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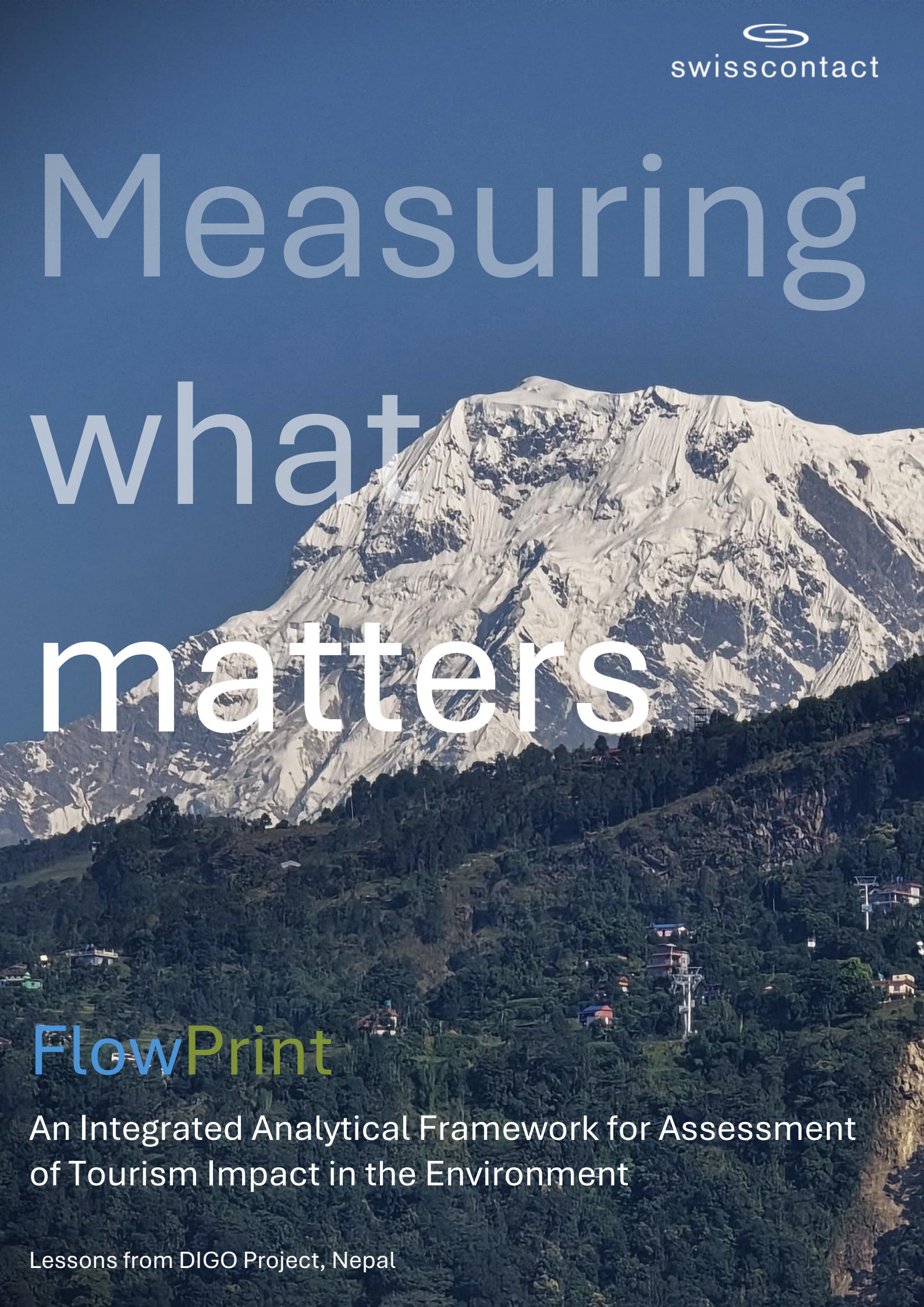
Measuring what matters



FlowPrint

An Integrated Analytical Framework for Assessment of Tourism Impact in the Environment

Lessons from DIGO Project, Nepal

Publisher: Swisscontact – Swiss Foundation for Technical Cooperation

Author: Tapas Neupane, with contributions from Sagar Chapagain and Saroj Panta

Disclaimer: Views expressed in this document do not reflect the views of the donors or DIGO project partners.

Abbreviations

ACAP	Annapurna Conservation Area Project
Asl	Above sea level
BCR	Benefit-Cost Ratio
CBA	Cost-Benefit Analysis
CO_2e	Carbon Dioxide Equivalent
DEWATS	Decentralised Wastewater Treatment System
DIGO	Developing Inclusive and Green Opportunities
EV	Electric Vehicle
ICE	Internal Combustion Engine
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LCT	Life Cycle Thinking
LPG	Liquefied Petroleum Gas
NPR	Nepali Rupee
NPV	Net Present Value
RO	Reverse Osmosis
STDM	Sustainable Tourism Destination Management
SVF	Strategic Visitor Flow
UniCoN	United Community Nepal

Acknowledgement

Measuring What Matters is the culmination of the collaborative efforts of many individuals and institutions who contributed directly or indirectly to the conceptualisation and implementation of the **FlowPrint** framework.

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We are deeply grateful to Professor Pietro Beritelli of the University of St. Gallen, Switzerland, whose Strategic Visitor Flow (SVF) tool, a core analytical component of Swisscontact's Sustainable Tourism Destination Management (STDM) methodology, provided the conceptual backbone of this work. This tool, applied here for the first time in Nepal, was instrumental in understanding visitor dynamics in a complex destination such as Pokhara and an emerging destination such as Madi.

The "Tourism Environmental Impact Assessment of Pokhara and Madi" that forms the foundation of this document was commissioned by Swisscontact in Nepal and conducted by Biome Ecosystem Pvt. Ltd., whose expertise gave substance to the **FlowPrint** framework in practice. The study would not have been possible without the mapped visitor flows by tourism stakeholders in the SVF workshops. Gratitude goes to hotel associations, hoteliers, travel and trekking agencies, guides, associations, and representatives of municipalities for their active engagement, time, and eagerness to share their knowledge openly. We are also grateful to the visitors who participated in the study and whose experiences provided direct evidence of visitor patterns, behaviours, resources consumption, and environmental footprint. Additionally, gratitude goes to the hotels of Pokhara Metropolitan City and the homestays of Tangting and Sikles of Madi Rural Municipality, whose readiness to share their information made it possible for the study to analyse potential green investments. Their collective contribution is what makes this document a record of what is possible when evidence gathering is rooted in genuine partnership.

Lastly, a big thank you to the DIGO project team and Swisscontact and UniCoN colleagues for their inputs, reviews, and unwavering support.

Swisscontact

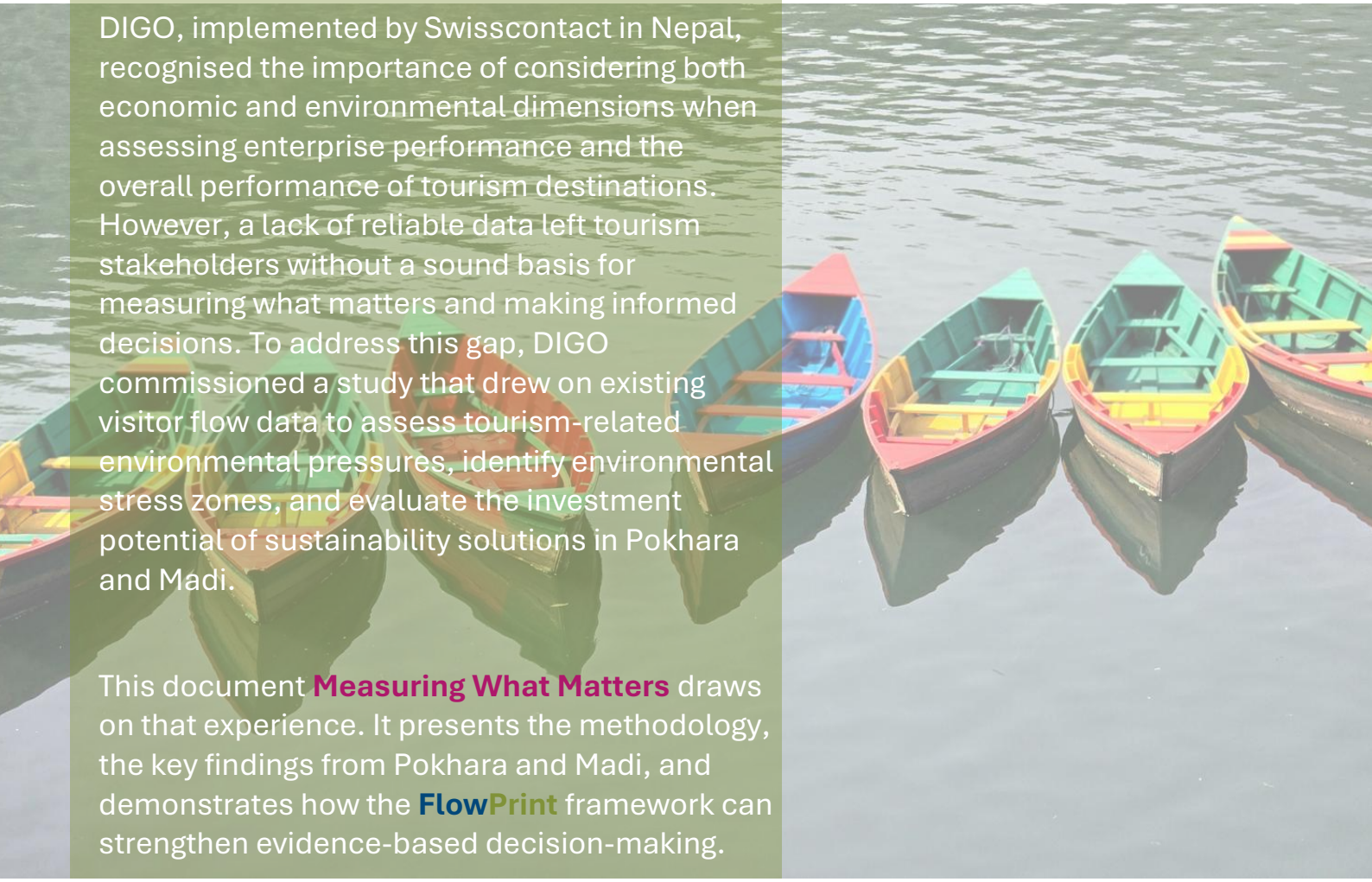
Swisscontact is the independent, business-oriented foundation for international development cooperation. Founded in 1959 by leading Swiss companies, Swisscontact has promoted skills development and entrepreneurship to make a sustainable contribution to economic growth in developing and emerging countries.

Swisscontact, registered as an International Non-Governmental Organisation in Nepal, has been operating in Nepal since 1991. Currently, Swisscontact in Nepal has six development programmes across all seven provinces.

About DIGO

Developing Inclusive and Green Opportunities (DIGO) project aims to create additional jobs and income in Nepal's tourism sector while generating positive environmental impacts. The project intends to achieve this by enhancing the sustainable tourism offer of tourism destinations and enterprises in Gandaki Province by guiding their transition towards responsible and sustainable tourism practices. This will be achieved by strengthening destination governance and planning capacities, improving tourism business models and practices, and building human resource skills and capabilities of public and private stakeholders.

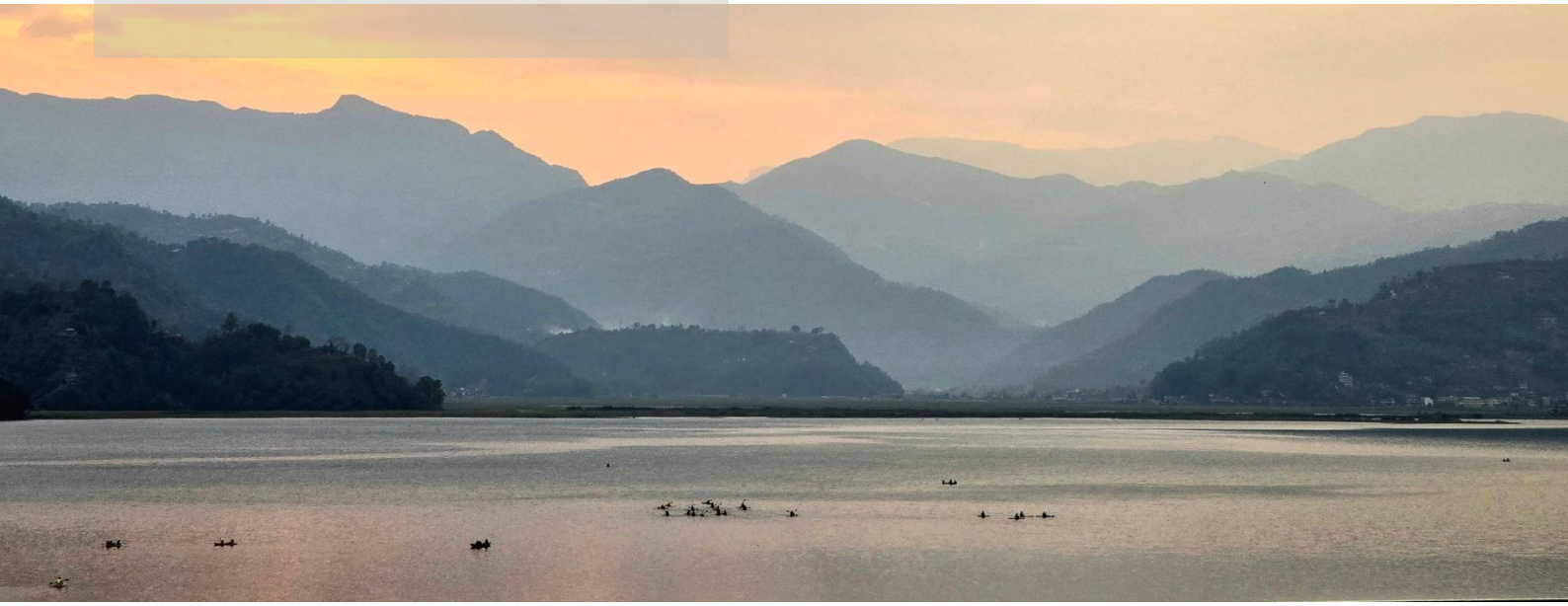
Measuring What Matters



DIGO, implemented by Swisscontact in Nepal, recognised the importance of considering both economic and environmental dimensions when assessing enterprise performance and the overall performance of tourism destinations. However, a lack of reliable data left tourism stakeholders without a sound basis for measuring what matters and making informed decisions. To address this gap, DIGO commissioned a study that drew on existing visitor flow data to assess tourism-related environmental pressures, identify environmental stress zones, and evaluate the investment potential of sustainability solutions in Pokhara and Madi.

This document **Measuring What Matters** draws on that experience. It presents the methodology, the key findings from Pokhara and Madi, and demonstrates how the **FlowPrint** framework can strengthen evidence-based decision-making.

01 WHEN GROWTH BECOMES THE PROBLEM



Communities in Gandaki Province are deeply woven into the fabric of tourism. Tourism has been generating employment, sustaining livelihoods, and anchoring the economies of destinations as diverse as Pokhara's lakeside promenade and the Gurung villages of Sikles and Tangting in Madi Rural Municipality. Yet the very growth that has been foundational for the development of these communities is now placing its tourism assets under noticeable strain. Lakes are getting polluted by the day. Rivers that once ran clear now carry the cumulative burden of unmanaged wastewater, plastic, and waste. Unsustainable tourism practices and other human-induced pressures are exacerbating the impacts of climate change, pushing vulnerable mountain ecosystems towards critical tipping points beyond which recovery becomes increasingly difficult.

Pokhara Metropolitan City

Pokhara, Nepal's tourism capital, is the largest city and provincial capital of Gandaki Province, as well as Nepal's second-largest city. Situated at the edge of Phewa Lake and surrounded by many others, its skyline is framed by the mountains of the Annapurna range to the north, most notably the iconic Machhapuchhere.

The city's tourism offer is anchored by Phewa Lake, alongside many activities including boating, paragliding, cycling, and the Lakeside strip with its restaurants, pubs, and souvenir shops. Cultural sites including the World Peace Pagoda, Pumdikot, Bindhyabasini, and Tal Barahi temples, and Gupteshwor Mahadev cave add religious dimensions to its offer. It also serves as the pitstop for many trekking routes in Gandaki Province, including Mardi Himal, Annapurna Circuit, and Annapurna Base Camp Trek, to name a few, as well as to the very revered Hindu and Buddhist pilgrimage site of Muktinath in Mustang.

Pokhara attracts a substantial share of Nepal's international tourists. Although city-level data are limited, estimates suggest it receives several hundred thousand foreign visitors annually, potentially approaching 1 million in strong years. According to the Hotel Association Pokhara Nepal, average hotel occupancy in Pokhara is around 65%, exceeding 90% during peak seasons. Visitors comprise roughly 50% domestic travellers, 30% Indian tourists, and 20% other international visitors. According to the *Pokhara Sustainable Tourism Action Plan*, tourism is a key economic pillar, contributing an estimated 25% of Pokhara's economy.

Madi Rural Municipality (Sikles and Tangting)

Madi Rural Municipality lies northeast of Pokhara in the lap of the Annapurna Range, spanning elevations from 520 m to 7,937 m above sea level (asl). Within the municipality, the traditional Gurung villages of Sikles and Tangting have attracted domestic and international visitors since the 1980s, with visitor numbers increasing in recent years, largely driven by social media exposure.

Sikles, located at around 2,000 m asl, consists of around 457 households and lies on an east-facing hillside overlooking the Madi Khola (river). It serves as a key gateway for trekkers heading to Kori highland and Kapuche Glacial Lake, Nepal's lowest-altitude glacial lake, situated at approximately 2,450 m.

Tangting, located at roughly 1,665 m asl, comprises of around 266 household and is oriented on a north-west

facing slope, across the Madi Khola from Sikles. It primarily caters to the domestic weekend market through homestays, short hikes to Krapu Hill, and cultural tourism experiences.

Both these villages are emerging destinations offering community homestays and attracting predominantly domestic weekend visitors from Pokhara and other cities of Nepal, alongside a smaller number of trekkers. Although tourism in Madi remains modest compared to Pokhara, it is an important source of local income and livelihood. Local estimates indicate that visitor numbers can reach around 1,000 tourists per day during peak seasons, while off-season arrivals may fall to as few as 20 per day. Average visitor expenditure is estimated at approximately US$20–30 per person per day.

Beyond growth: Rethinking how we measure destination success

Tourism in Pokhara and Madi is growing, but growth alone does not make a destination sustainable. The cost of inaction is not abstract. It is already very visible. Eventually, tourism that degrades the assets it sells will undermine itself and along with it the livelihoods of the current and future generations who depend on it. Growth in visitor numbers, length of stay, spending, and revenue, by themselves, provide an incomplete and potentially misleading picture of the destination's performance and its trajectory. To determine whether a destination is genuinely thriving rather than simply growing, it is imperative to look beyond economic performance and give equal consideration to environmental outcomes. This requires rethinking how destination success is defined and measured. The challenge, then, is how to assess environmental performance meaningfully and effectively in complex destinations where reliable data are often scarce, so that evidence can inform decisions and drive change.

Evidence gaps in sustainable tourism planning

The harder questions are: what should be protected, where should investment be directed, what needs to change, and who should act? Yet these decisions are often made without the evidence to make them sound. Despite the significance of tourism in Pokhara and Madi, planners, enterprises, and local governments have historically lacked three interlocking types of evidence that are critical to informed decision-making.

Gap 1: How do tourists move in a destination?

Most destinations do track how many tourists arrive but not where they go, what they do, or which places bear the real weight of their visit. This matters first for the environment. Without knowing where visitors concentrate, it is impossible to identify which sites, water bodies, or ecosystems are under the most pressure. There would be no basis for deciding what to count, where to count it, or whose behavior to change.

But the gap runs deeper than that. Without observed patterns of visitor movement, tourism planning rests on assumption. A municipality deciding where to build an infrastructure or invest in a new product is essentially guessing. Flow shapes everything in the destination and it is almost never mapped. Visitor flow mapping is not a preliminary step. It is the precondition for every other decision in the system.

Gap 2: What does tourism cost the environment ?

Environmental concerns exist but operate without numbers. The basic questions are almost never asked.How much water does a guest use per day? How much waste does a trekker leave behind? How much of Phewa Lake's pollution comes from tourism versus the city?

These questions sound simple but the answers barely exist. Without this data, a destination cannot set meaningful targets. A tourism enterprise cannot track its sustainability performance. Policies are developed in general terms and exist on paper. Sustainability remains rhetorical.

Gap 3: What is the business case for sustainability?

The global case for solar panels, rainwater harvesting, waste management systems, and cleaner transport is well established. But "it works in principle" is not enough for a homestay owner in Madi or a hotel in Pokhara weighing up a significant investment. They need to know what it costs in Nepal, how long before it pays back, and whether the risk is worth taking given their margins.

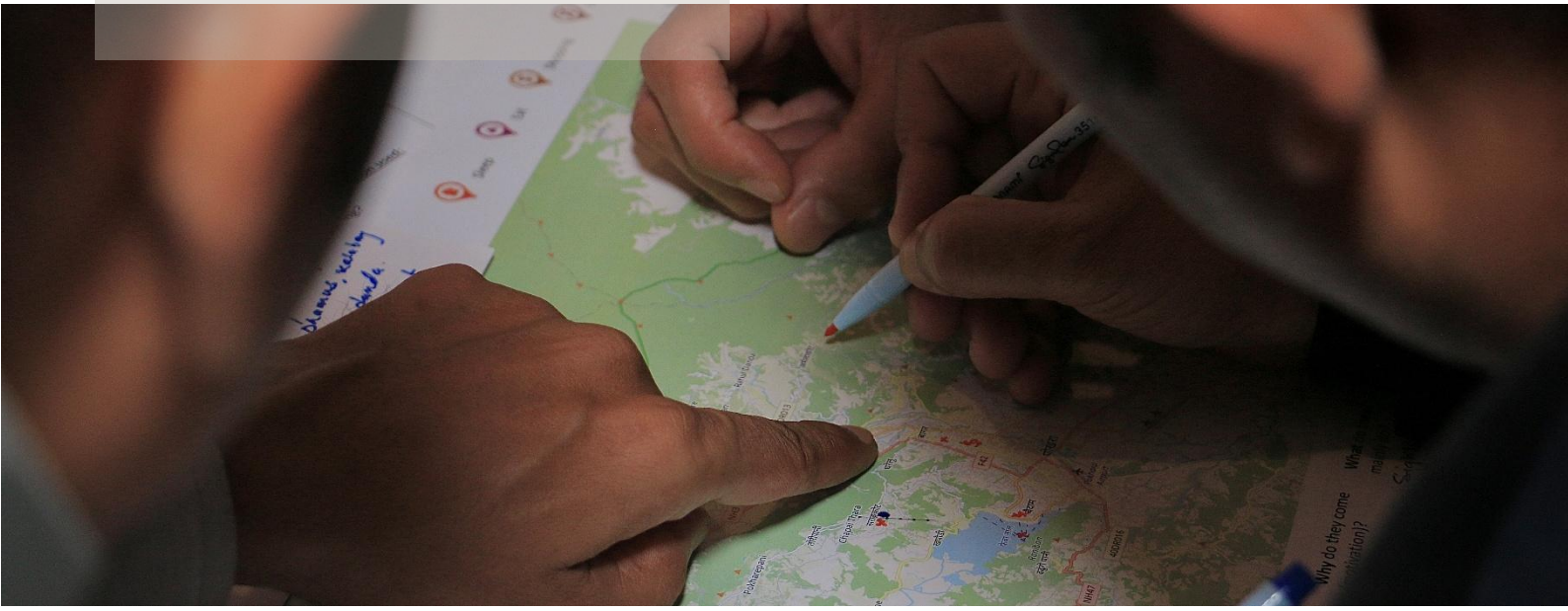
Without a locally grounded business case, enterprises have no reason to act even when the willingness or the concern is there. And without this evidence, destination planners and local governments have no basis for designing incentives or setting standards that enterprises can realistically meet. The gap is not just missing evidence. It is the absence of evidence calibrated locally.

How do the gaps connect?

These three evidence gaps are sequential rather than independent. Without understanding how tourists move, you do not know what to measure. Without measuring environmental pressures, you cannot make the case for change. Without a locally grounded case for change, neither planners nor enterprises can confidently invest in solutions, even when the willingness to act exists.

Figure 1:Three evidence gaps in sustainable tourism planning

02 METHODOLOGY AND ANALYTICAL FRAMEWORK



Recognising that sustainable tourism requires balancing economic and environmental outcomes, DIGO adopted environmental performance alongside economic performance as a key measure of success at both destination and enterprise levels. This enabled the project to track and demonstrate progress while providing destinations and enterprises with a basis for monitoring their sustainability performance.

However, the information required to support these ambitions was limited. To address the gaps outlined in the previous chapter and equip decision-makers with a shared evidence base, Swisscontact commissioned the ***Tourism Environmental Impact Assessment of Pokhara and Madi*** study. Drawing on existing visitor flow data, the study sought to answer three critical questions: how tourists move within destinations, what environmental impacts result from these movements, and which locally viable sustainability solutions make economic sense.

Early in the process, it became clear that no single methodology could adequately address all three questions. The challenge was therefore to design a practical framework suited to data and resource scarce and complex destination contexts, while also moving beyond diagnosis to support decision-making.

In response, DIGO combined three complementary components, described in following sections, into the **FlowPrint** framework. Rather than functioning as independent analytical tools, they operate as an integrated system in which each stage provides the foundation for the next.

Strategic visitor flow tool

Strategic Visitor Flow (SVF) is an analytical tool that is used within Swisscontact's Sustainable Tourism Destination Management (STDM) methodology. It helps understand how visitors move within a destination, why they travel, and how they spend their time and money. Rather than treating visitor demand as a single aggregate, it breaks down tourist activity into distinct flows, that can be traced spatially and temporally, defined by characteristics such as origin, motivation, demographics, and spending behaviour. By revealing how different visitor groups interact with a destination, SVF provides evidence for tourism planning, visitor management, product development, infrastructure investment, and a more balanced distribution of tourism benefits and pressures.

Developed by Professor Pietro Beritelli, Swisscontact has applied the SVF tool in more than 15 countries since 2017 across Asia, Latin America, Africa, and Eastern Europe. In Nepal, it was used for the very first time in the DIGO project.

How did we use SVF in DIGO?

For the purposes of Nepal, DIGO adapted the tool to respond to the local context. It was applied under the umbrella of participatory tourism planning and used as a standalone analytical tool outside the broader STDM methodology. Implemented as a separate body of work under DIGO, the SVF process generated evidence on visitor flows and tourism dynamics to inform municipal decision-making and sustainable tourism planning.

Figure 2:SVF process adapted for DIGO in Nepal

Using the SVF tool, DIGO facilitated participatory workshops where stakeholders mapped and analysed visitor flows, attractions, services, opportunities, and challenges. The resulting flows were digitised, validated, and used to identify priority tourism development themes and recommendations, which were subsequently reviewed by stakeholders and submitted to municipalities to inform destination planning and decision-making. The outputs of this process later served as a key input into the Tourism Environmental Impact Assessment and the development of the **FlowPrint** framework.

Life cycle thinking (LCT)

Life Cycle Thinking (LCT) is an environmental assessment approach that evaluates the impacts of a product, service, or activity across its entire life cycle rather than at a single point in time or location. As such, it provides a more complete picture of their environmental impacts.

In the context of tourism, LCT considers the full visitor experience, including accommodation, food, transport, water use, and waste generation, helping identify where environmental pressures are concentrated and which activities contribute most to them.

Life Cycle Assessment (LCA) is the standardised methodology used to operationalise LCT. LCA framework codified in ISO 14040 and 14044, comprises four interconnected phases:

1. **Goal and Scope Definition**: Decide objectives and boundaries of the assessment and functional unit of measurement.
2. **Life Cycle Inventory (LCI):** Collect data on all the inputs (energy, water, fuel, food) and outputs (waste, wastewater) connected to the activity being studied.
3. **Life Cycle Impact Assessment (LCIA)**: Convert data into meaningful environmental indicators, such as kilograms of carbon dioxide emitted or litres of water consumed.
4. **Interpretation**: Analyse the findings, use the results to identify environmental "hotspots," draw conclusions, and inform actions.

Note

For the purposes of the tourism environmental impact assessment, the more rigorous LCA was adapted and simplified and was not a full ISO-compliant LCA. It was done so to fit the requirements and constraints of the assessment. The goal of the assessment was to identify hotspots and key environmental consequences to support decision-making, rather than undertake a fully comprehensive LCA. The assessment applies LCT supported by inventory analysis and partial impact characterisation. Accordingly, LCT is the more accurate term and is used throughout this document.

Cost-benefit analysis (CBA)

Cost-Benefit Analysis (CBA) is an economic tool used to assess whether the benefits of an investment outweigh its costs over time. Widely applied across various sectors, it helps decision-makers evaluate the financial viability of different options.

CBA typically involves three steps. First, all relevant costs and benefits are identified and, where possible, monetised. In the case of accommodation enterprises, costs may include capital expenditure and operating costs, while benefits may include utility savings, reduced procurement costs, increased revenue, and quantifiable environmental benefits. Second, future costs and benefits are discounted to reflect their present value. Third, they are combined into summary metrics such as Net Present Value (NPV), Benefit-Cost Ratio (BCR), and Payback Period.

In the context of sustainable tourism, CBA bridges environmental findings and investment decisions. For example, while assessments may show high water or energy use in enterprises, decision-makers also need to know what a sustainable option will cost, what returns it will generate, and how quickly it will pay back.

The FlowPrint framework: From visitor flows to investment decisions

The methodological contribution of the **FlowPrint** lies in integrating the three complementary analytical components, SVF, LCT, and CBA, into a single framework, where the output of each stage informs the next. Together, they answer three critical questions: how tourists move within destinations, what environmental impacts result from these movements, and which sustainability solutions make economic sense.

SVF frames what gets assessed by identifying and mapping visitor flows, which define the scope and boundaries of the LCT analysis. Each visitor flow is treated as a distinct tourism product with its own sequence of activities.

LCT then collects, analyses, and interprets information on the resources consumed and wastes generated throughout these visitor experiences to assess environmental pressures and hotspots. This enables meaningful comparison across visitor types and helps identify where impacts are concentrated and which activities contribute the most.

CBA then evaluates locally relevant sustainable solutions and their financial viability, translating environmental findings into practical investment decisions.

FlowPrint's innovation is not in introducing new tools, but in combining visitor-flow analysis, environmental footprint assessment, and investment appraisal into a single framework that helps destinations move from understanding tourism and associated environmental pressures to identifying practical and financially viable responses. By linking specific visitor flows, locations, and activities to environmental consequences, the framework produces findings that are directly actionable for destination planners and tourism enterprises.

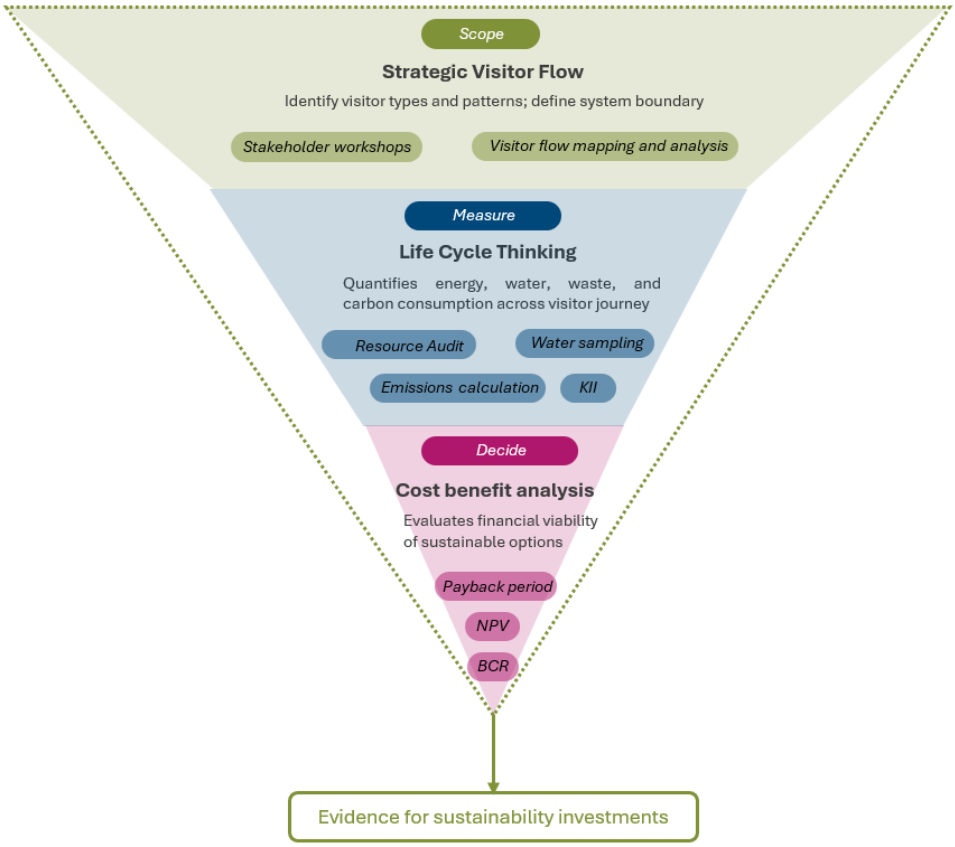


*Figure 3:**FlowPrint** Approach - An integrated framework for identifying tourism flows, measuring environmental impacts, and evaluating sustainable transition options.*

03 HOW WE MEASURED WHAT MATTERS

Identification of key visitor flows

The SVF analysis facilitated by DIGO across Pokhara and Madi mapped 19 visitor flows in Pokhara and 8 in Madi. The visitor flows are not necessarily exhaustive and may expand through further stakeholder deliberation. Given the complexity of both destinations and the constraints of this assessment, it was not feasible to apply LCT to all identified flows. The assessment therefore focused on three representative visitor flows in each destination, capturing the dominant tourism patterns, visitor types, motivations, and visitor volumes. These flows were considered sufficiently representative to support broader destination-level analysis and interpretation.

Each flow was mapped across a typical two to three day visit, capturing daily activity sequences, transport modes, accommodation types, and key site visits. Where relevant, transport required to access destinations and attractions within the assessed visitor flows was included as part of the tourism product.

This made it possible to define functional units and assess environmental impacts across different visitor types. A key advantage of grounding LCT within the SVF tool is that system boundaries emerge from visitor behaviour, rather than being defined through administrative, geographic, or expert-defined assumptions.

The value of this approach is illustrated by the contrast between visitor flows that might otherwise appear similar. In Pokhara, for example, the international trekking tourists and the Indian religious tourists may stay in comparable hotels and use some of the same services, yet their movement patterns, transport choices, and activity sequences differ sufficiently to generate distinct environmental footprints.

In Madi, the weekend domestic leisure visitors and the multi-day trekkers both arrive by the same road and stay in similar homestays, but interact with the destination in different ways, resulting in different resource consumption profiles. Collapsing either of the pair into a single visitor category would have obscured these differences and undermined the precision of the environmental assessment.

Translating visitor flows to products and applying LCT

The assessment translated the visitor flows into six distinct tourism products and applied LCT to each. As noted in the methodology section, the assessment applies LCT rather than a full ISO-compliant LCA, using inventory analysis and partial impact characterisation to map environmental pressures across key visitor flows. The findings mentioned in the ensuing chapter should be read in that context.

The assessment was grounded in a deliberate sequencing of preparatory work, field engagement, and data compilation across three sites: Pokhara Metropolitan City, Sikles Village, and Tangting Village in Madi Rural Municipality. All fieldwork was conducted in December 2025, which included on-site surveys, environmental evidence collection, key informant interviews, resource audits, observation of tourist activities, and stakeholder engagement.

Table 1:LCT process in the assessment

LCA phase	What this study did
Goal & scope definition	Functional unit defined as one tourist day within a selected visitor flow. System boundaries were derived from observed visitor behaviour and covered in-destination services including accommodation, food and beverage, local transport, leisure activities, and waste management. Long-distance origin-to-destination travel excluded.
LCI	Data on electricity, petroleum, LPG, firewood, water consumption, wastewater generation, and solid waste were collected and quantified per tourist day across all six representative flows. Data were derived through visitor surveys, field observations, resource audits, utility records, and key informant interviews.
LCIA	LCIA was partially applied. Resource consumption data were aggregated and translated into environmental indicators, including carbon emissions using standard emissions factor for Nepal. Eutrophication risks were assessed qualitatively through water sampling of Phewa Lake tributaries. Other environmental dimensions including waste management, land-use change, and biodiversity concerns, were assessed through field observation and stakeholder consultation.
Interpretation	Results were analysed to identify environmental hotspots, dominant tourism stressors, and differences across visitor flows. Findings were used to estimate the overall environmental footprint of tourism in each destination and to inform the subsequent assessment of sustainable transition options through CBA.

Note

Long-distance origin-to-destination transport (e.g. flights and intercity travel) was excluded from the system boundary. However, transport that formed part of the assessed visitor flows was included. Consequently, the figures reported represent visitor-flow level footprints rather than tourists' full trip-level lifecycle impacts.

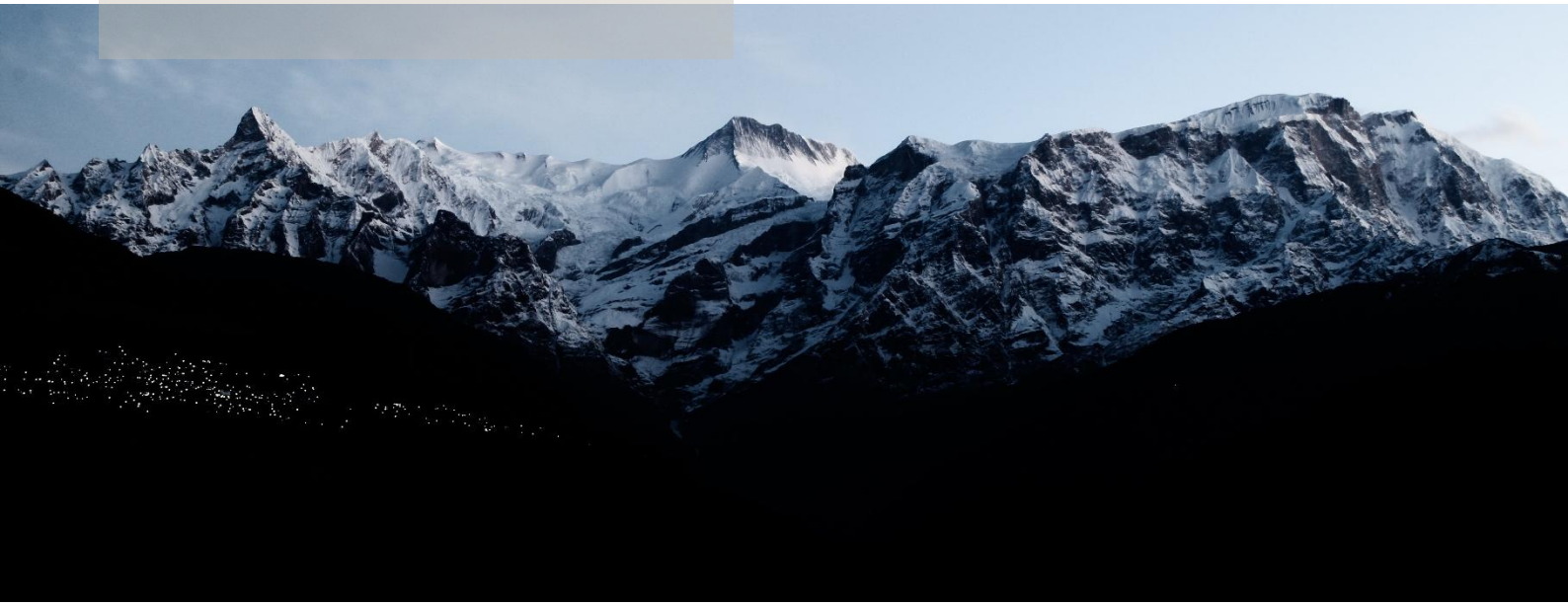
Cost-benefit analysis

While the LCT assessment provided a destination-level understanding of tourism's environmental pressures, evaluating potential responses required a more detailed understanding of resource consumption, operational practices, and costs at the enterprise level, where many of these pressures manifest. Given that accommodation enterprises were a key target group of the DIGO project, resource and cost data were collected from accommodation enterprises in Pokhara and Madi to provide a practical basis for solution assessment.

Drawing on the environmental pressures identified through LCT, together with operational and financial data collected from accommodation enterprises, the assessment identified five relevant sustainable transition options: rainwater harvesting, solar energy combined with heat pumps, decentralised wastewater treatment systems (DEWATS), reverse osmosis (RO) water filtration, and electric vehicles.

For each option, the assessment estimated capital costs, operating costs, and potential savings using enterprise data, market rates, and local case examples. Standard financial indicators, including NPV, BCR, and Payback Period, were then calculated to assess financial viability and identify the most promising sustainability solutions.

04 SNAPSHOT OF KEY FINDINGS



This chapter presents some of the key findings from the assessment conducted in Pokhara and Madi. Drawing on the application of the **FlowPrint** framework, it provides evidence on tourism-related environmental pressures, hotspot areas, and practical opportunities for sustainable transition.

Per-tourist-day environmental footprint

Table 2:Environmental footprint of tourist per day

	Pokhara Metropolitan City	Madi Rural Municipality
Daily carbon footprint	12.4 kgCO_2e	14.6 kgCO_2e
Daily water consumed	216.9 Litres	65 Litres
Daily electricity consumption	5.2 kWh	0.5 kWh
Daily liquid fuel consumption	3.7 Litres	5 Litres
Daily LPG consumption	0.26 kg	0.2 kg
Daily solid waste generated	1 kg	0.35 kg

The numbers are weighted average environmental footprint per tourist per day derived from key visitor flows that were identified for the assessment. The selected visitor flows were considered sufficiently representative to support broader destination-level analysis.

The visitor flows assessed in Pokhara and Madi represent two fundamentally different tourism consumption profiles, yet they converge on one critical finding: despite very different resource-use patterns, both generate daily carbon footprints that are roughly ten times higher than Nepal's average daily per-capita emissions.

Across most indicators, the Madi visitor flows exhibit substantially lower consumption. Electricity use is roughly ten times lower, water use is three times lower, and solid waste generation is nearly three times lower than in Pokhara. In many respects, the Madi flows represent a lower-consumption tourism model compared to Pokhara's more resource intensive urban tourism environment. Yet, the weighted average daily carbon footprint for the Madi visitor flows is higher.

The petroleum figure provides the explanation. Madi's weighted average petroleum consumption is 36% higher than Pokhara's, largely due to travel between Pokhara and the villages of Sikles and Tangting, which formed part of the assessed visitor flows. Given the distance and mountainous terrain, this journey accounts for a substantial share of fuel consumption, making transport the dominant contributor to the footprint of Madi visitor flows. While the Madi visitor flows perform better across several resource-use indicators, these gains are offset by higher transport-related emissions.

The findings highlight that different tourism products generate environmental pressures in different ways, requiring different sustainability responses.

Similarly, wastewater generation in Pokhara and Madi was derived as follows.

Figure 4:Wastewater generation per tourist day in Pokhara(litres/day)

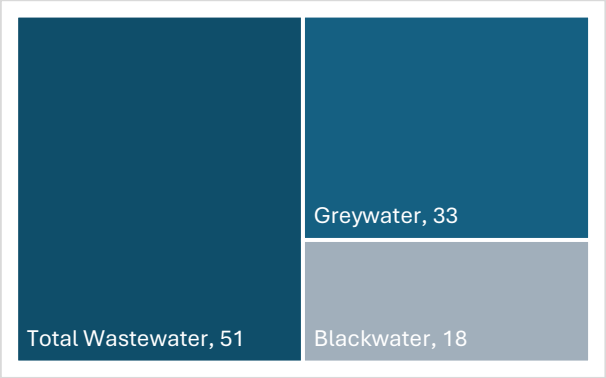


Figure 5:Wastewater generation per tourist day in Madi (litres/day)

Environmental stress zones and challenges

Pokhara

Environmental pressures in Pokhara are concentrated around Phewa Lake and its tributaries, high-footfall tourism sites, and the Lakeside area. Tributaries feeding into Phewa Lake, particularly Phirke Khola and Bulaudi Khola, carry untreated wastewater and urban runoff from surrounding hotels and settlements, contributing to nutrient loading and lake degradation. Solid waste accumulation, especially single use plastic and food packaging, is most visible at high-footfall viewpoints such as Sarangkot, the World Peace Pagoda trails, and Pumdikot. Increased traffic, construction activities, and open waste burning continue to affect air quality. The Lakeside area also faces growing noise and social disruption from nighttime entertainment activity, affecting both residents and the broader tourism experience.

Madi (Sikles and Tangting)

In Sikles and Tangting, environmental pressures are concentrated around common recreational areas, natural ravines, trails, and waterways that traverse the area. In Sikles, plastic waste accumulation and open waste burning are particularly visible around sites such as Sikles Park. The natural ravines (*kholchas*) in both Sikles and Tangting act as informal dumping grounds for mixed solid waste, which during monsoon season is washed downstream into the Madi River, threatening water quality and local groundwater. In Tangting, noise pollution and disruptive visitor behaviour during weekends have emerged as a distinct social stress, while the dewatering effect of upstream hydropower infrastructure has been noted as contributing to perceived microclimatic changes in the village.

Although the environmental challenges differ substantially between destinations, both illustrate that tourism impacts are spatially concentrated rather than uniformly distributed. This reinforces the need for geographically targeted interventions rather than uniformly applied destination-wide measures.

Sustainable transition options

The assessment found that several sustainability investments can simultaneously reduce environmental pressures and generate attractive financial returns. While the assessment identified key environmental challenges relating to energy use, water consumption, wastewater generation, plastic waste, transport emissions, and other destination-level pressures, the investment analysis demonstrated that many of these challenges can be addressed through financially viable interventions.

The most attractive opportunities were generally those linked to resource efficiency, particularly rainwater harvesting, RO water filtration, and solar energy systems. These options offer relatively short payback periods while directly addressing some of the environmental pressures identified through the assessment. Other interventions, such as decentralized wastewater treatment system (DEWATS) and electric vehicles (EV), provide important environmental benefits but require longer investment horizons. In particular, the financial performance of EVs is highly sensitive to vehicle utilisation, fuel and electricity prices, and replacement timing. While returns are relatively weak under the assumptions applied in this assessment, viability can improve significantly where EVs replace ageing internal combustion engine (ICE) vehicles or operate at higher utilisation rates.

The findings show that destination-level challenges and enterprise-level opportunities are closely connected, and that many environmental pressures can be reduced through interventions that are both environmentally beneficial and financially attractive.

Within DIGO, these findings have served as a baseline for engagement with accommodation enterprises and have informed subsequent sustainability assessments with partner businesses. They have also been communicated to relevant stakeholders and decision-makers, providing an evidence base for future sustainability planning and investment discussions.

Table 3 summarises the financial performance of the sustainable transition options assessed.

Table 3: Analysis of key sustainability solutions

Sustainable Solutions	Key Assumptions	Monetized Environmental Impact (Annual Savings)	Benefit Cost Ratio	Payback Period (years)	NPV (NPR)
Rainwater Harvesting	1000 sq. ft roof; 3800mm rainfall; replaces tanker water	NPR 172,185 (344,370L water saved)	10.27	0.59	927,279
Solar + Heat Pump	2000L tank; 60% solar reliance; replaces electric geysers	NPR 409,855 (30,660 kWh energy saved)	1.92	3.4	1,350,000
DEWATS System	25,000L daily use; 70% recycling efficiency	NPR 315,000 (+Reduced freshwater extraction)	1.12	7.9	360,000
RO Water Filtration	Replaces plastic bottles/year; 60% occupancy	NPR 700,000 (Eliminates 35k plastic bottles)	3.26	1.5	2,625,715
Electric Vehicles	EV cost at NPR 5 million	NPR 425,000	0.67	13	See note*

Note

The financial projections in this analysis are based on 2025 Pokhara market prices, a 10-year analysis period, and a discount rate of 10%. Savings projections will vary depending on property size, occupancy rates, roof area, solar exposure, and guest volume. *EV returns may improve significantly under higher vehicle utilisation rates or when replacing an ageing ICE vehicle. These figures are intended as indicative benchmarks to support investment planning.

05 WHY THIS FRAMEWORK CREATES VALUE

The FlowPrint value proposition

Destinations and enterprises alike need to understand where tourism-related environmental pressures occur, how significant they are, and which responses offer the greatest environmental and economic return.

Many sustainability assessments in tourism either identify impacts without evaluating responses or evaluate responses without adequately connecting them to environmental evidence and local context.

The value of **FlowPrint** lies not in any individual component, but in the way visitor-flow analysis, environmental assessment, and sustainability investment appraisal are combined within a single decision-support framework. The framework answers three interconnected questions:

1. Where are tourists going?
2. What impacts are they creating?
3. Which responses offer the greatest environmental and economic return?

By linking these questions within a single decision-support framework, **FlowPrint** helps move decision-making from assumptions to evidence and from diagnosis to action.

> *"Sustainability investments can be understood as an insurance premium on a destination's stewardship and future revenue."*

Value for different stakeholders

Different stakeholder groups require different forms of evidence, and **FlowPrint** generates distinct value for each according to the decisions they are responsible for making.

Table 4:Value created for stakeholders

Destination Planners & Local Government	Identifies environmental stress zones, dominant stressors, priority sustainability challenges, and investment opportunities, supporting more targeted destination management, infrastructure investment, and environmental performance monitoring.
Tourism Enterprises	Enables enterprises to benchmark their environmental performance against peers and identify opportunities for improved resource efficiency. Investment analysis translates sustainability opportunities into financial metrics such as payback periods, benefit-cost ratios, and net present values, supporting investment decisions and strengthening the business case for accessing finance.
Development Programmes & Donors	Generates evidence to inform programme design, prioritise investments, and support targeted sustainability interventions. Also provides a baseline for monitoring outcomes, supporting accountability, learning, and replication across destinations.

What makes FlowPrint effective

Several features of the framework merit particular attention as sources of its effectiveness and analytical robustness.

Visitor flows as a unit of analysis

Using visitor flows as the unit of analysis allows comparison across visitor segments, locations, and tourism products This produces insights that are specific to individual visitor flows, making it possible to identify which flows are most resource intensive, which locations generate the greatest environmental pressures, and which activities drive resource consumption. Such insights help planners prioritise interventions more effectively.

Integration of environmental and economic evidence

Another key strength is the integration of environmental assessment and economic appraisal, enabling decision-makers to prioritise interventions based on both environmental and economic considerations.

Multi-source evidence base

The framework draws on a multi-source evidence base, combining participatory workshops, structured checklists, field-based assessments, laboratory sampling, and key informant interviews. The different sources triangulate and reinforce one another, while quantitative findings are contextualised by qualitative insights.

Replicability and adaptability

The framework is primed for replicability. The core tools are accessible and the process attainable through modest resources. With appropriate adaptation, it can be applied in any tourism destination where visitor flow data can be gathered and resource consumption across visitor flows or tourism products accessed.

While the transition options presented in this assessment focus primarily on accommodation enterprises, the same approach can be applied to other tourism actors, provided actor-specific resource consumption and cost data are collected to inform the analysis.

Likewise, since visitor flows and enterprise performance evolve over time, the framework is equally suitable for periodic re-assessment, enabling destinations to monitor environmental performance and evaluate the effectiveness of implemented interventions.

Limitations

Although **FlowPrint** provides an integrated decision-support framework, its findings remain sensitive to data quality, assumptions regarding visitor behaviour, and the scope of assessment. This application focused on environmental pressures and economic viability and did not systematically assess the social dimensions of sustainable tourism.

Methodological choices are inevitably influenced by available resources and data. The framework should therefore be viewed as a decision-support tool that benefits from periodic updating rather than as a one-time assessment.

Concluding reflection

Ultimately, sustainable tourism cannot be managed effectively without understanding how visitors move, where environmental pressures occur, and which interventions offer the greatest return. By integrating these perspectives within a single analytical framework, **FlowPrint** provides a practical foundation for evidence-based tourism planning, investment, and long-term destination stewardship. Designed for application in data and resource constrained settings, the framework transforms fragmented information into actionable insights that support informed decisions across destinations, enterprises, and development programmes.

Oasis Complex, 4th Floor 211 Madan Marg,
Patan Dhoka, Lalitpur

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