While the work of the consortium in the first year was focused on expanding clinical protocols to the field of telemedicine and on developing new protocols, the **key task of the second year** comprised

designing and testing the core functions of the telemedicine system

for implementing the processes, as well as

analysing the profitability of the processes and services

to be implemented with the help of the system via the protocols. In preparation for the decision-making, the work groups prepared their analyses, based on which the project committee will select the protocols suitable for implementation at the start of the 3rd work phase. In the 2nd work phase, work was performed by the following work groups:

- clinical work group: Semmelweis University;
- protocol repository work group: Answare Kft., HUMANsoft Kft., Semmelweis University, Bay Zoltán AKK;
- system design work group: Answare Kft., HUMANsoft Kft, Bay Zoltán AKK;
- core system work group: HUMANsoft Kft., Answare Kft.;
- endpoint devices work group: Bay Zoltán AKK, ThorMed Kft.;
- profitability work group: HUMANsoft Kft., Answare Kft.

The professional work in the second year was headed by Answare Kft., which also performed the project leadership and coordination functions.

In accordance with the research plan, work was done along three main lines:

1. Clinical aspects:

- developing new components for the eHEALTH8 protocol package (eH8 descriptive, BPMN and XPDL protocol), updating the other components of the package as necessary, then producing the eH8 packages;

- consultations and workshops concerning the endpoint devices required for the protocol, as well as the economic and operative model;

2. Economic aspects:

- setting up the model required for profitability calculations;

- based on the protocols created, performing profitability calculations which allow the ranking of protocols;

3. System design and development:

- finalising the system concept;

- implementing the design, development and testing cycles for the protocol repository and the telemedicine system.

Several work groups of the consortium were involved in the work done in each of the three fields.

In the first work phase, the **clinical work group** – taking into consideration the guidance received from the consortium, the technical resources and directions of innovation, as well as the experience from international applications – created
clinical
protocols
including the use of telemedicine procedures in the following fields:

1. Asthma care with the help of telemedicine

2. Caring for lung transplant patients via telemedicine

3. Diagnosing, and setting and supervising a treatment for obstructive sleep apnoea using telemedicine

4. Telemedicine, in absentia care based on the current STROKE guideline

5. Telemedicine, in absentia care for mentally declining patients based on the recommendations of the Hungarian guideline

6. Telemedicine, in absentia care for Parkinson's patients based on the recommendation of the Hungarian college of neurology

7. The role of telemedicine in at-home BiPAP breathing support for sleep apnoea

8. Telemedicine consultation system for optimising pre-hospital machine breathing support

9. Telemedicine protocol for pregnancy care.

The new protocols were discussed by the consortium individually, on multiple occasions. The experts of the consortium drew up the first version of the BPMN flowchart model, which was discussed with the medical professionals developing the clinical protocol. After several rounds of consultation, the final version of the BPMN protocols was produced. The designers in the protocol repository work group then created the descriptive component of the protocol based on the clinical protocols, which were again reviewed and validated by the clinical work group.

The work of the **profitability work group** focused on clarifying the profitability aspects of telemedicine and on creating the relevant model of operation. The work group looked at the methodologies successfully used in international and domestic health care, collected information, and analysed such information to formulate a proposal for selecting the protocols which were most favourable economically.

For the purpose of the models created and used for assessing profitability, the work group took into consideration the following models, which are widely used in healthcare, as well as their applicability: Quality-Adjusted Life Year (QALY), Disability-Adjusted Life Year (DALY) DALY = Years of Life Lost (YLL)
+ Years Lived with Disability (YLD). Additionally, their conclusions were based on the decision tree model and Markov chain as simulation procedure, the data for which were obtained from the ESKI database. An important finding of the work group states that the more widespread use of telemedicine methods requires greater flexibility in the preconditions of OEP (National Health Insurance Fund) funding.

Currently the high entry barrier can prevent the spreading of the procedures and the realisation of the relevant economic benefits. In the absence of OEP funding, the potential benefits of the methods are limited to improving cost efficiency and freeing capacities.

The model developed looks at economic impacts at the level of society, institutions, service providers and patients in detail. Specific conclusions are made difficult by the limited availability of data and information which relate to the illnesses examined and are useful for the purpose of our research (e.g. the number of sick pay days associated with the primary diagnosis). In the context of our analysis it is especially important to emphasize that the fact that the future condition of the healthcare system does not depend on its past condition is especially true for our case. i.e. the future application of telemedicine. This also means that the description of the current situation includes all information which may affect the future status of our processes.

Earlier conditions of the system can only haven an impact on its future condition via its current status.

Building upon the results of the first year’s work, the **protocol repository work group** worked with the clinical work group on continuing the formalisation of protocols. As a result of the iterative consultation process, which took the form of several rounds for each protocol, the formal descriptive components were produced. From these the work group created the eHELATH8 protocol packages, whose content is defined in the protocol representation framework. The first phase of formalisation – the creation of the primary BPMN protocols - was followed by the creation of the components of the core component repository. At the end of the current work phase, this repository now includes the reusable components suitable for

specifying the new telemedicine protocols. The work group further developed the protocol representation framework specification – primarily by adding definitions concerning running information. It also started mapping the primary BPMN protocols to the framework and the core component repository.

The work group created the second version of the protocol repository, which implements the fundamental processes required for the management of the protocols.

Working with the central system work group and the endpoint devices work group, the system design work group focused on designing the required functions of the system. The starting point for this work was the identification cases of application relevant to the expected operations and selecting those which were necessary for the implementation of the prototype. The work group follows an ambitious development methodology to implement the items in the list of functions. The central core system is being developed and tested on the server and network infrastructure built in the first year. By the end of the second year, development of the process components specified in the core component repository, required for the implementation of the processes, as well as the further development and functional testing of the protocol repository application were completed.

The **endpoint devices work group** collected and organised the technical requirements specified in the protocols. The requirements were then evaluated in terms of technological criteria, assessing the novelty and robust implementation of the technical solutions used. The work group analysed and clarified the functional requirements applicable to the individual endpoint devices and identified those devices which would be worth developing as part of the project.

After designing the endpoint architecture, the work group – simultaneously with creating the system designs – developed the communication protocol for endpoint devices. The functioning and suitability of such protocols were then tested on a model of the breadboard model of the measured data collection and communication component (OKE) used in the system.

The functions of the endpoint devices (measuring devices, testing instruments) have not yet been finalised by the work group; their development is ongoing. When designing the devices, the work group took into consideration the characteristics of the target group specified in the protocol (interests, difficulty using the devices, reduced manual manipulation ability etc.) to ensure that they can use the devices as easily as possible and that the devices cause as little

interference with their daily routines as possible.

In line with the project and the market requirements, Thormed Kft. developed a device called ‘SpiroTube Mobile Edition’ and prepared it for introduction to the market. This device is capable of exchanging data with telemedicine systems either directly or through an intermediary measurement data collection component.