AlgaePro BANOS

STATE-OF-THE ART REPORT ON ALGAE DATA AND TOOLS

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ABOUT THIS DOCUMENT

AUTHOR(S) AND ORGANISATION(S)	Tushi Agarwal, SUBMARINER Network Ferdinand Bulmer, SUBMARNER Network Stefan Jänicke, University of Southern Denmark Haidi Cecilie Petersen, University of Southern Denmark Tariq Yousef, University of Southern Denmark
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LIST OF ABBREVIATIONS

Abbreviation	Description
CA	Consortium Agreement
CDE	Communication, Dissemination and Exploitation
CO	Confidential
D	Deliverable
DEM	Demonstrator
DoA	Description of the Action
DoW	Description of Work
EAB	External Advisory Board
EB	Executive Board
EC	European Commission
EU	European Union
GA	Grant Agreement
IPR	Intellectual Property Rights
KER	Key Exploitable Result
M	Month
PC	Project Coordinator
PM	Project Manager
PSG	Project Steering Group
PO	Project Officer
PP	Project Partner
PU	Public
QC	Quality Control
SCA	Strategic Communication Action
SEN	Sensitive
SME	Small and Medium Enterprises
WP	Work Package
WPL	Work Package Leader
SCA	Strategic Communication Action

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EXECUTIVE SUMMARY

Digital tools are vital in the algae sector. The digital tools survey carried out under the AlgaeProBANOS project uncovered key insights into their adoption and impact and identified technology and data gaps. The methodology of the survey is outlined, and the profile of the respondents alongside limitations are discussed. Survey findings in relation to the usage among respondents of digital tools in areas including e-commerce, business intelligence, environmental and operational management, innovation, and quality assurance are presented, and technology and data gaps are identified. Recommendations are provided for digital tools development under the AlgaeProBANOS project.

1. Introduction

1.1 Significance of digital tools in the context of algae businesses

In a rapidly evolving world, digital tools have emerged as indispensable assets for businesses across various industries. In the context of algae businesses, these digital tools play a role in everything from the optimisation of the cultivation and processing of raw materials to the logistics and marketing of algae-based products. Digital tools empower algae businesses by facilitating precision farming, data-driven decision-making, and efficient resource management. They enable real-time monitoring and optimisation of growth conditions, and help in the processing of data of algae's biochemical composition. Algae are often produced far from markets, and digital platforms support and enhance market reach, connecting algae businesses with consumers, retailers, and buyers, for direct sale or processing of innovative and sustainable products. In a world where sustainability and efficiency are paramount, digital tools have unlocked new possibilities for optimising production and logistics, helping algae businesses, catalysing their growth while contributing to a greener, more sustainable future.

1.2. Objective and rationale of the survey

The AlgaeProBANOS project, which aims to accelerate algae product development in the Baltic and North Seas, includes a work package on Digitalisation and Tools, the objective of which is to deliver digital support tools that accelerate algae product development and market access, based on end-users' needs. Specifically, the project aims to implement a centralised backend for the integration of existing data resources and services, as well as a set of sophisticated tools and dashboards that make use of existing data and services, linking and extending these to support end-user needs that are not addressed by state-of-the-art tools. The needs will be matched with existing platforms and on-line data-sources to determine new development targets and specifications for business intelligence tools, putting emphasis on technology-gaps. In order to understand the current state-of-the-art and end user needs, the AlgaeProBANOS consortium designed and implemented an assessment of stakeholder needs on digital tools support. The survey and interview were designed to address the following objectives:

- To identify the existing digital tools and online data sources used by the algae industry
- To understand how these tools are used by the industry and the costs involved
- To assess which functionalities the tools provide, and which are missing for end users
- To identify technology gaps and what data sources/workflows are require digital support

Overall, the assessment aims to gain a thorough understanding of the state-of-the-art with regards to digital tools and resources as used by (i) AlgaeProBANOS pilots and (ii) the wider algae sector, thereby laying the groundwork for the development of new tools to comprehensively fill the technology gaps in business intelligence and knowledge sourcing for the EU algae industry.

2. Methodology

2.1 Survey design

The primary data collection tool for this assessment was an online questionnaire. The questionnaire sections were developed based on the identified objectives and the existing knowledge of the project partners. *Jotform*, an online survey platform, was used to conduct the survey since this permits multiple question and table types and conditional logic, while providing an easy-to-use interface for respondents. Survey questions consisted of a mixture of open-ended and closed-ended questions, in order to facilitate comparability of responses while also leaving space for respondents to offer their own suggestions, particularly with regards to yet-to-exist digital tools. Furthermore, the open-ended questions permitted the survey reviewers to identify respondents with the most relevant answers for conducting follow-up interviews. The questions were

divided into sections, relating principally to different types of digital tools, allowing respondents with no need or knowledge of certain tool types to skip those sections. Respondents were able to answer anonymously if they wished, but were also invited to provide their contact details in order that a follow-up interview could be organised if appropriate, and survey results could be shared.

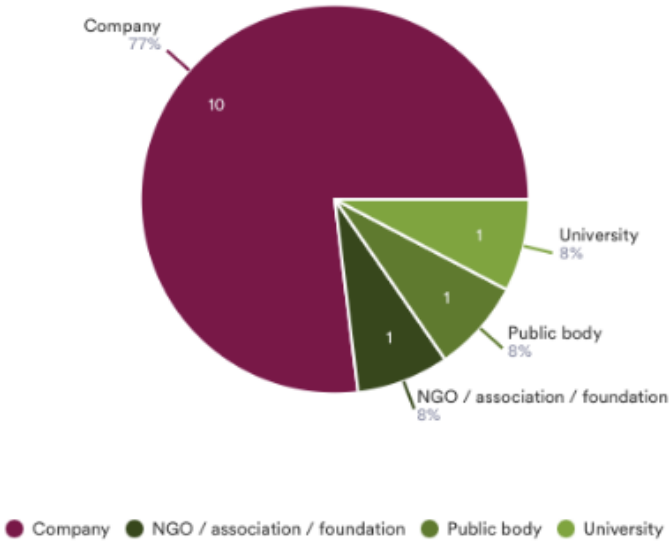
A pilot version of the survey was conducted with selected project partners to evaluate the clarity, relevance and completeness of the survey questions, and to maximise utility of the data collected while minimising the time required to complete the survey. Adjustments and refinements were made based on the feedback received, and the full survey was made available to external parties for a period of three weeks during August-September 2023. Project and partner social media channels and e-mail newsletters were made use of to attract respondents to the survey.

Following the closure of the survey, selected respondents were contacted for a short follow-up interview lasting 30 to 45 minutes, the main focus of which was the technology and data gaps identified. Each interviewee was asked a range of standard questions together with some specific questions which were developed in response to their answers in the online survey. The interviews were carried out by computer science experts who will be tasked with developing the new tools under the framework of the AlgaeProBANOS project. Interviews were recorded with participants' permission to facilitate analysis of answers.

2.2 Profile of the respondents

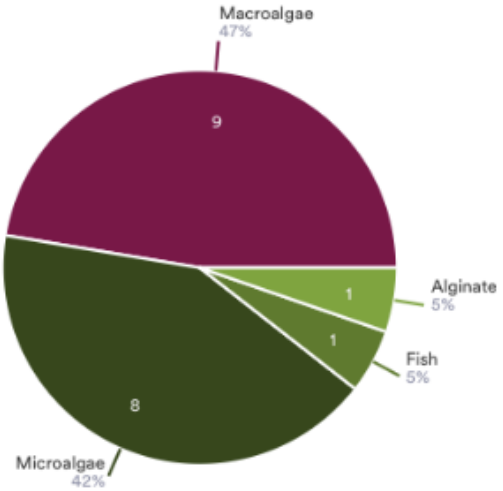
A total of 13 survey responses were collected. This included 8 female respondents and 5 male respondents. The majority of respondents were based at companies, with one respondent each coming from a university, a public body and an NGO/association/foundation.

FIGURE 1 TYPE OF ORGANISATION



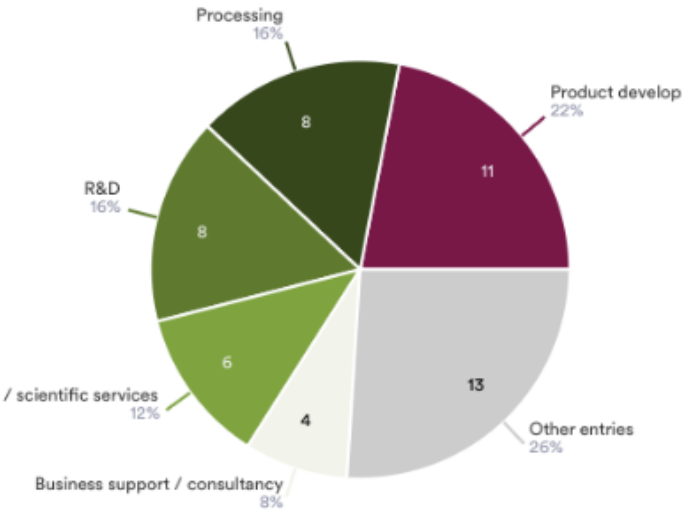
With regards to organisation size, nearly half of the respondents were based at organisations with less than five employees. Only two of the respondents were based at organisations with more than 50 employees. In terms of the main raw materials used by companies, both microalgae and macroalgae were well represented among respondents, with eight and nine organisations respectively, with alginate and fish being less represented, with one company each.

FIGURE 2 MAIN RAW MATERIALS OF THE ORGANISATION



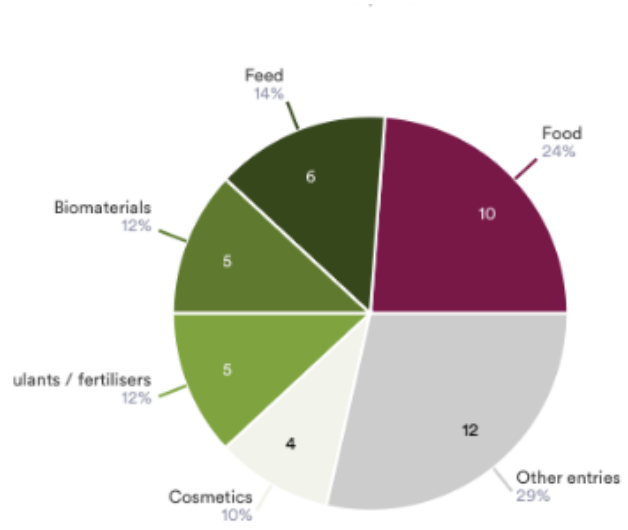
Respondents represented a range of business areas with product development being the most frequent, followed by processing and R&D (see figure 3).

FIGURE 3 MAIN AREA OF THE BUSINESS



Similarly, a variety of product sectors were represented, with food and feed being the most common (see figure 4).

FIGURE 4 PRODUCT SECTORS OF THE ORGANISATION



Six of the thirteen respondents, and all of the five interviewees, represented AlgaeProBANOS pilots.

2.3 Limitations and biases

The survey conducted to assess digital tool usage in the algae industry yielded a valuable dataset. However, it is imperative to acknowledge the inherent limitations and biases stemming from the small sample size of 13 respondents. While the insights obtained from these responses are valuable, their generalisability and the robustness of the findings are restricted by the limited sample size which may not represent the algae industry as a whole.

AlgaeProBANOS pilots are well represented in the sample, and it should therefore be emphasised that the survey results will be highly applicable to this group. Overall, while the small sample size and associated biases make it challenging to generalise the findings to the broader algae industry, the AlgaeProBANOS pilots are fully represented in the results and findings taken from respondent interviews offers more in-depth qualitative information to meet the objectives of the assessment.

3. Survey results

3.1 Overview of the survey

In the online survey, respondents were asked about their knowledge and use of seven types of digital tools, namely (1) e-commerce tools, (2) business intelligence tools, (3) environmental management tools, (4) innovation management tools, (5) operational management tools, (6) quality assurance tools and (7) techno-economic optimisation tools. The questions were specifically asked to understand the current engagement of respoendents with the tools and their level of interest in adopting tools they don't currently use. Additionally, the survey enquired about the budget that the organisations spend on these digital tools. We see that this expense can range from €500 - €5000 per tool category, depending on the size of the organisation, the tools in use and the number of platforms which the organisations use.

Regarding the preferred version of digital tools which they would like to use, the majority of the respondents selected a web browser based application as their top choice, followed by a desktop app. Only in the case of operational management tools, did a mobile application receive equal preference to a desktop app. In the case of all other tools, web browser and desktop app based software was preferred over mobile applications.

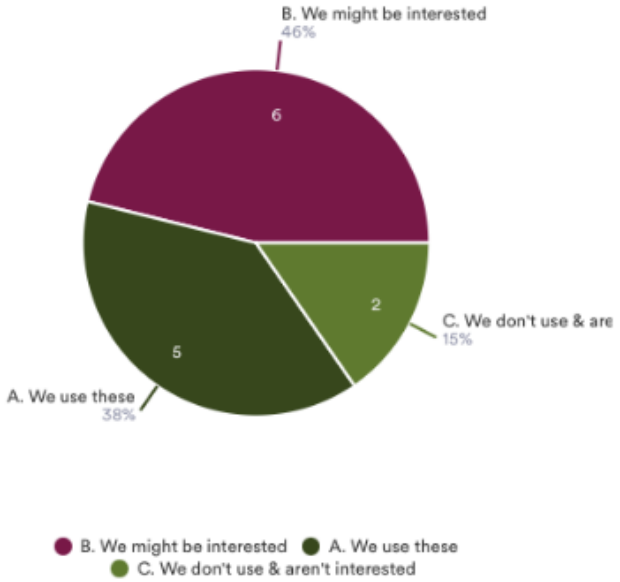
When asked about the language of the tool interface, in all categories, the majority of respondents answered that they didn't feel it was important to have the tool in languages other than in English.

3.2 E-commerce tools

This section of the survey was targeted at understanding the familiarity and interest of the respondents in e-commerce tools. E-commerce tools can assist businesses and organisations in fast-tracking their products' reach and delivery, in addition to supporting algae-based solutions and knowledge sharing. The survey further tries to analyse the perception of e-commerce tools and their role in organisations' functions.

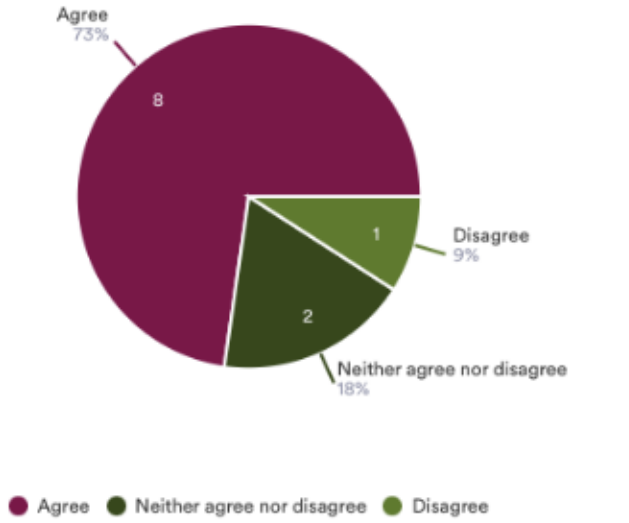
The survey results show that of the 13 respondents, five use the tools, six were interested in them and the remaining two neither used the tools nor were interested.

FIGURE 5 E-COMMERCE PLATFORMS/TOOLS



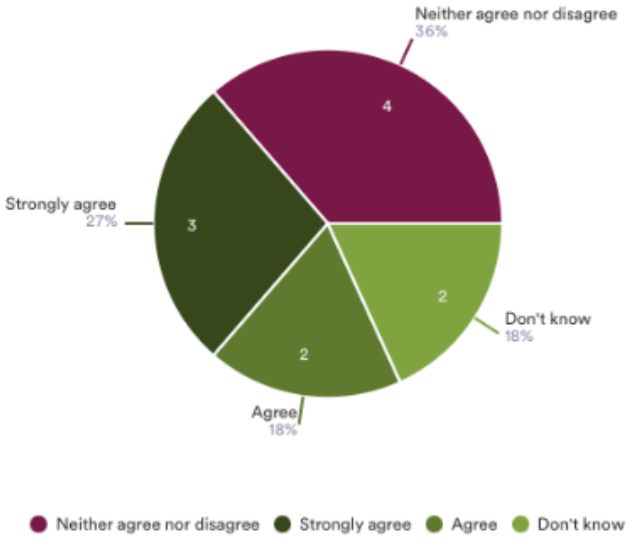
Five organisations acknowledged that they are familiar with certain e-commerce tools and mainly use them for B2C sales and exports. However, even amongst these respondents, only three mention using the e-commerce platforms actively, while others know of some tools but do not use them. Of 11 respondents, 6 admitted to engaging with e-commerce tools for their business; 2 each as a buyer, a seller, or as both. The responses regarding the engagement of the companies with e-commerce tools reflect that these tools are not very popular amongst the organisations for day-to-day functions. However, eight out of eleven respondents agreed that e-commerce platforms can be used to actively facilitate networking and collaboration amongst algae businesses and suppliers within the industry.

FIGURE 6 TO WHAT EXTENT DO YOU AGREE WITH THE FOLLOWING STATEMENT? "E-COMMERCE PLATFORMS FACILITATE NETWORKING AND COLLABORATION AMONG ALGAE BUSINESSES, SUPPLIERS, AND DISTRIBUTORS WITHIN THE INDUSTRY"



Furthermore, 45% of the respondents collectively agree that e-commerce can play a critical role in their company's growth strategy while the other 36% and 18% respondents neither agreed nor disagreed or didn't know about this, respectively.

FIGURE 7 TO WHAT EXTENT DO YOU AGREE WITH THE FOLLOWING STATEMENT? "E-COMMERCE IS A PART OF MY COMPANY'S'S GROWTH STRATEGY"



Sales – B2C and research were the most popular uses of the e-commerce platforms. Businesses use platforms such as amazon.com, shopify.com, ebay.com amongst others for sales. Additionally, other platforms in use were LinkedIn and Asana for market research and management. These e-commerce platforms are used primarily on a weekly or a daily basis.

When asked about what the respondents would like to see in an e-commerce platform, they pointed to a market place and a platform which would give information.

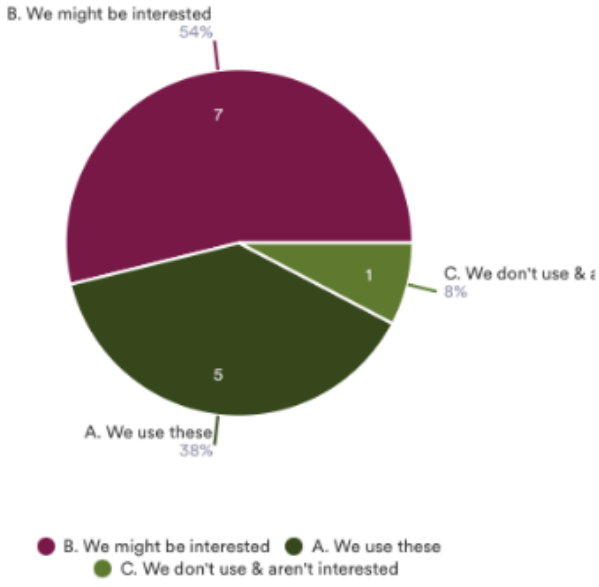
"A B2B market place, e.g. a small commodity exchange"

3.3 Business intelligence tools

Business intelligence tools can be extremely useful for understanding markets, intelligence in topics of interest and regulation research. They can help to streamline and standardise business processes, thus optimising the work. This section of the survey was used to understand the awareness and popularity of business intelligence tools amongst organisations in this sector.

From the 13 respondents of the survey, five use certain business intelligence tools and seven said they would be interested in the tools.

FIGURE 8 BUSINESS TOOLS



From the respondents who have been using business tools, most of them use it for market intelligence sales and purchases. Science Direct, Bloomberg, Reuter, Funnel and SPINS are some of the tools which the respondents mentioned. Compared to the e-commerce tools, business intelligence tools are used less frequently; weekly or monthly.

One respondent also pointed out the expensive nature of these tools to be used, which eventually reduces accessibility of these tools. Respondents highlighted how they would like the tool to provide a regulatory research integration platform with real-time updates, data visualisation, etc. Additionally, the development in AI was addressed by another respondent. Thus, AI and other technologies could be used to provide and meet the expectations from such tools.

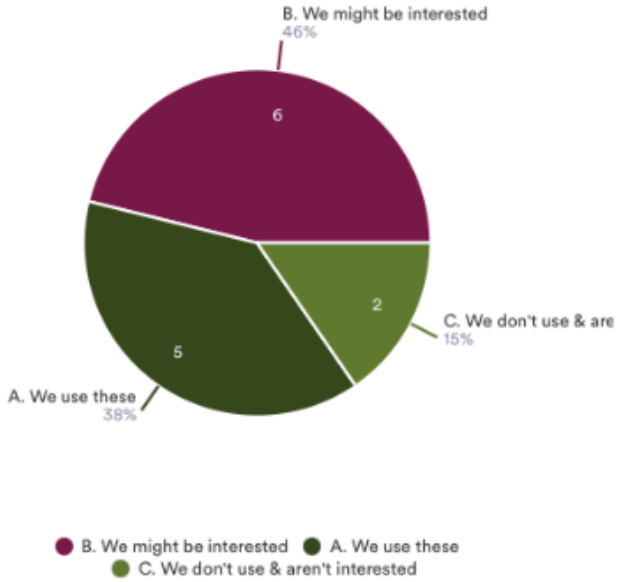
"AI could be a game changer"

3.4 Environmental management tools

Environmental management tools help with environmental monitoring, hazard and impact assessment, etc. Adopting these into use can help businesses assess their strategies in terms of environmental impact, mainly based on large scale scientific evidence and analyses.

In our survey, of the 13 respondents, five use such environmental monitoring tools, six said that they would be interested and the remaining two neither use such tools nor would be interested in them.

FIGURE 9 ENVIRONMENTAL MANAGEMENT TOOLS



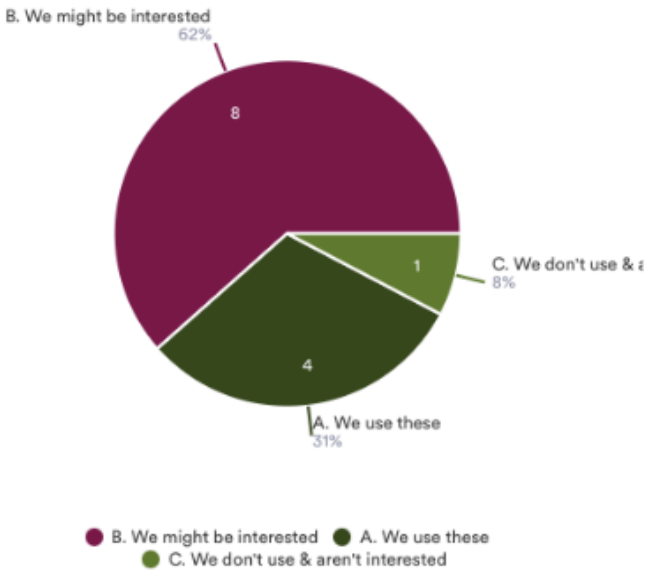
The primary use of these tools, as stated by the respondents, is environmental monitoring, followed by other applications such as risk assessment, risk mitigation, and resource optimisation. Some of the tools mentioned by the respondents are vesi.fi, Tarkka and Sargassum monitoring, among others. Since the role of environmental monitoring tools can differ based on the data and the use, the frequency to use them differs widely from daily to monthly.

3.5 Innovation management tools

Innovation management tools provide a structure to the ideation process in organisations, from concept formulation in the initial days to final implementation and monitoring. This section of the survey was designed to understand how our respondents viewed these tools and assess the desirability of organisations to adopt such tools.

Innovation management tools were among the most popular of all the categories of tools mentioned in the survey. From all of the survey respondents, four of them use these tools, while eight of them would be interested in them.

FIGURE 10 INNOVATION MANAGEMENT TOOLS



The respondents pointed out that they primarily use these tools for idea capturing, and for selecting ideas, collaborating, etc. Some of the softwares mentioned for innovation management are Microsoft packages, IdeaScale and ViiMa. Like the environmental management tools, the purpose of these innovation management tools differs across platforms and thus, the frequency of use differs; from daily to monthly.

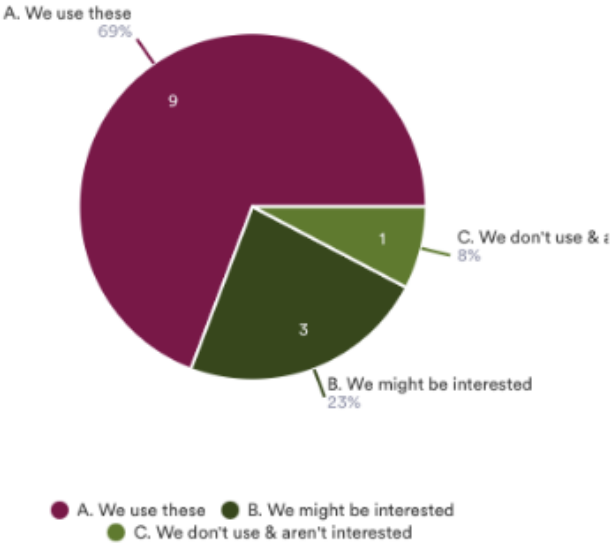
In terms of expectations from innovation management tools, respondents answered that they would expect such tools to be easy to use and have the functionality of version control. Other ideas for the tools included being a networking platform with a Q&A forum, information about other companies, newsletters and case studies, etc.

3.6 Operational management tools

Companies can use certain operation management tools for workflow management, task organisation, and much more. This section of the survey asked questions about such tools being used by organisations, to understand how the organisations function and organise tasks.

From the responses, we understand that this category of digital tools is amongst the most widely used. Of the 13 respondents, operational management tools are used by nine of them. Three others mentioned that they would be interested in them.

FIGURE 11 OPERATIONAL MANAGEMENT TOOLS

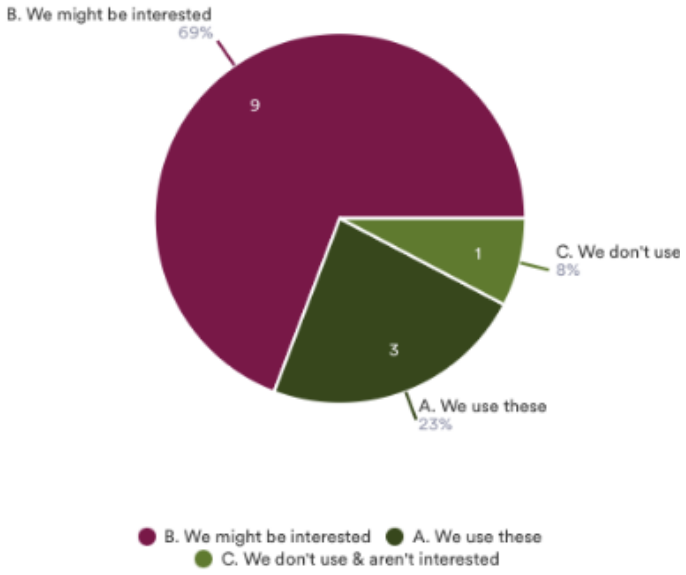


Organisations largely use these tools for workflow, task and project management. Some of the tools which the respondents use are Microsoft Teams, Monday.com, Craftnote, and Clickup. Operational management tools are the most frequently used tools as they deal with everyday functioning and organisational tasks.

3.7 Quality assurance tools

To maintain monitoring and evaluation, managing inspections and quality control, quality assurance tools can be of much assistance. This part of the survey analyses the use of quality assurance tools amongst organisations. From all of the digital tools, this was the category of tools which the respondents were most interested in, despite a low level of use currently. Three of the respondents use certain quality assurance tools in their businesses while nine answered that they would be interested in using them.

FIGURE 12 QUALITY ASSURANCE TOOLS



Corrective and preventive action and maintaining standard operating procedures (SoPs) were among some of the uses mentioned by the respondents who use the tools. Similar to some of the previously mentioned tools, since the use of these tools is very diverse, the frequency of their use also varies across platforms.

Similar to the expectations of innovation management tools, respondents expect quality assurance tools to be collaborative and informative.

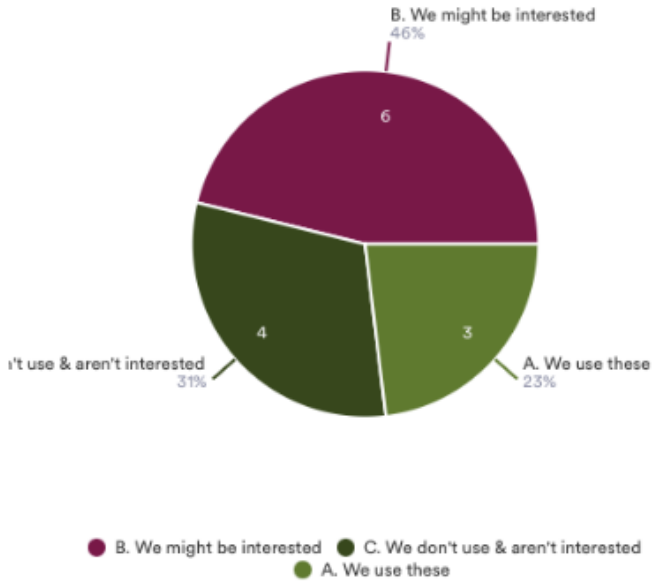
"Easy to work in collaboration with other colleagues, especially when it comes to updating information"

3.8 Techno – economic optimisation tools

Techno-economic tools can be very useful to facilitate simulations, replicating symbiosis, and much more. This section of the survey analyses the usage and interest among respondents toward such techno-economic optimisation tools.

Of the survey respondents, three mention that they use such tools, while six show some interest in them. Four respondents neither use nor were interested in any of the techno-economic optimisation tools.

FIGURE 13 TECHNO-ECONOMIC OPTIMISATION TOOLS



The users of such tools either use their own internally designed tools or other softwares such as CAD/CAM.

3.9 Data gaps

Survey respondents were asked about data gaps for the algae industry, and identified quality criteria as the most significant priority in knowledge needs on biomass production and uses, with ten respondents mentioning this as important. Food safety was also a priority, with eight of the thirteen respondents mentioning this as lacking in the necessary data, followed by new species and local species profiles, with seven mentioning this as a priority.

With regards to biomass production data, information on genetics and biomass was seen as the main knowledge gap by five respondents, with four each mentioning reporting standardisation on biomass

metrics and on cultivation methods being among the main knowledge gaps.

Data confidentiality was seen by the survey respondents as a major constraint, with six out of thirteen seeing it as among the main constraints to data reporting.

"With an easy tool, that professionals know about, it should become common practice to make data reports."

3.10 Technology gaps

While the questionnaire did not yield a large amount of information on perceived technology gaps, this was the principal focus of the interviews. Creation of a digital twin and virtual chatbot were elements raised, which were discussed during the interviews. The recommendations based on the identified technology gaps are explained in more detail in the following section.

4. Conclusion and recommendations for the AlgaeProBANOS project

Based on the results of the survey, there is a diversity in current digital tools usage among the respondents, with some using very few digital tools and others using a wide variety. However, among those who do not use certain categories of tools, there is in most cases an interest in their potential.

In light of the insights gathered from the survey and interviews, we would provide the following recommendations with the goal of creating a comprehensive digital ecosystem that addresses the needs and challenges of the algae production community.

Enhanced Sourcing Solution: Creating an advanced sourcing tool that provides comprehensive access to seaweed and various algae resources, such as farming, cultivation, harvesting, etc. Include detailed information about the history of harvest actions and cultivation practices. This aligns with the upcoming implementation of the Algae Farming dashboard in task T4.6. This tool should act as a bridge between resource availability and the requirements of the algae production companies, making sourcing more efficient and informed.

Product Catalogue: Establishing a comprehensive product catalogue that showcases offerings available in the algae market. This catalogue should provide detailed information about products, their producers, pricing, and relevant specifications. This initiative corresponds with the forthcoming implementation of the Algae Products dashboard during T4.7.

Networking Tool for Stakeholder Collaboration: Developing a networking tool that facilitates connections and collaborations among stakeholders in the algae sector. This tool should allow stakeholders with resources to connect with those in need, such as those with stocks to sell, biological materials, available equipment, or specialised services. Notably, the interviews revealed a high demand for such a networking tool, which is being implemented under WP8.

Algae Species Centre: Creating an Algae Species Centre to offer in-depth insights into how seaweed extracts and compounds can be applied across different industries, including food, medical applications, and dietary supplements. Ensure that this centre also includes information about certifications and biological control. Collaborate closely with seaweed producers to keep this resource up-to-date and valuable.

Support for Research Collaboration: Promoting collaboration with research projects that involve seaweed and algae. Establish a Research Hub where stakeholders can share research findings and insights. This platform should facilitate knowledge exchange and collaboration, encouraging innovation within the community.

Integration of a Digital Twin: Exploring the feasibility of integrating a digital twin technology to assist in optimising algae processing, enhancing operational efficiency, and improving resource management.

Implementing a Chatbot for Quick Assistance: Incorporating a chatbot feature trained on community-provided data to provide prompt responses to user inquiries and enhance the user experience.

These recommendations provide the basis for the forthcoming work under the AlgaeProBANOS project to develop digital tools which will serve the evolving needs of the European algae industry and support its continued growth.