

**Metsäteho Report 235
12 February 2015**

Potential Business Models for Forest Big Data

DIGILE's Data to Intelligence (D2I) program

**Pirjo Venäläinen
Tapio Räsänen
Jarmo Hämäläinen**

ISSN 1796-2374 (Online)

METSÄTEHO OY
Vernissakatu 4
FI-01300 Vantaa, Finland

www.metsateho.fi

Potential Business Models for Forest Big Data

DIGILE's Data to Intelligence (D2I) program

Pirjo Venäläinen
Tapio Räsänen
Jarmo Hämäläinen

Metsäteho Report 235
12 February 2015

ISSN 1796-2374 (Online)

© Metsäteho Oy

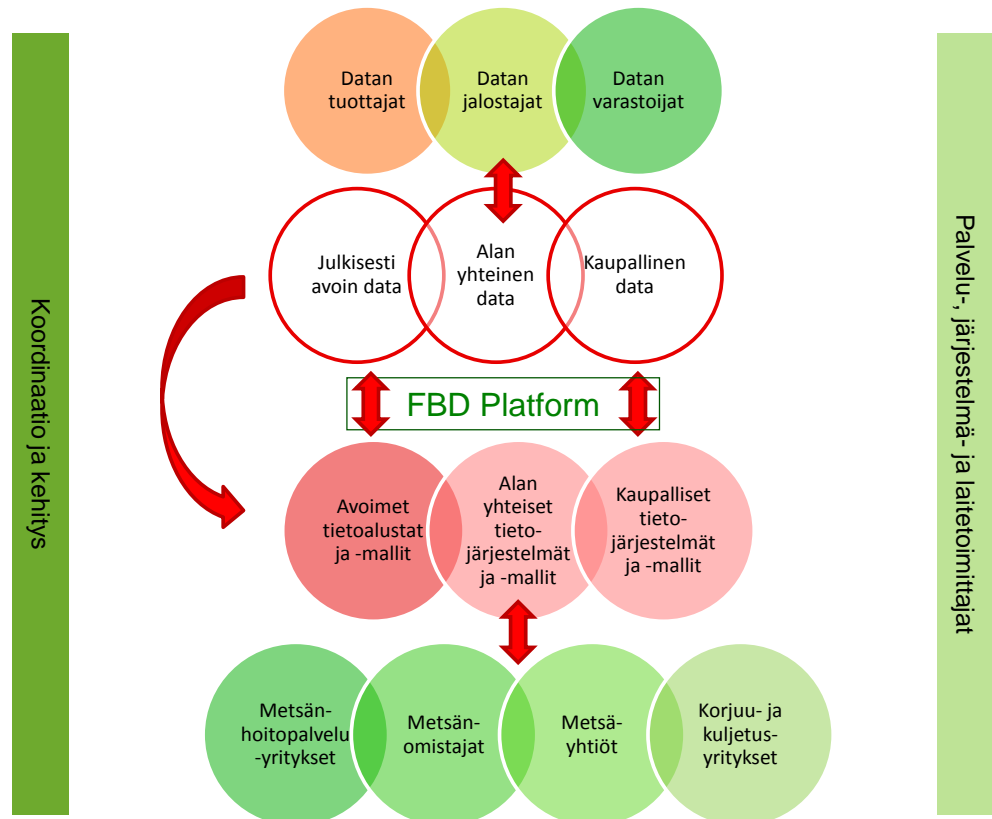
TIIVISTELMÄ

Tämän selvityksen tavoitteena oli kuvata metsävaradataa (Forest Big Data) hyödyntävien palveluiden potentiaalisia liiketoimintamalleja Suomessa. Selvitys toteutettiin osana DIGILEn Data to Intelligence (D2I) -ohjelmaa, jossa Forest Big Data edustaa yhtä seitsemästä liiketoimintasektorista. Forest Big Data (FBD) -projektin tavoitteena on tuottaa tutkimuksellinen pohja seuraavan sukupolven metsävaratietojärjestelmälle Suomessa. Visiona on koko metsäsektoria palveleva järjestelmä, joka sisältää nykyistä tarkemmat, monipuolisemmat ja ajantasaisemmat puusto- ja olosuhdetiedot. Tämä tutkimusosio toteutettiin kirjallisuustutkimuksena, jossa hyödynnettiin liiketoimintamallinnusta koskevaa tutkimusta ja tuloksia FBD-projektin muista osioista. Selvitys ei sisältänyt kattavaa sidosryhmäyhteistyötä. Selvityksen päätavoitteena olikin tuottaa perusteita ja ideoita projektin jatkovaiheissa tapahtuvalle keskustelulle ja päätöksenteolle yksittäisen liiketoimintamalliehdotuksen sijasta.

Forest Big Data kattaa laajan määrän dataa aina yksittäistä puuta koskevasta inventaariodatasta prosessidataan, jota syntyy puun koko hankintaketjun aikana. Forest Big Data -vision toteutuminen edellyttää laaja-alaista julkisen ja yksityisen sektorin verkostoa, joka tekee yhteistyötä datan saatavuuden ja laadun takaamisessa sekä datan jalostuksessa ja päivittäisessä hyödyntämisessä tarvittavien työkalujen ja teknologioiden kehittämisessä. Päällimmäisenä tavoitteena on, että FBD parantaa koko puun toimitusketjun (aina puun hankinnasta tuotantoon) suorituskykyä ja suomalaisen metsäteollisuuden kansainvälistä kilpailukykyä.

FBD-liiketoiminta koostuu kolmesta pääkomponentista: Forest Big Datasta, FBD Platformista ja FBD-sovelluksista. Data kattaa julkisen ja yksityisen sektorin tuottamaa avointa, jaettua ja kaupallista dataa. FBD Platform on tekninen alusta, joka kokoaa, jalostaa ja välittää metsiä koskevaa dataa. FBD Platformin liiketoimintaa ylläpitää FBD:n koordinointiorganisaatio, joka hallitsee alustan ylläpitoa ja kehitystä sekä yhteistyötä ekosysteemin keskeisten sidosryhmien kanssa. FBD-sovellukset hyödyntävät Forest Big Dataa. FBD-sovellukset ovat ainakin jossain määrin kehitetty tai ylläpidetty yhteistyössä FBD Platformin ja koordinointiorganisaation kanssa. FBD-liiketoiminnalla tarkoitetaan tässä liiketoimintaa, jota kehitetään Suomessa valtakunnan tason yhteistyönä.

Liiketoimintamallinnuksen tavoitteena on kuvata toiminnassa olevan tai suunnitellun liiketoiminnan pääelementit. Tässä raportissa on sovellettu liiketoimintamallinnukseen **CSOFT-mallia**, koska malli on suunniteltu erityisesti ICT-perusteisen liiketoiminnan kehittämiseen.



Yhteenveto Forest Big Datan toimijoista ja tietojärjestelmistä.

CSOFT-mallinnuksen ensimmäinen vaihe on kuvata liiketoiminnan **strategia, visio ja strategiset tavoitteet**. Tämän raportin kirjoitusvaiheessa ei ollut toiminnassa FBD-organisaatiota tai -verkostoa, joka voisi olla vastuussa strategian määrittelystä. Tämän takia liiketoimintavision lähtökohtana käytettiin D2I-projektin metsäsektoria edustavien partnereiden laatimaa FBD-visiota. FBD-vision mukaan Forest Big Dataa hyödyntäviä palveluita kehitetään kansallisella tasolla toimivassa, julkisen ja yksityisen sektorin toimijoista koostuvassa verkostossa. Palveluiden hyötyjinä ovat eri toimijat puun koko hankintaketjussa. FBD Platformin osalta tavoitteena on, että se on toiminnassa vuoteen 2020 mennessä.

FBD-visiota on täydennetty tämän osaprojektin yhteydessä ehdottamalla täydentäviä strategisia tavoitteita, joita ovat mm. kansainvälisesti kilpailukykyisin puun hankintaketju, sähköiset palveluketjut, puuraaka-aineiden korkeampi jalostusarvo, uudet FBD-yritykset ja niistä syntyvät uudet työpaikat.

FBD-liiketoiminnan **asiakassegmentit** (C=Customers) kattavat kolmen tyyppisiä asiakkaita. Primäärit asiakassegmenttiin kuuluvat toimijat puun hankintaketjuissa (metsänomistajista tuotantolaitoksiin) sekä metsäsektorin julkisen sektorin toimijat. Nämä segmentit ovat FBD-sovellusten loppukäyttäjiä. Sekundaarisia segmenttejä ovat Forest Big Datan datantuottajat ja FBD-sovelluskehittäjät, jotka ovat FBD Platformin työkalupalveluiden osta-

jia. FBD Platform ei välttämättä itse tuota dataa tai sovelluksia. Tämän takia on olennaista, että FBD Platform tukee datan ja sovellusten kehittämistä muissa organisaatioissa ja varmistaa niiden riittävän saatavuuden päämääreille asiakassegmenteille. Tertiääriseen asiakassegmenttiin kuuluvat FBD-sovellusten satunnaiset käyttäjät (esimerkiksi kansalaiset sekä vakuutus- ja sähköyhtiöt).

FBD-liiketoiminnan **palvelukomponentteja** (S=Services) ovat Forest Big Data, FBD Platformin datanhallinta- ja työkalupalvelut sekä FBD-sovellukset. FBD Platformin palvelukomponentit suunnittelee FBD koordinointiorganisaatio ja ne edellyttävät vielä yksityiskohtaisten määrittely- ja toteutussuunnitelmien laatimista. Forest Big Dataa ja sovelluksia tuotetaan puolestaan pääosin koordinointiorganisaation ulkopuolisissa tahoissa. Tämän takia FBD:n koordinointiorganisaation roolina on laatia suosituksia ja seurata datan ja sovellusten kehittämistilannetta. Joissakin tilanteissa FBD:n koordinointiorganisaatio voi nähdä tarpeellisenä olla itse aktiivinen sellaisten sovellusten kehittämisessä, jotka ovat kriittisiä FBD Platformille ja sen hyödyntämiselle. FBD Platformin ja eräiden FBD-työkalujen sisältömäärittelyä on jo tehty FBD-projektin muissa osioissa. Määrittelytyön on suunniteltu jatkuvan projektin jatkovaiheissa sekä D2I:n ulkopuolisissa erillis-hankkeissa.

Vaikka FBD-palveluita ei ole vielä yksityiskohtaisesti määritelty, projektissa on tunnistettu mahdollisten palveluiden lisäarvoja liiketoiminnalle ja asiakkaille. Yhteistyössä kehitettävä FBD-liiketoiminta ja FBD Platform tarjoavat kaikille metsäsektorin toimijoille helpon ja kustannustehokkaan pääsyn ajantasaiseen ja luotettavaan metsävaradataan ja datatyökaluihin. Niiden avulla saavutetaan entistä tehokkaampia ja laadukkaampia suunnittelu- ja toteutusprosesseja puun koko hankintaketjussa.

FBD Platformia koskeva visio edellyttää toteutuakseen kansallisen tason **organisaation** (O=Organisation), joka on vastuussa paitsi teknisestä kehittämisestä ja toteutuksesta myös erilaisista koordinoititehtävistä (esimerkiksi avoimen metsävaratiedon saatavuuden ja laadun varmistaminen, kansainvälinen standardointiyhteistyö, ohjeiden ja suositusten laatiminen FBD-sovellusten kehittäjille sekä yhteisten kehittämisprojektien koordinointi ja rahoitus). FBD:n koordinointiorganisaatio voidaan toteuttaa erilaisilla organisaatiomalleilla. Organisaatiomuoto voi myös muuttua ajan myötä, kun liiketoiminnan, operaatioiden ja vastuiden määrä kasvaa. FBD-sovelluskehittäjien ja -toimittajien organisaatiomuodolle ei ole rajoitteita. Pääasia on, että sovelluskehittäjät tekevät edes jossain määrin yhteistyötä FBD:n koordinointiorganisaation kanssa. Tällä varmistetaan standardisoitujen ja yhteensopivien palveluiden kehittäminen.

Paitsi organisoinnille, myös FBD-liiketoiminnan ja sen kehittämisen **rahoitukselle** (F=Financing) on useita vaihtoehtoja. Viranomaiset ja tutkimus- ja

tilasto-organisaatiot tuottavat jo tällä hetkellä suuria määriä avointa metsävaradataa. Tämän datan parempi hyödyntäminen voidaan käynnistää esimerkiksi epämuodollisella toimintojen koordinoinnilla ICT-investointien sijasta. Näin ollen ensimmäiset vaiheet eivät välttämättä vaadi erityistä rahoitusta.

FBD-palveluiden kehittäminen toteutuu osittain kansallisissa verkostoissa, joiden tavoitteena on parantaa suomalaisen metsäsektorin kilpailukykyä. Näin ollen merkittävä osa FBD-”liiketoimintaa” voi toteutua ilman rahallisia transaktioita. Lisäksi FBD-liiketoiminnan päätavoitteena on metsäsektorin arvoketjun operatiivisen suorituskyvyn kehittäminen FBD-palveluntarjoajien taloudellisen menestyksen sijasta. Toisaalta kaupallisesti menestyvillä FBD-palveluilla voi olla positiivisia vaikutuksia työllisyyteen ja siten kansantalouteen.

FBD-projektin ensivaiheessa FBD-palveluiden määrittäminen painottui sisällölliseen määrittelyyn. **Tekninen** (T=Technological) määrittelytyö käynnistyy vuoden 2015 aikana. Keskeisiä teknisiä kysymyksiä on varmistaa erilaisten ratkaisuiden yhteensopivuus, kasvavien datamassojen tehokas hyödyntäminen sekä puun hankintaketjun toimijoiden kokoerojen huomioonottaminen.

FBD-liiketoiminnan visio ja strategiset tavoitteet muodostavat perustan **avaintunnuslukujen** (KPIs) määrittämiselle ja seurannalle. Verkostoperusteisessa liiketoiminnan kehittämisessä painottuvat toimialakohtaiset indikaattorit. Tunnuslukuseurannan pääkohteita ovat FBD Platform ja FBD:n koordinointiorganisaatio. Lisäksi on tarpeen seurata FBD-sovellusten kehittämistä ja suorituskykyä, koska liiketoiminnan primäärit asiakassegmentit hyötyvät FBD:sta nimenomaan sovellusten kautta.

FBD Platformin arvioidaan olevan toiminnassa vuonna 2020. Riippumatta FBD-liiketoiminnan organisointitavasta on tärkeää käynnistää eri sidosryhmien keskusteluita ja päätöksentekoa useisiin organisointiin sekä laillisiin ja rahoituksellisiin kysymyksiin liittyen. Yhteisen liiketoimintamallin laatiminen ja hyväksyminen on lähtökohta konkreettisimmille vaiheille (kuten liiketoimintasuunnittelu ja operatiivinen mallinnus). Tämän selvityksen lopputuloksena on ehdotus liiketoimintakehityksen seuraavien vaiheiden **tiekar-taksi**. Tässä selvityksessä on hyödynnetty CSOFT-liiketoimintamallinnusta. Sen lisäksi on useita muita malleja ja työkaluja, joita voidaan soveltaa jatkovaiheissa liiketoiminnan ja operatiivisessa mallinnuksessa.

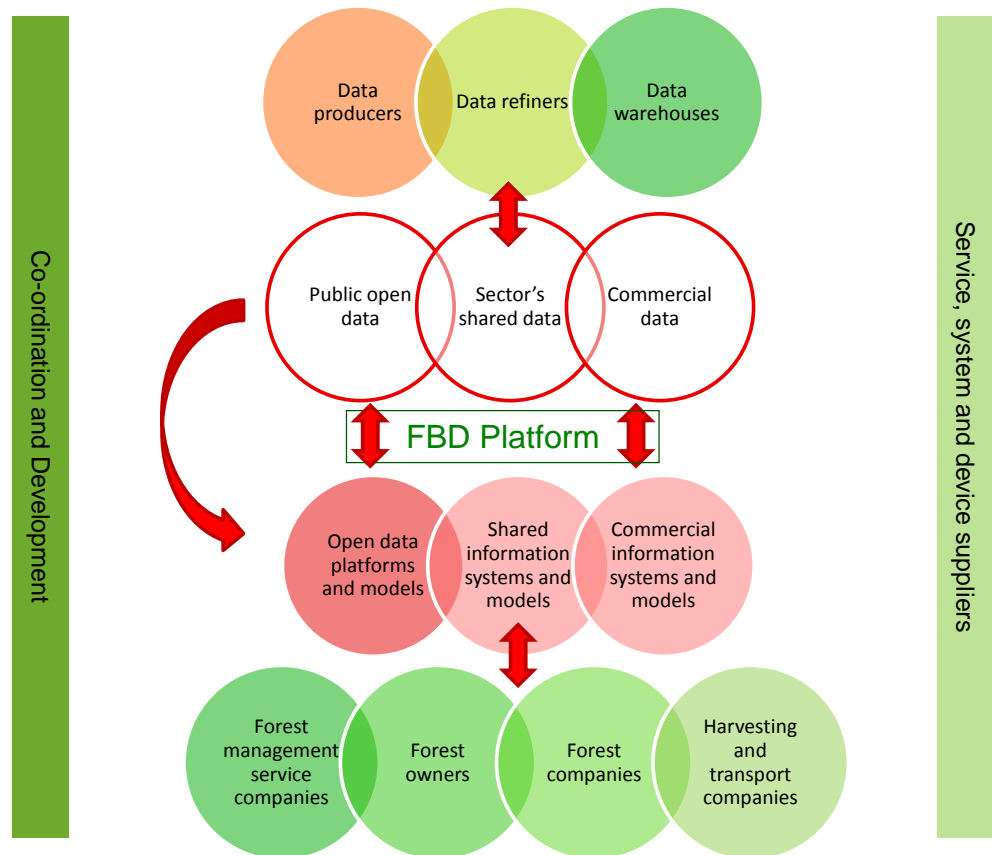
SUMMARY

The aim of this study was to describe potential business models for Forest Big Data (FBD) services in Finland. The study was carried out as a part of DIGILE's Data to Intelligence (D2I) program, in which Forest Big Data represents one of its seven business sectors. The target of Forest Big Data (FBD) is to produce research basis for the next generation forest resource management system in Finland. The vision for the Forest Big Data is an information system that serves the whole wood supply chain and contains more precise, versatile, and up-to-date forest resource and condition data than what it is available today. This part of the study was carried out as a desktop research utilising research on business modelling and results from the other Tasks of the FBD subproject. The study did not involve large scale stakeholder consultation. Therefore, the main objective was to provide a basis and ideas for later discussions and decision making, not a single recommendation for a certain business model.

The **Forest Big Data** covers a large amount of data from single-tree inventory data to process data produced during the wood procurement chain. The vision of the FBD calls for a wide network of public and private actors to cooperate on the availability and quality of data as well as development of tools and technologies for data refining and utilisation in daily business operations. The eventual objective is that the FBD improves the performance of the whole wood supply chain, that includes in this context both wood production and wood procurement, and consequently international competitiveness of the Finnish forest sector.

The FBD business includes three main components: Forest Big Data, the FBD Platform, and the FBD Applications. The data covers open, shared, and commercial data produced by public and private actors. The FBD Platform is a technical platform for collecting, refining, and transferring forest data. The Platform business is run by the FBD Coordination Organisation that coordinates the technical platform, its development, and collaboration between relevant stakeholders in the ecosystem. The FBD Applications are applications that utilise Forest Big Data and are developed or maintained in some degree of cooperation with the FBD Platform and the Coordination Organisation. Altogether, the FBD business is delimited here to business that is developed in Finland's national level cooperation.

The aim of the business modelling is to describe the main elements of an existing or planned business. In this report, **CSOFT modelling technique** was applied, since the model is particularly designed for development of ICT-driven business.



Overview of the FBD actors and systems.

The CSOFT modelling starts with defining the **strategy, vision, and strategic objectives** for a business. At the time of writing this report, there is no national FBD organisation or network that could be in charge of business strategy formulation. Therefore, the shared FBD vision created by the D2I's forest sector partners was taken as a basis for the business vision. The FBD vision envisages that the FBD services are developed by a national public-private network for the benefit of the whole wood procurement chain. The technical FBD Platform is planned to be in operation in 2020.

This jointly developed vision was supplemented in this Task by suggesting strategic objectives: internationally the most competitive forest supply, electronic service chains, improved added value for wood raw materials, and new FBD businesses and employment.

The **Customer (C) segmentation** of the FBD business covers three types of customers. The primary customer segments are the actors in the wood procurement chain (from the forest owners to production plants) as well as the public authorities in the forest sector. These segments are the users of the FBD Applications. The secondary segments are the Forest Big Data producers and FBD Application suppliers. These are the buyers of the FBD Platform's Tool services. The FBD Platform does not necessarily produce any data or applications itself. Therefore it is vital for the FBD Platform to en-

sure that it supports the development of data and applications in other organisations and thereby ensures their adequate availability to the primary customers. A tertiary group of customers includes occasional users of the FBD Applications (such as citizens, insurance and electricity companies).

The **service (S)** components of the FBD business are Forest Big Data, Data management services of the FBD Platform, FBD Tools of the Platform, and the FBD Applications. The service components of the FBD Platform are planned by the FBD Coordination Organisation and detailed specifications and implementation plans need to be developed. The Forest Big Data and Applications, in turn, are mostly developed in external organisations. Therefore, the FBD Coordination Organisation mainly gives recommendations and follows the development status of data and applications. In some cases, the FBD Coordination Organisation may find it necessary to take an active role in development of certain common applications critical for the FBD Platform and its utilization. The content specifications of the FBD Platform and some FBD Tools have been carried out in the other FBD Tasks. Further specification work is planned for the continuation projects as well as in ongoing separate projects.

Even though detailed specifications of the FBD services are not yet available, a number of business and customer values of the potential services were recognised. The jointly developed FBD business and FBD Platform will provide all the forest sector actors easy and cost-efficient access to up-to-date and reliable forest data and data tools. This will lead to more efficient and high quality planning and operations in the whole forest procurement chain.

The vision for the technical FBD Platform development calls for a national-level **organisation (O)** that will be responsible not only for the technical development and implementation of the but also for coordination of several FBD issues (for instance ensuring availability and quality of open forest data, international cooperation in standardisation, providing guidelines and recommendations for development of FBD Applications, as well as coordinating and financing joint development projects). There are different options for the organisational form of the FBD Coordination Organisation. The form may also evolve over time, as the scale of business, operations, and liabilities expands. The organisations of the FBD Application developers and suppliers can be of any form. The main question is that the developers cooperate at least in some degree with the FBD Coordination Organisation. The aim of this is to support development of standardised and compatible solutions.

As in organisational issues, there are several options for **financing (F)** FBD business and its development. Large amount of open forest data is already being produced by public authorities as well as research and statistical in-

stitutions. The better utilisation of this data may start with informal coordination instead of ICT investments. The first steps do not necessarily require any additional financing.

Partially, the FBD business development takes place in national networks and aims to improve competitiveness of the Finnish forest sector. Therefore, a notable share of the “business” takes place without monetary transactions. Further, the main focus is more on the development of the operational performance of the value chain rather the financial performance of the business solution suppliers. However, the successful launch of commercial FBD businesses may have several positive economic impacts on employment and national economy.

At the moment, the most of the specification work on the FBD services focus on contents, whereas **technological** specification work is expected to start in 2015. The major issues are to ensure compatibility of the different solutions, effective use of growing data masses, and to take into account differences in organisation sizes in the wood procurement chain.

The vision and strategic objectives for the FBD business set the basis for defining and monitoring of the **Key Performance Indicators (KPIs)**. In the networked driven business development, emphasis needs to be laid on sector-wide indicators. The main target of the KPI monitoring is the FBD Platform and the FBD Coordination Organisation. Further, the status of FBD Application development and performance need to be monitored as well, since the primary customers gain the benefits from FBD through applications.

The FBD Platform is envisaged to be operational in 2020. Regardless of how the FBD business will be organised, it is imperative to engage the stakeholders in discussions and decision making on several organisational, legal and financial issues. Drafting and approval of a joint business model is a starting point for more concrete stages such as business planning and operational modelling. The outcome of this study is a suggestion for a **road map** of further steps in business development. In this study, only the CSOFT business modelling framework was applied. There are also several other frameworks and ICT based tools that could be applied in the future business and operational modelling.

CONTENTS

TIIVISTELMÄ.....	2
SUMMARY	6
1 OBJECTIVES AND BACKGROUND OF THE STUDY	11
2 FOREST BIG DATA AND BUSINESS MODELLING	13
2.1 Business Approaches to Forest Big Data	13
2.2 Objectives of Business Modelling	14
2.3 CSOFT Business Modelling Framework.....	14
3 POTENTIAL CSOFT BUSINESS MODELS FOR THE FOREST BIG DATA.....	16
3.1 Introduction	16
3.2 Strategy and Vision	17
3.3 Customers (C).....	18
3.4 Services (S)	21
3.4.1 Overview of the FBD Services.....	21
3.4.2 The FBD Use Cases.....	23
3.5 Organisation (O).....	25
3.6 Finance (F).....	28
3.7 Technology (T).....	30
3.8 Key Performance Indicators (KPIs).....	31
3.9 CSOFT Cases for the Forest Big Data.....	32
3.10 Road Map for Further Actions	32
REFERENCES.....	35
APPENDIX	

1 OBJECTIVES AND BACKGROUND OF THE STUDY

Objectives and Execution of the Potential Business Models Study

The Forest Big Data (FBD) covers:

- tree and grid (eg. 16 * 16 m) level forest attributes
- forest condition and environmental data (for example permanent soil attributes and changing real-time weather data or zoning information)
- forest research and statistics data
- selected process data (data exchanged between actors in the wood procurement chains).

The aim of the “Potential Business Models for the FBD Study” was to outline potential business models to create added value for forest management and wood procurement through Big Data. The goals of the potential business models study were:

- To identify potential elements in developing business models which utilize Big Data decision support systems (DSS’s)
- To describe options for business and operational models for discussions and decision making taking place at the later phases of the project as well as in separate development projects
- To assess how the use of novel data and applications change the present processes and operations in them.

The study was carried out as a literature review without a wide stakeholder consultation. Therefore, the potential models identified and described in the study need to be discussed and developed further with potential actors in the FBD business development. This report does not represent any opinions or decisions made by project partners or other stakeholders.

The CSOFT business model was chosen as the modelling technique for the study as it is specifically designed for planning of ICT driven business models. The reference material for the study was composed of research articles on networked business modelling as well as reports from the other FBD Tasks of the D2I program.

This report was prepared by Pirjo Venäläinen, Senior Researcher at Metsäteho Oy. The work was supervised by Tapio Räsänen, Senior Researcher and Jarmo Hämäläinen, Manager, R&D at Metsäteho Oy. Professor Dr Jukka Heikkilä, Senior Research Fellow Dr Marikka Heikkilä, and Researcher Mikko Pohjola at the Centre for Collaborative Research, University of Turku provided valuable feedback on the draft report as well as research material.

Data to Intelligence Program and the Forest Big Data Tasks

This study was carried out as a part of the Data to Intelligence (D2I)¹ program. D2I is a research program, which is focused on big data, data reserves and user-centric service development (Table 1). The program is financed by Tekes and program's business and research partners. The program is coordinated by DIGILE Ltd that is one of Finland's Strategic Centres for Science, Technology and Innovation (SHOKs).

Table 1. The vision and the mission of the D2I program.

The vision of the D2I Program is:

We have developed in the D2I program the necessary **intelligent methods and tools for managing, refining and utilizing diverse data pools**. The results enable innovative data-intensive business models and services with supportive ecosystems.

The mission of the D2I Program is:

To boost Finnish international competitiveness through intelligent (context-sensitive, personalized, proactive) **data processing technologies and services** that add measurable value.

Forest Big Data (FBD) represents one of the miniecosystems in the D2I Program. The objectives of the FBD Tasks are:

- Radical leap in the cost effectiveness of wood supply and forest management through new digital services and Big Data applications.
- Added value into the value chain of wood based products.
- Global leadership as competence platform for forest based information and related applications and services enabling global business growth.

The general target of Forest Big Data is to produce research basis for the next generation forest resource management system in Finland.

¹ Program website www.datatointelligence.fi

2 FOREST BIG DATA AND BUSINESS MODELLING

2.1 Business Approaches to Forest Big Data

In the D2I program, the Forest Big Data (FBD) business comprises three main approaches: the Forest Big Data, the FBD Platform and the FBD Applications (Figure 1). The Forest Big Data covers forest resource, forest condition, and wood procurement process data. The FBD Platform connects and refines data from various data sources and delivers refined data to application suppliers. The application suppliers, for their part, sell various services to end users (i.e. actors in the wood procurement chains). Applications are divided into two groups: the FBD Applications that are developed in cooperation with the FBD Platform and other applications that are developed without cooperation. The business modelling in the D2I program is delimited to the FBD business that is developed in sector-wide collaboration (including partners both from the public and private sectors). Therefore, the business models of purely commercial applications and services are not covered here. However, it is important for the FBD business network to follow the development in the whole market in order to identify new possibilities for collaboration and to avoid overlapping development work.

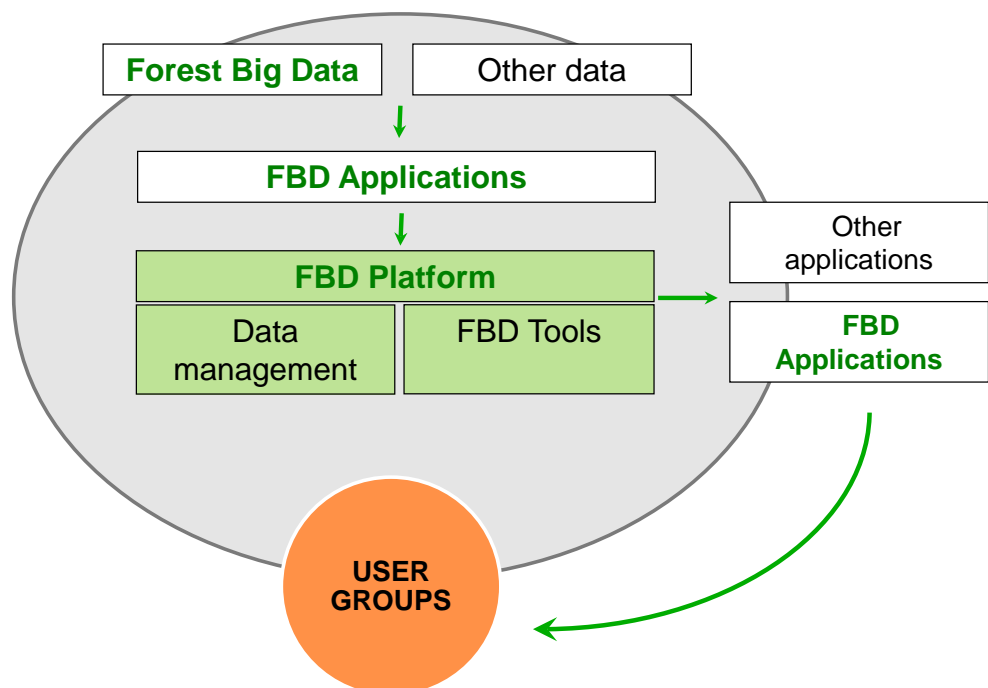


Figure 1. The Forest Big Data business approaches.

The FBD business modelling is a good example of network driven business development. The primary goal of the FBD business is to bring business value and operational benefits to the user groups who represent the value network of forest sector. The commercial result of the FBD business itself does not play as big role as in typical business.

2.2 Objectives of Business Modelling

The main aim of the FBD business is to bring added value to the end users of the FBD Applications. Therefore, the success of the FBD business is measured by the performance of the FBD end users rather than by actual FBD business transactions. However, as in any normal business it is essential that the FBD business is developed, implemented, and maintained cost and resource efficiently and meeting its strategic and operational objectives. Since the FBD business will be developed in collaboration of a wide network, preliminary business modelling is needed already at an early stage to provide a concrete and structured starting point for debates and decision making.

The objective of business modelling is to communicate in a formalised format the strategic objectives and choices of a business entity, the main business concept and logic, and the main resources needed in the implementation of the concept. A business model is a strategic level tool and it needs to be supplemented with operational models such as business and information processing models. (Lambert, 2008)

This report merely intends to describe and suggest potential elements and approaches for the FBD business modelling, whereas the actual modelling work takes place at later phases in collaboration between the potential business partners.

2.3 CSOFT Business Modelling Framework

The CSOFT technique was chosen to be applied for the FBD business modelling. The technique is composed of stages, which are needed to describe the essential elements of a business model (Figure 2). The first stage in the model is the planning level where the strategy and the long-term goals of the business are defined. The architectural level is composed of the actual CSOFT elements of the model: Customers (C), Services (S), Organisation (O), Finances (F), and Technology (T). At the implementation level, operational models and processes are described. Key Performance Indicators (KPIs) are needed to monitor the performance of the operations in relations to strategic objectives set at the planning level. Only the planning and architectural levels were addressed in this report.

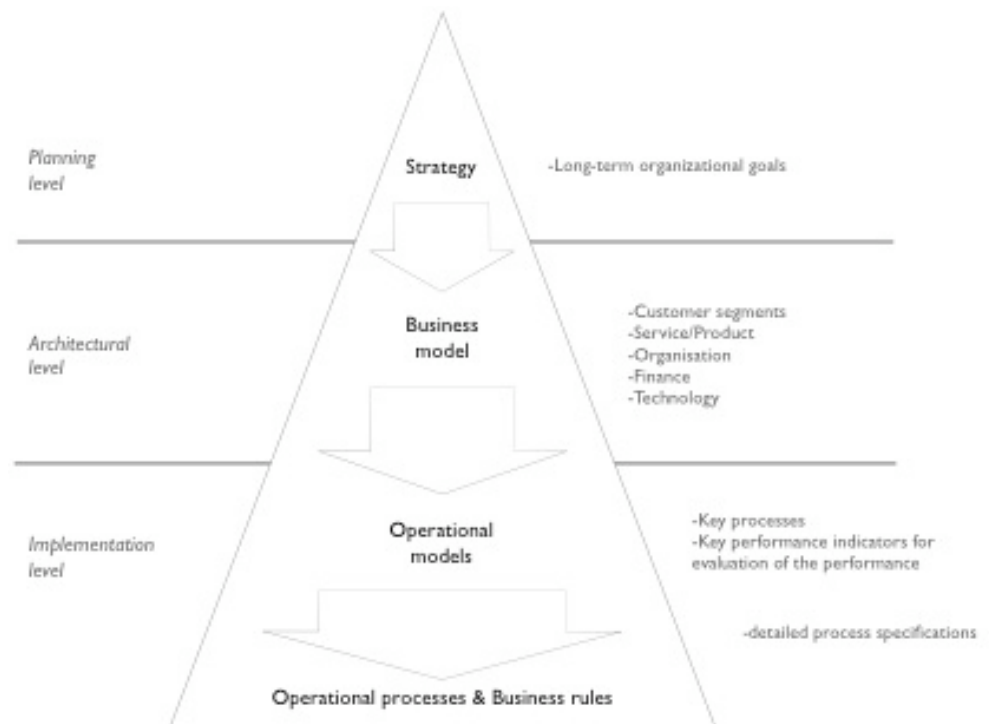


Figure 2. Levels in the CSOFT business and operational modelling (Heikkilä et al., adapted from Osterwalder & Pigneur, 2002).

3 POTENTIAL CSOFT BUSINESS MODELS FOR THE FOREST BIG DATA

3.1 Introduction

The stages of the CSOFT business modelling technique were applied to the FBD business areas: the Forest Big Data, the FBD Platform, and the FBD Applications (overview in the Table 2). The resulting model portrays potential objectives and factors of the FBD business. At the time of writing this report, there is no actual FBD organisation or network in Finland that could decide on the development and implementation of the FBD business models. Hence, the main aim is to provide here ideas and elements for future debates and decision making.

Table 2. Overview of the CSOFT modelling of the FBD business.

Customer (C)	Public sector (administration and research) Forest owner Forest company Forest management service company Harvesting and transportation company
Services (S)	Forest Big Data, FBD Platform, FBD Tools, FBD Applications
Organisation (O)	FBD Coordination Organisation / Application-specific organisations
Finance (F)	Public and private development financing, Income financing, Open solutions / Pricing models / Income and expense distribution
Technology (T)	FBD Platform system / FBD Tools / FBD Applications
KPIs	Network: Use of the FBD services, Network size, Sector wide savings and added value Public sector: Service development, Economic impacts of new business formation Supplier: Market coverage %, Turnover €, Profit % Client: Savings, Efficiency, Quality

Analysis of trends and drivers in the business environment is a typical stage in business modelling. The analysis helps in identifying the factors which may support or hinder the development of the business in question. The PESTE model is one of several frameworks for the analysis (Table 3). As it regards FBD, the political environment is favouring its development as several public authorities at national and international level are actively pursuing for open and big data driven business development and growth.

Finland's latest national forest strategy (Kansallinen metsästrategia 2025) was published in January 2015. The development of future forest data and electronic services is one of the strategic projects stated in the draft strategy. The aim of the project is to develop the next generation forest resource information systems, a process for updating the data, and develop the metsään.fi service into an open information sharing and service portal. Further, the Finnish Ministry for the Agriculture and Forestry has launched the Forest Data 2020 (Metsätieto 2020) project, whose aim is to define a vision for the next generation forest data and a development plan for its implementation.

Table 3. The PESTE analysis of the FBD business environment.

Political	Economic	Social	Technological	Ecological
<ul style="list-style-type: none"> • Competitiveness of the Finnish bioeconomy • INSPIRE directive • National forest data strategy • Support for public decision making 	<ul style="list-style-type: none"> • Cost-efficient data processes • New domestic and export business • Utilisation of the Finnish ICT know-how 	<ul style="list-style-type: none"> • Availability of labour in the forest sector & attractiveness of the sector • ICT readiness of forest owners • Urbanisation of forest owners 	<ul style="list-style-type: none"> • Increasingly faster and less expensive data transfer • Big data analysis methods • Improved performance of mobile devices • Internet of Things 	<ul style="list-style-type: none"> • Effective utilisation of forest resources • Environmental regulations in wood supply • Planning of nature conservation • Efficient timber transport

The European Union’s INSPIRE directive² calls for establishment of the Infrastructure for Spatial Information (in Finland www.paikkatietoikkuna.fi). The directive also defines several regulations and recommendations on the availability, use, format, and pricing of spatial information produced by public authorities. A service for sharing open data by public authorities at any sector is available at www.opendata.fi.

Progress in ICT technologies simultaneously decreases the costs of mass data handling and transfers as well as improves use of real-time data in mobile environment. This improves the possibilities of various stakeholders (even small and medium sized companies and forest owners) to adopt a wide range of FBD services.

3.2 Strategy and Vision

The starting point for business development is business strategy and vision. They address questions such as “Where are we in the business today and where do we want to be in the future?” “What are the strategic objectives of the business and how do we attempt to achieve them?” In the beginning of FBD project, the forest sector partners³ of the D2I program defined a vision for the Forest Big Data: the next generation forest resource data system that serves all the forest sector actors and contains more precise, versatile, and up-to-date forest resource and condition data than available today. This vision served as a basis for a suggested, more detailed vision (Figure 3). The aim of the Forest Big Data project is to set the basis for developing the next generation forest resource data system.

² Directive 2007/2/EC of The European Parliament and of The Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

³ Arbonaut, Metsähallitus, Metsä Group, Metsäteho, Ponsse, Savcor, Stora Enso, UPM-Kymmene, The Finnish Forest Centre

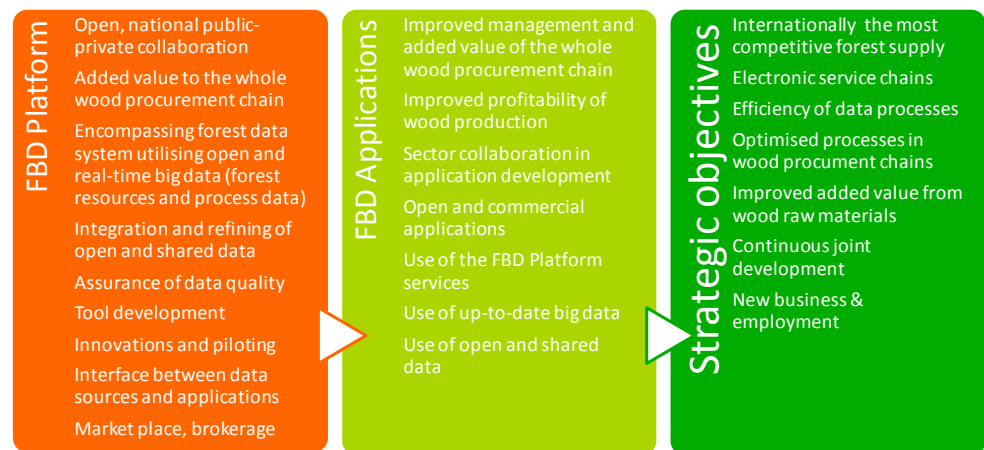


Figure 3. Proposed vision and strategic objectives for the Forest Big Data business.

The vision for the FBD Platform describes the potential role of the platform not only as a technological platform but also as a network platform that unites the major FBD players in Finland and seeks actively FBD business development. The proposed strategic objectives follow closely the vision that the FBD business should primarily bring value to the forest sector actors. However, the development of the FBD business as such is important not only to potential system and application suppliers but also to Finnish national economy. New FBD services and applications do not only serve Finnish users but may be developed and exported to other countries or business sectors as well. The financial objective of the FBD Platform is not necessarily to make profit (or the objective is to make profit in order to cover immediate investment and development costs). The FBD Applications may be developed by the FBD Platform or by separate networked or commercial organisations.

3.3 Customers (C)

The Customer part of the CSOFT model aims to identify the major customer segments and their potential volume for the business as well as to identify customer and network value creation of the business.

Customer Segments

The vision for the Forest Big Data stresses the importance of the whole wood procurement value chain in Finland (Figure 4). The whole chain approach is essential since:

- Each stage of the chain produces data that is used and combined at other stages of the chain

- Cost savings and efficiency gains in one part of the chain may have immediate or gradual impacts in other parts of the chain (correspondingly, inefficiencies in one part of the chain impact the other parts of the chain)
- The utilisation of FBD’s full potential requires that there are no manual bottlenecks at any stage of the value chain
- Development of FBD solutions only for certain actors in the chain may cause incompatibilities of the systems at later development stages
- Use of Forest Big Data is in many respects at the starting stage in Finland. Therefore, there is no thorough understanding of needs or possibilities, not even in the short-term time period.
- One of the main objectives of the FBD vision is to improve international competitiveness of the Finnish forest sector. The whole chain approach is needed to find all the relevant potential for improving performance.

The importance of the whole wood supply chain in the development of the FBD solutions does not mean that all the actors have the equal importance at different stages of development and implementation. The size of the actors in the chain varies tremendously, which impacts on the possibilities of the actors to invest resources on the development or even utilisation of FBD solutions. The development of the FBD solutions requires prioritisation and assessment of costs and benefits. While planning potential FBD solutions and setting targets for their markets and impacts, it is important to understand the potential volume of the users and usages (Figure 4).

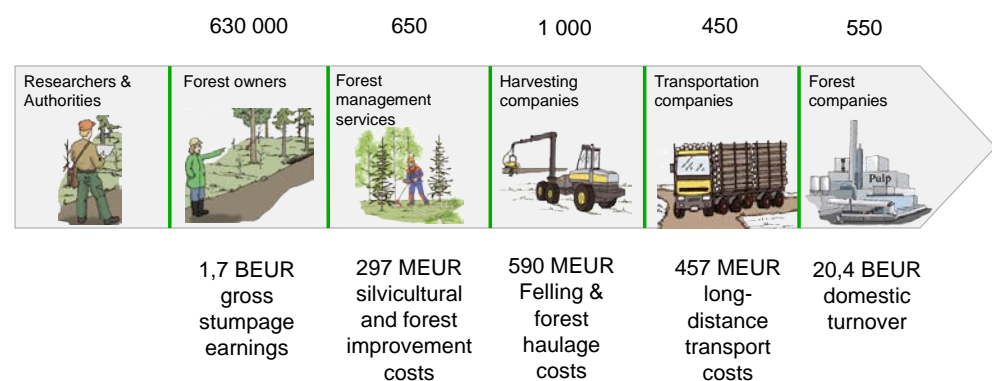


Figure 4. Timber procurement value chain and its volume in Finland (Metla 2014a-b; Metsäteho Oy, 2013; SKAL, 2014; Statistics Finland, 2014; The Trade Association of Finnish Forestry and Earth Moving Contractors, 2014).

The actors in the wood procurement chain are the primary segments of the FBD Applications (Table 4). For their part, the application suppliers are the main customer segment of the FBD Platform services. Commercial Forest Big Data producers have different options to access the market. The data may be sold to the FBD Platform, which then refines it and further sells it to

either the FBD Application suppliers or directly to end users. Alternatively, the FBD Platform acts as a broker of Forest Big Data and charges the producers for data transfer commissions. The process of handling open or shared data may be similar, but the pricing and financing models will be different.

Table 4. Grouping of the FBD customer segments.

- Primary Segments (Actors in the wood procurement value chain & Public authorities & Researchers)
 - The primary segment of the FBD services, direct buyer of the FBD Applications, the most important user and payer group.
 - The main focus is on the end users in Finland, but new possibilities in export business are covered, as well.
- Secondary Segments (Data producers & Application suppliers)
 - Primarily gaining income via the FBD Platform and applications, but possibly also paying trading platform fees and other brokerage fees to the FBD Platform organisation
- Tertiary Segments
 - Occasional and most likely free users of FBD applications (such as citizens, insurance and electricity companies)

The FBD business is a multi-sided market; it needs to attract both data producers, end users, and application suppliers, since the value of the business for each group is dependable on the number of actors on the other sides (Eisenmann et al, 2006). In addition, cost-efficient development of good quality FBD Applications is dependable on the adequate availability of Forest Big Data and FBD Platform services. A third group of FBD customer segments is actors who utilise FBD solutions only occasionally (and probably through services provided by the primary segments). This customer group does not bring FBD business income, but careful planning of the processes where they are connected to may bring substantial cost savings.

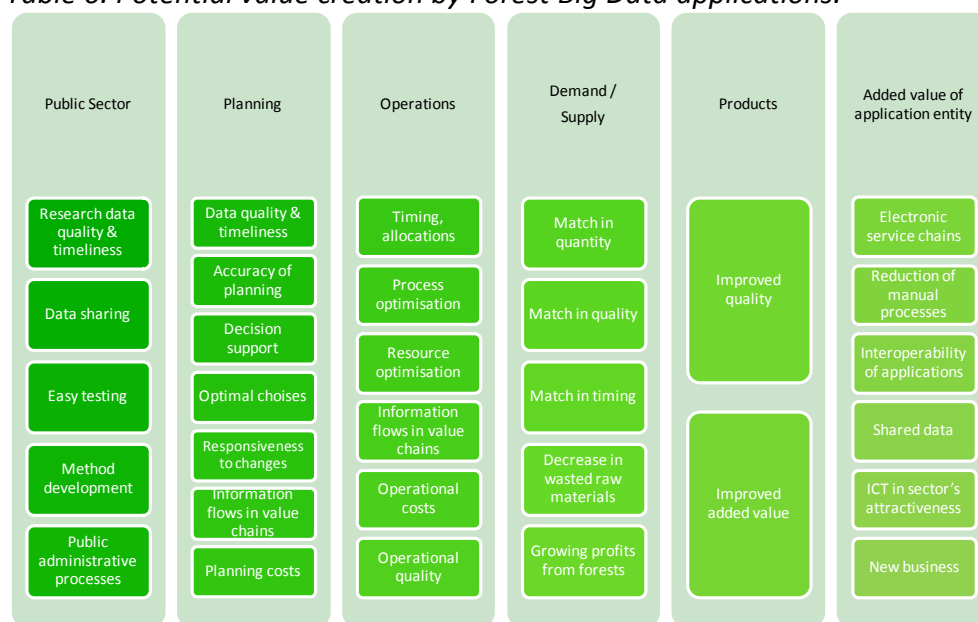
FBD's Value Creation

The vision for Forest Big Data calls for sector-wide improvement in competitiveness. The fulfilment of the vision and strategic objectives to be defined will materialise in the FBD services (the FBD Platform and FBD Applications). Even though the actual content and technologies of the FBD services have not yet been specified, the types of potential value have been recognised for actors in the public and private sectors (Tables 5 and 6). The value tables may be used as check lists when planning FBD solution development and assessing the performance and impacts of implemented solutions. Have all the customer values been recognised and how well they are met in the FBD services?

Table 5. Potential value creation by the FBD Platform (Value type categorisation Gregor et al., 2004).

Value type	Application suppliers	Public sector	Forest companies, Forest management companies, Harvesting and transport companies	Forest owners
Strategic	Int'l competitiveness New services New application business	Customer service National economic impacts of new businesses	Competitiveness Customer service	Forest asset management
Informational	Utilisation of centrally collected and verified data	Fast and easy access to aggregated and real-time data and applications Reduction in data handling errors and manual work due to increased connections between systems Reduction in system interfaces Collective recognition of information needs Knowledge sharing in the network		Up-to-date forest resource data
Transactional	Savings in operational and planning costs Distributed development costs and risks Addressing jointly development challenges Shared piloting and innovation platform Shared costs in data collection, handling, and distribution			Support for planning sales
Organisational	Extensive partner network	Reduction in overlapping and non-value added activities		

Table 6. Potential value creation by Forest Big Data applications.



3.4 Services (S)

3.4.1 Overview of the FBD Services

The Services stage of the CSOFT model describes the services that are available or being planned for the identified customer segments. It needs to be decided whether all the services are available for all the segments or whether there are different versions of the services for different segments. The optimal service portfolio needs to be designed.

Today, specifications and planning of different FBD services are at very different stages. Some **Forest Big Data** elements have been addressed in the

FBD Tasks 3.1-3.4. The content specification of **the FBD Platform system** has been carried out in the FBD Task 3.1. The technical specification work starts in 2015. The aim is that the system will be in operation in 2020. The FBD Platform provides two types of services: Data management services and Tools (Figure 5). Data management mainly covers such data administrative services that do not require ICT systems for implementation. Data management services are needed to coordinate and set guidelines for the networked development of the FBD solutions and to ensure involvement of various stakeholders. An important role of the Platform is to serve as a market place for unrefined and refined data as well as applications. The pursued extent of available market place services, liabilities of the Platform as a market place provider, and hence the extent of potential income from the market place services require careful consideration. As it regards standardisation questions, there are separately ongoing projects on the matter (see metsatietostandardit.wm.fi).

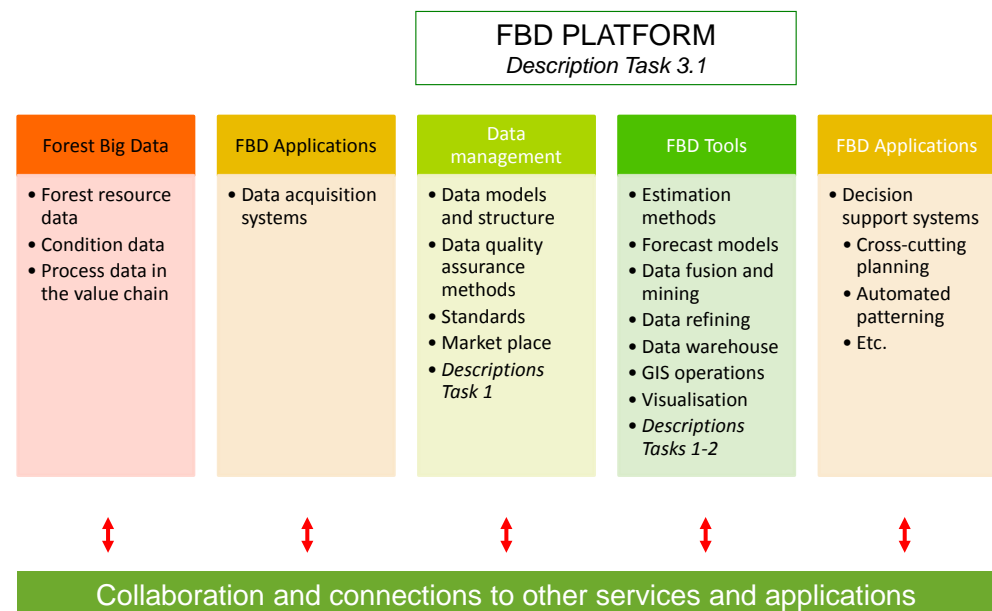


Figure 5. Overview of the Forest Big Data services.

The FBD Tools are jointly developed, generic applications that for example aggregate, refine, and visualise data from various data sources (especially in cases where such data handling is too expensive or technically too demanding to take place in individual FBD applications). Some of these tools have been under development in the FBD Task 2 (such as GIS operations, visualisation, and some forecast models).

The FBD Applications are needed to further refine data and provide additional tools so that Forest Big Data is usable in various business operations and systems. Some of these applications may be developed in sector-wide and open collaboration. The most are more likely to be developed as purely commercial products. In both cases, the FBD Applications are referred here as applications that are, at least in some degree, developed

and maintained in cooperation with the FBD Platform. Additionally, there are other applications which are developed without any link to the FBD Platform (for example applications developed for multi-sector use or by suppliers outside Finland). It is advisable to follow the developments of these other applications as well and take them into account in joint application development portfolios and road maps.

The exact need for or content of potential FBD applications have not been yet studied or specified. Instead, a number of potential use cases of FBD data have been recognised (see Chapter 3.4.2 and Hämäläinen et al, 2014). These use cases may act as a basis for later discussions and decision-making on the later stages of joint development. An example of an application which could be categorised as an “FBD Application” is the cross-cutting planning application. The content and technical specification of the application has been commissioned by a network of companies (i.e. the major Finnish forest companies). The decision on the implementation of the application is likely take place in spring 2015. Another ongoing, joint application project deals with automated patterning.

Examples of current forest data actors and systems in Finland are presented in the Table 7. Besides the national actors, there are various organisations dealing with big data issues at European and global scale (such as the United Nations, the European Union, the European Space Agency, and Google).

Table 7. Examples of present forest data actors and systems.*

Data producer	Data refiner	Data warehouse
Finnish Forest Centre	Finnish Forest Research Institute (Metla)	Finnish Forest Centre
Public open data	Shared data	Commercial data
Forest resource data	Stem bank	Raw data from laser scanning
Open information systems	Shared information systems	Commercial information systems
Forest Resource Information System Aarni	metsään.fi service	Forest planning systems
Coordination and Development		
Finnish Ministry of Agriculture and Forestry, Finnish Forest Centre		
Service, System and Device Suppliers		
ICT device and service suppliers, forest machine manufacturers		

** Data includes here both data and information. Data and information systems may be shared vertically (among the actors in the same wood procurement chain) or horizontally (among similar actors such as forest companies).*

3.4.2 The FBD Use Cases

Potential use cases of Forest Big Data were recognised in a stakeholder workshop arranged within the Task FBD Task 3.1 (Table 8). The aim of the

use cases was to concretise potential use of Forest Big Data by various actors and in various operations and to identify data needs and potential value creation in each case. The use cases do not specify actors, technologies, or concrete steps required to fulfil the cases. Rather, the use cases offer ideas for development of actual FBD services in the future.

Table 8. Potential FBD use cases for the actors in the wood procurement chain and researchers (identified in the FBD Task 3.1, Tampere University of Technology, 2014).

Actor (role) / Process	A. Inventory & Research	B. Forest asset management	C. Wood supply planning	D. Timber trade	E. Harvesting and transportation	F. Forest management	G. Production
1. Data supplier	A1 Production and updating of stand and soil data A2 Local updating of stand and soil data						
2. Forest researcher	A3 Collection and utilisation of research data						
3. Forest owner		B1 Forest planning and valuation		D1 Valuation and stand quantity estimation at forest sites		F1 Worksite planning of forest management	
4. Wood procurement organisation		B1 Forest planning and valuation	C1 Planning of timber procurement	D1 Valuation and stand quantity estimation at forest sites	E1 Periodic planning of harvesting E2 Planning of timber harvesting worksites E3 Cross cutting planning E4 Transportation planning E5 Productivity analysis		
5. Forest management service company		B1 Forest planning and valuation				F1 Worksite planning of forest management	
6. Harvesting or transport company					E2 Planning of timber harvesting worksites E3 Cross cutting planning E4 Transportation planning E5 Productivity analysis		
7. Forest machine or timber truck driver					E6 Harvesting planning and operations E7 Transportation planning and operations	F2 Forest management planning and operations	
8. Production facility							G1 Production management

The list of use cases identified in the Task 3.1 was supplemented with additional use cases, targeted to some public authorities (Table 9). The public sector may use FBD services in strategic decision making, target setting, operational planning, and monitoring of political and legal initiatives. The FBD Platform also provides the public sector access to new, combined data produced by private actors.

Table 9. Potential FBD use cases for Finnish public authorities.

Ministries (Forestry, Environment, Economy, Transport)	The Finnish Forest Centre
International forest policy and follow-up of the obligations (e.g. carbon balance)	Promotion of utilisation of forest resources
Forest policy: Effective utilisation of forest resources (e.g. targeting and monitoring State aids, development of infrastructure) Other political planning	Collection and maintenance of forest resource and condition data Dynamic planning of utilisation of forest resources
Planning of forest strategies, Target setting, and Follow-up of implementation	Monitoring fulfilment of the Finnish Forest Act
Regional economic studies of the forest sector	Maintenance and monitoring of the agreements under the Forest Biodiversity Programme (METSO)
Citizens information services	Assessment of the condition and renovation needs of the forest road infrastructure
	Inventory and evaluation of acute and slowly progressive forest damage
	Information services for forest owners and the forest sector

3.5 Organisation (O)

The Organisation stage in the CSOFT business modelling describes internal organisational resources and major collaborative partners needed to plan, execute, and develop the defined business services. As mentioned before, at the moment there is no FBD organisation or network in Finland that could coordinate or implement the FBD business model as a whole. However, there are several forest-sector related public and private actors who have long-established relationships in joint business, data, service, and ICT system development.

The FBD vision aims for one shared, national FBD Platform, as it regards to a technical system. Therefore, it is logical that there is one national **FBD Co-ordination Organisation**, whose role is to coordinate not only the development and maintenance of the technical platform but also of other FBD services described in this report. The FBD vision also aims for development of the whole wood procurement chain (including research and public administration). Therefore, the potential members and collaborative partners of the FBD Coordination Organisation should cover a wide range of actors, mainly in Finland but also at international level (Figure 6).

A recent report (Marjamäki, 2014) commissioned by the Finnish Transport Agency discusses the roles of different actors in the ecosystem of traffic data utilization and production. The report recognizes also individual users of the traffic services as potential innovators and developers of new traffic data applications. The report proposes the Agency to encourage end user

driven application development for example through competitions (for example Apps4Mobility competition⁴). Application competitions could be an interesting option for enhancing also FBD application development.

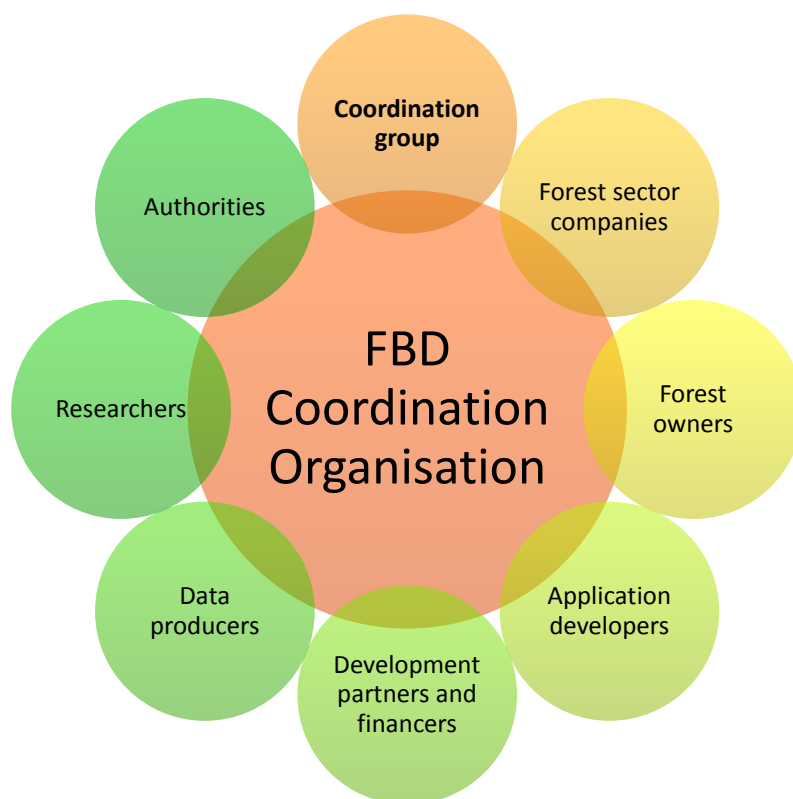


Figure 6. Potential members and collaborative partners of the FBD Coordination Organisation.

There are different options for the form of organisation of the FBD Coordination Organisation (such as a network, association, or company) (Table 10). The form of organisation may also evolve as the depth of collaboration and size of the involved network increases. At the very beginning, the cooperation may simply start with more coordinated sharing of open or restricted data. Since there are no actual business transactions, also the organisational form should be simplistic. Launch of the FBD Platform system, in turn, is a considerable project requiring investments in hardware, software, and interface development as well as continuous maintenance of the system. This demands a more structured organisation.

The forms of organisations of the **FBD Application** business depend on the application and its developers. In this study, the FBD Applications are defined as applications which are developed and maintained in some degree of collaboration with the FBD Platform. The level of collaboration may vary from case to case. In the simplest cases, the FBD Platform mainly provides recommendations for the development of a new application. In some other

⁴ <http://www.apps4finland.fi/kilpailu/apps4mobility/>

cases, the FBD Coordination Organisation itself could be the developer and commercial owner of a new application.

Table 10. Organisational options for different approaches of Forest Big Data business.

Approach	Organisational options
FBD Platform & Tools	<ul style="list-style-type: none"> • "FBD Coordination Organisation", whose organisational form for example company, society, or network • Coordination and development tasks • Strong public sector role (impact on availability and quality of open data as well as public financing; method development) • The role of the private actors in the organisation depends on the forms of organisations and collaboration; FBD Platform could also be divided to public and private parts
Data	<ul style="list-style-type: none"> • Data owners: Open and restricted data, rules on data utilisation • FBD Platform organisations's key contractual and collaboration partners
Applications	<ul style="list-style-type: none"> • Open or fully commercial actors, depending on the application • The level of cooperation varies between application suppliers and the FBD Platform

It is likely that the development of the FBD business will demand some discussions and planning on the roles of the different public and private actors in the **forest big data** production. The main objective is that the relevant forest data producers collaborate with the FBD Platform and therefore are participating in coordination of data production. Also the end users of the FBD Applications may act as data producers (of both forest resource and process data). An example of this is collection of forest resource data by harvesting machines (see Melkas & Hämäläinen, 2015). Ensuring active role of the end users in, often voluntary, data production is one of the challenges and will require development of activating incentives.

One of the major organisational questions is the separation between open and public actions and purely commercial FBD business actions (Table 11). One option here is to separate the FBD Coordination Organisation in two, public and commercial, parts but with close established business relationship. The selected form of organisation should support both improved availability of reliable open data and emerge of new businesses and business solutions.

Table 11. Potential tasks in the coordination and development of the FBD business.

	Coordination	Development
Public focus	Coordination and development of public availability (openness) of data, data quality, and standardisation	Planning, implementation, and development of the FBD Platform system
	Communication with public authorities	Collaboration with method developers (research institutions and companies)
	Management and operation of open forest data systems	Development of open applications utilising FBD
	Participation in international development	
Private focus	Drafting directions and recommendations for FBD and applications utilising FBD	Decision-making on execution and business modelling of applications developed in collaboration
	Coordination and exchange of information between application development projects and groups	International cooperation projects
	Management of the FBD market place (part of the FBD Platform)	

3.6 Finance (F)

Financial issues of a business model address for example pricing and earning models, distribution of costs, income, and risks within a network, as well as financing of investments. Since the FBD business is intended to be developed in a wide network of public and private actors, there is need for a variety of financial models, as well. The Figure 7 illustrates the potential roles of different financing sources in the development and operations of different aspects of the FBD business.

The financial questions of the FBD business are expected to differ from typical businesses in several aspects:

- **The major role of open data and services as well as networking.** The networked FBD “business” may start with improved sharing of open, public data and exchange of corporate data without monetary transactions. In this case, there would be no immediate need for an established organisation or investments, and thereby neither for notable financing. Free exchange of open or shared data does not remove the questions of data ownership and data rights.
- **National economic benefits.** Open forest data is one of the prerequisites for the development of new commercial applications. As a consequence, the public investment in open data production and

development may generate positive impacts in new business development, employment, and innovation⁵.

- **The role of the FBD Platform in new business generation.** The Platform is another prerequisite for generation of commercial FBD services. For that reason, the goals and indicators set for the financial performance of the Platform should take into account the performance and impacts of the application business.

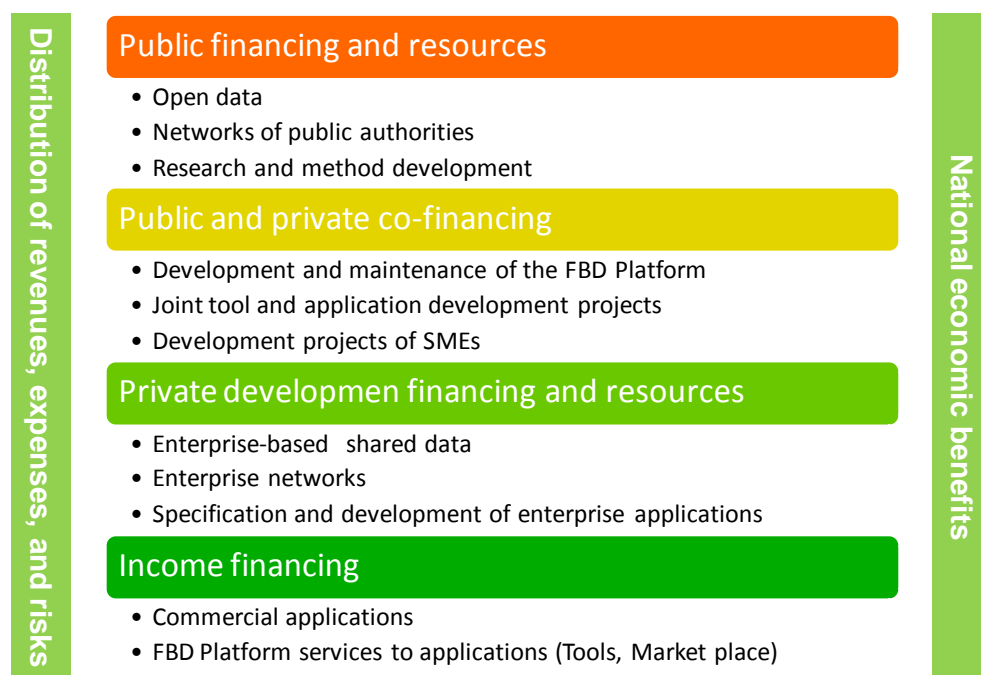


Figure 7. Financing options for the FBD service development and operations.

The prospective pricing models of the FBD services depend on the financing sources and the strategic objectives of the financiers (Table 12). The first and basic level FBD services may be provided free of charge in order to ensure critical mass for successful FBD market. The development costs of the most advanced FBD services may be covered by market pricing or by external pricing (for instance income from advertisements).

⁵ A recent European study (Buchholtz et al., 2014), estimates that Big Data will generate additional 2,1 % growth in Finland's Gross Domestic Product by year 2020.

Table 12. Prospective pricing models for the FBD services.

Source of financing	Prospective Pricing Models
Public financing and resources	<ul style="list-style-type: none"> •Open access and limited use •Market or cost-based pricing for commercial use
Public and private co-financing	<ul style="list-style-type: none"> •Open use or use for reduced price •Cost-based pricing
Private development financing and resources	<ul style="list-style-type: none"> •Cost-based pricing for participants in the development, market prices for external users •Indirect pricing (such as network membership fees including certain FBD services)
Income financing	<ul style="list-style-type: none"> •Market price •External pricing (income from advertisements)
	Pricing Models irrespective of the Source of Financing
	Market segment based pricing (depending on the type and size of the of the end user)
	Registration fee, annual fee, usage-based charges

3.7 Technology (T)

On the one hand, rapid technological development provides several possibilities for the FBD services and business (for example new advanced technologies in mass data collection and transfer). On the other hand, continuous changes increase risks with obsolete technologies or incompatibilities of ICT systems.

The technical specification, taking place in 2015, of the FBD Platform will set the major principles for the technical development of the FBD business. The functional specifications of the Platform have been described in the FBD Task 3.1. Some FBD Tools have been developed in the other FBD Tasks:

- Task 1: Data fusion and estimation methods
- Task 2: Multisource 3D/4D forest management methods, Autonomous UAV/hexacoptering imaging, Forest monitoring by means of low-cost data, Estimation of stand structure
- Task 4: Methods for measuring and modelling young trees, Methods for visualising measurements.

Since the technological questions are addressed in other FBD Tasks and projects, this report only identifies some general technological questions and principles that need to be taken into account in the future development of the FBD services (Table 13).

Table 13. The major technological questions of the FBD services.

Data	FBD Platform	FBD Tools	FBD Applications
<ul style="list-style-type: none"> • Mass data handling • Heterogeneous data • Transfer technologies • Automated collection and transfer • Sensor technology • Internet of Things 	<ul style="list-style-type: none"> • Architecture • Data structures • Interfaces • Application neutrality 	<ul style="list-style-type: none"> • Data base solutions • Open interfaces • Distributed system • Standards • Continuous service 	<ul style="list-style-type: none"> • Interoperability • Open interfaces • Modularity • Standards • Low technical barrier to entry for SME users • Mobility • Continuous service

3.8 Key Performance Indicators (KPIs)

Key Performance Indicators (KPIs) assist in monitoring the fulfilment of strategic and operative targets of an existing business and support in short- and long-term decision-making. The main components of KPIs usually include customer satisfaction, product or service performance, market coverage and competitive situation, operational efficiency, and financial result. The set of KPIs evolves with the maturity of the business. Moreover, different metrics are needed at the planning stages (such as cost-benefits analyses in comparisons of different options).

The KPIs for the FBD business should be set by the FBD Coordination Organisation or other national FBD network. The entities that require monitoring are the FBD Platform (as a technical system and market place for data), the FBD Coordination Organisation as a network of public and private stakeholders, as well as the set of available FBD Applications.

Since the aim of the FBD business is to improve the competitiveness and efficiency of whole wood procurement chains in Finland, the suggested KPIs emphasise the sector-wide impacts of the FBD services (Table 14). For the second, monitoring of national economic impacts of the FBD business (such as employment) may be necessary in the decision-making of the public sector. More detailed definition of KPIs takes place after the decision on the strategy and strategic objectives of the FBD business.

Table 14. Suggested Key Performance Indicators for the FBD Platform and FBD Applications as an entity.

FBD Platform & Coordination Organisation	FBD Applications entity
<ul style="list-style-type: none"> • Size of the network • Customers, Turnover • Implementation status of FBD Tools • Sector-wide costs • Share of real-time data • Customer satisfaction 	<ul style="list-style-type: none"> • Implementation status • Customers, Turnover • New companies, work places, export products and innovations • Replaced company-specific solutions • Utilisation of real-time big data • Electronic service chains • Sector-wide resource efficiency and cost savings • Share of standardised solutions • Customer satisfaction

3.9 CSOFT Cases for the Forest Big Data

In order to demonstrate the application of the CSOFT business model at a more concrete level, the technique was applied to a number of cases:

- the FBD Platform
- 1 FBD Application (Cross cutting planning service)
- 2 FBD use cases (Harvesting worksite planning and Forest Planning).

These cases were selected since they represent services at different implementation stages (for example the Cross cutting planning application is already at technical specification phase). Further, the services of the cases are targeted to different customer segments (FBD Platform's direct customers are application suppliers, Forest Planning services can be targeted to several customer segments, whereas cross cutting planning application will be mainly sold to forest companies).

Prior to the CSOFT modelling, value chain charts were drafted for each case. The value chains help in understanding the role of different actor groups in producing and using potential new FBD services. The charts also help in understanding who are the direct customers (i.e. actors who actually pay for the FBD services) and who are indirect beneficiaries. The value chain charts and CSOFT modelling tables for the cases are attached as appendices of this report.

3.10 Road Map for Further Actions

This report is the first attempt to describe potential elements in the networked development of business models for the Finnish Forest Big Data business. The baseline for the future steps in the business modelling is the

stated objective of having the FBD Platform system in operation in 2020. The full exploitation of the system will require an established organisation or network to coordinate the Platform development and to link it to various suppliers and developers as well as to end users. The network will need to decide on questions regarding financing, legal issues, risk management, quality management and first of all, setting and monitoring the goals of the business.

The next step is to set up a discussion process in order to involve and network the relevant stakeholders. One of the main questions is to understand the objectives of different actors and how these objectives can be combined to shared goals and actions. Stakeholder workshops and tools for describing and ranking goals may be used to facilitate discussions. The result of this debate leads to another set of questions: What should be the role of the FBD Platform? What kinds of FBD applications are needed and who should lead their development? How to ensure that currently unforeseen developments in information and communications technologies and user needs are not jeopardised by the decisions made today?

Several public and private actors already collaborate on use of Forest Big Data (in sharing and developing data, development of data collection technologies, Internet services, and new applications). This collaboration should continue and aim for rapid launching of new services. Hence, the road map for the future actions calls for parallel advancement at all levels of the FBD business (data, applications, the FBD Platform, and organisation) (Table 15). A more detailed road map for the FBD Platform system has been drafted in the FBD Task 3.1. Road maps for some data elements and tools have been drafted in the FBD Subtasks 3.1-3.4. Further development actions are likely to be identified when the need for new applications are studied and prioritised in the continuation projects.

A number of ongoing projects will provide additional information and views about the user needs, key players, processes, information infrastructure, and national strategies and plans as it concerns forest data use and development in Finland. The Forest Data 2020 (Metsätieto 2020) project commissioned by the Ministry for the Agriculture and Forestry will draft a proposal on the next generation forest data information infrastructure. It covers issues such as data contents, data collection, data needs and services, interface solutions, as well as roles of public and private sector actors in the data collection, maintenance, and utilisation. The FBD project needs to follow closely the development in the most relevant other projects.

Table 15. The proposed Road Map for further actions in the FBD business development.

	2015	2016	2017-2019	2020+
Open and restricted data	Data development, transfer technologies Usage rights Market analysis	Development plan	Continuous development	
Business model	Strategic objectives, Risk analysis, Legal issues and organisational rules	Market potential, Collaborative partners	Strategy, Business model, Business plan In operation	Further development of the business model
FBD Coordination Organisation	Organisational issues (roles, risks, financing, organisational model, distribution of income)		In operation	
The FBD Platform system	Specification of the system architecture, data structures, and interfaces	Other operational and technical specifications		In operation
FBD Tools & Data Management	Implementation and development plan Market place plan	Pilots and implementation Market place principles and technical implementation		
FBD Applications	Specifications, Cost benefit analyses, Priorisation, Implementation and collaboration plans, Pilots	Pilots and implementation		Pilots and implementation, Collaboration with the FBD Platform

REFERENCES

- Buchholtz, Bukowski & Śniegocki (2014). *Big & open data in Europe: A growth engine or a missed opportunity?* Internet: http://www.bigopen-data.eu/wp-content/uploads/2014/01/bod_europe_2020_full_report_singlepage.pdf
- Eisenmann T., G. Parker & M. W. Van Alstyne (2006). *Strategies for Two-Sided Markets*. Harvard Business Review OnPoint Article.
- Finnish Transport and Logistics - SKAL (2014). *Metsäalan kuljetusyrittäjät ry*. Internet: http://www.skal.fi/tietoa_meista/erikoisjarjestot/metsaalan
- Gregor, S., W. Fernandez, D. Holtham, M. Martin, S. Stern, M. Vitale & G. Pratt (2004). *Achieving Value from ICT: key management strategies*. Department of Communications, Information Technology and the Arts, ICT Research.
- Heikkilä J., P. Tyrväinen & M. Heikkilä. *Designing for performance – a technique for business model estimation*. Unpublished article.
- Hämäläinen, J., M. Holopainen, J. Hynynen, J. Jyrkilä, P. T. Rajala, R. Ritala, T. Räsänen & A. Visala (2014). *Perusteita seuraavan sukupolven metsävarajärjestelmälle – Forest Big Data -hanke*. Metsätieteen aikakauskirja 4/2014. Internet: <http://www.metla.fi/aikakauskirja/ff144.htm>
- Kansallinen metsästrategia 2025*. Internet: http://www.mmm.fi/attachments/metsat/MELxikU15/Metsastrategia2025_12022015.pdf
- Lambert S. (2008). *A Conceptual Framework for Business Model Research*. Internet: [https://domino.fov.uni-mb.si/proceedings.nsf/0/1e893ee544d680fec12574810042ac2d/\\$file/22lambert.pdf](https://domino.fov.uni-mb.si/proceedings.nsf/0/1e893ee544d680fec12574810042ac2d/$file/22lambert.pdf)
- Marjamäki, V. (2014). *Tiedon hyödyntämisen ekosysteemi*. Liikenneviraston tutkimuksia ja selvityksiä 56/2014. Internet: http://www2.liikennevirasto.fi/julkaisut/pdf8/lts_2014-56_tiedon_hyodyntamisen_web.pdf
- Melkas, T. & J. Hämäläinen (2015). *Hakkuukoneella kerätyn puustotiedon hyödyntäminen - Menetelmäkuvaus referenssitiedon keräämiseksi kaukokartoitukseen ja metsävarojen päivitykseen*. Unpublished draft report 2.2.2015.
- Metla (2014a). *Metsämaan omistus*. Internet: http://www.metla.fi/metinfo/mo/metsamaan_omistus.htm
- Metla (2014b). *Metsätilakokonaisuuksien omistusmuodoittain ja pinta-ala- luokittain vuoden lopussa*. Internet: <http://tilastot.metla.fi/>

Metla (2014c). *Metsätilastollinen vuosikirja*. Internet: <http://www.metla.fi/metinfo/tilasto/julkaisut/vsk/2013/index.html>.

Metla (2014d). *Palveluntarjoajat*. Internet: <http://www.metla.fi/metinfo/metsanhoitopalvelut/palveluntarjoajat.htm>

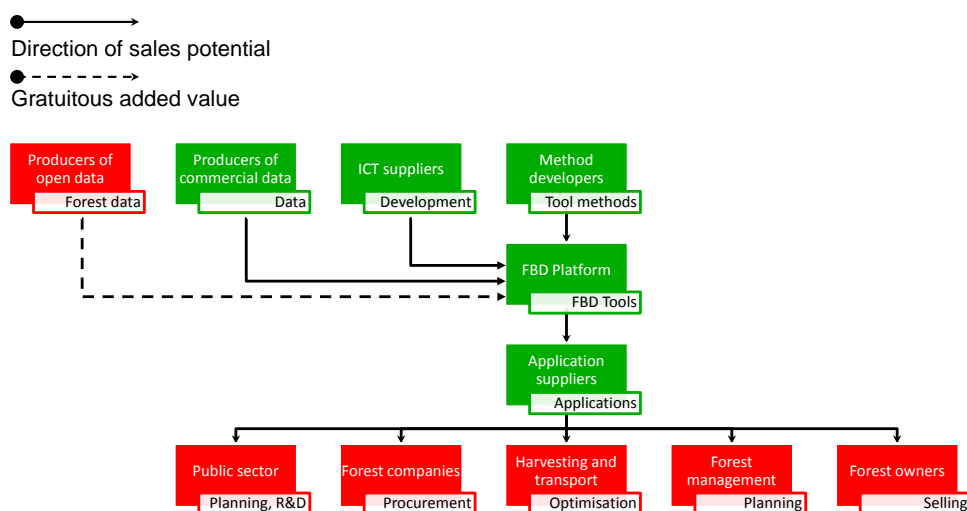
Metsäteho Oy (2013). *Puunkorjuu ja kaukokuljetus vuonna 2012*. Internet: www.metsateho.fi/metsatehon-katsaus?year=2013.

Statistics Finland (2014). *Teollisuus toimialoittain 2006-2012*. Internet: www.tilastokeskus.fi

Tampere University of Technology (2014). *DT1.1: Generic user requirements and traceability to use cases*. Slide show.

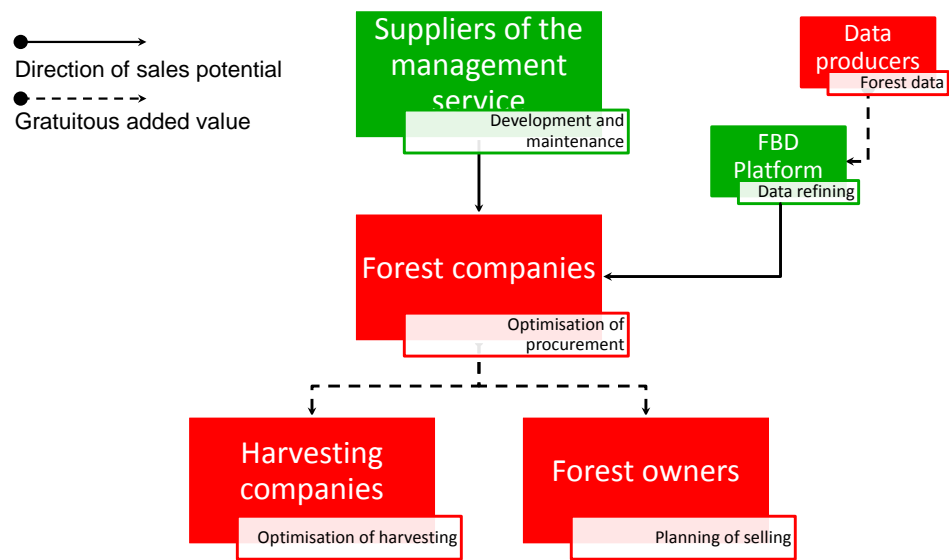
The Trade Association of Finnish Forestry and Earth Moving Contractors (2014). Internet page www.koneyrittajat.fi

FBD Platform (Value Chains & CSOFT Model)



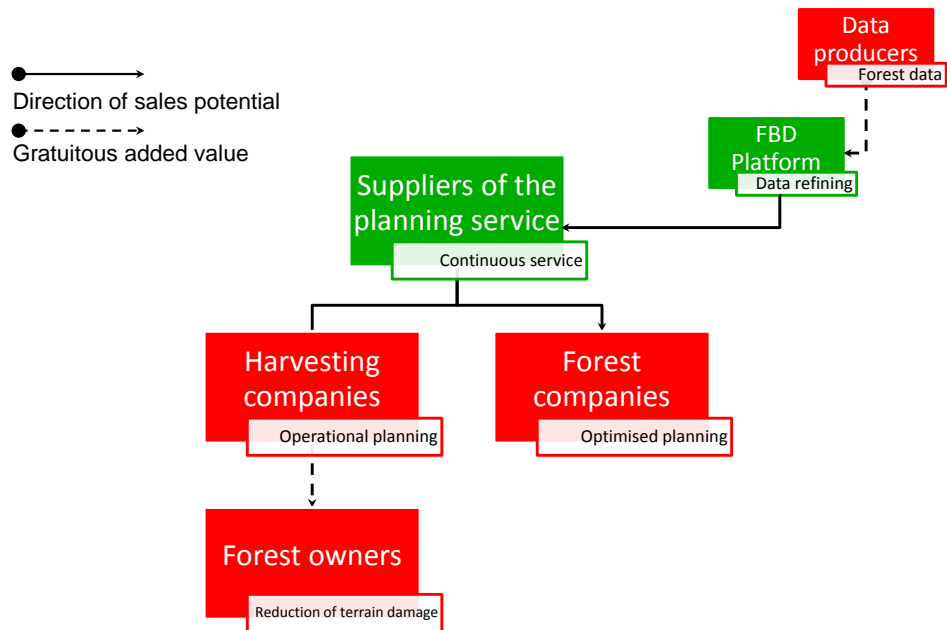
Customer (C)	Application suppliers	Indirect customers: Public sector, Forest owners, Forest Companies, Forest management service companies, Harvesting and transport companies
Services (S)	Market place for application services Selling of refined data FBD Tool services	Selling of refined data Selling of own application services
Organisation (O)	The FBD Platform organisation collaborates with its own ICT supplier, method developers, and application suppliers	Indirect customers are members of the FBD Platform developed group either directly or through associations; Collaboration with data producers and harvesting machine manufacturers
Finance (F)	Income from market place and service sales, joint development projects with public and private financing	Development financing of the development group, possibly public development financing
Technology (T)	Open source platform & Data management cloud service Possibly divided in public and commercial parts Content specifications in the FBD Task 3.1., technical specifications in follow-up projects	Connections to the FBD Platform through applications
KPIs	No. of clients, Sales volume €/a. Possibilities to utilise open and real-time data	Supplier: No. of client and market coverage, Sales volume €/a Buyer: Operational and planning costs €/a

Cross Cutting Planning Service (Value Chains & CSOFT Model)



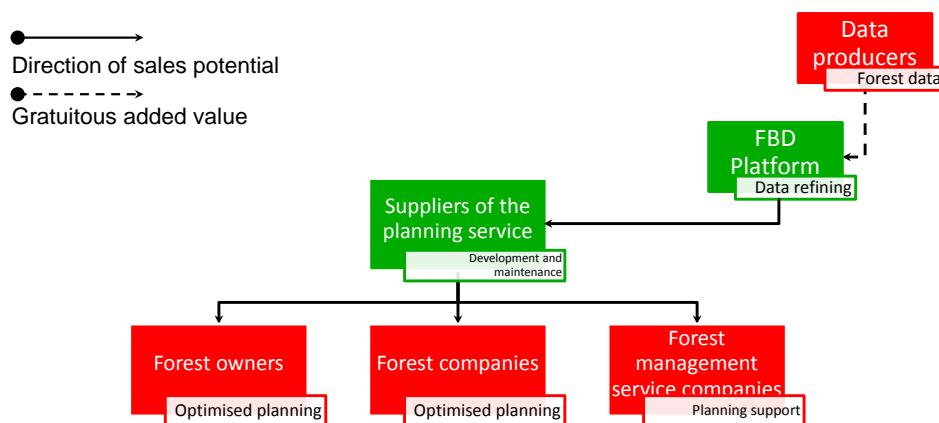
Customer (C)	Forest companies Volume: 51,5 million. M3 commercial round-wood removals (2012)
Services (S)	<i>Current status</i> Cross-cutting management programs in forest machines, that do not take into account site-specific differences <i>Objective</i> Optimised cross-cutting plan for each species of tree, based on the real-time site characteristics , worksite plan, and site harvesting objectives
Organisation (O)	<i>Current status</i> Forest company and forest machine specific solutions in use, A group of forest companies has set up a collaboration to procure a jointly developed solution, The group works in cooperation with forest machine manufacturers, The ICT supplier of the solution selected in 2014 <i>Objective</i> Cooperation with data producers
Finance (F)	<i>Current status</i> Company tailored solutions <i>Objective</i> Development, operating, and communications costs; reduced pricing for companies in the development group, otherwise commercial pricing
Technology (T)	<i>Current status</i> Company tailored solutions <i>Objective</i> New modular and continuous cloud service, The technical specifications of the service to be completed in 2015, Implementation and piloting 2015/2016, Deployment at the earliest in 2016
KPIs	<i>Supplier:</i> Number of users, Utilisation rate in cutting planning %, Turnover €/a <i>Customer:</i> Inventory turnover, Work time spent in planning of cross-cutting, Time to fulfil procurement needs, Increase in value added

Planning of Timber Harvesting Worksites (Value Chains & CSOFT Model)



Customer (C)	Forest company
Services (S)	<i>Current status</i> Worksite planning on the basis of site data acquired manually or through site visits, manual updating of plans <i>Objective</i> Optimised work site planning on the basis of an up-to-date forest plan and harvesting objectives, Adjustment of harvesting timing on the basis of up-to-date site and condition data, Support to adjustment of plans during harvesting
Organisation (O)	<i>Current status</i> Company-specific solutions <i>Objective</i> Collaborative network and/or commercial developer
Finance (F)	<i>Current status</i> Company-specific solutions <i>Objective</i> Collaborative or commercial development
Technology (T)	<i>Current status</i> Company-specific solutions <i>Objective</i> Jointly developed new applications, potentially later a joint data warehouse for data produced by harvesting machines
KPIs	<i>Supplier:</i> Number of users, Turnover €/a <i>Customer:</i> Worksite visit costs, Harvesting costs, Size of harvest sites, Reliability of plans (number of total interruptions), Terrain damage

Forest Planning (Value Chains & CSOFT Model)



Customer (C)	Forest owner	Forest company	Forest management service company
Services (S) New applications	Owner's own forest sites Existing forest plans Forest valuation Optimised forest plans	Own and private forests Forest valuation Annual forecast for forest resources updated with condition information Suggested actions in harvesting and transport	Clients' forests Restrictions in forest management Annual forecast for forest resources updated with condition information Suggested actions in forest management
Services (S) FBD Platform	Supporting services to forest planning applications: statistics, visualisation tools, simulation and optimisation tools, updated open data and data provided by harvesters		
Organisation (O)	Separate application development groups, Sector-wide development group for common data structures, development of the FBD Platform services, and ensurement of availability of up-to-date data		
Finances (F)	Commercially developed applications, Selling of FBD Platform's tool and data services		
Teknology (T)	Internet services	Interfaces to enterprise systems	
KPIs	<i>Supplier:</i> No. of users, Usage rate % <i>Buyer:</i> Wood sale price, forest profit, management costs/ha	<i>Supplier:</i> No. of users, Usage rate % <i>Buyer:</i> Harvesting and transport costs/m3, wood quality	<i>Supplier:</i> No. of users, Usage rate % <i>Buyer:</i> Planning and management time and costs €/m3a