

ELSA – BEAst

Energiledningssystem för anläggningar - Byggbranschens Elektroniska Affärsstandard
– a FEDeRATED LivingLab –



Illustration: Sandra Haraldson

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Executive summary

The ELSA-BEAsT LivingLab focusses on the turnover of energy and materials due to activities of the Swedish Transport Administration (Trafikverket). The aim is to create an information technology (IT) tool to monitor and curb, in the first step, emissions destroying the current and deteriorating climate.

A means of intersystem electronic communication for sustainable road and railway investments, maintenance, and operations is being developed and will be introduced on a national scale. The method is expected to result in more reliable data available in close to real time whereby, for example, carbon dioxide equivalents can be monitored with a precision resembling that of money flows by an economic administration.

The project is being carried out in close cooperation with contractors, their subcontractors, IT support and branch organisations.

As from March 2024, digital reporting of fuel consumption and mass transports by certain common types of machines will be compulsory in large contracts let by Trafikverket.

Swedish summary

Projektet ELSA-BEAs fokuserar på omsättning av energi och material till följd av Trafikverkets entreprenader. Syftet är att skapa ett IT-verktyg för att övervaka och stävja, i ett första steg, utsläpp som förstör holocent klimat.

En systemlösning för elektronisk kommunikation mellan aktörer verksamma vid väg- och järnvägsinvesteringar, underhåll och drift håller på att utvecklas och kommer att införas i nationell skala. Detta förväntas resultera i mer tillförlitliga data, nära realtid, varvid t.ex. koldioxidekvivalenter kan övervakas med en precision som liknar penningflöden av en ekonomisk förvaltning. Projektet genomförs i nära samarbete med entreprenörer, deras underleverantörer, IT-support och branschorganisationer.

Från och med mars 2024 kommer digital rapportering av bränsleförbrukning och massatransporter med vissa vanliga typer av maskiner att vara obligatoriska i stora entreprenader som Trafikverket upphandlar.

1 The need for digital data sharing in the transport sector

1.1 Vision from a Cornerstone of Information Theory

The ELSA-BEAs project originates from a thermodynamic and cyclonomic perspective on the metabolism of human society. (By cyclonomy we mean the tracing of material flows and quantities of substances, as in a double entry bookkeeping system). A system was envisioned whereby the turnover and balance of elements and compounds in an ecosystem, such as a lake, a territory, or a municipality, could be monitored – and correlated to a(n imagined) reference area with no human influence – in terms of chemical contamination, physical resource depletion, etc. To achieve this, it would be necessary to keep track of the energy and material flows of the various parts of society, such as organisations or commercial companies.

The physical resources transformed into waste could be summarised as loss of energy quality, also described as total exergy or 'information content of matter'. Examples of such physical resources are clean waters, fertile soils and concentrated mineral resources, as opposed to industrially dissipated metals or other substances in contaminated soils and waters, or fossil oil and coal deposits, and an oxygen atmosphere, vs smoke (carbon dioxide and water vapour) and waste heat. The contrast may be compared to that between a new battery and a dead one. This has been popularly described by Staffan Delin in his book 'Naturens teknik och människans' (ISBN 9136019755). For long term sustainability, the change in exergy, or total 'information content', in our planet's bio-geo-chemical ecosystem, should be positive. Since the start of the industrial era, it has been negative, and getting worse at an accelerating pace.

A generation ago, such an envisioned system was deemed a utopian fantasy. Now the computer power necessary may have been there for over a decade, but only recently the need to do something seriously real about environmental depletion has become fully recognised.

1.2 Setting Goals for Energy and Material Dynamics

The basic idea is that society should assess the amount of physical resource consumption available for a certain area in a certain period of time, for example in the form of an annual national 'carbon dioxide budget' concerning climate change. This budget should be broken down, like any budget, into parts which add up to the agreed total. One of those parts would be for transport sector activities, including the investments and maintenance operations of the Transport Administration. As such, Trafikverket would receive a scientifically based 'allowance' of net emissions of carbon dioxide equivalents, not to be exceeded, and have to adjust the number, amount and types of all activities to fit into this allowed budget. Trafikverket aims to reduce its climate gas emissions by 60 percent by 2030 and 100 percent by 2040, compared to a 2015 estimate.

Within Trafikverket, such a budget would have to be broken down according to the various parts of the organisation, such as divisions, regions and projects.

1.3 Cyclonomic Accounting

To monitor such an environmental budget by means of manual reporting, estimates of machine unit fuel consumption and non-verifiable, non-traceable data is not practically feasible. An automatic system is required. It has to be normalised in terms of format, content and interpretation of data, etc. This is why a standard is needed for the construction sector.

An organisation then has to follow up its environmental budget, down to the level of individual projects, in a way similar to ordinary economic follow-up. This is where the new IT system of Trafikverket, *Energiledningssystem för anläggningar* (ELSA), comes into the picture. Apart from monitoring the operational turnover of energy and matter, there may also be a need to keep track of precious substances which ought to be recycled rather than wasted, and of hazardous substances which ought to be collected as waste rather than left to dilute into the environment. Preferably, therefore, the monitoring system will be integrated with a geographical or building information model. But this expansion of ELSA is still in the future.

2 Realising the use case by digital data sharing

2.1 Supply Chains

The delivery or supply chain of construction works logistics is not only for goods (bulk and piece), but primarily for contractor services. These services are usually rendered by a delivery chain which, omitting the parts from raw material to goods production, may contain: ► materials providers → goods transporters → work machine owners → sub-sub-contractors → sub-contractor organisation → contractor → contracted service including materials delivered to → builder = client = infrastructure owner.

Some examples of such materials delivered are:

- bitumen for pavement works,
- gravel for same,
- cement for concrete works,
- rebar for same,
- stone for same,
- salt for road winter maintenance,
- sand for same.

In the supply chain there are various inputs of energy, still mainly from fossil deposits, which need to be reduced to fit into the availability of renewable sources.

2.2 The Contractor Tool

When the ELSA project manager explained to his system architect what data he wanted from the contractors, the latter said that if we make such demands, we should also provide the contractor with a tool to supply that information to us. So what is available?

Based on the ambition to monitor service deliveries machine by machine and day by day, an internet search resulted in one possible existing system. The system found is based in Sweden and is called *Byggbranschens Elektroniska Affärsstandard* (<https://BEAst.se>). BEAst in the international language translates as Konstru-Industria Normo De Elektronika Negoco (KINDEN).

BEAst is an association with more than a hundred members, including about ten construction sector organisations, totalling thousands of individual companies. Our ELSA-BEAst project has been active in its works committee (Anläggningsutskott) since 2016 and Trafikverket is a member of B.E.A.st. since 2017.

2.3 The Client Tool

BEAst will be the tool for providing Trafikverket with the information it needs. But there is also a need for an internal system within Trafikverket to monitor and analyse the acquired data. This is ELSA, our energy management system for facilities, which is being created in the project.

In a wider perspective, ELSA should be seen as a start of a process to obtain cyclonomic control of the organisation's activities, that is, mastering the flows of energy and materials that the operations of the organisation give rise to. The final goal is, of course, to achieve full sustainability of the sum of activities in a long term ecological context, including life cycle analyses of all involved products and services. It must be understood, however, that a balanced cyclonomy implies radical, not to say revolutionary, changes, on several levels, compared to the present situation, concerning the metabolism of human society including production, consumption and emissions.

3 The solution – a unified platform for seamless integration

3.1 Aim

The ELSA-BEAsT LivingLab in FEDeRATED (<https://www.federatedplatforms.eu>) aims to prepare for a digitalisation of the development and maintenance process of buildings and physical infrastructure in an efficient way that can be applied by all contractors and suppliers in the delivery chain to all public and major private clients. This includes, but is not limited to, the transport of goods, which is the purpose of the FEDeRATED project.

Trafikverket is starting in one end, digitalising its works contracts. Simultaneously, Trafikverket is cooperating with other organisations and parallel initiatives to ensure that they will all pull in the same direction, enabling a 'seamless' data communication between any parts of the building sector in the near future. Just as an example, the national housing authority (Boverket) is demanding climate declarations for all new buildings, based on environmental product declarations (EPD) as from 2022, but this is not yet adapted to BEAsT.

3.2 A Committee Question

At a BEAsT Anläggningsutskott session in September 2018, a young lady asked,

— *We have been trying this electronic standard now since 2012, for over six years, several contractors, in more than four hundred projects. Everybody likes it and nobody, from project managers and administrators to machine and truck drivers, wants to go back to the old manual system with papers. Still, it does not spread. Why not?*

An elderly gentleman turned his head and remarked,

- *No company is willing to invest in this method until they know for sure that it will be the dominating one.*
- *But how will they know that?*
- *Large clients have to lead the way.*

Whereupon, everyone present looked at the only participant from government, namely the manager of the Trafikverket ELSA project. And thus, the road forward was revealed. Five years later, the revelation had now reached the managements of major construction companies.

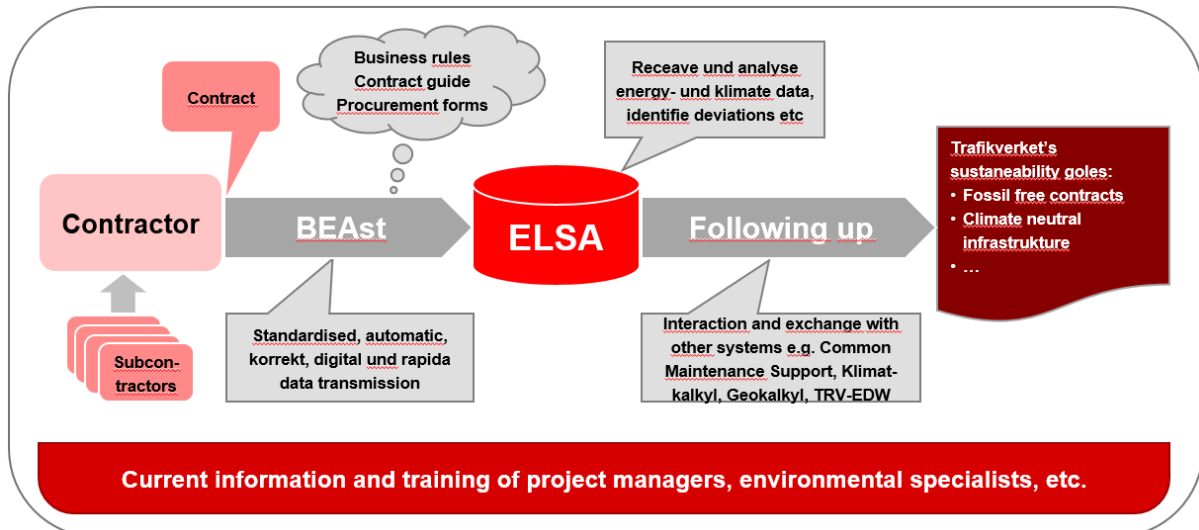


Illustration: Martin Strid (2023)

3.3 The Road

The intention is to reduce environmental impact and optimise resource efficiency by utilising the information quality available through the digital message standard.

The standard also has a paramount potential for reducing administration costs and improving communication on project progress and economy, which was and still is the basic idea of BEAst.

4 The process of digital collaboration

4.1 A Path

In view of the global climate impact focus, Trafikverket aims to monitor its energy turnover and emissions of climate gases in order to be able to reduce them in a controlled and efficient manner. It should be kept in mind that this is only the first step in a digitalisation process where other environmental factors should also be monitored.

Conscious of the slow start to digital communication development in the works and building sector, Trafikverket considers it essential that:

- reports be sent as electronic messages rather than delivered to login-based internet portals of various receivers,
- these reports be standardised so that a supplier may report in the same manner and format to various clients,
- the method enables accurate totalling at various levels, including national and international totals, monitoring not only quantities but also the quality (precision) of each figure,
- the system be easy to use, and affordable, from the perspective of large and small companies as well as drivers,

- the reporting and the system complies with EU directive Règlement général sur la protection des données (RGPD = GDPR), personal integrity of drivers and respect for business secrets of contracted and subcontracted companies.

4.2 Efforts

In order to develop the whole, efforts are being made on several fronts:

- Working within BEAst, especially its Anläggningsutskott, on developing a standard and unifying the semantics and the work procedures.
 - One of the adaptations was for BEAst to start thinking not only in terms of buyer and seller but conceiving whole supply chains, from a small private contractor or haulier through to the final client, in our case Trafikverket.
 - BEAst procedures are now coordinated with existing international standards, such as Pan-European Public Procurement On Line (PEPPOL), introduced by the European Union in 2008 and compulsory in all public procurements by Swedish government authorities as from 2013.
 - Trafikverket has led a BEAst focus group compiling a manual for clients on how to use the standard in a uniform way.
- Developing Trafikverket's own internal IT support system ELSA. Presently this occupies half a dozen programmers from a previously procured IT consultant (CGI).
- Carrying out pilot tests with contractors and their subcontractors, in a few already existing works contracts. A key group of partners in this part is the IT system provider of each contractor and subcontractor.
- Introducing the new digital way of working in Trafikverket, including:
 - To apprise the organisation of the coming digital methods, through information, staff training and adjusted routines,
 - To amend the procurement conditions and forms to accommodate KINDEN reporting.

5 The Used Information Model and Compliance with the FEDeRATED Model

5.1 Data to be reported

Each vehicle or works machine shall report delivery at least once per day. The electronic delivery note must have the following information:

- Contract number,
- Project number,
- Machine identity, e.g. vehicle registration number,
- Starting date and time,
- Stopping date and time,
- Type of fuel,
- Quantity of fuel,

- Calculation method: Estimate, Journal or Automatic measurement (e. g. CANBUS or ODB2),
- Fuel measurement unit,
- Distance (km) and/or work time (h),
- Type of engine.

In the case of mass transports, the compulsory additional information is:

- Provenance location,
- Delivery location,
- If weighed, weighing bill number,
- Environmental properties of mass, as defined by Återvinningsindustrierna recycling industries branch organisation,
- Net weight, or, if not weighed, an estimate of load ratio (full load, three-quarters, half full, quarter full),
- Weight measurement unit.

5.2 Data Transmission

In the ELSA-BEAs LivingLab each stakeholder (contractor, subcontractor) used its own IT system and cloud solution to register and send data according to the BEA standard. BEAs facilitates the exchange of various types of electronic documents, such as invoices, orders, and other business-related documents, between different parties involved in construction projects. BEAs relies on Electronic Data Interchange (EDI), which is a standardised method for exchanging business documents electronically. EDI allows for the structured transmission of data between different computer systems. This is crucial for seamless communication between various stakeholders in the construction industry.

BEAs uses specific document formats for various types of transactions. These formats are standardised to ensure that different systems can interpret and process the information correctly. Common formats may include Extensible Markup Language (XML) or other structured data formats. In the ELSA-BEAs LivingLab the message type Advanced dispatch Advice is being used to report on types and amounts of masses, transports, vehicles and fuels.

BEAs defines specific message standards that outline the structure and content of various types of documents. These standards ensure consistency and interoperability between different systems. Examples of message standards could include the United Nations standard EDI For Administration, Commerce and Transport (UN-EDIFACT) or industry-specific XML schemas. Many businesses in the construction industry use Enterprise Resource Planning (ERP) systems to manage their operations. The technical setting for BEAs includes integration capabilities with these systems to facilitate seamless data exchange.

The BEAs message is sent to Trafikverket's own receiving system ELSA. Both the new version BEAs 4.0 and ELSA are PEPPOL compliant.

The technical setting in the LivingLab would also need to address any legal or regulatory requirements related to electronic business transactions in the construction industry. In the ELSA-BEAs LivingLab this

is regulated in the contract with Trafikverket who is also the data owner and retains full rights and controls over all data received via ELSA. In this way Trafikverket can easily follow each project and the emissions it causes.

5.3 FEDeRATED principles met

As deemed by the ELSA system development architect and reported in November 2023, the ELSA-BEAs LivingLab **complies** with the following FEDeRATED principles:

- 1 All supply chain operators and public authorities involved in freight transport and logistics must be able to participate.
- 2 The information is to be encoded digitally, using a revisable structured format.
- 3 Data sharing must be compliant to existing legislation (e.g., GDPR) and privately agreed rules.
- 4 Each participant has to formulate the business service(s) it provides (service provider) or requires (customer). – In our LivingLab, according to agreements between parties.
- 5 Trust between enterprises is primarily driven by their real work relationships.
- 6 The business relations between participants are shown according to their outsourcing hierarchy from the perspective of for instance a shipper and/or consignee.
- 7 Business services and commercial mechanisms supporting negotiation between a customer and service provider specify the data that they will share.
- 8 Data requirements set by an authority are related to the legislative basis afforded to that authority.
- 9 Any organisation can specify its internal processing.
- 10 Public authorities that access enterprise data require a legal basis to refer to.
- 15 A legally allowed data sharing mechanism allow in case of:
 - a push, data to be duplicated by enterprises to authorities, or
 - a pull, data being made accessible to authorities.
 - – The ELSA-BEAs LivingLab solution is a push mechanism.
- 17 Whenever a public authority is responsible for governance of more than one regulation, the data requirements of those regulations will be combined into one data set. – the ELSA-BEAs LivingLab is congruent with the principle of Single Face To Industry (SFTI).
- 18 Each organisation is able to identify itself uniquely according to agreed attestations with transparent validation processes of these attestations (e.g. Chamber of Commerce Registration, AEO certificate). – BEAs 4.0 and ELSA are compatible with PEPPOL.
- 21 Sensitive data should not be accessible or changed by unauthorised users or organisations.
- 22 Any metadata specifying which data is accessed or shared between any two enterprises is not accessible by unauthorised users or organisations.
- 23 IT systems of an organisation that support the roles data provider and -receiver, are uniquely identifiable.
- 24 A common policy or agreement specifies the use and reuse of data as well as the manner in which it is stored or removed. – In the ELSA-BEAs LivingLab each party is owner.
- 25 A data owner determines the data it will share and retains full rights and controls over this data. – In the ELSA-BEAs LivingLab this is regulated in each agreement between two parts; sender and receiver.

- 26 Single sharing of links, multiple (controlled) access to data. – For article specifications, etc, in the ELSA-BEAsT LivingLab.
- 27 The data sets of which links can be shared. – Article specifications, etc, in the ELSA-BEAsT LivingLab to be managed by relevant branch organisation.
- 28 Use of baseline standard(s) that provide all common terminology, data formats, code values, etc. that can be re-used for implementation of the FEDeRATED models.
- 29 An event for sharing milestones has its own timestamp that can differ from the timestamp of a milestone.
- 30 Unique identifiers are used to create and share links of relevant data sets between any two enterprises. – the ELSA-BEAsT LivingLab uses project-ID.
- 31 Organisations select a solution of choice for data sharing with others (platform, peer-to-peer).
- 33 Data is either validated by a data provider or a – receiver against data sharing specifications (e.g. XSD) – the ELSA-BEAsT LivingLab has XSD and schematron validation.
- 34 Accuracy and consistency of data over its entire lifecycle is required.
- 35 Historical data sets are stored for optimising business processes (public authorities and enterprises), based on legal requirements (e.g. archiving).
- 36 Organisations store a (shared) immutable log and audit trail of the data they have shared.

5.4 FEDeRATED principles not met

The ELSA-BEAsT LivingLab does not fulfil the following FEDeRATED principles:

- 11 Public authorities publish their data requirements in a machine-readable form. – (Requirements are specified in project agreement, but in 2024 this will be included in the procurement).
- 12 Business services of all enterprises are discoverable according to harmonised search criteria. – (No, but perhaps in ELSA-BEAsT LivingLab version 2.0?).
- 13 A public authority or enterprise must be able to proof compliance or non-compliance with data. – (No, this is the task of the contractor).
- 14 Public authorities can share their data with enterprises for policy reasons within a legal framework.
- 16 An organisation must have the ability to subscribe to any relevant new data in accordance with fit for purpose (public authority) or a commercial relationship (enterprise). – (No, not yet).
- 19 Persons that act on behalf of an organisation are able to identify themselves as such and should be known and employed or delegated by that organisation.
- 20 The capabilities, i.e. the actions that may be performed, of an identified user are transparent to all other relevant users/organisations. – (No, only between commercial partners).
- 32 Organisations are able to share or access data with others. – (Not within the ELSA-BEAsT LivingLab. But KINDEN will generally facilitate sharing).
- 37 Each organisation is able to trace with whom and at what time particular data has been accessed or shared with any other organisation.

6 Scope of testing and testing plan

6.1 First pilot tests

Two small first pilots were carried out in the spring of 2017, to test reporting routines from road snow-clearing machines.

6.2 Second pilot tests

Further pilot tests were conducted in 2020 and the first messages to ELSA was sent by NCC at Västlänken in March 2021, after ten project meetings of two hours each in the autumn of 2020 on what information to include. Examples are:

- Part of Västlänken railway investment project, Göteborg, contractor NCC (WLC), IT support by Pipechain, Hogia and Kubicom, starting with excavated mass transports, 2021-. BEA-st reports to ELSA passed 100 000 tons of excavated masses by September 2022.
- Västra Södertörn road basic maintenance district, contractor Svevia, IT support by BM System, machine fuel reporting tests, 2021-. They were the first to collect fuel data directly from engines of two lorries in December 2020.
- Börjelslandet European highway E4 investment works, contractor GRK Infra, IT support by Kubicom, sent over 200 BEA-st reports to ELSA in 2022 on the fuel consumption of ten lorries and work machines.
- E4 highway works, Ljungby, contractor Svevia, IT support by Kubicom and Hogia, 474 fuel reports and 105 mass transport reports in 2023, totalling 10 000 tons of crushed rock, from 5 excavators, 1 wheel loader, 1 wheeled excavator and 5 lorries.

New pilot tests began in 2023 and 2024 with contractors PEAB and maybe Skanska.

6.3 Third pilot tests

When introducing conditions for KINDEN reporting in procurements from 2024, we are expecting that the first few weeks in each such contract will have the role of a pilot effort for those companies involved - the procured contractor, subcontractors and their IT support.



Figure F. Flow diagram example of fuel consumption information from transporting truck to ELSA.

Illustration: Martin Strid (2023)

7 Results of Testing

In conjunction with testing, reporting routines, semantics and information, bugs are being corrected continuously, resulting in a more unified flow of increasingly reliable data. The industry, understanding that the name of future client KINDEN IT required in public procurement is BEAst, is now beginning to prepare itself in terms of IT support, staff training, etc.

The BEAst daily reporting to ELSA of fuel consumption and mass transports will be compulsory on a national scale in Trafikverket procurements as from March 2024, commencing with large investment and basic road maintenance contracts. The number of such contracts is estimated to be between 50 and 100 per annum. Smaller contracts will be included later.

In the first stage the reporting requirement is limited to six common machine categories:

- Truck over 3,5 french tons total weight
- Backhoe loader over 14 tons machine weight
- Excavator on wheels over 15 tons machine weight

- Crawler excavator over 20 tons machine weight
- Wheel loader over 10 tons machine weight
- Dump truck over 20 tons load weight.

8 Summary: How Well Were the Needs Met – and Stakeholders Judgement

It is still too early to make an overall comparison between needs and fulfilment. Also, the amount and diversity of pilot trials was less than anticipated. Furthermore, so far only a small number of the stakeholders have been engaged in the pilots.

However, there is a long and strong need to obtain more accurate, early and reliable data on climate impacts. Trafikverket has been setting goals for carbon dioxide reductions in works contracts for nearly a decade. The lack of quality in such data has been felt for as long. There is a consensus that ELSA will constitute a decisive improvement to this situation.

As for mass transports, the administrative work procedure in parts is unwieldy and the automation brought by BEAst is welcomed by contractors and drivers.

Given that the urge and need to ‘do something’ is greater by far in the environmental field than for economic issues, the progress of economy routines is ‘lucky’ to have the climate crisis as a driving force, in this case the ‘trail breaking’ (Swedish for pioneering) need to get control of emissions from own activities. The introduction of BEAst is envisaged to streamline economic procedures and administrative routines, though this is not yet within the scope of the Trafikverket part of the project.

9 The Value of a Federated Approach and How to Achieve Scalability

The ELSA-BEAst LivingLab in FEDerATED has been, to use a Swedish idiom, a cat among ermines: It is

- the only LivingLab focussing on the building industry,
- the only one (so far) focussing on services rather than material products, and also
- a LivingLab focussing on data flows more than on common data servers, which we have deemed to be somewhat un-nerving to our partners, especially due to business secrecy.

The project is scalable and is being scaled up nationally by Trafikverket, the biggest building industry client, procuring a third of the Swedish construction market. Trafikverket has carried out a study on how to align with the ISO 14033 standard on Environmental Management. On a Nordic scale, we have already contacts with our colleagues in Norway and are bringing the issue to the Nordic Council.

Internationally we participate in the FEDerATED project hoping that this will induce one common way of working in the entire European Union instead of a threatening fragmentation. One important aspect

of this is adapting BEAst to the PEPPOL standard, which was achieved in 2022. PEPPOL also provides a message delivery platform as well as the message format specifications.

By introducing BEAst, thus digitalising the building sector, we believe we are paving the way for information sharing in a number of aspects, first of all for delivered material products, and later possibly bulkware, emission data and services rendered.

10 Dissemination

Considering the environmental issues at stake, the climate crisis and the size of the building sector including operations and maintenance of infrastructure, the results and consequences of the ELSA-BEAst LivingLab should be disseminated throughout Europe, on a large scale, urgently. The European Union has a serious responsibility for communications and ought to play a major role in the dissemination, as well as in further development.

11 Suggestions for Future Work

In order to make any practical progress, it has been necessary to cut out parts of the original vision, or rather postpone them until more concrete implementation has been achieved.

Apart from dissemination, the BEAst – ELSA (or sister to ELSA in another procuring organisation, such as a municipality) tool and method for approaching sustainability (or “sustainable metabolism”) ought to be developed, taking the following in to consideration:

11.1 Data Sharing

Progress would hardly have been feasible had we not heeded to the industry’s demands for business secret safety. The strategy has been to advance the project step by step. So integrated information sharing, ‘FEDerATED style’, has been all but excluded until further notice. But with growing market maturity, common shared data servers should become more of an option.

- One of the first such concerns environmental product declarations (EPD). (This is already within reach thanks to another project, Miljödata.Nu, managed by IVL, in which Trafikverket has only recently become involved). Ultimately, every purchased product could then be accompanied by (i) a monetary economic bill and (ii) an environmental cyclonomic bill.
- Another field of common data sharing is the categorisation of bulk materials (and energy), such as soil masses transported, pavement materials, cleared snow and consumed fuels. Such a data base should also provide opportunities for recycling, between projects and even between clients.

11.2 Whereabouts

The linking to model systems for building or geographical information (BIM or GIS) on final destinations of materials and products was also judged to be too cumbersome in this initial stage. But the positions of immobile equipment, materials and substances, and sometimes also their proveniences, may be very important for a resource efficient cyclonomy.

11.3 Meaning

A uniform semantics is desirable, at least within the EU, on how such information systems work, what they contain and what they are for. Leadership from the European Union has an essential role to play in this drama, unless we choose to give up on our civilisation.

11.4 Winning

In the infancy of the ELSA project, a study was made by a polytechnic university in Stockholm on the gamification of energy and climate efficiency. This is one of the tracks which has been abandoned for the time being. When the KINDEN communication and analyses are fully prosecuted, this track should be taken up again. Who knows, might it be the basis for nominating a Nobel Cyclonomy Prize winner in the future?

This LivingLab has been pursued within the FEDeRATED project (2019-2023). FEDeRATED (www.federatedplatforms.eu) is a both-feet-on-the-ground EU funded CEF data sharing project with the aim to demonstrate how a federated network of platforms as proposed by the EU Digital Transport and Logistics Forum (www.dtlf.eu) can actually work.