation differences, crowd distribution, and terrain adaptation are critical in shaping visual access. Uneven consideration of these factors across spectator zones leads to inconsistent experiences and disparities between central and peripheral audiences.

Moreover, the quality of the spectator experience extends beyond visibility. Real-time observation of athletes' movements fosters emotional engagement, excitement, and a sense of connection to the sport. When this connection is disrupted or mediated, the experience becomes more passive, reducing opportunities for deeper engagement with alpine skiing as both a cultural and sporting practice. These observations indicate that enhancing visibility is not only a technical challenge but also a design opportunity.

Reconsidering spectator positioning relative to the slope and the interaction between

spatial elements and sightlines can improve both the physical and experiential qualities of the event. This approach provides a foundation for developing design strategies to strengthen audience engagement in winter sports environments.



Figure 18, 19: Obstructive Views along the slopes

## Spatial Organization and Flow

The spatial organization of large-scale winter sports events is critical in determining visitor movement and overall experience. The Levi Alpine Ski World Cup exemplifies a clear, efficient zoning strategy, structured into distinct phases of arrival, transport, entry, and spectator positioning. This approach enhances operational clarity and facilitates the smooth movement of large numbers of visitors in a constrained, environmentally sensitive environment.

Although the system operates effectively from a logistical standpoint, the overall flow remains predominantly utilitarian. The sequence from remote parking areas to shuttle transport, followed by pedestrian movement to the event site, is intended to manage crowd distribution and access. However, this journey provides limited opportunities for experiential engagement or spatial variation. Movement is directed and controlled but not intentionally designed to enhance the event experience. This situation underscores the distinction between operational efficiency and experiential quality. The current spatial flow prioritizes function, safety, and capacity management, all of which are essential for large-scale events. However, the absence of intentional experiential layering within these transitions diminishes the potential to foster anticipation, immersion, and emotional connection as visitors approach the main event space.

Within the event site, spatial zones such as food areas, sponsor activations, and spectator sections are clearly delineated. Although this separation supports clarity and organization, it also produces a segmented experience in which each zone functions independently rather than contributing to a continuous narrative. Transitions between these zones remain largely neutral, lacking strong spatial cues or design interventions to guide or enrich the visitor journey. From a design perspective, circulation should be regarded not only as movement between points but also as an opportunity to shape experience. The journey to and within the event can be an integral part of overall engagement, with transitions, pauses, and interactions shaping how the event is perceived and remembered.

A key spatial observation is the existence of underutilized levelled areas adjacent to the slope, currently designated for operational movement, including media circulation and athlete access. Although these zones fulfill essential functional roles, substantial portions remain inactive during the event. This situation offers an opportunity to introduce spectator experiences without disrupting operational flows. Instead of combining public and restricted zones, circulation routes may be strategically separated. Through the implementation of alternative pathways and controlled access points, segments of these areas can accommodate spectators while maintaining uninterrupted athlete and media operations.

## Accessibility and Inclusion

Accessibility is a fundamental factor in creating inclusive experiences at large-scale sporting events. At the Levi Alpine Ski World Cup, accessibility is addressed through targeted interventions that facilitate participation for individuals with varying mobility needs. Dedicated viewing areas for wheelchair users and assisted transport systems, including small vehicles that transport spectators across challenging terrain, exemplify a considered and responsive approach to inclusion.

These measures demonstrate an awareness of the environmental constraints inherent to the Arctic landscape, where steep slopes, snow-covered surfaces, and extended walking distances present substantial barriers to access. Instead of attempting to remove these conditions, the event implements adaptive solutions that operate within

the existing terrain, enabling individuals with limited mobility to reach key viewing areas and engage in the event experience. From a design perspective, this underscores the significance of situational accessibility, in which solutions are tailored to the specific context rather than relying exclusively on standardized infrastructure. The integration of transport assistance, designated zones, and proximity to essential services such as accessible toilets indicates that accessibility has been incorporated into the overall event system. (Shown in Figure 8, 9, 11)

The event prioritizes accessibility through dedicated viewing areas, assisted mobility solutions, and accessible facilities integrated into the spatial system. These measures reflect a thoughtful commitment to inclusion in the challenging Arctic environment.

## Materiality and Environmental Practices

Environmental considerations are integral to winter sports events, especially in Arctic regions where natural conditions determine both feasibility and event quality. At the Levi Alpine Ski World Cup, environmental practices are evident in material selection, temporary infrastructure, and adaptive snow management strategies. The use of preserved snow, stored from previous seasons for early slope preparation, exemplifies a proactive strategy for managing seasonal variability. This approach extends the lifecycle of natural resources, enabling event operation amid uncertain climatic conditions. Simultaneously, it underscores the growing dependence on controlled snow systems in modern winter sports.

Materiality within the event further reflects an awareness of environmental impact. Temporary structures such as scaffolding-based spectator platforms, tents, and modular installations are designed for reuse across multiple events. The presence of wooden elements, locally familiar materials, and reduced reliance on single-use plastics in food and service areas suggests an effort to align operational practices with broader sustainability goals. Still, these eco-friendly efforts coexist alongside major event infrastructure, such as powerful lighting, broadcasting equipment, and large digital screens needed for worldwide media coverage. This mix highlights the ongoing challenge of balancing sustainability with the needs of international sports events, which often require significant energy and resources.

From a design perspective, the event operates as a hybrid environmental system. Here, natural processes and technological interventions coexist. Sustainability informs operational strategies, yet this is not always clear in the visitor experience. Practices like snow management, material reuse, and energy optimization usually remain backstage. They function as logistics, not as visible or engaging event features. As a result, visitors benefit from these systems without noticing or interacting with them.

This situation presents an opportunity to extend sustainability beyond operational efficiency and integrate it into the experiential dimension of the event. By making environmental practices more visible, comprehensible, and interactive, design can facilitate direct and meaningful visitor engagement with sustainability. Such engagement may extend beyond the immediate event context, influencing awareness, attitudes, and future behaviours. For instance, exposure to sustainable mobility systems, resource-conscious practices, and environmental narratives within the event could encourage visitors to reconsider their own choices, including travel decisions and daily habits. In this context, sustainability is not just about how the event runs; it also shapes culture and behaviour. When it becomes something, visitors can notice and experience, it can have a lasting effect. The event can then reduce its environmental impact and help build an audience that cares more about sustainability.

## Engagement and Experience Gap

The Levi Alpine Ski World Cup is well organized and internationally recognized, yet there is a notable gap between its operational efficiency and visitor engagement. Although attendees can access the sport, their experience is mostly limited to passive observation, either in person or via screens. This limits opportunities for deeper interaction with the event environment and alpine skiing culture. The event experience is mainly structured around viewing, with few opportunities for immersive or participatory engagement. While food areas and social spaces are available, they operate independently and do not contribute to a cohesive or interactive event experience. As a result, the visitor journey lacks depth and does not actively encourage exploration, interaction, or emotional connection with the sport.

This suggests that the event experience lacks a multi-layered approach. This situation raises concerns regarding the sustainability of long-term audience engagement with alpine skiing. Although the event attracts spectators and generates a strong atmosphere, the experience remains largely focused on viewing and does not fully extend into broader, multi-dimensional engagement. Although alpine skiing is dynamic and physically intense, the spectator experience does not fully convey this intensity in accessible or immersive ways. Opportunities to experience the sport beyond visual observation, such as through interactive, sensory, or technology-mediated engagement, remain largely unexplored. From a design perspective, this is an opportunity to integrate engagement into the event system. By moving beyond passive viewing, the event can support more active, immersive, and meaningful participation, strengthening connections between visitors, the sport, and the environment.

## Design Opportunities

An analysis of the Levi Alpine Ski World Cup reveals that visibility, spatial flow, accessibility, sustainability, and engagement are interconnected elements within a comprehensive experiential system shaped by visitor movement and interaction. While the event is efficient, findings reveal opportunities for design-led development.

Enhancing spectator visibility throughout the event landscape is closely linked to the experiential system identified earlier, particularly as variations in viewing conditions highlight the uneven distribution of sightlines between central and peripheral areas. By reassessing how terrain, elevation, and spectator positioning relate to one another, improvements in sightlines would not only create more consistent and engaging viewing experiences but would also reinforce the interconnectedness of visibility, spatial flow, and engagement.

The organization of movement remains a key opportunity for improvement, closely tied to both the experiential and accessibility findings. While arrivals, transport, and circulation are managed efficiently, the functional approach to the visitor journey from parking to the event and within the site offers limited experiential value, a factor closely related to the limited engagement previously noted. Redefining movement as part of the event could create transitions that foster anticipation, interaction, and engagement,

while the pragmatic approach to accessibility, though effective in targeted zones, could be leveraged more broadly. Expanding inclusive design across the spatial system would not only enhance accessibility but also increase opportunities for sustained engagement and interaction for diverse users.

The site employs strong environmental practices, such as snow management, material reuse, and adaptive infrastructure, that directly support the event's broader sustainability objectives. However, visitors rarely notice these efforts, indicating a gap between operational sustainability and visitor engagement, a recurring theme across the findings. Making sustainability more visible and integrated into the event experience would reinforce not only environmentally conscious systems but also further engage audiences, just as expanding participation could. The analysis consistently reveals a strong opportunity to enhance visitor engagement by shifting from passive observation to deeper immersion and connection with alpine skiing culture. Integrating participatory and socially engaging experiences would unite the strands of visibility, sustainability, and engagement into a more cohesive visitor experience.

Taken together, these opportunities confirm that the future of winter sports events relies on integrating spatial, experiential, and behavioural dimensions, as consistently revealed by the analysis. Design does more than drive efficiency; it shapes how visitors perceive and connect with the event, weaving visibility, movement, sustainability, and engagement into a unified system. The next section introduces design proposals that address these interconnected strategies to enhance the event.

## Design Proposals

**Terrain-Based Viewing Systems:** The analysis identifies uneven visibility across spectator areas as the main spatial limitation. Elevated platforms and central zones provide clear sightlines, while spectators on slopes often have restricted views due to flat terraces and crowd density. This disparity creates an imbalanced spectator experience.

To address this, the proposal introduces terrain-based viewing systems that use the existing landscape. Instead of new structures, compacted snow forms stepped terraces along slope edges. These terraces create gradual elevation changes, improving sightlines for spectators in peripheral areas while preserving the terrain.

These terraces are built using snow compaction techniques common in Arctic environments. Snow layers can be shaped manually with simple Molds and compacted by foot. Alternatively, they can be mechanically shaped with small equipment, such as ATVs equipped with front-mounted blades. Light machinery works for less steep areas. Manual methods are preferred in steeper or more sensitive zones. This flexible approach creates stable stepped surfaces that support spectators throughout the event. As a temporary and reversible solution, it aligns with the site's seasonal conditions and minimizes long-term environmental impact.

Beyond improving the spectator experience, this intervention may also affect the atmosphere. Increased visibility and evenly distributed spectators can create a stronger, more continuous audience presence along the slope. In alpine skiing, environmental conditions and atmosphere influence performance perception. A more engaged, visible crowd may enhance the event's intensity and energy. While this study cannot determine the direct impact on athlete performance, amplifying audience presence may create a more dynamic, immersive competitive setting.

Overall, terrain-based viewing transforms the ground from a passive surface into an active spatial component, enhancing both the functional and experiential qualities of the spectator environment. (As shown in Figure 20)

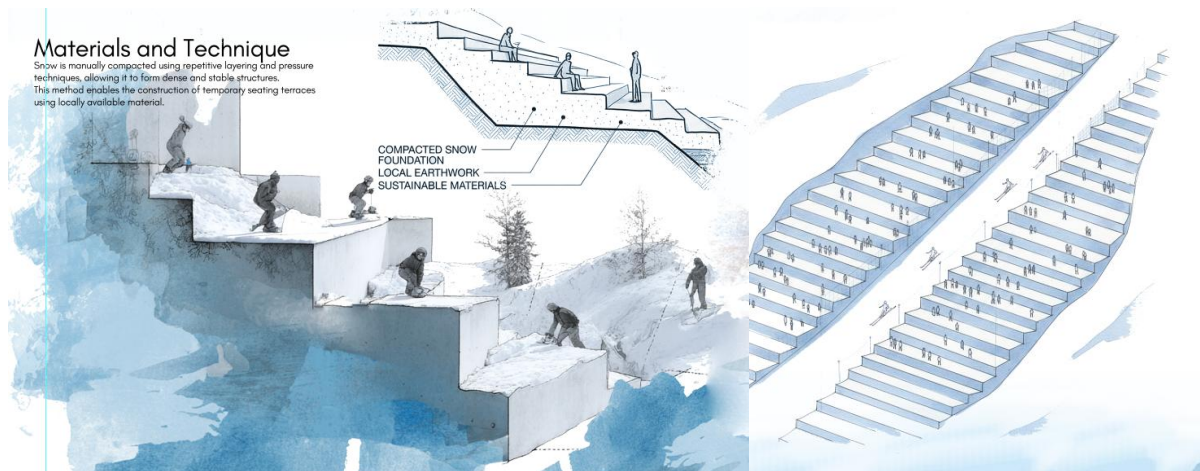


Figure 20: Proposed Sketches for Snow Based Spectator Terraces

**Social Interaction Zones:** A primary limitation of the event environment is the absence of accessible, comfortable resting spaces for general spectators. Most areas are snow-covered and often wet, making it difficult to sit or remain in one place for long. As a result, spectators must stand throughout the event, which limits engagement. The only clearly defined seated and sheltered viewing area is in the VIP section, separated from general spectators by large glass facades. The VIP section offers enhanced comfort and unobstructed sightlines. In contrast, general spectators lack these amenities, creating a disparity in viewing experiences.

To address this, the proposal introduces social and warmth-based interaction zones for general spectators. These zones enhance spectator comfort by providing protected seating, rest areas, and gathering spaces with clear views of the event. Features include simple seating, sheltered structures, and localized heat sources, all tailored to Arctic conditions, improving audience enjoyment and well-being.

The proposal also suggests context-responsive seating, such as compacted snow blocks shaped into low seating, offering spectators a place to rest without permanent infrastructure. This site-specific, reversible approach enables rapid adaptation. Adding natural materials, such as responsibly sourced reindeer skin or wood, provides thermal insulation and cultural relevance, enhancing comfort while reinforcing regional identity and connection to the environment. Key benefits include minimal environmental impact, cultural resonance, and improved user comfort.

Instead of locating these spaces away from the main activity, the zones are integrated within spectator areas and along circulation paths. This ensures that visitors can access rest and comfort while still remaining engaged in the event environment. The outcome is higher visitor satisfaction and an increased likelihood of extended stays and social interaction.

From a design perspective, these zones shift the spectator experience from passive observation to sustained participation. They encourage longer stays and interaction, which makes the event more socially dynamic and inclusive by facilitating conversation and shared activities. The addition of warmth enhances the sensory experience, fostering comfort and connection that help guests feel welcome and engaged beyond just watching the race. These spaces support informal interaction and shared moments among spectators. They foster a sense of community bonded by Alpine Ski. By combining comfort and engagement, the proposal strengthens the experience. It encourages a deeper connection with the event environment. (See Figure 21)



Figure 21: Proposed Sketches for Social Interaction Zones

**Immersive Spectator Experience Systems:** A key limitation is that the spectator experience remains largely passive. Although the event showcases a vibrant, technically demanding sport, its intensity and physicality are not fully transmitted, particularly for those outside prime viewing areas. As a result, engagement is predominantly visual.

To counter this, the proposal introduces immersive spectator experience systems that expand engagement beyond simple viewing. These systems transform the physical intensity and spatial complexity of alpine skiing into tangible experiences for spectators. One approach uses extended reality (XR) technologies, such as virtual reality (VR) headsets or augmented reality (AR) glasses, allowing visitors to experience an athlete's descent from a first-person perspective.

Content for these immersive experiences may originate from athlete-mounted cameras, which are cameras attached directly to the athlete (such as GoPro, a compact, durable camera often used in action sports, or cameras built into ski goggles that provide a view from the skier's perspective). Pre-recorded high definition runs use video captured beforehand at high resolution to show detail. Another source is live and archived footage from first person-view (FPV) drones; FPV refers to drones operated to give a video feed as if seeing through the athlete's eyes, with footage broadcast live or saved for later viewing. These perspectives provide dynamic portrayals of speed, terrain, and movement, offering spectators richer insight into the sport than static vantage points alone.

These immersive systems are installed in dedicated interaction zones at the event site, where spectators can access shared devices or use their own equipment. Located along circulation paths or near gathering areas, these installations complement, rather than replace, live viewing. This lets spectators alternate between observation and immersion, enhancing the event experience.

From a design perspective, this approach enhances the event experience by bridging the gap between spectators and athletes. It allows visitors to both watch and understand the physical demands of alpine skiing. This shift transforms the event from a purely observational setting into a more interactive and emotionally engaging environment. Moreover, immersive experiences can foster long-term engagement by deepening the audience's connection to the sport. Letting spectators experience skiing from a first-person perspective can promote greater appreciation, curiosity, and enthusiasm, especially among new audiences. This strategy advances the broader aim of nurturing and expanding alpine skiing's appeal beyond the event.

**Experiential Circulation and Journey Design:** Analysis indicates that movement throughout the event is highly efficient yet primarily functional. The sequence of arrival, shuttle transport, pedestrian movement, and on-site circulation is well organized. However, they offer limited experiential value, so the journey remains transitional rather than part of the overall experience. To address this limitation, the proposal redefines circulation as a journey of sequential moments that build anticipation, engagement, and connection. Movement is not just a necessity; it is a progression that gradually introduces visitors to the atmosphere, scale, and intensity of the event. The following paragraphs outline specific improvements along this journey.

The visitor experience may begin at arrival. Here, visual and spatial cues signal entry into the event environment. This sense of transition continues on the shuttle journey, where subtle narrative elements such as visual media, audio, or environmental cues introduce the context of the event, the sport, and the location. As a result, the journey becomes an extension of the event rather than just a logistical phase.

The pedestrian approach to the event site is a key opportunity for experiential design. The existing steep pathway, which serves a functional purpose, can be reimagined as an active transition space. By adding spatial markers, framed views, or subtle engagement elements, anticipation can build as visitors approach. Furthermore, small interactive moments, like timed walking segments or informal challenges, may foster play and participation. These will not disrupt flow or safety. On the event site, zone circulation can create a sense of continuity. Movement between viewing areas, social zones, and service points should maintain visual and experiential connections to the event. This reduces fragmentation and supports a more cohesive experience.

From a design perspective, turn circulation into an active event element. Plan moments of interaction, anticipation, and orientation during movement to boost engagement and immersion. These features build on earlier ideas, making circulation a foundation of visitor engagement. Ultimately, experiential circulation deepens the link between space, movement, and perception. It lets visitors engage with the event environment step by step, making the journey a meaningful experience rather than just a route between destinations.

**Sustainable Mobility Services:** A significant aspect of the event extends beyond the physical site. This is especially true regarding visitor travel to Levi. Due to its remote Arctic location, many spectators depend on long-distance transportation. These options include flights and private vehicles. Although the event incorporates localised mobility solutions, such as shuttle systems, the broader journey to the event is largely unaddressed in the current experience.

From a sustainable and service design perspective, this situation is a critical opportunity. The event system can expand beyond its spatial boundaries and address the whole visitor journey. Travel to the event should be seen not only as a logistical need, but also as a vital part of the full experience. Design can shape behaviour, perception, and decision-making along the way.

To address these challenges, the proposal introduces a sustainable mobility system. It integrates transportation, experience, and incentives within a cohesive service framework. This system prioritises lower-impact travel modes, such as train and bus networks. It establishes coordinated travel routes connecting major cities to Levi. Instead of presenting these options as alternatives, the system incorporates them as integral parts of the event experience.

The journey is reconceptualised as a pre-event phase, enabling visitors to engage with the event prior to arrival. This phase may include curated travel experiences, shared transportation environments, and informational or narrative elements that introduce the sport, the landscape, and the event context. Consequently, travel becomes a social and experiential extension of the event rather than a separate activity.

A central part of this system is the use of incentive-based access strategies. Instead of mandating behavioural change through restrictions, the design promotes sustainable choices by linking them to enhanced experiences. For example, visitors who select lower-impact travel methods may get access to improved viewing zones, priority services, or exclusive experiential areas within the event. This approach creates a direct link between sustainable behaviour and experiential value.

From a systems perspective, this approach aligns environmental objectives with user motivation. It recognizes that visitor decisions are shaped not just by convenience, but

also by perceived value and experience. By embedding sustainability within the event's service structure, the proposal moves visitors from awareness to action. Visitors can adopt more sustainable practices without losing the overall experience.

Ultimately, this proposal frames mobility as a design opportunity that goes beyond the event's physical boundaries. By integrating transportation, incentives, and experience into one system, the event can influence behaviour more widely. This advances both environmental objectives and deeper visitor engagement. (See Figure 22)



Figure 22: Sustainable Mobility Solutions

## Discussion

The findings of this research underscore the complexity of designing and managing winter sports events in environmentally sensitive, experience-oriented contexts. Although the Levi Alpine Ski World Cup demonstrates a high level of operational efficiency (Levi Ski Resort's Evolving Environmental Program, 2025). Yet the event cannot be understood solely in terms of logistics, infrastructure, or environmental management. It functions as a socio-spatial, experiential system where visibility, movement, accessibility, atmosphere, and sustainability are interconnected. This shifts the discussion beyond technical performance, making design central to how such events are encountered and interpreted.

Looking at sustainability, the event can be seen through a framework that brings together environmental, social, and economic factors (Elkington, 1997). Efforts like snow preservation, using reusable infrastructure, and managing transportation show an understanding of environmental limits and resource efficiency. Still, the findings show that these steps are mostly operational, and visitors do not always notice them as part of their event experience. This means that making events sustainable is not just about what is done, but also about how it is communicated and included in the visitor experience. The mix of eco-friendly practices and high-energy media infrastructure seen in this study also shows the ongoing tension between sustainability goals and the global scale of modern sporting events (Cerezo-Esteve et al., 2022).

The findings are consistent with resilience theory. This theory addresses how winter destinations adapt to uncertain climatic conditions (Folke, 2006). The use of stored snow, snow farming, artificial snowmaking, and other environmental management practices shows reliance on adaptive systems. This reliance moves beyond stable natural conditions. This aligns with broader tourism research, which notes that destinations depend on both natural processes and technology. The study further shows that resilience is not only technical. The event's ability to remain meaningful and attractive depends on the quality of the participant experience, not just efficiency.

Arctic research highlights the importance of cultural sustainability and placemaking. In these environments, identity and meaning carry (Huhmarniemi et al., 2021). Events like

the Levi Alpine Ski World Cup serve as cultural platforms, shaping and reflecting regional identity. The limited focus on culture and experience in this study creates a chance to improve how events share northern knowledge, traditions, and environmental awareness. This aligns with ideas in creative tourism, where hands-on experiences help sustain sustainability and maintain interest.

Spectator experience reveals a clear hierarchy. The internationally recognized event offers a vibrant atmosphere, but viewing conditions are inconsistent. VIP areas offer comfort and outstanding sightlines, while general spectators face wet or snowy ground, limited seating, and limited comfort. This division highlights how access and environment shape participation. User-centered design shows that comfort, perception, and engagement are as critical as access. The absence of warm seating, resting places, and social spectator zones points to a design focused on viewing over dwelling. The limited engagement observed in the event environment suggests that design can influence not only spatial arrangements but also visitor movement, interaction, and participation (Kantola et al., 2018).

This insight informs the proposed terrain-based viewing systems and warmth-based interaction zones in the design chapter. Compacted snow creates stepped spectator terraces to address visibility challenges. It also offers a chance to pursue place-based design. Arctic design research says solutions should use local materials, align with climate realities, and work with environmental logic. Imported models or excessive construction are discouraged. In this setting, shaping snow into terraces and seating is both a spatial and context-sensitive design response. Proposals for warmth-based social zones with fire, snow seating, wood, and local materials address the lack of comfortable spaces for general spectators. These interventions relate to placemaking, cultural sustainability, and embodied experience in Arctic environments. They activate the landscape as an essential part of the event, not just a backdrop.

This local and material-focused view is extended by research on Arctic art and art-based action research. This research highlights the importance of practice, material engagement, and local knowledge for sustainable outcomes (Jokela & Huhmarniemi, 2022; Jokela et al., 2021). Here, knowledge is produced through analysis and by interacting with place, materials, and communities. The study's findings support this

approach. Understanding of the Levi event came through direct observation, spatial experience, and interpreting environmental conditions. This reinforces that design in Arctic contexts is a form of situated knowledge production. Meaning and insight develop through engagement, not detached evaluation.

The findings align with principles of user-centered design, emphasizing the importance of understanding user experience, emotion, and participation. The limited availability of spaces for rest, interaction, and immersive engagement observed in this study highlights the need to design for diverse user needs. In this context, design extends beyond spatial organization to shape how people feel, interact, and connect within the event environment. This is particularly important in large-scale events, where multiple user groups interact within a shared system.

Technology integration is also crucial. Research on Arctic and outdoor interaction design recommends context-sensitive, subtle, and supportive technology for extreme environments (Häkkinen & Colley, 2020). The proposed immersive systems use digital tools to foster understanding and engagement without disrupting natural or social qualities. These methods show technology can enhance, not detract from, environmental and experiential values.

Movement in the event space extends current literature. The system for parking, shuttles, walking, and internal circulation is efficient but mainly utilitarian. Mobility is treated as an operational issue rather than as an experience. Strategic design theory is relevant here. It sees design as shaping processes, systems, and relationships over time (Manzini, 2015; Fry, 2009). The proposal for experiential circulation reframes the visitor journey as a key component of the event. In this way, movement is not just access. It becomes a designed sequence that creates anticipation, interaction, and orientation. This shifts the focus from isolated sites to viewing events as extended systems of experience.

This systems perspective matters for travel and access. Levi's remote Arctic location means long-distance travel has major environmental impacts. Still, the journey to the event is rarely part of the event design. The thesis adds a service design perspective, treating mobility as part of the event rather than an external factor. The proposal for

sustainable mobility includes coordinated train and bus routes and incentives. These come from seeing mobility as part of the system. Sustainable behaviour is encouraged by linking lower-impact travel options to better experiences. This aligns with service-oriented principles, which say people engage best with systems that are understandable, rewarding, and aligned with real motivations. Thus, the event aims to influence behaviour, not just consumption.

The findings can also be interpreted through the lens of socio-ecological systems theory, which posits that human activities, environmental conditions, infrastructure, and cultural meanings are closely interconnected (Berkes & Folke, 1998). Levi functions as such a system: snow conditions influence operations, infrastructure shapes visitor movement, cultural symbols reinforce identity, and mobility systems extend the event beyond the immediate site. This study contributes by recognizing that design can intervene within these relationships at multiple scales. Design can reshape terrain, structure movement, support inclusion, communicate sustainability, and influence participation. Thus, design is not a secondary layer applied after logistical concerns are addressed; rather, it is a mediating practice that connects environmental realities, operational systems, and human experience.

In summary, the discussion demonstrates that sustainability in winter sports events cannot be addressed solely through technical management or environmental targets. An integrated perspective considers spatial design, visitor experience, and cultural meaning together. This thesis contributes to this perspective by illustrating how design can transcend efficiency and serve as a tool for shaping more meaningful, engaging, and adaptive event systems in Arctic contexts. The identified opportunities for improvement indicate that design interventions could strengthen these relationships, fostering greater balance and responsiveness (Liu, 2018).

## Conclusion and Implications

This thesis examined the reconceptualization of winter sports events from a design perspective to address environmental sensitivity and improve spectator experience. Using the Levi Alpine Ski World Cup as a case study, the research analysed the operation of a large-scale Arctic sporting event within a complex system influenced by climate conditions, spatial organization, infrastructure, and human interaction. The study was motivated by broader concerns regarding the future of winter sports in vulnerable environments. As climatic conditions become increasingly unpredictable, winter events must adapt technically, strategically, and in terms of participant experience. In this context, design plays a critical role not only in shaping physical environments but also in structuring how events are experienced, accessed, and understood.

Employing an arts-based action research approach, the study integrated field observation, visual documentation, and spatial analysis to examine the event from a visitor's perspective. The research process encompassed both observation and participation, documenting interactions, movement, and spatial use. This methodology enabled the study to capture not only the organization of the event but also its perception and experience by various users, while also generating design proposals as part of the research process. The findings indicate that the Levi Alpine Ski World Cup is a well-executed event that provides a high-quality international experience. The infrastructure is efficient, accessibility measures are carefully implemented, and the event atmosphere is vibrant and engaging. Features such as shuttle transport systems, temporary structures, and material choices reflect consideration for both functionality and sustainability.

However, the analysis reveals that many aspects of the event prioritize functionality at the expense of experiential quality. Specifically, the general spectator experience along the slope is constrained by issues of visibility, spatial hierarchy, and engagement. While premium viewing areas offer optimal conditions, spectators in standard zones often rely on screens rather than direct visual contact with athletes. Physical barriers such as safety nets and sponsor installations further disrupt sightlines, resulting in a fragmented

viewing experience. From a design perspective, these observations highlight a substantial gap between operational efficiency and experiential quality. Although the event functions effectively as a system, opportunities remain to enhance participant engagement. This shift from emphasizing functionality to prioritizing experience represents a central contribution of this thesis.

In response to these findings, the study proposes a series of design interventions at both spatial and systemic levels. Spatially, the introduction of snow-based spectator terraces is recommended to improve visibility by utilizing existing materials and techniques. Creating compact, stepped formations directly in the terrain can enhance viewing conditions without requiring additional infrastructure. This approach aligns with the environmental context and improves the spectator experience. Beyond spatial improvements, the research addresses broader event systems. The study recognizes that sustainability encompasses not only material use and infrastructure but also the ways in which people travel to, access, and participate in the event. Accordingly, the proposals include reimagining mobility systems to foster more engaging and sustainable travel experiences, encouraging collective transportation, and introducing incentives to promote environmentally responsible behaviour.

This systemic perspective signifies a shift in the designer's role. Rather than focusing exclusively on physical form, the designer serves as a mediator among environment, infrastructure, and human experience. The thesis demonstrates that design contributes not only through objects or spaces but also through strategies, systems, and interactions that shape the event holistically. The study also acknowledges its limitations. The research is based on a single case study and relies primarily on observational data collected within a defined time frame. While this approach yields rich qualitative insights, it does not fully address the long-term operational, economic, or technical dimensions of the event. Additionally, interactions with stakeholders were constrained by the event environment, limiting deeper engagement with organizers and decision-making processes.

Furthermore, the proposed design interventions remain conceptual. Although grounded in observed conditions and realistic practices, their implementation would require further testing, stakeholder collaboration, and technical evaluation. Therefore, these

proposals should be regarded as exploratory design directions rather than finalized solutions. Despite these limitations, the study contributes by framing winter sports events as systems that can be designed rather than as fixed structures. This perspective encourages a shift from event management to active shaping through design strategies that address environmental sensitivity, user experience, and long-term sustainability.

In addition to spatial interventions, this study proposes a shift in how participation in the event is structured through mobility systems. The research identifies that travel to the event constitutes a significant portion of its overall environmental impact. In response, the thesis recommends the introduction of incentive-based ticketing strategies that encourage visitors to select more sustainable modes of transport, such as trains, buses, or shared mobility options, rather than air travel. This approach repositions the ticket not only as an access tool but also as a behavioural design instrument. By linking benefits such as reduced ticket prices or access to enhanced experience zones with environmentally responsible travel choices, the event can actively influence visitor behaviour.

This expands the role of design from shaping physical environments to structuring decision-making processes, aligning individual experience with collective sustainability goals. Future research could build upon this work by engaging more deeply with stakeholders, including event organizers, local communities, and environmental experts. Comparative studies across various winter events may provide broader insights into the adaptability of design strategies. Further exploration of the relationship between event experience and sustainable behaviour could also strengthen the connection between design interventions and real-world impact.

In conclusion, this thesis demonstrates that winter sports events in Arctic environments sit at the nexus of nature, infrastructure, and human experience. Overcoming climate sensitivity and spectator engagement challenges requires more than technical solutions; it demands a design-led approach that integrates environmental awareness, spatial quality, and experiential depth. Viewing sustainability as an avenue for innovation, this research shows how design can foster more adaptive, engaging, and meaningful event systems.

## Acknowledgment of Use of Artificial Intelligence (AI) Tools

The following AI tools were used in a limited and supportive capacity:

- **ChatGPT (OpenAI, Web-Based Tool):** Used to improve clarity, grammar, and sentence structure. Assisted in refining academic language and phrasing. Supported understanding of complex terminology and theoretical concepts
- **Grammarly (Web-Based Writing Assistant):** Used for grammar correction and sentence structure refinement
- **Midjourney (AI-based visual tool):** Used selectively for visual ideation and stylistic exploration for creative part and Exhibition. Assisted in refining colour tones and visual atmosphere in some sketches

### The use of AI tools was limited to:

Language support (Refining English/ Translation from Finnish to English in some cases), Conceptual clarification, Minor visual enhancement (For Assistance of the visuals for Exhibition). All research content, analysis, arguments, and design decisions remain the independent work of the author

### Non-AI Design and Visual Tools

The following tools were used for design development and visual production:

Adobe Photoshop

Adobe Illustrator

Adobe InDesign

Procreate (iPad)

These tools were used for: Creating sketches and drawings, developing diagrams and layouts, refining visual presentation, preparing exhibition visuals

These are standard design tools and were not used as AI systems

### Visual Material and Authorship

The majority of photographs included in this thesis were taken by the author during field observation at the Levi Alpine Ski World Cup

Additional images were sourced from official Levi event materials and publicly available resources provided by the organizers

### Authorship Statement

All core ideas, research design, analysis, and design proposals are the original work of the author

AI tools were used only as supportive instruments and did not replace critical thinking or authorship

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# Appendices

## Fragile Slopes

Rethinking Sustainable Event Systems in the Arctic  
FIS Alpine Ski World Cup 2025 as case study

### Introduction:

The project focuses on the Arctic region, which is a unique and fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

### What is Alpine Ski?

Alpine skiing is a winter sport in which participants descend a slope of snow on skis and poles. It is one of the most popular winter sports in the world. The sport involves a combination of speed and control, and it is a challenging and exciting activity. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

### Location and Site Analysis:

The location of the event is in the Arctic region, which is a unique and fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

### Why this Matters?

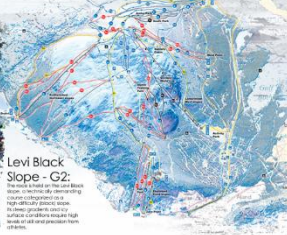
The project is important because it explores the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

### What is the Event?

The event is the FIS Alpine Ski World Cup 2025, which is a major international winter sports event. It is one of the most prestigious events in the world and attracts thousands of spectators. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

### Designer/Researcher's Perspective:

The designer/researcher's perspective is to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Preserved Snow Infrastructure:

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.

## Appendix A: Introduction and Site Analysis

This sheet presents an overview of the project, including the context of the Levi Alpine Ski World Cup, site analysis, and key themes explored in the research. It introduces the spatial, environmental, and experiential conditions that form the basis of the study.

## Observed Event Systems and Experience

An analysis of spatial organisation, user experience, and event systems

### Arrival and Transition

After entering the area and leaving their vehicles, visitors are directed to the event entrance. The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Experience Flow

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Obstructed View

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Pre-Event Zone

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Spectator Experience

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Social and Cultural Experience

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Safety and Event Operations

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Services and Amenities

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Accessibility and Inclusion

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



### Temporary Structures and Spatial Setup

The project aims to explore the challenges of hosting a major event in a fragile environment. It is one of the most vulnerable areas on the planet, and its preservation is crucial for the future of the world. The project aims to explore the challenges of hosting a major event in this region and to propose sustainable solutions that minimize the impact on the environment.



## Appendix B: Existing Infrastructure and Identified Gaps

This sheet documents the current event infrastructure, spatial organization, and spectator amenities. It highlights key observations from the site, identifying limitations related to visibility, accessibility, and overall spectator experience.





### **Appendix D: Visual Exploration of Alpine Ski Experience**

This sheet features a visual collage capturing the atmosphere, intensity, and cultural identity of alpine skiing. It serves to communicate the experiential and emotional qualities of the sport as represented in the exhibition.



### **Appendix E: Sketch of reimagined alpine ski Finish line**

### *Appendix F: Portfolio of Design Work*

- Showreel: [SHOWREEL 2024 - OSAMA BABAR - CD JS EVENTS.mp4 - Google Drive](#)
- Portfolio: [https://drive.google.com/file/d/1vxgbHHeN6Xq3YI3Pz0SXRujtmfSNW0fP/view?usp=drive\\_link](https://drive.google.com/file/d/1vxgbHHeN6Xq3YI3Pz0SXRujtmfSNW0fP/view?usp=drive_link)

### *Appendix G: Visuals from The Gallery Puito – University of Lapland – Creative Component of the study:*





### ***Appendix H. Exploratory Design Sketches for an Imaginary Activity Park***

This appendix presents a selection of exploratory design sketches developed as part of the broader design process. The sketches visualize speculative concepts for an imaginary activity park, focusing on spatial ideas, atmosphere, and user experience. The visuals were created using Procreate, Photoshop, and Midjourney, combining manual drawing and AI-assisted techniques.

