

BRINGING TECH INTO GEOTECHNICS

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KEYWORDS

digitalization, innovation, SaaS, data-driven solutions

ABSTRACT

The Norwegian Geotechnical Institute (NGI) recognizes the pivotal role of ground engineering in the ongoing digital transformation of the construction industry. We have embraced this challenge by establishing NGI Digital where expertise from the tech industry converges with cutting-edge domain knowledge from geotechnical and geo-environmental engineers. With natural hazards escalating due to climate change, it's imperative for the geo-industry to innovate using data-driven solutions. The goal? Ensuring that we live on safe ground. In addition, to harness the power of emerging technologies and AI, we must first confront and resolve the industry's issues with data quality and availability. Borrowing best practices from the tech world can be transformative. This includes leveraging cloud technologies, deploying DevOps teams, embracing design thinking, and adopting agile methodologies to create high-quality digital products. Over the past 5 years, NGI Digital has grown impressively. Proudly, we introduced Field Manager, our first Software-as-a-Service, to the market in March 2023 and we have developed 4 additional digital products that have redefined how we work. At NGI, we also foster a culture of continuous learning. Our "Code Academy" is a testament to that, propelling innovation across the organization.

INTRODUCTION

The effective use of digital data represents the future of the digitalisation of the construction sector [1]. In-line with this, NGI has recognized the need for a new strategy to fully leverage emerging technologies, including artificial intelligence (AI). Our journey revealed that capitalizing on these technological advancements posed significant challenges stemming from fundamental issues related to data quality, data availability, and the absence of standardized data formats.

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Addressing these fundamental challenges is a formidable task that demands substantial investments. Consequently, NGI's management took decisive ownership to tackle these issues head-on. We recognized the need to embrace cutting-edge technologies and invest in expertise. As a result, NGI established a new department called NGI Digital, specializing in digital product development and technology.

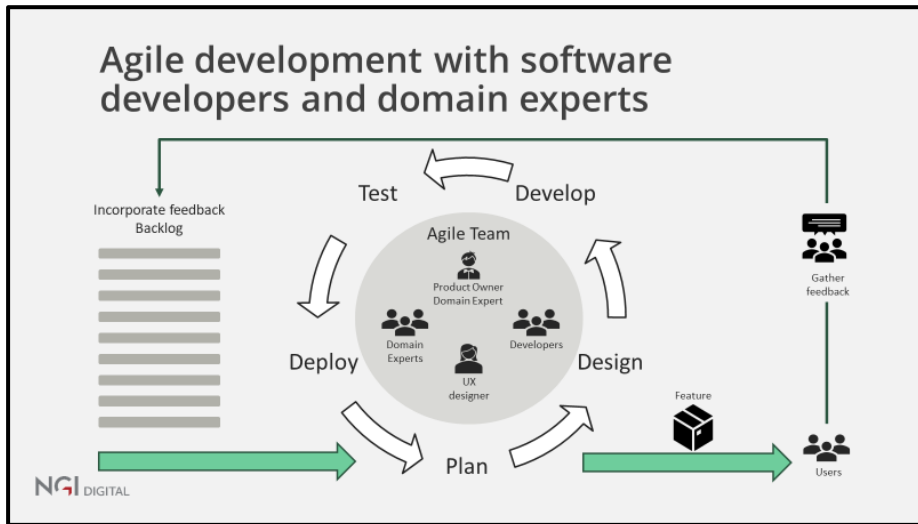


Figure 1: Agile development with software developers and domain experts.

Over the past 5 years, we've built a team of 18 developers, UX designers, and business developers. Given the inherently complex nature of geotechnics, successful outcomes hinge on close collaboration between developers and geoscientific experts within agile teams, as shown in Figure 1.

Furthermore, we have established NGI Code Academy to enhance the proficiency of scientific developers and engineers across the organization. The aim of the course series is to elevate our coding practices by focusing on code quality, improving collaboration, use of API's and creating web applications.

DIGITAL PRODUCT DEVELOPMENT

The main driver for the initiative Geo Hub, which constitutes our collection of digital products including our flagship product Field Manager, and the establishment of NGI Digital, was to unlock data-driven decisions in the geosciences. Our first mission was to make our core data, from field, lab and instrumentation, easily accessible and useful. A key part of this was to make the data is available through APIs (Application Program Interfaces). APIs are the backbone of internet communication and digital innovation. They ensure that different digital products can communicate dynamically and seamlessly.

Field Manager is web-based and has quickly become an important tool for both NGI and external customers to improve the processes of collecting data from ground investigations and provides a comprehensive overview of ground conditions in all projects. An example screenshot is shown in Figure 2.

Efficient sharing and transfer of data and information between stakeholders in the value chain is considered a key factor for successful digitalization [2]. In Field Manager, the process of collecting data from field and lab is simplified through intuitive planning tools, collaboration between project stakeholders, immediate visualization, and quick and easy QA. The platform enables safe and secure data sharing and is tailored for improved efficiency and automation of work processes and deliverables.

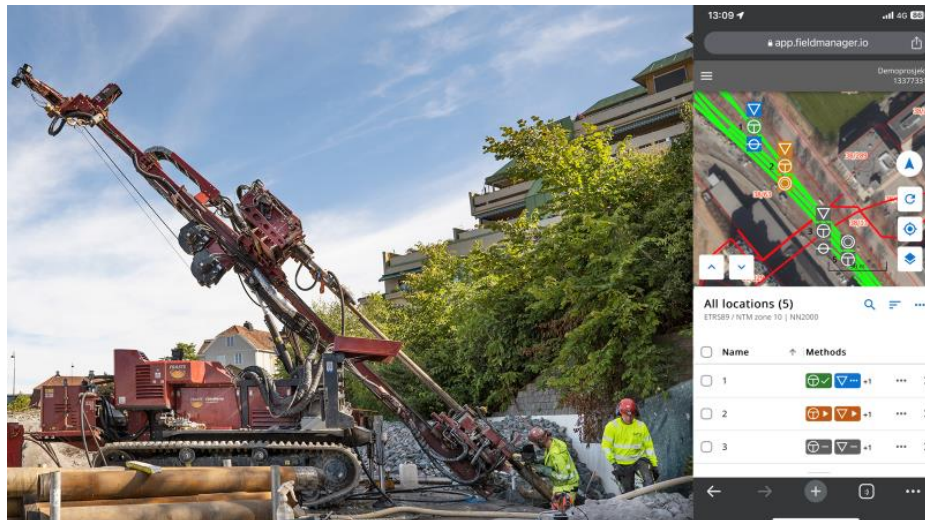


Figure 2: Screenshot of Field Manager mobile view for use during field work.

HOW WE WORK

At NGI Digital, we adopt a cloud-first approach, focusing on building applications exclusively for the cloud using modern technologies. Our DevOps expertise allows us to create scalable, reliable, secure, and sustainable digital products using open-source technologies. Our DevOps teams are responsible for constantly improving their digital product by owning the whole IT value chain of planning, testing, deployment and operations.

Design thinking is at the core of our product development. We prioritize simplicity and intuitiveness, recognizing that users expect these qualities in the modern age. By closely collaborating with users across the value chain, we empathize with them before designing solutions.

Finally, our agile development process involves software developers and domain experts. We release new features continuously, guided by a domain expert who serves as the product owner. Close dialogue with customers ensures that we address industry

needs effectively. This collaborative approach, combining professionalized software developers with domain experts, is our true strength.

CONCLUSION

Buildings represent approximately 40% of energy consumption in the European Union and account for about 36% of CO₂ emissions. [3] There exists a huge, untapped potential in leveraging technology and data to advance sustainability goals. Improvements must be made in all parts of the life cycle, and ground engineering must carry its fair share. To drive digital innovation effectively, we must adopt a collaborative mindset—one that transcends organizational boundaries. NGI has already embarked on this journey by organizing and structuring high-quality ground investigation data, making it easily accessible and useful. Now, we extend an open invitation to all: join us in transforming the geosciences and contribute to meeting climate goals.

REFERENCES

- [1] European Construction Sector Observatory. 2021. Digitalisation in the construction sector. Analytical report.
- [2] Labonnote, N., Bryhni, A. and Lech, T.C. 2021. Digital samhandling og datadeling i bygge-, anleggs- og eiendomsnæringen. SINTEF report; 2021:00373
- [3] [The confusion about embodied carbon and scope emissions \(nordesg.de\)](#)