

Forest inventory in a pocket: The Di-Gozd Digital Forest Inventory App (Di-Gozd)

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Teaser

Private forest owners often do not know the potential volume of timber in their forests. Gaining access to the publicly available forest inventory data can help and incentivize active management of private forests. A practice-based innovation project in Slovenia's forest sector created a user-friendly application (Web-based and mobile) to estimate one's forest annual yield. The innovation was identified in the FOREST4EU project, which seeks to promote different forestry and agroforestry Operational Groups in EU countries, categorize their innovations into five so-called ITHubs, and evaluate them. Through a three-step process of evaluation, FOREST4EU identified 25 innovations to be promoted as best practice examples. One of these innovations is the Di-Gozd Digital Forest Inventory App (Di-Gozd).

Introduction

Innovation is recognized as a driver of economic prosperity, and policymakers are showing increasing interest in ways to foster it at different levels. This is particularly important in countries like Slovenia, which lags behind other EU Member States in terms of innovation.¹ Business innovation is vital to keeping pace with growing international competition, and this is also true for the forest and wood sector. This sector has been identified in the Slovenian Sustainable Smart Specialization Strategy (S5) as having a high potential for development.² At the same time, forest products also have great potential to contribute to the objectives of sustainable and multifunctional forest management. Innovation in the forest sector plays an important role in efforts to adapt to and mitigate climate change, for example.

The Slovenian Resolution on the National Forest Program includes assessments and statements on the importance of innovation but lacks a

clear strategy or specific programs to promote innovation in forestry. The Resolution is a government document outlining strategic goals, policies, and actions for managing forests within a specific country or region. It aims also at aligning national forest management with broader societal goals, such as protecting biodiversity, mitigating climate change, and ensuring other ecosystem services. The current Slovenian forestry (sectoral) innovation system is informal and still developing. It is characterized by a lack of resources and human capital in entrepreneurship and innovation, a small market, a tradition less supportive of entrepreneurship, administrative hurdles, and a bureaucratic mindset.⁽³⁾ The innovative activities of organizations within the Slovenian forestry innovation system primarily depend on collaboration with other organizations, state agency projects, and the personal initiative of employees.

Commercial use of forest inventory data with digital technologies exemplifies how collaboration between different actors can drive innovation in forestry. Forest inventory is traditionally based on measuring sample plots in forest stands and then deriving estimates for the whole forest area. Data on forest parameters defining the structure, health, and condition is collected by manual fieldwork. Technological developments now complement the manual data collection. Airborne laser scanner and unmanned aerial vehicle (UAV) imagery are now more common in forestry. In the past, this data suffered from a lack of information about single trees and inaccuracy. However, the methods and technological innovations for digital forest inventory have advanced and enabled the development of user-friendly tools for practitioners.

A Slovenian Operational Group has invented the Di-Gozd Digital Forest Inventory with an online and mobile application for forest owners and

managers, which allows users to review own forest land based on existing public data and to estimate the value of their own forest's annual yield. To learn more about the Di-Gozd App, the article starts by summarizing the forest sector characteristics of Slovenia, which is the context for development of the Di-Gozd App. Then, it introduces the OG partnership before explaining how the App is built up and what it offers to users. The conclusion summarizes the key messages of the article.

Slovenia's forest sector

Slovenia is the third most forested country in Europe, after Finland and Sweden. 1,176,542 ha of forests cover more than a half of the country (58 %). The area of managed forests is 1,068,288 ha, there are 98,828 ha of protective forests and 9,426 ha of forest reserves. Most of the forests are located in the area of beech, fir-beech and beech-oak sites (70%), all of which have a relatively high production capacity. Growing stock and increment have been increasing for more than 50 years.

According to the data of forest management plans by the Slovenia Forest Service, the growing stock of Slovenian forests amounts to 304 cubic metres per hectare. In Slovenian forests there is an annual increment of 8,736,972 cubic metres of wood or 7.4 cubic metres per hectare.(4)

Slovenia is not only one of the European countries with the highest forest cover, but also one of the countries with the lowest share of state-owned forests. 75.3% of forests in Slovenia are privately owned, 20.5% of forests are public (owned by the state), and 4.2% of forests are owned by local communities. The largest private forest owner is the Roman-Catholic Church. The average forest property is 2.8 ha, while only 14% of private owners in Slovenia (without cooperatives and church) own a forest larger than 5 ha. The number of private forest owners is estimated to be 300.000 (with co-owners even more).(5)

In Slovenia, the major challenges for active management and wood mobilization are: small sizes of forest properties, large size of owners, lacking efficiency in logging systems/enterprises, limited interaction among industries and forest operators, and low utilization of forest potential.(6) An important issue is also how to balance the social, environmental, and economic aspects of forests.(7) The Slovenian Statistical Office informed that 64% of the allowable cuts under forest management plans have been harvested in 2022, representing a 12% increase as compared to 2021 yet a lower share than in the years between 2014-2018. (8) The Di-Gozd App can help mobilizing timber from Slovenia's forests and increase income for private owners.

The Di-Gozd partnership

The partnership was established as EIP-Agri Operational Group (now under EU CAP Network). An Operational Group is a group of people working together to develop concrete solutions to practical problems or innovative opportunities whose projects are supported by European rural development policy. An Operational Group is made up of several partners—a farmer or forester, a consultant, a researcher, and many other actors—who come together to obtain a practical solution to a specific problem faced by a farmer. Slovenia has so far supported 67 EIP-Agri Operational Groups with a total of 18,179,450.99 in approved funds, which shows the great need for such practical projects. Four of these OGs are related to forestry. The composition of the partnerships is diverse, with over 800 partners involved so far, with an average of 12 partnership members per project.(9)

The Di-Gozd App

The forest inventory app is practice-based and technologically advanced. Research, forest administration, and forest owners collaborated on its development and piloting. The App uses publicly available inventory data to provide

EIP AGRI – Operational Group Di-GOZD

OG coordinator

- Kočevski les d.o.o.

Partnership

- Technology partners**
 - Abelium d.o.o.
 - CtrlArt d.o.o.
- Researchers - Educators**
 - Faculty of Biotechnology, University of Ljubljana, Department of Forestry
- Business and promotional partner**
 - Kočevarje Business Incubator
 - Forest managers / consultants
 - Kočevski les d.o.o.
 - Marko Kalič s.p.
 - 7 forest owners

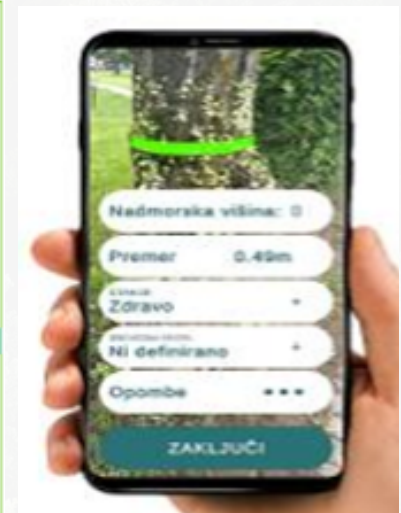
Challenges

The innovation addresses four key challenges of private forest land owners:

- a large amount of administrative obstacles;
- lack of specific forest estate plans for land owners;
- lack of integration in the field of marketing of wood products;
- lack of systematic data collection of the entire agricultural-forestry ecosystem

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estimates of the value of trees, including the national forest inventory data. It encourages owners to manage their forests and actively find professional help if needed. The Operational Group inventors believe that their App “will revolutionize forestry inventory across Europe, ushering it into the digital age by making all necessary equipment accessible on personal mobile devices.”(10)

The Di-Gozd Digital Forest Inventory consists of a web application for forest management and a specialized mobile application for recording the forest.¹¹ The web application is the entry point of the Di-Gozd platform, which allows users to manage their forest plots, review existing public data and estimate the value of the annual yield. It offers users analytical tools for reviewing the created images, a methodology for calculating the value of trees and a system for monitoring events on the forest property. In a nutshell:

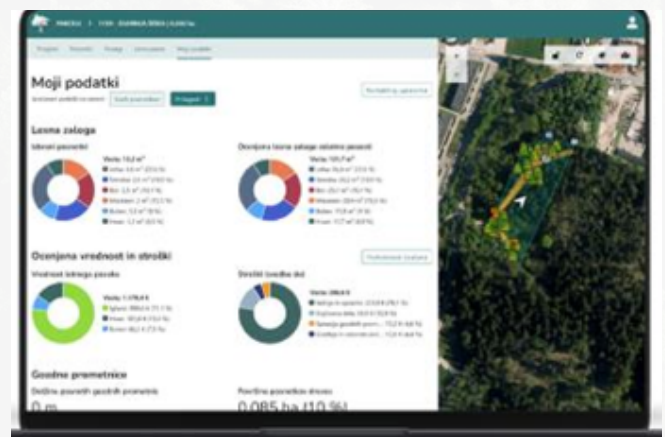
- Accurate assessment of the current state of the forest on the plot.
- Information about planned cut and its value.
- Possibility of checking what was really cut.

The mobile application complements the web application by supporting the execution of recordings on the forest property via a direct connection of user accounts. It enables the execution and updating of various types of recording with the help of augmented reality

technology. It also allows automatic and manual tree measurements. In a nutshell:

- Guidance to location of the forest plot throughout Slovenia.
- Taking pictures trees and other properties in forests.
- Monitoring of forest changes by updated images.

Users can assess the condition, value, and control measures of the forest based on the images that are created with the mobile application. It provides users with analysis tools for reviewing these images, a method for calculating the value of trees, and a system for the monitoring of activities on the forest plot. The web application is free of charge. It is available for Android and IOS.⁽¹²⁾



Slovenian forest owners are invited to test the App.(13) It's bottom-up development can be seen as a Good Practice Example for developing new solutions in forest management with existing data.

Conclusion

Effective information support for key forest management and sales processes helped forest owners to achieve better their forest management objectives, such as maximizing returns to owners while respecting the principles of sustainable and multifunctional management of privately owned forests.

The digital tools developed under the Di-Gozd Operational Group aim to facilitate the acquisition of forest data at the parcel level, digitize existing forest data capture processes, increase interest in forest estate management (especially by remote owners) and support the correct and equitable implementation of forest interventions. The mobile app is a digitized forest inventory innovation for the pocket by allowing users to use their smartphones to capture the location, diameter, volume, type, and condition of trees, the length and comments of various forest paths (thoroughfares, trails, etc.). In combination with a web-based app it offers an online database of high-quality digitized data on forest plots, analytical tools for estimating the annual yield from potential tree felling, methodologies for estimating the volume of timber and, consequently, the value of standing trees based on digital images taken in the forest, and tools for monitoring the

implementation of interventions in the forest.

The networking of the Operational Groups under the CAP Network and the FOREST4EU project has proven to be important in promoting innovation and sustainability in the forest and agroforestry sector. Going forward, continued support for the Operational Groups and their innovative activities is crucial to foster progress toward a more sustainable and economically viable forestry sector in Slovenia and beyond. Innovative intermediaries are also introduced to promote such projects, operating within the framework of the public agricultural advisory service, and distributed regionally in all eight agroforestry services.

Further information

[Discover Di-gozd application](#)

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