DELIVERABLE 2.2.1
ECOSYSTEM MAP

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Abstract:
The deliverable presents the results of activity AT 2.2 Ecosystem analysis. The deliverable describes the mapping methodology and discuss the various application of value maps in analysing and developing business models. To illustrate the proposed approach, the reports provides the examples from project regional case studies.

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1. Introduction

The following deliverable (DT 2.2.1- Ecosystem map) presents the results of the second activity (AT 2.2-Ecosystem analysis) of the work package T2 (WP T2)- Creating Hydrogen Utilization Business Models. The activity's objective is to develop understanding of existing (or projected) business ecosystem and create a map depicting business actors and value streams between them. The map is therefore the continuation of AT 2.1. Stakeholders analysis and utilizes the results presented in DT 2.1.1-Stakeholder value analysis.

The report provides mapping approach with illustrative example from regional case studies. Due to the nature of the report the detailed descriptions of the case studies are omitted, it can be found in the respective deliverables (DT 2.1.1 Stakeholder value analysis and DT 2.5.1-Case study scenarios). The methodology of data collection and preparation have been already presented in deliverable DT 2.1.1- Stakeholder value analysis therefore in current report we focus only on specific aspects related to the map creation.

In the following parts we first describe the mapping methodology, next present illustrative examples of its practical application with project regional case studies. In the final part we provide the summary of the conducted work.

2. Mapping methodology

The ecosystem maps utilised the data collected during activity AT 2.1-Stakeholder analysis (see DT 2.1.1 Stakeholder value analysis for details). Having identified the business actors (stakeholders from the supply side and customers), value streams between them the map representing these relationships can be created. The create the multi-organization value stream map we follow the approach proposed in Pynnönen et al (2008).

The starting point for map creation is a stakeholder analysis table where all ecosystem stakeholders are listed and classified. Depending on the available information and required degree of resolution the number of considered business actors may vary by including or excluding actors situated further upstream or downstream the supply chain (see figure 1).

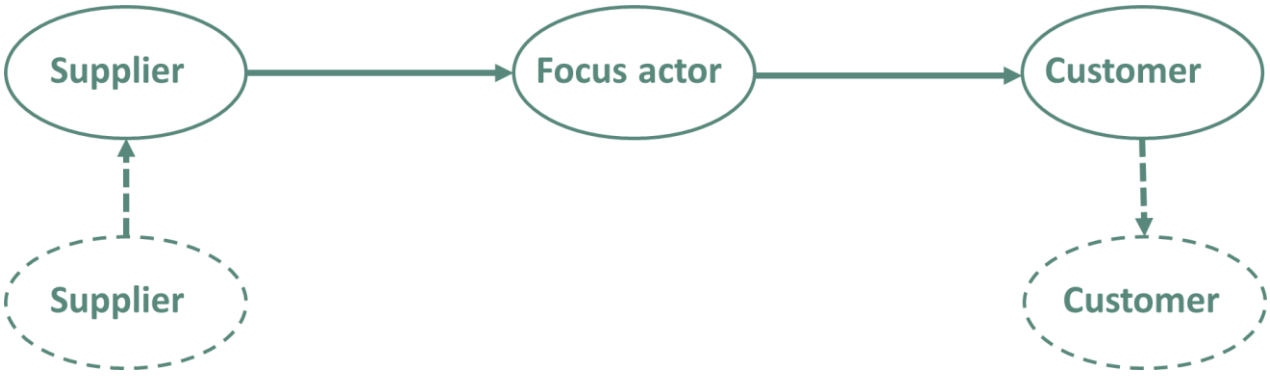

Figure 1. Extending the map upstream/downstream

The value stream consists of company offering and respective reward received from customer. The offering can be classified into products, services, information etc. and reward can be monetary or non-monetary. Similarly, as with the number of actors considered the number of included offerings may vary depending on the mapping objectives. In other words, if the company has multiple various offering only those which play role in the current ecosystem need to be considered.

The finalized ecosystem map describes the relationships between business actors and can be utilized for identifying missing actors/resources thus signaling the business opportunities and for refining the business model of focus organization. In the second case, the map provides systematized input for commonly used business model developing tools such as e.g. Business Model Canvas by Osterwalder (Osterwalder and Pigneur, 2010)

3. Case study examples

To illustrate the mapping approach, we provide examples from the project regional case studies. The case studies have been described in more details in previous deliverable (DT 2.1.1 Stakeholder value analysis) consequently we will omit non-critical aspects and present here just the actual results of mapping exercise. The further information about case studies can be found in respective deliverable DT 2.5.1 Case study scenarios which summarizes the project findings and tools application to the case studies.

The ecosystem map can be seen as a visual representation of the stakeholder analysis table from DT 2.1.1 Stakeholder value analysis, showing the value streams between actors. During the project work the case studies maps were drawn in Microsoft Visio tool. However, to facilitate the process the online and downloadable canvases were created. They are described in DT 2.3.1 Ecosystem orchestration toolbox.

Figure 2 presents the ecosystem map for **Finnish case study**. The ecosystem is compact and in addition to the actual focus actor consist of only few key players. That narrow focus is appropriate for the case study objectives (the focus region already has producers and perspective suppliers of hydrogen and other needed raw materials with their subsequent supply chains). However, in case of replication the solution in other regions especially in less industrially developed which may not have readily available sources of hydrogen and CO2 their manufacturing needs to be taken into account. At this stage the ecosystem does not include the intermediaries and services providers which again, may be added when the case is transferred to another regions (in the Finnish case the raw materials suppliers take care of all complementary services like e.g. intermediate storage and transportation). Therefore, in spite of current compactness the ecosystem reserves the opportunities for new business players providing complementary services (which may be required if the solution is to be scaled up or replicated in another region).

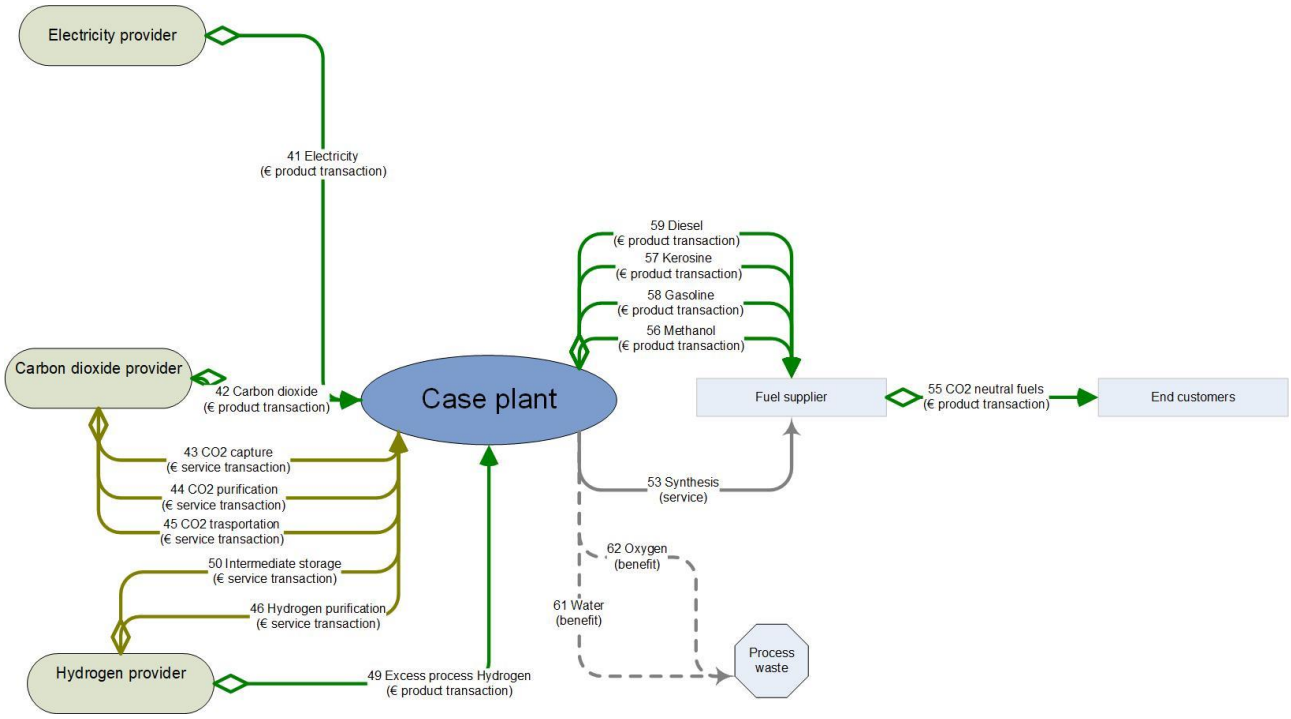

Figure 2. Ecosystem map: Finland case study

Figure 3 presents the ecosystem map for **Icelandic case study**. Comparing to Finnish case this ecosystem is more detailed including hydrogen producer and its suppliers as well as suppliers of special equipment (i.e. hydrogen trucks) and service providers (HRS operator). At the stage of case study, the specific details of their operations were not known, thus the map assumes the hydrogen transportation, intermediate storage services are accomplished by the producer. However, in theory that can be subcontracted to another company, thus opening new business opportunities. Similarly with trucks supplier- this company is assumed to also provide maintenance service, however that can be accomplished also by another actor. The current map includes only direct customers (e.g. businesses ordering transportation services), however the case allows for inclusion also non-direct customers benefitting from hydrogen production by-products, thus creating the holistic hydrogen ecosystem.

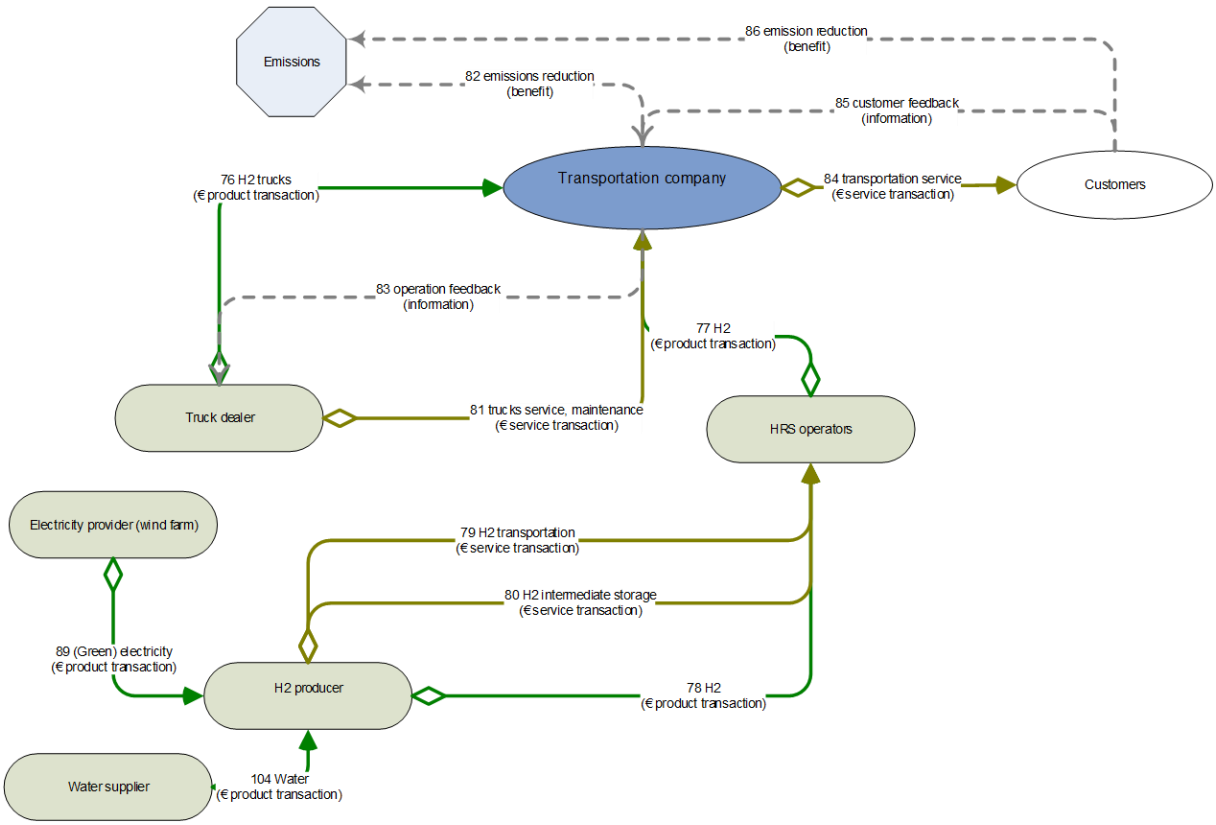

Figure 3. Ecosystem map: Iceland case study

Figure 4 presents the ecosystem map for **Faroe Islands case study**. This ecosystem is considerably more complex comparing to prior cases and includes multiple interconnections between players. Similarly, to Icelandic case study the ecosystem includes the supply chain for hydrogen producer and assumes a separate HRS operator, however the transportation and intermediate storage of hydrogen is accomplished by one of these actors (the service which can be also transferred to a new business actor). The Faroe Islands case ecosystem include several indirect customers benefitting from hydrogen production y-products such as district heating operator and fish farm owners who can possibly utilize the oxygen and excess heat arising from hydrogen production. That from one side limits the location alternatives for hydrogen production facilities but from the another increases the level of utilization of products within the ecosystem, enhances the value streams. It should be noted also that fish farm acts also as a direct customer for working catamaran operator.

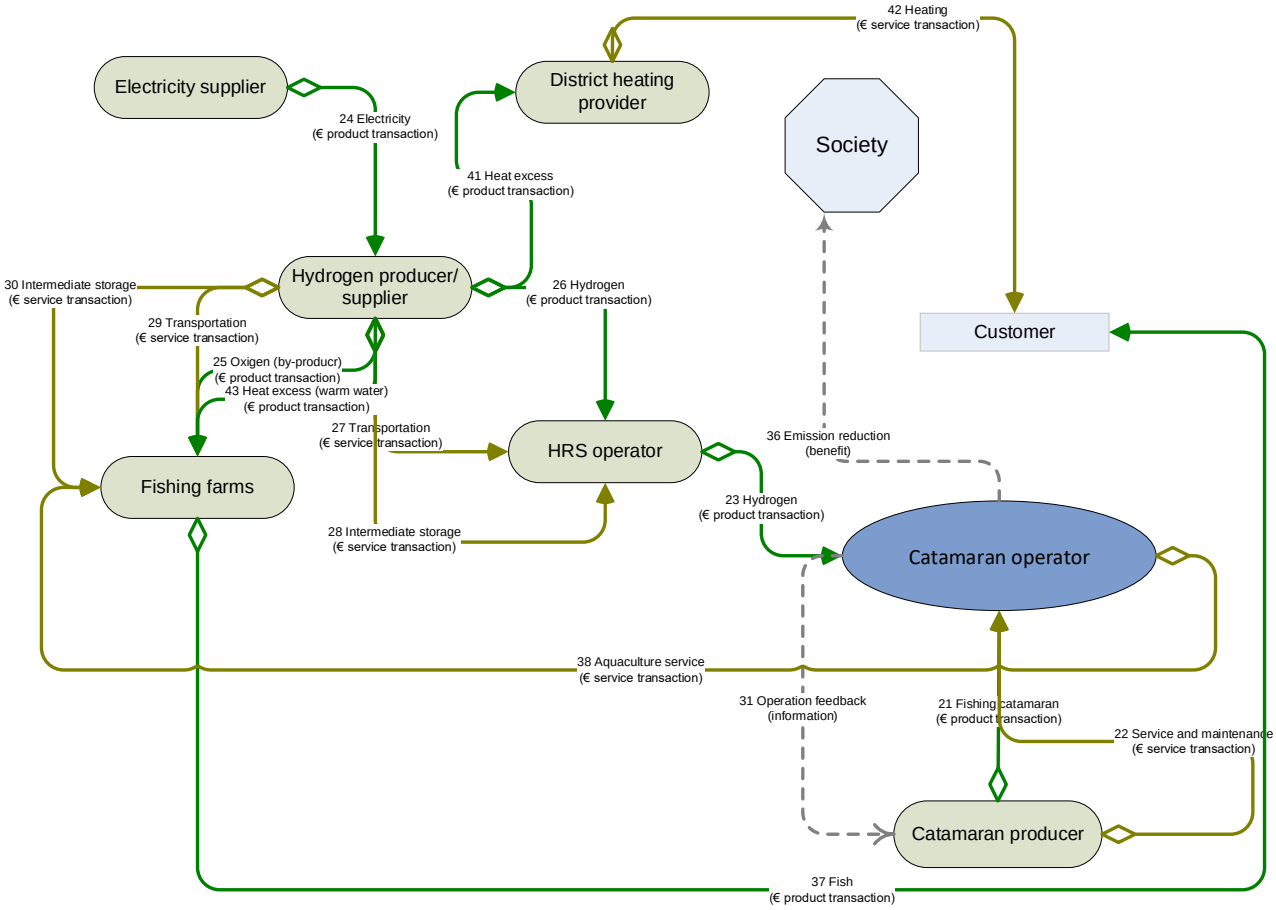

Figure 4. Ecosystem map: Faroe Islands case study

Figure 5 presents the ecosystem map for **Aran Islands case study**. This map features the dual hydrogen production facilities (with associated suppliers) and HRS operators. The objective is to create independent supply chains on Islands and also at the Galway port. Both sub-systems are drawn at relatively generic level (i.e. without inclusion of potential business actors providing complementary services), however even at current level of details the ecosystem features multiple interactions between actors. Thus, Galway port providing services for ferry/cargo boat operators can also benefit from the actual hydrogen production facilities by adoption of hydrogen-powered equipment (e.g. trucks). Similarly, islands hydrogen supply chain can create novel business opportunities (e.g. for local transportation) which eventually open spaces for new business actors to join the ecosystem.

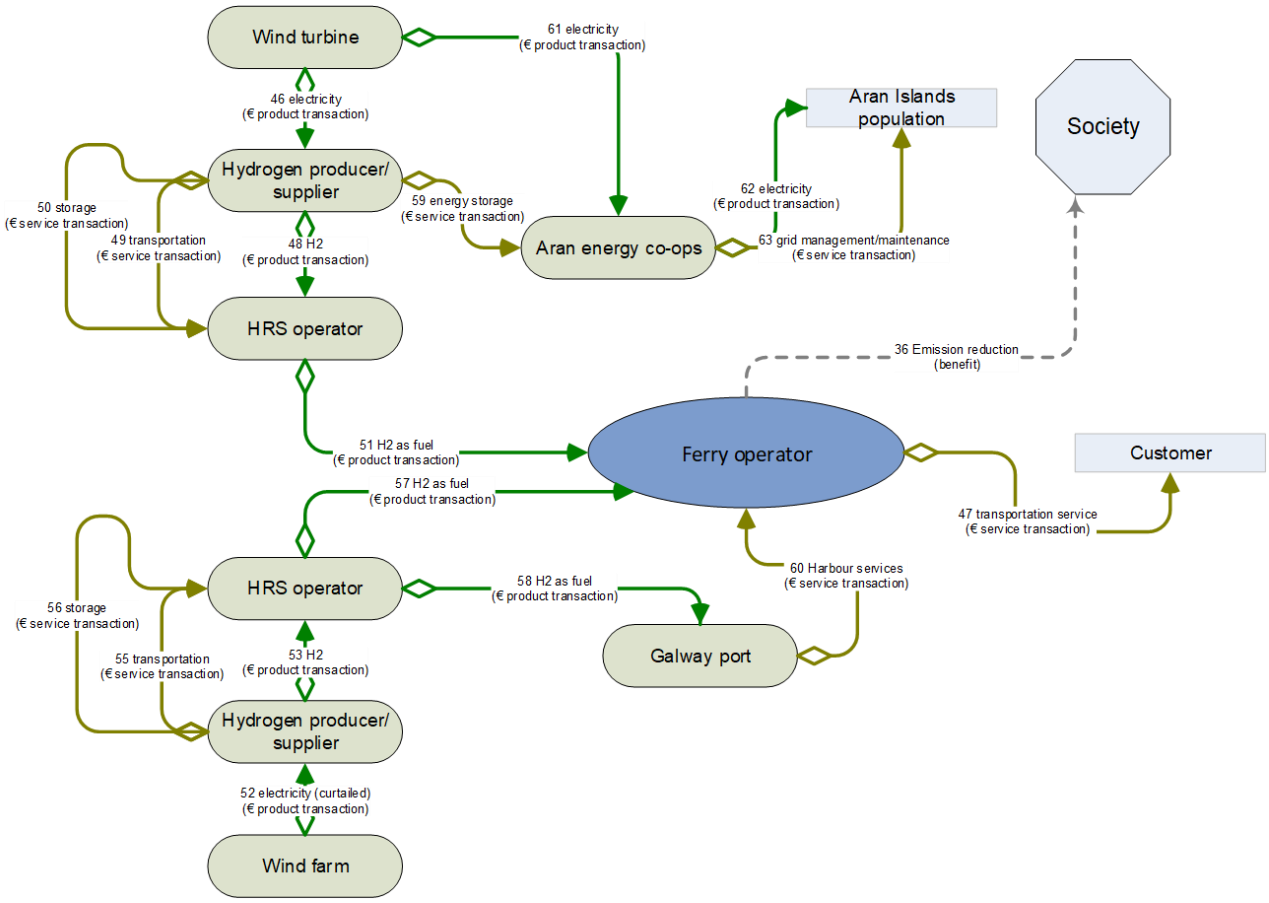

Figure 5. Ecosystem map: Aran Islands case study

Figure 6 presents the ecosystem amp for **Scotland case study**. In this case study, to some extent similarly to Finnish case study we do not consider in any details the associated supply chain of hydrogen supplier – in Scottish case the hydrogen supplier is already existing business actor located outside of the focus region. Similarly, not presented in details other suppliers (specifically LPG) supply chins. Scottish case study opens opportunities for many services providers – logistics (for hydrogen and LPG) transportation and maintenance contractors. At the current stage the ecosystem is quite narrow and does not include many other beneficiaries except for direct customers, however if the initial trial is considered successful the proposed hydrogen ecosystem can grow including other actors utilizing hydrogen and thus creating additional value streams and connections between the business actors.

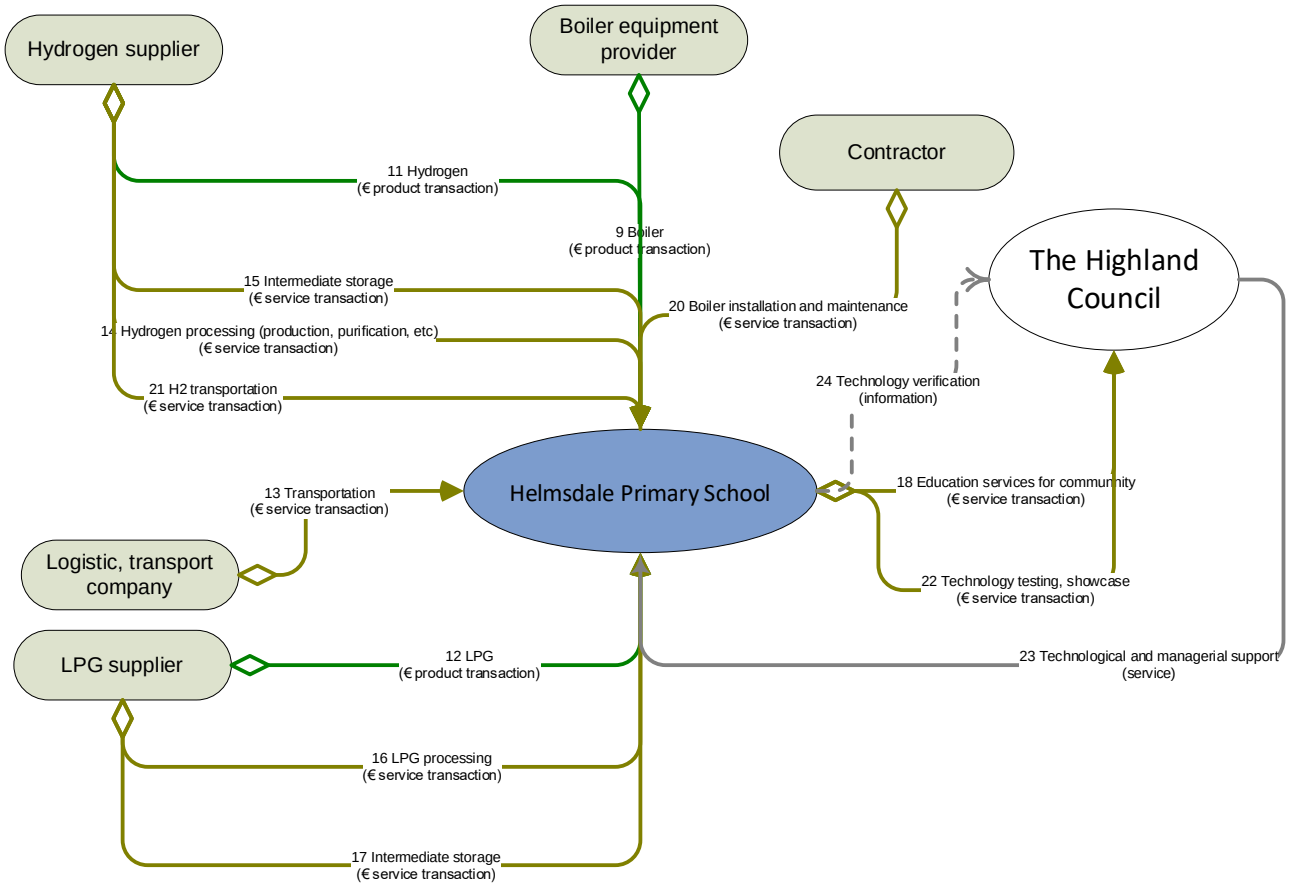

Figure 6. Ecosystem map: Scotland case study

4. Conclusion

The following deliverable describes the mapping process and illustrates it with the case study examples. The presented maps describe the relationships between business actors withing the specific case study ecosystem. The maps can be used as such for developing the better understanding of business environment, identifying the business opportunities and serve as an input for developing or modifying the business model with other tools such as Business Model Canvas.

It should be noted that the mapping is an iterative process and after the developing the initial map it should be verified by pilot partners and if necessary updated. Depending on the case study progress the actual business actors (stakeholders and end-users) can be also involved (see data collection methodology in DT 2.1.1). The mapping therefore is a continuous activity which can be adjusted depending on case study development stage and updated as the case study progresses.

To facilitate the mapping process the specific ecosystem mapping tool was developed. The tool is basically an mapping template available in two forms – online and downloadable pdf template facilitate the synthesis of stakeholder and value analyses and creation of ecosystem maps. The tool itself is described in the deliverable DT 2.3.1 Ecosystem orchestration toolbox.

References

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons.

Pynnonen, M., Hallikas, J., & Savolainen, P. (2008). Mapping business: Value stream-based analysis of business models and resources in information and communications technology service business. *International Journal of Business and Systems Research*, *2*(3), 305-323.