

TAP.IT

«Tap.IT» is a sensor-solution that leverages new technology (Embedded Machine Learning) in order to mitigate issues related to food-safety and quality in the food service industry (Horeca). Our ambition is to become a global provider of insight related to the production and distribution of wine and beer by providing a solution that enables more data-driven decision-making for the global brewery-industry. Data from «Tap.IT» will facilitate more transparency through the value-chain (brewery distributor end-user), where we will generate customer-value by providing more predictable operations by using real-time consumption-data in operations related to planning of production and maintenance.

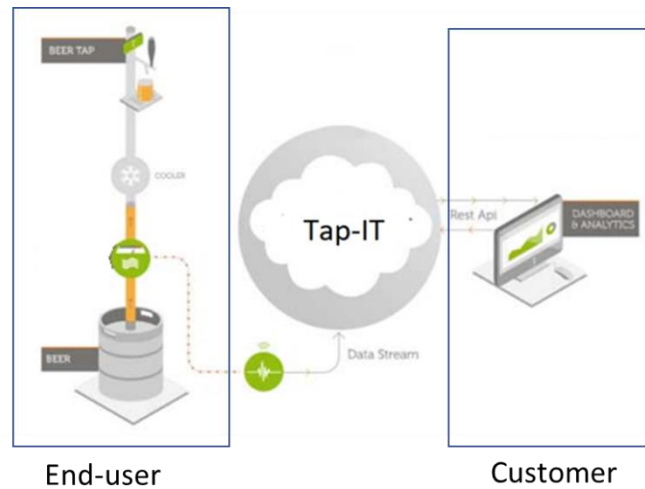


FIGURE 1 - CONCEPT-FIGURE "TAP.IT"

Our product-solution proposition is based on in-depth knowledge of the industry through years of working as a supplier of bar-equipment and running a bar. Through our network we have performed several in-depth interviews of potential customers in order to gain more insight about the nature of the problems that needs solving. From the customer-dialogue the project-team have identified issues food-safety and product-quality due to the lack of maintenance of tap (draft) equipment. In combination with “state-of-the-art” knowledge about micro-controller units (MCUs) and Machine Learning the project team is confident in providing the customer a cost-effective solution that will generate value from day one.

During the project period the focus will be on industrialization the sensor-solution in collaboration with partners and establish a beachhead-market in the craft-beer brewery (small and mid-range breweries)-segment through extensive testing with pilot-customers (attachment - letters of intent) we hope to prove a marked-product fit.

1. RESEARCH AND INNOVATION

RESEARCH AND/OR KNOWLEDGE

The core team has several years of industry knowledge and are currently studying in the field of entrepreneurship and innovation at BI Norwegian Business School. Simon R. Larsen has previously started and operated a number of Horeca companies. Together, Simon and Petter has started The Tap Company AS, which supplies draft beer-equipment to the brewery and the Horeca industry, where they have gained insight into the needs of the industry which has provided the basis for Tap.IT. In the operation of The Tap Company AS, they have daily contact with several players in the industry, especially with breweries and restaurants. The project group have had this contact since 2016. During this period, they have sold manual metering systems and often heard customers express that a digitalisation is needed here. During their studies with tasks from reality in core subjects such as Marketing Management, methodology and market insight, growth strategy for start-ups and start-ups, they have immersed themselves into the brewery industry.

The enabling technology was developed by the technical team that has worked with Embedded Machine Learning (EmML) in process technology. Balder Klanderud writes about EmML and is working experimentally to develop microprocessor sensor processing technology (MEMS) under the guidance of Odd-Ivar Lekang. Balder studies Mechanical engineering and process technology where process improvement in combination with data science has been a focus area as greater knowledge of Industry 4.0 has been a key motivator during his studies.

This project is based on the knowledge that process technology and the sensor group at NMBU have acquired and added to the teaching at NMBU where the technical team has taken their own specialization courses where the development of this concept was the focus. Central to this project is Dr. Odd-Ivar Lekang's professional contribution in process technology and experience from the food industry. He is the main supervisor for Balder's master thesis where method development for EmML in air quality sensors is application.

Through the academic studies, the project group has developed an early acting "MVP" (TRL level 4) which will continue. In the next step of the project, a longer test will be conducted where the goal is to develop an industrial version, where the sensor system is ready for several pilot tests with demanding customers during demanding periods.

In order to commercialize the project, the team has been expanded with students who have experience in technical product development.

LEVEL OF INNOVATION

Tap.IT group has together developed a model for predictive maintenance (Remaining Useful Life (RUL)) based on several years of industry experience and dialogue with customers. This model enables several needs to be addressed through a smart approach to maintenance. The needs of the project group have been identified are:

- Service and maintenance management.
- Logistics
- Waste and loss of product
- Regulatory framework and reporting.

Service and maintenance: Today, it is done as a result of issues with the equipment being discovered by staff and this is usually discovered during serving, which leads to a lot of waste and lost turnover as the tapping systems often stand useless until technicians arrive. However, there may be several days between the failure occurring and being detected.

The most common maintenance problems for customers of the breweries are, refrigeration unit failure; loss of cooling capacity leads to higher temperature of the beer and hence the beer releases more CO₂, this often leads to excessive foam production and beer which is impossible to drain without large amounts of waste.

Poor or deficient cleaning; Clean at the right time is a success factor in serving good and tasty beers. Unfortunately, cleaning the drainage systems causes some waste of beer, as you must drain the remaining beer from the lines to flush through with detergent. Today, tapping facilities are cleaned at scheduled intervals and often well in advance before this is needed. This means that the restaurants have more waste of draft beer than is necessary.



FIGURE 2 TYPICAL LINES AFTER A MONTH OF USE AND AFTER CLEANING

Logistics: Logistics and production planning are an important part of operations for breweries. As a brewery, one must depend on having goods in stock when customers request it, while beer is a fresh product that can withstand storage. Today, most breweries in Norway sell their beer through Asko, Vectura and Vinhuset (wholesaler). The wholesaler dispatches goods to bars and restaurants after ordering, leaving any goods that are not stocked. When the wholesalers are empty of goods, they place an order for new goods from the breweries, which then hopefully have goods in their warehouse. By using information from our system, the breweries will be able to keep track of how much beer

they have in the market, read out in the restaurant. One brewery that has their product lines connected to TAP-IT will be able to know not only the wholesaler's inventory, but also how much goods they have at the restaurants. Through this insight, they will be able to plan their production and logistics to a greater extent in order to minimize storage time and lost sales.

Waste: It is a known case that there is a lot of wastage in the HORECA market in the form of theft of alcohol by employees. With TAP-IT we will give the restaurant manager / owner direct access to the counting systems mounted on the tapping systems. For the purpose of detecting unregistered waste.

After several years of industry experience and dialogue with customers, the project team has discovered a number of needs that the entire value chain wants to solve. This forms the background for TAP-IT, which is to provide a low-threshold way for the food industry, in particular the brewery industry to drive process improvement, through:

- Data-driven maintenance for the entire value chain
 - Associated unforeseen maintenance jobs. The restaurants and breweries will significantly reduce the costs associated with the cleaning of beer lines (7L beer / 100m beer line is wasted, in a standard 5-line plant it is usually more than 100m) as a result of using TAP-IT sensors to optimize cleaning cycles. Figures from customers show that this results in a loss of goods of NOK 525 per purge.
 - Digital Maintenance Assistant - Predictive maintenance for customers who come up with suggestions for performing cleaning that is made visible to the breweries so that they can also have an overview. (Breweries often offer a price reduction on their products if the restaurant cleans itself monthly, there is currently no system that captures or guarantees that cleaning is performed as agreed.)
 - "Clean yourself" or "order clean"
 - Provides a time of cleansing based on historical data when it is most appropriate.
- Ensures product quality
 - Strengthen food safety for end-user and brewery.
 - Reduces wastage and expenses associated with poorly maintained equipment.
- Supports production planning.
 - Digital and interactive point of contact between restaurant and brewery.
 - Ordering service and or spare parts directly in the user interface - here the breweries save time that they would otherwise have used to further communicate the need for service partners.

The purpose of TAP-IT is to contribute with insight and better decision-making for the value chain. TAP-IT's approach to addressing this need is a two-part solution

1. «TAP.IO»– Intelligent module that collects key process data from the customer that can be retrofitted to the tap or integrated into new ones. In the module, we will implement a maintenance model based on measured parameters online.
2. «TAP.MAP» - an API that provides a graphical representation of information for the customer

TAP-IT alerts the bartender when the barrel is too hot or when the line pressure is too high. It also shows how much is left in each barrel and when the tap is empty, allowing the bartender to take immediate action.

2 IMPACTS AND OUTCOMES

MARKET INSIGHT AND AREAS OF APPLICATION

The global beverage market is estimated at \$ 1860 billion by 2024, with the global alcoholic beverage market valued at \$ 1439 billion in 2017, and is expected to reach \$ 1,684 billion by 2025. This continuous growth and growing need has given rise to a huge development in technology which intends to support suppliers to meet this demand county providing an enhanced user experience. Companies in the food and beverage industry face unique challenges as they often experience harsh production environments and stringent regulatory requirements. The Internet of Things (IoT) helps food and beverage companies gain greater visibility over their manufacturing, production and transportation processes to offer higher quality products to end consumers while operating efficiently and staying in compliance with government. The market that focuses on traceability for manufacturing in the food industry was valued at \$ 4.08 billion in 2017 in market revenue and is expected to reach \$ 8.43 billion by 2025. The food and beverage industry (F&B) is not exactly what one would call an early adopter of technology, and complicated supply chains, a large number of stakeholders from completely different businesses, heavy regulation and a wide range of products have all contributed to the sector's digital drought. However, the Industrial Internet of Things (IIoT) offers a "cocktail" of automation, openness, traceability and higher productivity. After several years of industry experience and dialogue with customers, the project team has discovered a number of needs that the entire value chain wants to solve.

The market we envision is spread across various different segments of the food industry, but as a limitation, the project group focuses on the brewery industry. The supply chain in this industry consists of

- Brewery (Ringnes, Aass, etc)
- Wholesaler (Asko, Vinhuset etc)
- Customer (restaurant owner, bar owner etc) serving the end user.

This forms the basis for further market estimates and mapping needs as well as the background for TAP-IT, which is to provide a low-threshold way for the food industry to drive process improvement:

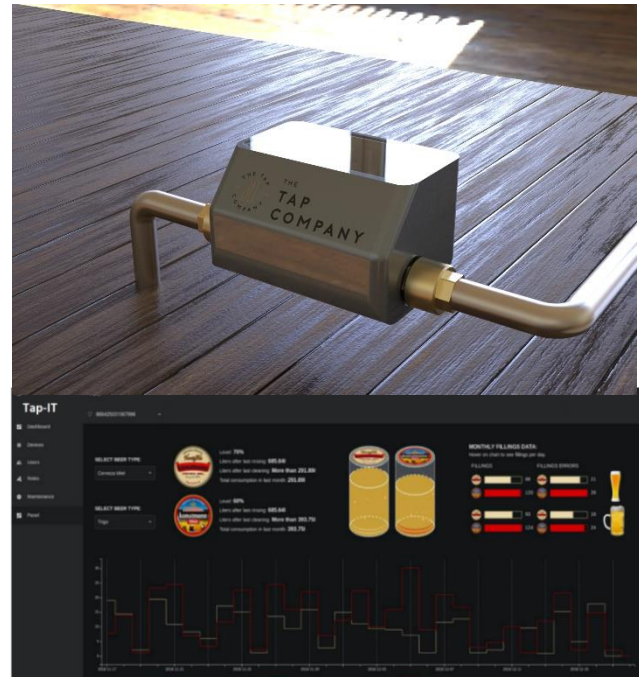
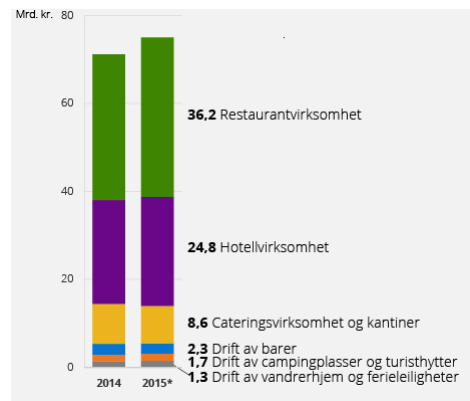


FIGURE 3 THE TAP.IO MODULE AND THE ADMINSTRATIVE INTERFACE IN THE TAP.MAP

Market Overview – In Norway, there are 14 648 companies in the hospitality and catering business that have the following distribution. In Norway, there are approximately 7500 permits for serving alcohol. If we say that there are a 5 taplines in 5000 of these places then this amounts to a monthly waste of about 35,000L beer and a loss which will be about 2.6 MNOK per month. In addition, there is around 52 microbreweries in Norway¹ that will be our beachhead market in the brewery market.



FIGUR 1 NATIONAL OVERVIEW OF MARKET BASIS

¹ <https://www.magma.no/norske-mikrobryggeriers-lonnsomhet>

Competitor analysis - There are several players working on IIoT solutions aimed at breweries, but they mainly focus on developing intelligent tapping towers. These actors have met the project group at various trade fairs. Pubinno is one such system where each crane costs \$ 35 (£ 27) a month. They are currently in 30 ++ bars and breweries in the US and Europe using this system.

Cambridge scientific Beersaver6 is also a solution, but focuses on biofilm removal in the pipelines that reduce maintenance, but does not give the user insight into when maintenance is needed.

USBeersaver is a bar management system that measures sales against actual consumption. The system costs \$ 50 a month. A similar concept as USbeersaver is BruVe, and Kegbot but which focuses on traceability and non-conformity detection.

There are several players working on the private market and home brewing segment such as Binary Beer, Plaato etc but they focus on optimizing production for the enthusiast market. Overall, there are solutions out there that solve the individual needs that the project group has mapped. Some solutions are better than others, but it lacks a simple approach that addresses several of the key needs that connect traceability to maintenance. That's what we're going to do through Tap-IT and thus make it easier for the industry to implement improvements and thus offer a more complete system than the existing solutions offers.



FIGURE 4 OVERVIEW OF EXCISTING SOLUTIONS

STRATEGY FOR REALIZATION

The objective of the project period is illustrated in the gantry chart and can be summarized as follows:

- Develop a production ready prototype with third party
- Developer API and software.
 - Minimum solution focusing on key functionality.
- Development of a test system that makes it possible to
 - Train model based on the test system data.
 - Conduct an up-scaled demonstration of the Tap-IT system where we invite relevant stakeholders to be observers and who represent key player from within the brewery industry or have a leadership role eg LO food and drink to inform about Tap-IT.

Based on the initial tests and the development work done in 2019-2020, Tap-IT has received a letter of intent with "Anheuser-Bush InBev (Bud) on a further collaboration based on the results of the Stud-ENT project. Furthermore, we will also collaborate with bars and restaurants that will provide input to the system during development. In addition we have received oral confirmation of intent, but the goal is to get this in writing during the project.

POSITION I VALUECHAIN - At each tier in the value chain there will be a supplier that assists the respective parts of the value chain with services and supplies of equipment. Our position in the value chain will be sales to a supplier that serves the breweries and the end user, enabling a scalable business model that strengthens the partner's position in the value chain.

BUSINESS MODEL - Tap-IT focuses on the B2B segment. TAP-IT's business model will be based on the main segments of the value chain: the breweries and the wholesaler

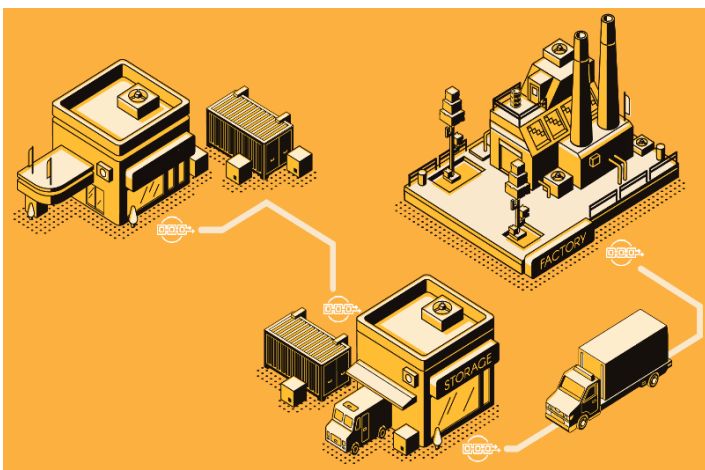


FIGURE 5 TAP-IT VALUECHAIN: BREWERY, SUPPLIER AND CUSTOMER

Investment required in the Tap-IT system will be 3000 NOK (ex MVA) pr unit. Upon installation, the customer will have several subscriptions to choose from that will help generate a cash flow to Tap-IT and connect various services from our supplier to the customer.

For Breweries:
Subscription – 10 000-100 000 NOK per month. <ul style="list-style-type: none"> • User insights trough Tap-MAP. • Overview of the installed equipment
For wholesale supplier
Subscription – 200 000 NOK per month <ul style="list-style-type: none"> • Direct contact to customer and breweries
For customer:
Subscription 1 – 150 NOK per month <ul style="list-style-type: none"> • Access to analytics module <ul style="list-style-type: none"> ○ Consume overview
Subscription 2 – 450 NOK i per month <ul style="list-style-type: none"> • Access to analytics module • Predicative maintenance
Subscription 3 – 1050 NOK per month <ul style="list-style-type: none"> • Access to analytics module • Predicative maintenance • Maintenance service • Orders system connected to the supplier

The total market potential is approximately NOK 60 million with an annual potential cash flow of NOK 19 million. This is the starting point for demonstrating "added business value" for the entire value chain. Securing the national market and working with small scale breweries will provide a bridgehead for further growth. This will be done through our collaboration with Anheuser-Bush InBev, which has an annual turnover of around NOK 500 billion on an international basis. The goal is through efficient distribution, so we aim at a market that is approximately 1.5-2 billion NOK after the securing the beachhead market.

CONDITIONS AND RIGHTS

Pouring times are strictly regulated throughout Skjenkelovens paragraf: § 4-4. Tidsinnskrenkninger for skjenking av alkoholholdige drikker. Each municipality is responsible for complying with the law and the

municipality has again given this responsibility to the holder of the individual grant. However, it is difficult and costly for the municipalities to ensure that this law is maintained to punk and dot. TAP-IT will make it possible to control the times when the tapping equipment can be used which in turn will enable automatic reporting.

SWOT analysis for the project - In order to obtain an overview of the assumptions that facilitate Tap-IT, we have conducted a SWOT analysis to provide an overview of the assumptions that must form the basis for successful commercialization and identify possible pitfalls in advance of the project.

Strengths– strong market insights and an interdisciplinary project group.

- The team is competent and has sales experience from the industry.
- The core team consists of expertise in Electronics, Economics, Innovation, Entrepreneurship, Programming. Complementary expertise and equipment can be found at the innovation lab “Eik idea workshop”.
- Short way from demonstration to pilot.
- Good dialogue with potential partners.
- Based on mature technology.
- Intent agreement with key players ensures sales on a completed Student project.
- Flexible team with the ability to quickly introduce changes based on demand from the market.

Weakness – Detailed market overview

- No detailed national and international market estimate, this is something Tap-IT will work with before and at the beginning of the project period.

Opportunities -

- Increased competition throughout in the value chain.
- The value chain is looking a way to digitalize their operations.
- More focus on product quality
- Tap.IT is built with ease of implementation in mind.

Threats – small business

- Tap-IT is a small company that does not have an established brand name. Migrated through collaboration with established key players.
- Weak IP on the hardware itself, but the training data and model will be protected through an encrypted EmML algorithm that is Tap-IT's trade secret.

SOCIAL BENEFIT AND SUSTAINABILITY

Tap-IT works to follow the guidelines as defined by the UN in the Global Compact and in the Guiding Principles and by the OECD in the Guidelines for Responsible Business. Furthermore, a fully developed system will contribute to the UN's sustainability goals through innovation. In addition we work for reducing the waste and increase the hygiene in this market.

3. IMPLEMENTATION

Project plan- As Tap-IT currently has an MVP and has received letters of intent from key players in the value chain, the project launch process in August will continue in order to reveal technical problems and completion of test rigs for long-term testing in order to reduce overall risks in the project. The time has been chosen as the core team can start focusing on completion and technical concept as it has been long-term tested during the summer holidays – a period with high demand.

Milestones and activities		2020 - 2021											
		A	S	O	N	D	J	F	M	A	M	J	J
M1	Market-, user-, IPR and partner analysis												
A1.1	Mapping of the market potential (national and international)												
A1.2	IPR-analysis – Freedom To Operate												
A1.4	In depth stakeholder analysis – identify synergy effects between partners.												
M2	Technology demonstration												
A2.1	Development of IO module – Dynamic Precision AS												
A2.2	Test production of IO module - Dynamic Precision AS												
A2.3	Installation in the NMBU test rig												
A2.4	Software development of MVP – database and Rest-API												
A2.5	Data collection												
A2.6	Data analysis and preliminary model validation												
M3	Business development												
A3.1	Business model												
A3.2	Product and price strategy												
A3.3	Preliminary sales												
M4	Network and financing												
A4.1	Dialogue with investors												
A4.2	Participation on Investment seminars												
A4.3	Incubator membership												
M5	Pilot start												
A5.1	IO v2.0 development based on results from testing												
A5.2	Production of IO modules for pilot												
A5.4	Data analysis and presentation for partners												

Financing before and after the STUD-ENT project period:

Before the project period, available, facilities, equipment and personnel from Eik Idea Workshop and through master's theses are used. In addition, the core team partially funds the project using their own time. During the project period, a key milestone in creating investor relations.

As the goal of the student project is to trigger a pilot collaboration that can lead to innovation contracts and direct sales with several players in the value chain to cover parts of the upscaling after the project period

MANAGEMENT, TEAM AND EXPERTISE

Project team

Name	Role	Percentage
Petter Hagberg	CEO	100%
Balder Grenness Klanderud	Project manager - Embedded Developer	80%
Simon Rohde Larsen	COO	100%

Studentteam

Oliver Alexander Nordtveit Orefellen	Product Development	20%
Esben Tobias Kjærstad-Iversen	Electronics	20%

The students will be engaged for hours through the studentconsulting company Ledo, but will have the opportunity to receive shares in Tap-IT based efforts throughout the project period as sweat-equity. Any redistribution of shares during the project period must be approved by the NFR

Mentorer

Name	Role	Description
Kristian Omberg	Teknisk rådgiver – Sensorutvikling	NMBU/Overingeniør
Odd-Ivar Lekang	Faglig mentor –prosessteknologi	NMBU/Førsteamanuensis
Simon Hesleskaug	Forretningsutvikling og investornettverk	Grindøy Rådgivning AS/ Daglig Leder
Tor Haugnes	Kommersiell mentor	Polvott AS

Partners

Name	Role	Description
Anheuser-Bush InBev	Pilot customer	Represents a large brewery
Kinn bryggeri	Pilot customer	Represents our beachhead market.
Rekom	Supplier	Represents our supplier
Oslo bar og Bowling	Pilot	Represents customer
Villa paradiso	Pilot	Represents customer

Contribution from university

Contribution	Description of contribution to the project	Tick for yes
Office space	We allocate a office area in our student incubator (NMBU and BI)	x
Access to lab and test facilities	Tap-IT will be given access to low threshold labs and can use our prototype services.	x
Access to specific scientific expertise	We will arrange meeting with relevant faculty personnel if needed.	x
Other advisory services	We will arrange for cooperation with the innovation lab "eik Ideverksted".	x
Assistance in carrying out tasks	Certain mechanical task can be done through out mechanical workshop or rapid prototype lab.	x
Other		

Budget- As the goal of the student project is to trigger a pilot collaboration that can lead to innovation contracts with several players in the value chain to cover part of the upscaling after the project period.

To complete the project, Tap-IT applies for NOK 1 000 000 where approximately 25% of the budget is dedicated to salaries to the project team (inc the students). The basis for this distribution is that the interdisciplinary expertise of the project team means that we are confident of being able to carry out this project. The student contributions are compensated through the student consulting company "Ledo", which is an active part of the innovation environment at NMBU.

For the project period August 2020 - August 2021.

Activities	Cost (NOK)
Wage project team	270
Mentors	10
Development cost – IO modul	440
Testrig	100
Production of IO modul v1.0	100
Market research	50
IP process with the «patentstyret»	50
Administrative costs	50
Total	1070

Amount is shown 1000

Financing plan August 2020 - August 2021.

	2020	2021
Privat funds	30	
NRC Student ForNY	500	500
Sales		40
Total	530	540

Amount is shown in 1000NOK

The financing plan only shows financing during the project period.