Maximizing Value Creation in the Public Sector – The Case for NMHSs and the Role of SAHF

Abstract

This note proposes a new approach to improving the long-term sustainability of National Meteorological and Hydrological Services (NMHSs) by shifting the focus from justifying financial support purely on public good and return on capital employed to one that focuses on maximizing value creation. While traditional cost-benefit analyses may be sufficient to justify investment in a large economy, this may not be the case in a lower income country. Fundamental to the proposed approach is the acceptance that there is value creation in the public sector. It explores current and future efforts of the South Asia Hydromet Forum (SAHF) to help NMHSs document and maximize value creation.

1 Introduction

Recognizing the need of everyone to be able access actionable and reliable weather, climate and hydrological information, MDBs and other development partners have actively supported the modernization of NMHSs. These efforts have focused on increasing the skills of weakest NMHSs to, at least, a minimum acceptable level of service. While there have been some successes, the overall results are mixed. Promised uplifts to national budgets to maintain these services have often not materialized resulting in the rapid deterioration in service quality.

Justification for increased financial support has focused mainly on the socio-economic argument, based on multiple studies, that the benefits far exceed the cost of investment. While the argument has merit, it is easier to determine in economies with robust and transparent financial reporting systems. For example, the contribution of the UK Met Office to the civil aviation sector can be determined through public accounts with charges for services paid to the Met Office. In contrast, aeronautical meteorological services are rarely compensated directly in developing countries. Accounting for potential and avoided losses due to early warning of hazardous situations is more nuanced and more appropriately measured in value creation through social and relational capital.

For countries where it's accepted that the public sector creates value, it is important to understand the value of each public entity and how to maximize value creation. This requires integrated thinking within an organization to understanding the relationships between its various operating and functional units and the resources and relationships that the organization uses or affects. This enables the organization to think holistically about strategic, social and natural impacts as well as its financial outcomes. In short, it enables the organization to understand its value in the short, medium and long term and identify the opportunities to maximize value. An example is the creation of value from meteorological and hydrological observational data: one

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option would be to restrict access and sell data; other options would be to make data freely available or selectively. By analysing how these data are used, the value of data can be determined and the option that maximizes value selected.

A tangible outcome is the ability to engage more effectively with the organization's owners within government and the citizens whom they serve. Placed in the wider context of value creation in the public sector, it helps ensure that its value is recognized, how it is created is understood and impediments to maximizing value are identified.

The process may, at first sight, seem somewhat overwhelming. For NMHSs in South Asia interesting in applying these concepts, SAHF Technical Advisory Group (TAG) can provide guidance.

2 How do NMHSs Create Value?

NMHSs create value by delivering services and achieving outcomes that benefit society. Here's how:

1. **Service delivery:** The primary objective of an NMHS is to create value by providing impactful, high-quality weather, climate and hydrological services. These activities are essential for the well-being and development of societies.
2. **Resource allocation:** NMHSs manage and allocate resources efficiently to ensure that public funds are used effectively. This includes budgeting, financial management and investment in public goods and services–for example, weather forecasts and warnings.
3. **Sustainable outcomes:** NMHSs focus on achieving sustainable economic, social and environmental outcomes. This involves long-term planning and decision–making to ensure that its services and infrastructure are maintained and improved for future generations.
4. **Accountability and Transparency:** By being accountable and transparent, NMHSs build trust with citizens and stakeholders. This includes clear communication about how resources are used, the outcomes achieved, and how decisions are made. While forecasts may not always be correct, clear communication enables citizens to understand the limitations of forecasting without losing trust in the NMHS.
5. **Stakeholder engagement:** NMHSs engage with a wide range of stakeholders including citizens, services users, employees and other government bodies. This helps to understand and address the needs and expectations of different groups, ensuring that services are relevant and effective.
6. **Integrated thinking and reporting:** By adopting integrated thinking and reporting, NMHSs can provide a holistic view of how they create value. This involves considering the interconnections between various resources and relationships (defined as capitals) and how they contribute to achieving strategic goals.
7. **Balancing short-term and long-term goals:** NMHSs must balance immediate needs with long-term goals. This includes managing current resources while planning for future challenges and opportunities.

3 Integrated Thinking and Reporting

To understand the value of an NMHS requires the means to measure and communicate its value to stakeholders. One approach is based on “Integrated Reporting”, which is a process founded on integrated thinking that results in a periodic integrated report by an organisation about value creation over time[1]. It combines financial and non-financial information to provide a holistic view of an organization's strategy, governance, performance, and prospects in the context of its external environment. The goal is to explain how an organization creates value in the short, medium, and long term. By providing a clear and comprehensive view of the NMHS’ activities, performance, and prospects, reporting helps to build trust with stakeholders, including service users, owners and policy makers.

The approach also supports better decision-making, improves management practices, and helps enhance the overall efficiency and effectiveness of the NMHS. It is not just about producing a report; it is about fostering integrated thinking within the NMHS to improve overall performance and sustainability.

Integrated Reporting uses the *six capitals model* (stocks of value) to provide an inclusive view of how NMHSs create value. Capital is a term used in economics to describe anything that confers value or benefit. For any business, public or private including NMHSs, it is important explain how financial, manufactured, intellectual, human, social and relationship, and natural capitals are utilised and transformed through activities to create value. By combining business models and stories, Integrated Reporting helps the NMHS communicate a clear, concise, and comprehensive picture of how they create value, fostering greater transparency and trust with stakeholders. Key elements of an integrated report are:

1. **Holistic view:** An easy to understand, holistic view of the entire NMHS, covering both financial and non-financial aspects.
2. **Six capitals model:** The report is structured around the six capitals with detailed reporting on each.
3. **Two-part structure:** The first part focuses on reporting on the six capitals; the second part contains the required financial information.
4. **Stakeholder insights:** the report includes insights for stakeholders, showing how the organization creates value over the short, medium and long term.
5. **Internal benefits:** The report should identify how the process contributes to stock taking of all the NMHS’ assets, both tangible and intangible.
6. **Strategic alignment:** The report should align with the NMHS’ strategic and long-term goals, helping employees and stakeholders understand the material issues affecting the NMHS and the non-financial impacts of certain decisions.

The six capitals are:

1. **Financial Capital:** This includes the funds available to the NMHS to use in the production of its services.

[1] https://integratedreporting.ifrs.org/wp-content/uploads/2016/09/Focusing-on-value-creation-in-the-public-sector-_vFINAL.pdf

2. **Manufactured Capital:** These are physical objects such as observational networks, IT systems, buildings used by the NMHS to produce its services.
3. **Intellectual Capital:** This consists of knowledge-based intangibles. It includes intellectual property, like software and licences, as well as organizational capital such as tacit knowledge, systems and procedures.
4. **Human Capital:** This refers to the competencies, capabilities and experience of the staff of the NMHS. It includes their motivation to innovate, their alignment with the organization's governance framework, risk management approach, ethical values, and their ability to understand, develop, and implement the NMHS's strategy
5. **Social and Relational Capital:** This encompasses the institutions and relationships within and between communities, stakeholder groups and other networks. It includes shared norms, values, behaviors, key stakeholder relationships, and the trust and willingness to engage that an organization has developed. It also covers the intangibles associated with the brand and reputation of the NMHS.
6. **Natural Capital:** This includes all renewable and non-renewable environmental resources and process that provides goods or services that support the past, current, or future prosperity of the NMHS. While a minor component of many NMHSs, it may be more significant for hydrological services embedded within a larger water management or irrigation ministry.

4 Stories

Stories in Integrated reports provide the narrative that explains how the NMHS' strategy, governance, performance and prospects lead to value creation. They help stakeholders understand:

- **The NMHS' mission and vision** – what it aims to achieve
- **The external environment** – The context in which the NMHS operates, including economic, social and environmental factors.
- **The business model** – how the NMHS' activities transform inputs (capitals) into valuable outputs and outcomes.
- **Value creation** – how the NMHS' activities and outputs lead to outcomes that create value for the organisation and its stakeholders over time.

Box 1 is an example of how value is created internally and externally with the food sector.

Box 1 Value creation in the Food Sector

The NMHS wants to help the food sector increase it financial capital and its overall resilience in the face of climate change and short-term impact of weather events. It looks at the potential for external value creation by the various stakeholders in the food sector and then considers its interventions would also increase its own value.

External Value Creation

Financial institutions (Commercial banks, financial institutions, insurance companies) need to ensure that their portfolios take account of climate risks, which may be a regulatory requirement for some of them. They must also consider weather, climate and hydrological risks that may impact the viability of their clients.

Weather, climate and hydrological information is needed for scenario-based investment planning. Data and intelligence could be drawn on from a central, curated platform.

Large companies in the food and beverage sector depend on a supply/value chain, which includes many SMEs including, small holder farmers and a transportation network to ensure produce reaches stores and export markets. They recognize that they have a duty of care to ensure the resilience of the supply chain.

Weather, climate and hydrological information is needed on the short, medium and long timescales to plan and optimize operations.

Small holder farmers need to optimize planting and cropping but often lack understanding of the environmental factors that affect their productivity.

Accurate seasonal and short time scale forecasts and outlooks can help maximize productivity. To utilize this information effectively small holder farmers may need the assistance of intermediaries to access and apply this intelligence effectively. This might be a combined effort on the part of the large companies, which depend on this supply chain, microfinance institutions that provide financial support to SMEs, district/divisional secretariats, which have responsibility for their communities; and agriculture extension works that provide direct guidance to farmers.

Haulage companies, which may or may not be owned by the large companies, are responsible for transporting perishable goods from the field to the market need ensure there are no significant delays. This requires continuous knowledge of road conditions, which may be impacted by rain, flooding and landslides.

Impact forecasts of road closures using weather and hydrological information can be used to select routes, travel times and thereby optimize haulage.

In this story improved decisions, informed by weather, climate and hydrological intelligence, increase the financial, manufactured, social and relational, and natural capitals in this sector. In turn, the increase in financial capital results in an increase in tax returns to the treasury.

Internal Value Creation within the NMHS

The NMHS decides to increase access to its quality controlled observational data and climate analyses through a central platform with the financial sector. This is expected to increase the NMHS's ***manufactured capital and Intellectual capital***.

In addition, it decides to provide tailored weather and climate products to the large companies in this sector. It realizes that it can't necessarily do this on its own and works with other weather service providers to ensure the quality of the products. This venture may be a public-public partnership or a public-private partnership. The NMHS's current business model focuses on non-revenue activities with the aim of increasing ***social and relational capital*** and maximizing ***manufactured capital*** by making services available at minimum cost.

These large companies, in turn, are encouraged to share these products with smaller enterprises in their supply/value chain. The NMHS further increases its ***intellectual capital, social and relational capital*** and ***manufactured capital*** because of the wider use of its products. NMHS staff also benefit by having the opportunity to develop new skills to provide services to the food sector increasing ***human capital***.

As a part of its public duties, the NMHS also decides to supply tailored farm-related products to intermediaries, including district/divisional secretariats, microfinance institutions increasing ***social and relational capital***.

The NMHS decides to supply other partners with weather information is used to drive hydrological landslide models,

Figure 1 further illustrates the story showing how weather and climate information can be transformed into weather intelligence and used throughout the supply and value chains of the food sector. It highlights, the role of large enterprises and extension services as intermediaries between the national weather service and beneficiaries. Such a partnership has the potential to increase the value of the NMHS by ensuring weather intelligence reaches and is actionable by all beneficiaries. Not shown, but also important are the dependencies on weather and climate impacts on energy and communications and the need to factor these into the food sector supply and value chains.

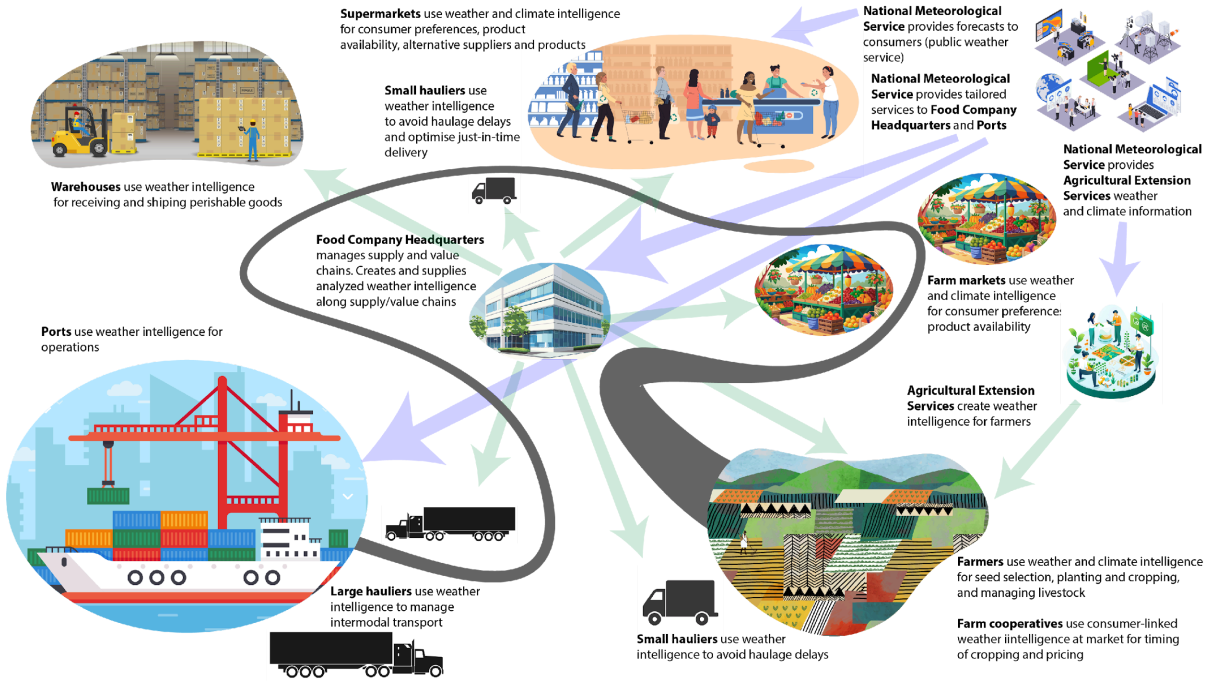

Figure 1Illustration of use of weather intelligence in the food sector value / supply chain

5 Evaluation of NMHS' Capitals

An evaluation methodology is needed to understand how each NMHS' value creation results from increases, decreases or transformation of financial, manufactured, intellectual, human, social and relationship, and natural capitals. This will help determine current strengths and weaknesses and help identify solutions to increase value. Proposed steps:

- **Identify Relevant Capitals:** Determine which of the six capitals are relevant to the NMHS.
- **Set Key Performance Indicators (KPIs):** Develop quantitative and qualitative KPIs for each capital to measure their contribution to value creation. For example, human capital can be assessed through employee engagement and training metrics, while financial capital can be measured through budget allocation against national and international norms. (see annex 1 for examples).

- **Conduct a gap analysis:** Compare current reporting and data collection practices with the requirements of the Integrated Reporting framework to identify any gaps in information. Some of the required data may be available from sources such as the Country Hydromet Diagnostics reports[2].
- **Collect Data:** Gather data on the identified KPIs from various departments and sources within the NMHS.
- **Analyse interconnections:** Evaluate how different capital interact and contribute to the overall value creation process. This involves understanding the trade-offs and synergies between different capitals.
- **Report on outcomes:** Use the framework to report on the outcomes of the NMHS' activities and their impact on the capitals. This includes both positive and negative consequences.
- **Continuous improvement:** Regularly review and update the KPIs and data collection processes to make sure they remain relevant and accurate.

6 Development of an Integrated Report

The preparation of an integrated Report is underpinned by seven guiding principles (Table 1).

Principles	Description
Strategic focus and future orientation	The report should provide insight into the NMHS's strategy and how it relates the NMHS's ability to create value in the short, medium and long term and to it use of and effects on the capitals.
Connectivity of information	The report should show a holistic picture of the combination, interrelatedness and dependencies between the factors that affect the NMHS's ability to create value over time.
Stakeholder relationships	The report should provide insight into the nature and quality of the NMHS's relationships with its key stakeholders, including how and to what extent the NMHS understands, considers and responds to their legitimate needs and interests. It should help understand how stakeholders perceive value
Materiality	The report should disclose information about matters that substantively affect the NMHS's ability to create value over the short, medium and long term.
Conciseness	The report should be concise.
Reliability and completeness	The report should include all material matters, both positive and negative, in a balanced way and without material error.
Consistency and comparability	The information in the report should be presented: • On a basis that is consistent over time • In a way that enables comparison with other NMHSs to the extent it is material to the organization's own ability to create value over time.

Table 1Integrated Report Guiding Principles

[2] https://alliancehydromet.org/country-hydromet-diagnostics/

In addition, it should include eight content elements that are posed a questions (Table 2)

Content elements	Brief Description
Organizational overview and external environment	What does the NMHS do and what are the circumstances under which it operates?
Governance	How does the NMHS's governance structure support its ability to create value in the short, medium and long term?
Business Model	What is the NMHS's business model? This is the system of transforming inputs, through its business activities, into outputs and outcomes that aims to fulfil the NMHS's strategic purposes and create value over the short, medium and long term. It requires: ● Explicit identification of the key elements of the business model ● A simple diagram highlighting elements, supported by a clear explanation of those elements to the NMHS. ● Narrative flow that is logical given the circumstances of the NMHS. ● Identification of critical stakeholder and other dependencies and important factors affecting the external environment. ● Connection to information covered by other content elements, such as strategy, risks and opportunities and performance (including KPIs) **Inputs** An integrated report shows how key inputs relate to the capitals on which the NMHS depends, or that provide a source of differentiation for the NMHS, to the extent they are material to understanding the robustness and resilience of the business model. **Business Activities** ● How the NMHS differentiates itself ● The extent to which the. NMHS depends on revenue generation (e.g., sale of data) ● How the NMHS approaches the need to innovate ● How the business model has been designed to adapt to change ● The contribution made to the NMHS long-term success by different initiatives **Outputs** Identification of the NMHSs key products and services **Outcomes** Outcomes are the internal and external consequences for the capitals because of the NMHS's business activities and outputs, both positive and negative. ● Employee morale ● NMHS reputation ● Customer/consumer satisfaction ● Brand loyalty ● Social and environmental effects ● Financial impact

Risks and Opportunities	What are the specific internal and external risks and opportunities that affect the NMHS's ability to create value over the short, medium and long term, and how is the NMHS dealing with them?
Strategy and Resource Allocation	Where does the NMHS want to go and how does it intend to get there?
Performance	To what extent has the NMHS achieved its strategic objectives for the reporting period and what are its outcomes in terms of effects on capitals?
Outlook	What challenges and uncertainties is the NMHS likely to encounter in pursuing its strategy, and what are the potential implications for its business model and future performance?
Basis of Preparation and Presentation	How does the NMHS determine what matters to include in the report and how are such matters quantified or evaluated?

Table 2 Content Elements of an Integrated Report

7 Contribution of SAHF

SAHF has an opportunity to assist each of its members maximize value creation by helping to structure thinking around the six capitals model to provide greater insights into how value increases, decreases or is transformed by the organisation itself and for others (Figure 2). This would provide material evidence on the value of the NMHS to their owners, ministries of finance and to development partners planning to invest in NMHSs.

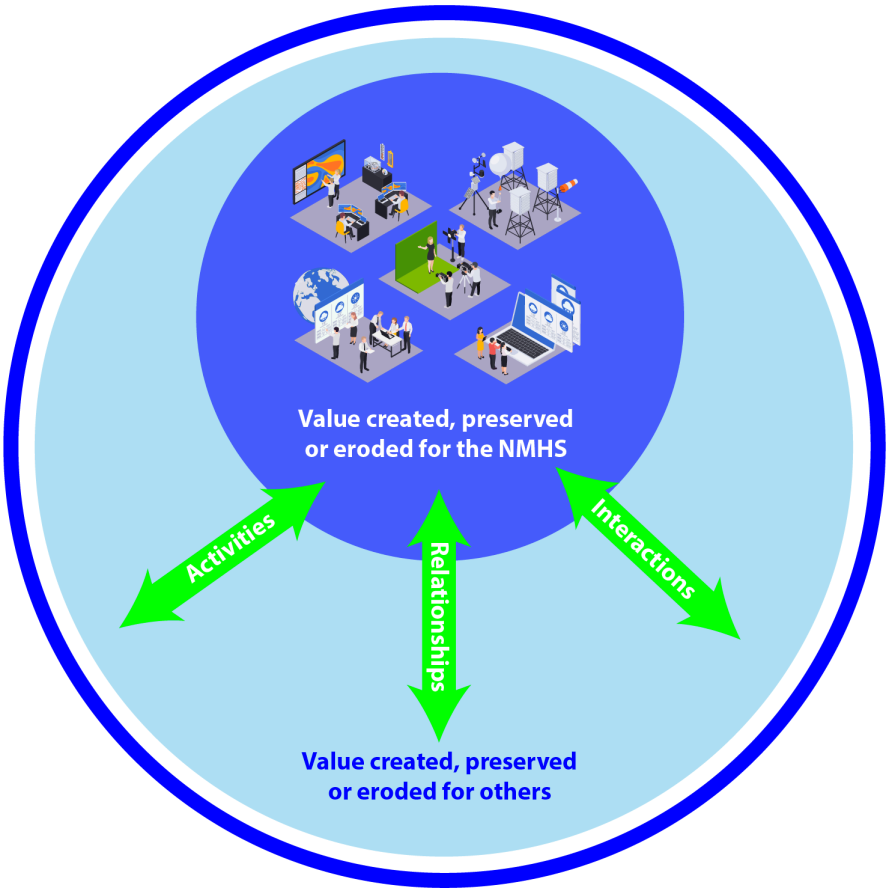

Figure 2 Value created, preserved or eroded for the organization and for others (After: International <IR> Framework (www.integratedreporting.org))

Currently SAHF interventions are contributing to value creation of NMHSs through five capitals (Table 3)

	Capital	Activity
1.	Financial	The role of SAHF is to help NMHSs use value creation to justify government financing and increase opportunity for grant or debt generated investments.
2.	Manufactured	SAHF is investigating new ways to enhance in situ observational networks (e.g., CML rainfall, data as a service)
3.	Intellectual	1.Support for R&D / innovation. CREWS SA aims to explore application of NWP–AI/ML techniques to create hyperlocal forecasts from global integrated forecasting systems. 2. Knowledge. The SAHF knowledge hub aims to be a dynamic repository of experience and knowledge that each SAHF member can contribute to and draw on 3. Know-how. The weekly forecaster forum enables expertise to be directly shared to help improve national forecasts of extreme events.
4.	Human	Staff training and education, including Met Office /RIMES led impact-based forecasting.
5.	Social and relational	Assessment of business organisations weather information / weather intelligence needs. Survey of small, medium and large businesses in Sri Lanka, Workshop on public–private engagement.
6.	Natural	Not Applicable

Table 3 SAHF contribution to capitals model

7.1 Relationship between Country Hydromet Diagnostics and Value Process

The Country Hydromet Diagnostics (CHD) is a peer-to-peer process designed to standardize the assessment of NMHSs. It comprises ten elements (Table 4) to assess the maturity of NMHSs, their operating environment and their contribution to the provision of hydromet services.

	Element	Description
1	Governance and institutional setting	How the NMHS mandate is formalized, and how it is implemented, overseen, and resourced.
2	Effective partnerships to improve service delivery	How the NMHS brings together national and international partners to improve its service offering, including academic, research, private sector, and climate and development finance institutions.
3	Observational infrastructure	The level of compliance with prescribed standards that surface-based observations infrastructure and data quality achieve
4	Data and product management and sharing policies	The appropriateness of availability and practice as assessed at a national, regional and global level.

5	Numerical model and forecasting tool application	The role NWP and other forecasting aids play in product generation, as well as whether models are run internally, and if value-added compared to global models is determined.
6	Warning and advisory services	NMHS's role as the authoritative voice for weather-related warnings, and its operational relationship with disaster and water management structures.
7	Contribution to climate services	NMHS's role in and/or contribution to a national climate response framework.
8	Contribution to hydrology services	NMHS's role in and/or contribution to hydrological services according to its mandate and country requirements.
9	Product dissemination and outreach	Effectiveness of the NMHS in reaching all public and private sector users and stakeholders
10	Use and national value of products and services	Engagement with public and private sector stakeholders in delivering services and ensuring continuous improvement.

Table 4 The ten elements of the Country Hydromet Diagnostics (Source: Alliance for Hydromet Development)

The CHD and value process are complementary with the former focusing mainly create 5 slides to pitch ton contributions to manufactured, intellectual, and social and relational capitals, outputs, and the utility of the services, while the latter focuses on the transformation of value through the NMHSs' business activities. Three SAHF countries, Bangladesh[3], Bhutan[4] and Maldives[5] have completed CHD reviews. Figure 3 illustrates how the CHD process informs value creation.

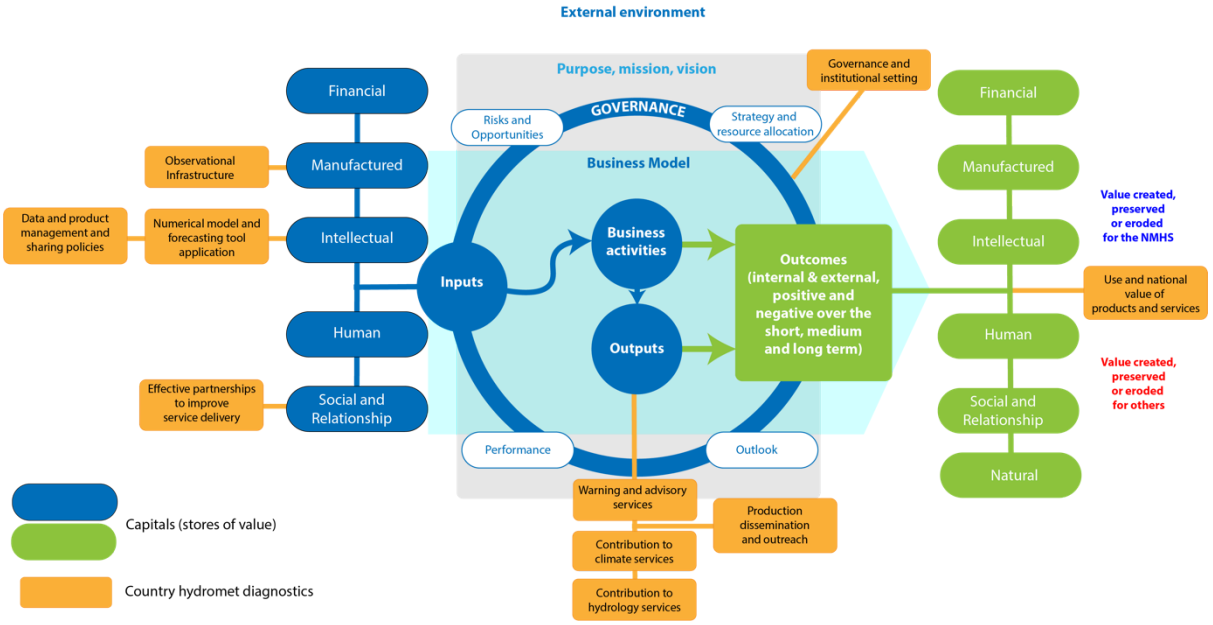

Figure 3 Process through which value is created, preserved or eroded (adapted from: International <IR> Framework (www.integratedreporting.org)) and relationship with the elements of the Country Hydromet Diagnostics

Figure 3 illustrates how the capitals, representing stocks of value are inputs to the NMHS's business model and are transformed by its activities into outputs and outcomes. The outcomes may have a positive or negative impact on the short, medium and long-term creating, preserving or eroding value for the NMHS and the external environment. As noted earlier, value creation, preservation or erosion is

3 https://alliancehydromet.org/wp-content/uploads/2024/08/CHD_Report_Bangladesh_Submitted14.06.24-screened-Final05.08.24_met.no_signed.pdf

4 https://alliancehydromet.org/wp-content/uploads/2024/02/bhutan_chd_final.pdf

5 https://alliancehydromet.org/wp-content/uploads/2023/10/Maldives-CHD-Report-2023_Final_31October-1.pdf

determined by how the NMHS is governed, its strategy, its business model, how it responds to risks and opportunities, its performance and outlook. A critical aspect of the NMHS, like all public sector organizations, is its value to society. Measuring this value remains a challenge. It would be advantageous to develop KPIs that can measure stores of value in the external environment. Abbreviated forms of the internal KPIs (detailed in Annex 1) and potential external KPIs, mapped onto the value process diagram, are shown in Figure 4. KPI_Ex4 (Knowledge based intangibles created), for example, could be constructed from the amount of observational data downloaded from the NMHS' website and used in an external process. By establishing intellectual property rights and licencing arrangements for data sets, the NMHS can assess the uptake these data and monitor their use through the licences (be it at cost or no cost to the user). In turn, this would inform strategy and the NMHS' business model.

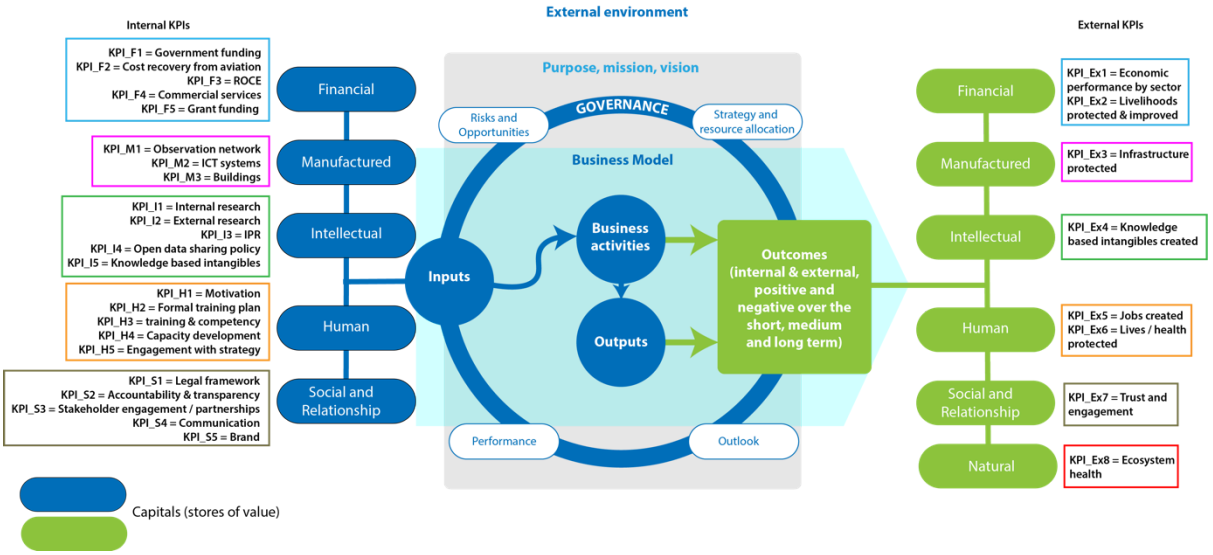

Figure 4 Process through which value is created, preserved or eroded (adapted from: International <IR> Framework (www.integratedreporting.org)) and associated, illustrative internal and external Key Performance Indicators.

7.2 Potential Next Steps

At the outset, it is not expected that this value process and its reporting structure could be fully embraced by all SAHF NMHSs. Rather, the approach should focus on building confidence among the SAHF NMHS' Director-Generals on the usefulness of the process to support their efforts to sustain and improve their organization's performance.

It will help to identify the external conditions which contribute to an increase, decrease or transformation of value and help SAHF members adapt their strategies and business models accordingly. It is anticipated that this will draw on the vast experience of the SAHF Technical Advisory Group to support the Director-Generals of the participating NMHSs and the World Bank Group's expertise in this area.

While any of the SAHF members may join this effort, those which have recently completed CHD, roadmaps, legal frameworks, and investments would likely benefit

the most. These existing instruments would provide insight into gaps, current capabilities and capacity of the NMHSs, and risks and opportunities to their services.

Several NMHSs have expressed interest in exploring how to create new revenue streams. This would require adjusting business models to include the provision of public and private goods services. This presents multiple risks but also opportunities. The following section briefly discusses value creation in aviation and road transport sectors to illustrate potential opportunities for NMHSs.

7.2.1 Tailored Services – Contributing to Value Creation in the Transport Sector

One service area common to all SAHF members is the provision of aeronautical meteorological services. As regulated services, the cost of provision is recovered from the airline industry by the government. Depending on the business model of the NMHS, these funds may or may not go directly to the NMHS. When they do not, as is the case throughout South Asia, the actual financial value of the service is unclear and, without direct interaction with airlines, it is difficult to assess the value in terms of financial capital (e.g., efficiency), manufactured capital (e.g., asset protection), human capital (e.g., passenger safety), social capital (e.g., passenger satisfaction), or natural capital (e.g. reduced carbon emissions). Demonstrating the value of the aviation weather forecasts provided by the NMHS simply from the consumption of weather data is not possible, rather it emerges from the improvement of economic decisions by airlines thanks to their use of weather-related intelligence. This can only be derived from direct interactions with users. In doing so, this could provide opportunities for the NMHS to enhance its tailored services beyond safety to enable individual airlines to enhance their profitability; for example, by reducing the costs associated with carry additional fuel based on forecast conditions at destination airports[6]. This is also an opportunity for public-private engagement to provide new services.

A similar approach can be applied to road transport of goods, which provide an economic to the national economy (recall Box 1 and Figure 1). Here there are four different dimensions:

- Increased profitability of companies
- Less government spending due to resource-saving in the provision of public services (either directly through the public sector or indirectly through state-owned companies)
- Avoiding damage to infrastructure and equipment as well as avoiding health risks and personal injury, and
- Individual benefits in terms of travel time savings[7].

Both examples are based on the development of a prescriptive model (Figure 5 is for road transport) that views weather intelligence as a factor in the decision-making

[6] von Grünigen, S., S. Willemse and T. Frei, 2014: Economic value of meteorological services to Switzerland's airlines: The case of TAF at Zurich airport. Weather, Climate and Society, 6:264–272

[7] Details can be found in Rogers, D.P. & V.V. Tsirkunov, "The Public Body – How to Create Commercially Viable National Meteorological and Hydrological Services", World Bank (Available from the authors).

process that can be used by decision-makers to reduce uncertainty. Decision-makers choose actions that either maximize expected financial capital or minimize expected costs, under conditions of imperfect knowledge about weather conditions.

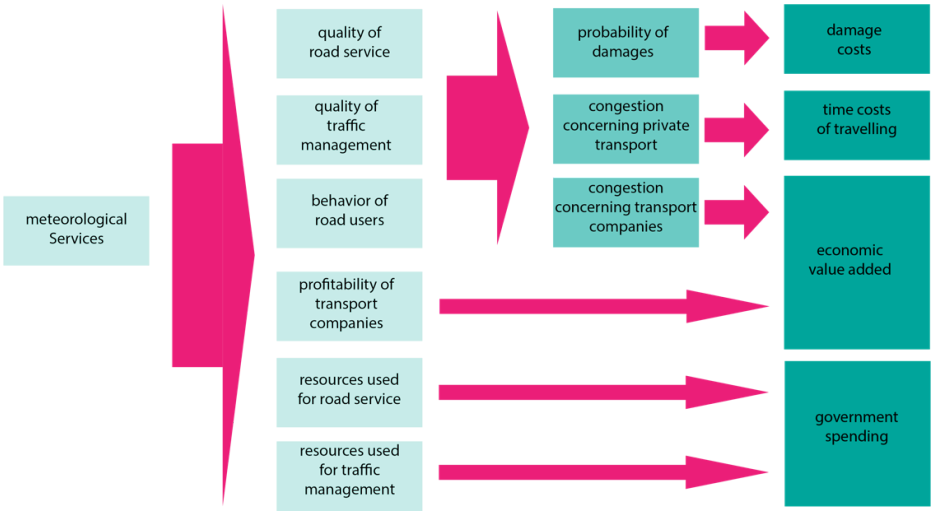

Figure 5 Model of economic impact of meteorological services (source Frei et al. 2014[8])

Absent direct cost recovery for services, NMHSs could focus initially on estimating the cost of the provision of services to aviation. Since these costs are recovered by government, it should be possible to more accurately determine the value of the services to the economy. A similar approach could then be developed for other sectors and applications on a case-by-case basis resulting in a better understanding of business opportunities. The example of the food sector presented earlier would be an opportunity to explore partnerships for the co-production of weather intelligence with the industry

8 Summary

NMHSs can be more sustainable by focusing on value creation rather than just financial support. The note highlights the challenges faced by NMHSs, especially in lower-income countries, and the importance of understanding and maximizing value creation in the public sector. SAHF can help NMHSs maximize value creation through integrated thinking and the six capitals model. The process provides a holistic view of an organization's value creation over time, which can help the providers of financial capital understand the value of an NMHS to society.

[8] Frei, T., S. von Grünigen and S. Willemse, 2014: Economic benefit of meteorology in the Swiss road transportation sector. Meteorological Applications, 21:294–300

9 Glossary

9.1 Business Model

A business model describes how an organization creates, delivers and captures value, in the form of capitals. The business model describes the specific way in which the business conducts itself.

9.2 Capitals

9.2.1 Financial Capital

This includes the funds available to an organization to use in the production of its services.

9.2.2 Manufactured Capital

These are physical objects such as observational networks, IT systems, buildings used by an organization to produce its services.

9.2.3 Intellectual Capital

This consists of knowledge-based intangibles. It includes intellectual property, like software and licences, as well as organizational capital such as tacit knowledge, systems and procedures.

9.2.4 Human Capital

This refers to the competencies, capabilities and experience of the staff of an organization. It includes their motivation to innovate, their alignment with the organization's governance framework, risk management approach, ethical values, and their ability to understand, develop, and implement an organization's strategy

9.2.5 Social and Relational Capital

This encompasses the institutions and relationships within and between communities, stakeholder groups and other networks. It includes shared norms, values, behaviors, key stakeholder relationships, and the trust and willingness to engage that an organization has developed. It also covers the intangibles associated with the brand and reputation of an organization.

9.2.6 Natural Capital

This refers to all renewable and nonrenewable environmental resources that provide goods or services that support the past, current or future prosperity of an organization.

9.3 Country Hydromet Diagnostics

A peer-to-peer, standardized approach to assess hydromet services.

9.4 Prescriptive Model

A prescriptive model is used to help determine how a specific decision affects a business outcome and how to adjust it to increase their chances of success.

9.5 Weather Intelligence

Weather intelligence is the ability to acquire, interpret and effectively apply weather and climate knowledge and skills to inform decision-making. Weather intelligence can be combined with many other sources of digital information relevant to societal and economic aspects that are sensitive to weather and climate conditions.

Annex 1 Examples of Key Performance Indicators for Capitals

Capital	Definition	Type of KPI		KPI number	Benchmark	Min Level	Country Relevant Y/N	Score: 0 min, 5 max
Financial	Funds available to the NMHS to use in the production of its services. The financial capital will change as the stock of capital flows from financial capital to other capitals. For example, if donor funds are used to buy equipment there will a flow of capital to manufactured capital, similar if funds are used to support staff development there will be a flow to human capital.	Government Financing		KPI_F1	100% funding from government, which is sufficient to cover the cost of public services insuring sustainable operation. Funds received cover the costs of the level of services agreed with government. This includes O&M and staff paid directly or indirectly	0%		
		Aeronautical Meteorological Services	Many NMHSs are responsible for the provision of aeronautical meteorological services, the costs of which are eligible to be recovered from airlines. Although cost-recovery should go directly to the service provider, few NMHSs in developing countries receive payment.	KPI_F2	100% costs of service are compensated (per ICAO regulations), and funds remain with NMHS	0%		
		Return on Capital Employed (profit)	Government finances the NMHS but expects a return on its investment. This can be considered an efficiency saving, i.e., doing the same for less. Alternatively, the NMHS might provide paid-for commercial services, and this income would provide a return to government.	KPI_F3	ROCE is agreed percentage of income (e.g., 2%).	0%	Optional	

Capital	Definition	Type of KPI		KPI number	Benchmark	Min Level	Country Relevant Y/N	Score: 0 min, 5 max
		Commercial Services	The income generated through the sale of services	KPI_F4	Equivalent of X percent (e.g., 10%) of the net income provided by government to operate the NMHS	0%	Optional	
		Grants	Donors may grant the NMHS funds for specific activities. This metric is used to determine the relative donor support the NMHS receives within the region.	KPI_F5	Long term average number of grants received by governments to support NMHS activities (Average of all SAHF members)	0	Optional	
Manufactured	These are physical objects such as observational networks, ICT systems, buildings used by the NMHS to produce its services.	Observation Network		KPI_M1	Down time of all observational networks is below 5% (ref. Total cost of ownership model)	100%		
		ICT Systems		KPI_M2	100% operational ICT systems (O&M fully supported – Total cost of ownership model)	0%		
		Buildings		KPI_M3	100% functional and maintained (TCO model)	0%		
Intellectual	This consists of knowledge-based intangibles. It includes intellectual property, like software and licences, as well as organizational capital such as tacit knowledge, systems and procedures.	Internal research		KPI_I1	100% Fully functional research facility section/department producing required analytical products	0%		
		External research		KPI_I2	Take full opportunity of all available relevant external research activities (opportunities need to be defined)	0%		
		Intellectual property rights		KPI_I3	IPR is applied to all data and services developed and owned by NMHS	0%		
		Open data sharing policy		KPI_I4	100% of the data produced, in support of the public task, by the NMHS is made available to any users at no or nominal cost (only the cost of making the data available)	0%		
		Knowledge-based intangibles		KPI_I5	100% of products created by NMHS are available electronically	0%		

Capital	Definition	Type of KPI		KPI number	Benchmark	Min Level	Country Relevant Y/N	Score: 0 min, 5 max
		(websites & apps)						
Human	This refers to the competencies, capabilities and experience of the staff of the NMHS. It includes their motivation to innovate, their alignment with the organization's governance framework, risk management approach, ethical values, and their ability to understand, develop, and implement the NMHS's strategy	Motivation	Leadership engenders trust and respect of staff (measured by anonymized staff surveys).	KPI_H1	Greater than 80% of staff trust and respect management/leadership	<10%		
		Continuous Professional development	Formal training plan	KPI_H2	Existence of a formal training plan based on NMHS requirements	None		
			Training & Competency	KPI_H3	Training and competency development is available to all staff (including on-the-job training) 100%	0%		
			Capacity Development	KPI_H4	Number of eligible staff able to take advantage of opportunities for attachments to other NMHSs and/or research entities	0		
		Engagement with Strategy		KPI_H5	Objective setting and annual appraisal of all staff and remedial actions as needed	0		
Social & Relational	This encompasses the institutions and relationships within and between communities, stakeholder groups and other networks. It includes shared norms, values, behaviors, key stakeholder relationships, and the trust and willingness to engage that an organization has developed. It also covers the intangibles associated with the brand and reputation of the NMHS.	Legal Framework		KPI_S1	Legal framework that conforms to international norms (eg. As defined by GFDRR)	Inadequate/ no instrument		
		Accountability & Transparency		KPI_S2	An annual financial report; an annual performance report; an intergrated report (IR) that conforms to international norms.	No reporting		
		Stakeholder engagement	Partnerships	KPI_S3	Existance of a formal partnership (e.g., Naturla Hazards Partnership) to includes all stakeholders impacted by weather, climate and hydrological events.	None		
			Communication	KPI_S4	Targeted communication plans for each identified stakeholder groups	None		
		Brand		KPI_S5	Majority (>50%) of respondents to a survey rate the NMHS brand as	<10%		

Capital	Definition		Type of KPI	KPI number	Benchmark	Min Level	Country Relevant Y/N	Score: 0 min, 5 max
					valued and trusted (defined within a survey instrument)			