Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

APPENDIX K: BEST PRACTICES FOR ICE SERVICE VALUE CHAIN MANAGEMENT

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During IICWG XX it became apparent that there are gaps in the Value Chain of the Ice Services. The goal of this Task Team is to describe a best practice for managing the full value chain as best practice for ice services.

The Value Chain includes remotely sensed observations, predominantly satellite and buoy data; in-situ data, scientific providers, and extends through model services, ice service analysts and forecasters, to the End Users. "End Users" vary within the value chain. Ice services are end users of satellite imagery and some derived products, while mariners are the end users for the operational ice services. Currently, some parts of the value chain see a product as a tool, while others see the same information and regard it as a product.

Communication and a structured path for product development is needed to ensure ice products clearly indicate their intended use and operational status (i.e. experimental, prototype, not for navigation, etc.). Strong collaboration between research and development, scientists and the ice services is necessary to present the best possible information to the maritime community.

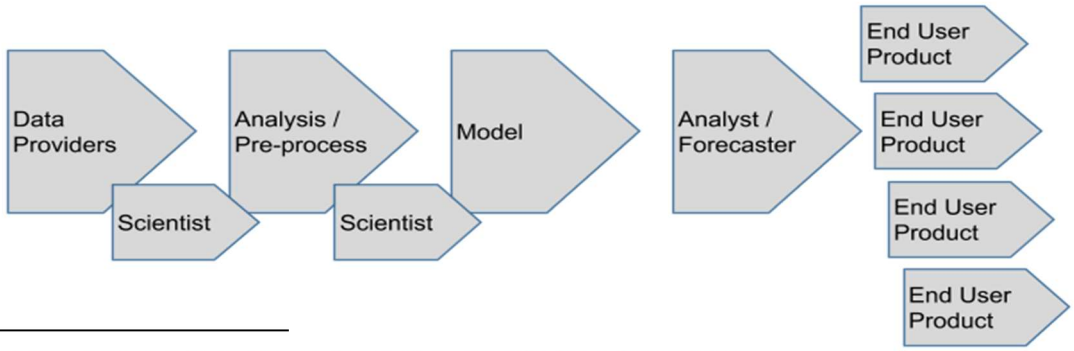
The following is an attempt to describe the Value Chain of the Ice Services, a common vocabulary, a proposal for a best practice to manage the Value Chain and an example of a product described by the steps taken to ensure the proper management of the Value Chain.

The Value Chain

A value chain is a business model that describes the full range of activities needed to create and disseminate a product or service

The value chain is often seen as either the *firm value chain*, including e.g. administration, HR, technology and procurement, or the *industry value chain* including suppliers, firm, distribution and customers[1].

For this task, the team has restricted the work to describe the industry value chain, which may be presented as in the below figure:



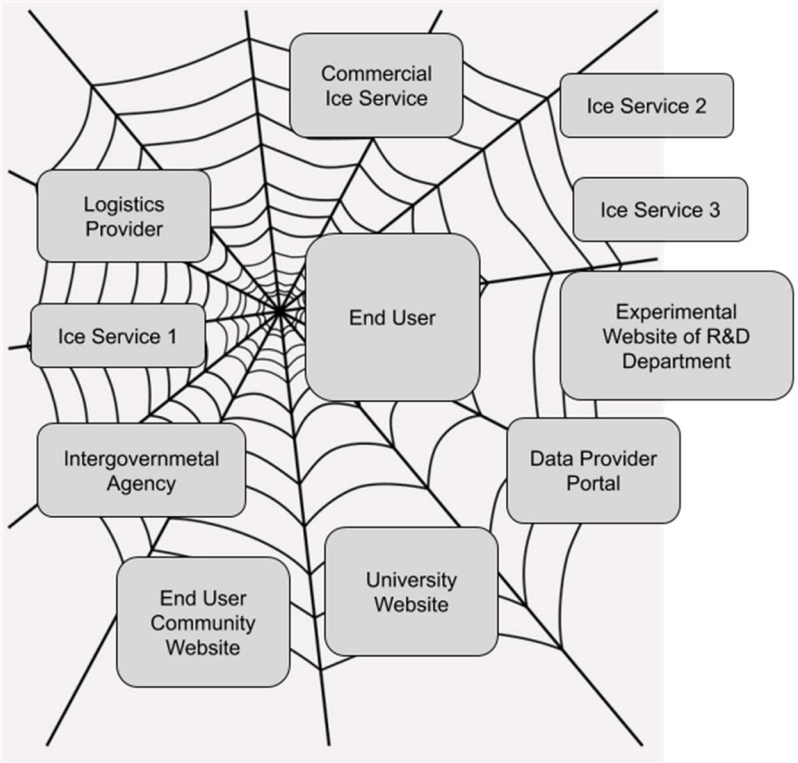
[1] Laudon: Management Information Systems, Managing the Digital Firm, Ch.3

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

It is important to recognize that the volume of available data and products for the end user become greater as we move through the value chain. The increasing amount of information providers gives the end-user the capability to pick between data and services without being aware of any limitations on the performance or the intended use of the product. Research and academic products may not be developed to meet the requirements of the particular end user using the product. Ice service products, on the other hand, are most often tailored for tactical awareness, hazard mitigation, and decision making, all under the umbrella of Safety of Navigation or Safety of Life at Sea.

Different steps in the value chain are seen when R&D community displays their work at experimental or community websites, making the operational ice services unable to manage the full value chain. As an example: a university working with ice modelling takes data from an open data provider and displays their results on the open internet. This is beyond the control of the ice services community.

In the digital world, the end user or the customer will often pick and choose between data and services depending on what he or she likes the most. So, the reality may look more like this:



Which means that the End User collects data and products from:

a) multiple sources at multiple states of development,

b) directly from the source or via a service provider, or

c) even from a service provider who received data and products from another service provider.

This leads to the end user blending all the different data sources on their own to make critical navigational decisions.

No single provider can keep control of the data and products accessed by the end user and no service provider is able to control the sequence in which the end user receives the products.

The ice services should however work to endeavor to be the authoritative source for operational ice information offering an authoritative, exhaustive, coordinated, well balanced and scientifically sound portfolio of products. Still, each step in the value chain must accept ownership for the full range of products offered to the users from his or her service.

Finance models of the products

In the commercial world, satisfied customers will return and create revenue for the firm and there will be a strong bond between satisfying the customers and financing resources.

As producers of maritime safety information, which is not always commercially viable, e.g. distributing ice information for mariners in sparsely populated areas with little marine traffic, we may think that the finances and the users are not that closely related.

However, this is not entirely true. Politicians who experience citizens and maritime communities who are happy with what we do or ask for products that we can do, will more likely grant resources. This is particularly true for user requirements directly addressed to them.

In the digital world politicians are conscious of the value of data and many initiatives have been launched granting finances to public agencies with the aim of opening data. This brings us back, although many of us are government agencies, to focus on the value we create for the users.

There is one element in the value chain that we need to consider. Research is not always financed by government requirements and grants related to the operational ice service or by direct demand from the operational service. Often a research department or a research institution will answer to calls for research with a specific aim in the form of research projects. Included in the tender may often be a requirement for publication of the results, a demonstration service or a product suiting a demand anticipated by the tenderer.

So, we need to recognize that the financial input is injected at different stages in the value chain, and thus the desire to release products may be driven by the same different steps.

The Management of the value web

The outcome and the users

In this document the "end user", is predominately the ice services end user – the mariner.

In the meteorological world we often use these definitions:

End User: The recipient of Products or Value-Added Services, who uses them for their own commercial, industrial, or personal purposes and does not pass them on to any third party, nor uses them to generate Value Added Services[2].

and

[2] ECMWF Standard License Agreement. Definition also used by EUMETSAT

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

Service Provider: Those users who acquire Products (from the ECMWF Catalogue) in order to supply Value Added Services under specific license conditions to a third party clearly identified and known to the Service Provider[2]

Interpretation: Unless we add no value, we are all Service Providers no matter where we are in the value chain.

In modern management literature the attention to customers has many names - "focus on core activities", the "OUTCOME"[3], the "customer perspective"[4], ensuring that we are responding to user requirements[5] etc. These principles have one thing in common: We must focus on what creates value for our users. In our context of supplying information to mariners (and others travelling or working on the sea ice) we work first and foremost with the purpose to enhance the safety of life at sea.

So, in this context there is no way around it: It must start with the users.

Hence the first interactive feedback loop must be with the users.

It is also in the best interest of ice services to provide feedback to science on how their product is performing. Ice services should translate what end users want, as well as the needs of the ice services themselves to the scientists.

Much has been written on the gathering of user requirements and collaboration with the users. This is a topic is outside the scope of this paper[6].

This paper is on the governance of the Value Chain.

Having established that the users are the starting point and that we wish to be the authoritative source of ice information we need to establish our product portfolio to comply with user requirements.

For this document, the definition of "product" will be an item in the product portfolio of a service provider[7].

Most products are published over the internet. It is important to bear in mind that the responsibility for the content of a website lies with the author of the content. In our world the responsibility for ice information published on the internet, will rest with the legal person who publishes. Most often this will be the entity who "owns" the website.

This responsibility for the product portfolio should rest with the operational service. The operational service has most of the contacts to the user communities and most of the ideas and requirements from the user community will arrive at the operational ice services. The ice services are responsible for the compliance with legislation and international guidelines, obligations, and conventions. However, the point is not that the operational service manages the value chain, but that someone does it in a structured way.

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[3] Actknowledge, University of New York

[4] The classic Kaplan and Norton balanced scorecard

[5] WMO no. 1023

[6] A full discussion can be found in Wagner et al., 2020 and KEPLER 2020.

[7] Adapted from ECMWF Standard License Agreement

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

Whoever has the management of the value chain must ensure that the necessary feedback mechanisms are established backwards in the value chain answering the questions:

- Does this contribute value to the user?
- What results do we anticipate?
- What are the products that we will offer?
- How will we develop and deliver the products?
- Do we have the resources?[8]

The operational ice service must understand the user community enough to know how its products contribute to the value creating of the user.

Also, it should be established what results we expect and how to measure the value creation. This could be user surveys, numbers of incidents, number of downloads, verification, and validation of the product etc. This will require that communication and feedback loops are established with the users.

To decide what products to offer in a product portfolio, it is necessary to establish what is possible, how to display the product (experimental, not for navigation, etc.), or how to develop the product. Often adjustments can be implemented by the operational ice service on its own. But, when products become a bit more sophisticated, technically, or scientifically, it will require assistance from IT and R&D.

Good communication and feedback loops with the users is not enough. There need to be even more communication and feedback loops established in a systematic way between the operational service, the research community, other ice services, other agencies and data providers.

Operational Ice Services

For this paper, the operational ice services should be understood as the services providers delivering products to end users.

The traditional value chain of the ice services takes all products and services through the full chain and second to no products were bypassing the ice analysts. However, the world of the information age is much different.

The analysis of sea ice and icebergs is automated to a different extent depending on the topic and the importance the manual analysis is decreasing. The automation is not complete and most analysts and researchers will still argue that the combination is useful.

The ice "forecast", which was earlier based on the analysts interpretation of the movement of the ice and his or her knowledge of wind and current, is changing and more and more we, as a community, are able to model the development, movement and decay of the ice, thereby arriving at a scientifically sound, physics based forecast, as we know from meteorology.

The possibility of creating a production process for the ice services, which is similar to that of meteorology, is appearing on the horizon.

[8] New Public Management, Lundquist and Vedsted

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

The ice services find themselves in a quite changing environment from doing the analysis and forecasts manually to become consultants and advisors for the users. For many years to come however the work of the ice service will still rely on the combination of the manual and automated process.

Most analysts have many ideas on how to make their work better and easier and as described later this process rarely causes problems.

Problems occur when the analysts, sometimes during the process of delivering consultancy services to a client, discover that the client asks for comments on a product, published by the institute of the analyst, but one that he or she was not aware of.

It such cases the analyst will also be unknowing of the production process, the scientific quality and the status of a product e.g. if it is experimental or operational or something else.

The operational ice service needs to be kept in the picture so that the analyst has the adequate knowledge of the making, quality and status of any product or service developed and published by his organization.

For products not produced by his or her own entity, any ice service analyst should know what he or she would recommend using from data providers, fellow services or research institutions.

This information on what the service does or recommends, should be formalized, agreed upon and coordinated through the organization.

Research and development

By research and scientists in this context should be understood processes and people mainly involved with development and research and to a lesser extent with operational analysis and forecasting tasks.

Research and development span a wide section of the value chain from reception, preprocessing and delivery of satellite or radar imagery, automated interpretation of remote sensing data, numerical modelling to advanced product generation.

When research is driven by requirements from the operational ice service, this rarely causes problems. The research is driven by a wish to enhance the quality of some product, an analysis (ice chart) or a forecast. Then good communication between the researchers and the ice analysts is in place from the start. In this case, the requirement has been translated into a specification and before going to press, several iterations will often take place between the operational service and the researchers. Finally, the end product may be authorized via the Quality Management System.

This is the way we should always when publishing ice services information.

We are seeing an increasing number of products, which bypass one or more parts of the value chain. Often scientists have produced results, which are well suited to be published directly to the end users.

Often the scientist, developer or analyst creating such a product would like to publish or distribute downstream, quite likely directly to the end user, and does not have the time or patience to go through the documentation and approval process, set out by the Quality Management System of

the operational service for a research to operations project. There may be no approval process in place at all. Such products often find their way to community websites or similar.

Another more difficult variation of this is when a scientist, due to requirements in the research tender that he or she replies to, place their product on a research community website or university website. It also happens, that someone publishes their research appearing more or less as operational information on social media via their personal profile.

It is important that products published in these ways are coordinated with each step in the value chain. Not to say that they need to be approved, but at least everybody should know that the products exist.

Also, agreement should be reached on the labelling of the product. Should it be marked with the logo of the entity and be entered into the product portfolio, should it be marked with "experimental product or unverified/unvalidated" or should it not be entered into the ice services product portfolio?

If a scientist expect the product to be offered in the ice services product portfolio, these decisions should be made early in the development stage.

Another solution could be to publish experimental products in a testbed or sandbox product portfolio at a separate website or information channel or in a separate section.

The data

Data, in this context, is input to our value chain. They may be anything from in-situ data to processed satellite data.

Sometimes the input to the value chain may be raw sensor data, processed by the ice services themselves, but often, in the case of satellite data, this preprocessing is done by the data provider.

The vast majority of data used in the value chain of the ice services is satellite data. Typically, these data is provided by a government space agency, but they may also come from the increasing numbers of commercial satellite providers. In any case, seen from the from the perspective of the ice service, satellite data comes from a 3rd party.

Observational in situ data in the Arctic and Antarctic are scarce. Some are collected by research projects controlled fully or partially by the agency also running the ice service, but they may also be ships observations and as such 3rd party data, but most times data will be under the control of the ice services.

Also, we get valuable data from aerial recce. These data will typically be under the control of the ice services too and although the ownership legally may rest with the flight operator e.g. the relevant air force, we do have good control over these and the control will lie close to the operational service.

When data is collected by research projects, we have similar problems as we have with research/experimental products. They may be displayed or published openly bypassing several parts of the value chain. However, observation data are much easier to explain since it is often obvious what is measured, so what you see is what you get.

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

When it comes to remote sensing data it is much more complex than the other steps in the chain. Satellite data ise provided by a satellite data provider. As noted above, the remote sensing data providers most often will be 3rd party, in the sense that they are from another agency or a commercial company. They may process data to a certain level and the ice services will add value to the data.

If we take high resolution visible wavelength imagery as one example, once preprocessed and geo referenced they will be highly valuable information for the end users and the ice services may include them in the product portfolio with no or very little value adding as long as the data policy of the provider permits it.

The remote sensing providers are well aware of this and when they are government agencies they will often have an open data policy and develop excellent view services on the open internet, e.g. NASA World View or Sentinel data hub. Having a wide range of service providers and users with all kinds of different tasks and requirements, these data hubs have disclaimers saying that the users bear all responsibility and liability for their use of the data.

A drawback of the open data hubs is that interpretation of e.g. SAR (Synthetic Aperture Radar) images is not always straightforward and the unexperienced may take wrong decisions, for example by mistaking very smooth ice for open water.

If the imagery was under the control of the ice services, they might not wish to publish all SAR imagery without interpretation or would like to restrict it to professional mariners with ice experience.

The delivery of imagery, however, is not and should not be controlled by the ice services, but are examples where the internal value chain of the ice services, is completely bypassed.

It does not however free the ice services from having a policy. The policy could be, that in order to not develop their own image service, they would link to the open portals. Others may link to the portals and issue guidance material. A solution could be to develop your own image service and only publish selected easy to interpret imagery or to publish value added imagery only.

The essence is that the open satellite data portals will be used by the end users. If they feel that the information is valuable, the ice services will have to decide how to manage this substitution of their products, which could be seen by them as disrupting the industry. Rather the ice services should manage how they want to embrace this in their product portfolio.

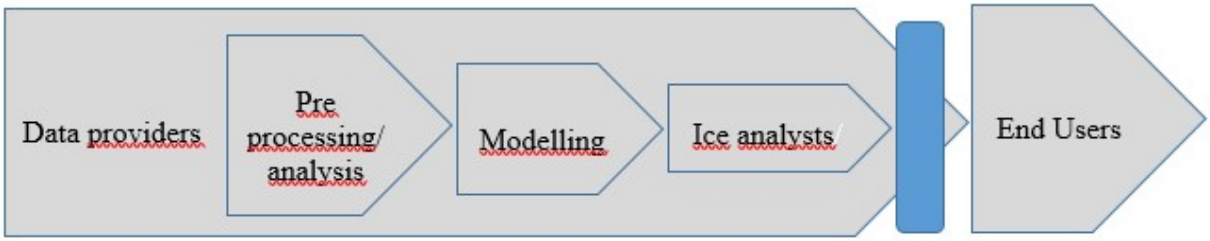
To be fair, it should be said, that the satellite providers are quite keen to listen to the ice community when designing new missions.

Conclusions

As stated in the beginning of this document, this process must start with the End User perspective. Everything depends on the user experience. When accessing an Ice Service, the user should meet an authoritative, exhaustive, coordinated, well balanced and scientifically sound portfolio of products.

In reality, the value chain looks more like this, where substantial parts of products used by the end user bypasses some part of the value chain:

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management



The Ice Services should have an approval process defining its official product portfolio (indicated in blue). It does not imply that everything has to be accessed through the distribution of the Ice Service, but that anything published by the entity in question and bears its logo, or is clearly identifiable as such, should have been approved and added to the portfolio.

The product portfolio may very well include products from 3rd parties e.g. imagery providers, intergovernmental agencies, partner services, research communities e.t.c.

It should be the Ice Service, who manages the product portfolio using the normal steps in the Quality Management Processes:

1. An official product portfolio should be established taking into account all steps of the value chain including:

a) Products from data providers
b) Products from other agencies
c) Research or experimental products
d) Own products
e) Products from international partners

And including the user perspective:

a) Does this contribute value to the user?
b) What results do we anticipate?
c) What are the products that we will offer?
d) How will we develop and deliver the products?
e) Do we have the resources?

If a product is published by someone in the organization – it is included here.

2. The operational status of the product should be agreed upon and stated e.g. "operational", "experimental" or something else.
3. It should be established how to monitor, validate and verify the products
4. Improvements and changes to the portfolio should be decided based on the results of the monitoring.
5. New products should be considered based on input from users, research, data providers, partners other agencies etc.

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

The product portfolio should, as outlined, be managed by the ice service. Nested in this is the important responsibility to coordinate with all steps in the value chain and to hold the initiative to arrange the necessary periodic meetings.

Whether they should be weekly or monthly meetings or could fit into the Quality Management evaluation cycle should be decided in the organization. Care should be taken, that the process allows for an agile management of the product portfolio, but at the same time avoid duplication of QMS procedures.

Example: A North Atlantic limit of icebergs including iceberg density inside the limit.

One very recent addition to our product portfolio is the establishment of a limit of icebergs in the Atlantic, including areas outside of air recce, and improving the limit in comparison with an iceberg limit largely based on climatology.

In addition, the product includes information on the density of ice bergs inside the limit.

The product has been born in collaboration between NAIS and DMI and the product available to the end users will be a chart.

Following the above steps, the development at publishing would look as follows.

1. Entry into the product portfolio.

The iceberg product is an idea based on the user requirement for reliable information on icebergs.

The scientists should present this idea and its concept to the ice service, broadly outlining

- How this contributes value to the user?
- What results do we anticipate (how will we verify and validate)?
- What are the products that we will offer?
- How will we develop and deliver the products?
- Do we have the resources?

It is agreed that this is a product that will enter the product portfolio, given the development is successful.

2. Status of the product

It is agreed that the trial products will be labeled as “experimental”. Also, it could be agreed to publish only to a closed user group. In this case alignment with international partners should be established.

3. Validation and verification

Often it will already have been outlined how to evaluate the product, but it should be agreed on how to validate and verify in detail, and who does it. Outline targets should be agreed on for when the product is published or will change status.

Appendix K: Task Team 9 – Best Practices for Ice Service Value Chain Management

In this case user trials have been arranged and the scientists will present the verification and validation results when available

4. The results from the verification and validation is discussed between the scientists and the ice service.

If agreed that the product is ready to enter the product portfolio as "operational" its status is changed.

The necessary steps are taken jointly between Research and Operations to ensure that the production process is operational and supported to the level decided for operational products.

5. New products

The verification and validation may give rise to changes of the product. Scientists may have new ideas fostered by the work; users may require a different product. The process then starts over.