Annex to the Health-RI proposal

Topsectors Knowledge and Innovation Agenda's 2016-2019

KIA Life Sciences and Health (LSH / 'Health~Holland')

LSH identifies three key challenges in life science related to our increasing ageing population, non-communicable (Chronic) diseases and resulting disability burden:

1. ***Maintain health and functioning, focus on prevention (including personalized primary prevention and prognostic pathways)*** – assist people to remain vital and functioning without medical needs, or supportive care.
2. ***Maximise effect, minimise burden*** – if disease or disability occurs, support people to maintain and/or regain vitality and functioning as much and as fast as possible.
3. ***Manage health and disease outside the hospital*** – if disease and/or disability persists enable people to adapt, self manage and function at their best in their living environment.

Although this LSH agenda addresses the coming four years, it may be expected that elements of the proposed nation-wide infrastructure for personalised medicine and health research will already assist in the scientific breakthroughs necessary to realise this agenda. In addition, *Health-RI* components can help in aligning industry and academia of this sector around the construction of a collective infrastructure of growing value, that guides high quality experimental design and execution and assists in the data stewardship aspects of LSH programmes. The connection with LSH stakeholders will also assure the optimal alignment with initiatives in care, home-care and e-health.

KIA Agri&Food 2016 – 2019

Roadmap Agro and Food	Link Health-RI
Topic: Nutrition and Health **Description.** Nowadays, consumers are able to measure the effects of their nutrition on health and they can use this to make reasoned choices regarding their diet. This can contribute significantly to vitality and well-being, healthy life and reduce healthcare costs. There is a sub-optimal health because of our modern lifestyle, our eating behaviour and demographic changes which is expressed by, among other things, reduced well-being and increase in chronic, diet-related diseases such as obesity, cardiovascular disorders, effects on mental functioning and diabetes. This puts great pressure on public health care costs, economic growth and other social factors. Research into the relationship between nutrition and should focus more on being able to determine the specific impact of food on individuals and groups and less on the average impact on groups of people. In the future, this should lead to a simple and accessible system maximize their personal dietary choices.	In 2025 a participant will have its own personalised diet, because it is generally known that standardised diets can achieve opposite effects for some people. Individuals do not only respond different to diseases and medication due to i.e. genetic elements and lifestyle, but they can also respond different to identical foods due to differences in their microbiomes. A personalised diet, in combination with a healthy lifestyle can bring individuals closer to their potential health curve.
Topic: Consumer and Chain **Description.** Understanding consumer behaviour helps to achieve a more sustainable food production, consumption and a healthier diet. The market demands to provide high quality and safe products. Citizens want that these products are created in a sustainable manner. Interventions aimed at sustainable and healthy food production and consumption should reflect as much as possible in habits, motivations and desires of consumers, eg by making advice personally. That makes more likely that eating habits and food procurement will actually change. Personal advice can reduce healthcare costs and improve quality of life and wellbeing.	Research into the relationship between eating habits, consumer manners, personal advice on nutrition and the effect on the potential health curve.

KIA ICT 2016 - 2019

The ICT sector creates crossovers with many sectors, including LSH and Agri&Food. Focussing on the relevance for personalised medicine and health the sector has clearly identified important innovation topics relevant to the creation of the *Health-RI* infrastructure. The ICT KIA 2016-2019 (termed 'Dutch Digital Delta') has selected Healthcare Systems and Services (e-health) and Life Sciences and Health as major fields for ICT innovation and it supports the need for better data stewardship and data interoperability based upon the FAIR principles, as developed with in the life sciences. It is clear that the proposed ICT infrastructure that will serve as the linked-data backbone among the *Health-RI* resources will require a strong involvement of the ICT research community. In this respect, it is a very positive sign that the topic of personalised medicine and health is one of the pillars in the whitepaper COMMIT2DATA4LIFE, sketching the contours of a cross-sector ICT research programme in the Netherlands. Especially topics such as distributed learning across local data resources, high-performance and privacy-preserving analytics of (personal) health data and digital security are of paramount importance to the proposed nation-wide integrated infrastructure for personalised health research and care. These topics are in full alignment with the above-sketched computer science case.

THE NATIONAL SCIENCE AGENDA LINKS TO HEALTH-RI VISION ON SEVERAL OF ITS "ROUTES"

Route number	Agenda	Link Health-RI
081. How will genetics play a role in understanding, screening and the treatment of rare diseases?	Many diseases have a genetic component. Often multiple genes play a role. Finding the exact cause of the disease, and identifying possible treatments is very complex. In addition to genetics, environmental factors may also determine whether a disease is expressed.	Infrastructure makes it easier to gather different research outcomes. The availability of information about different aspects of the human life (genetics, environment, daily activities) will create a more comprehensive understanding of a patients journey and situation over time.
095. How can the health sector, be more focused on the uniqueness of a person?	The effectiveness of drugs and therapies is not always as desired. The importance of a person-centered approach to health care is widely shared and manifests itself increasingly in both policy and research: from average patient to personalized medicine.	Personalised Health. Health-RI will create the possibility for scientists to find ways to target diseases on a tailor made way for each individual
098. How can we make breakthroughs in basic medical examinations and better translate them to the development of new drugs?	Upcoming breakthroughs in biomedical research & drug development will greatly affect us in a positive way: - Next generation DNA sequencing to get information about patients can be gathered more quickly; - Developments in advanced therapies, such as gene therapy and immunotherapy, stem cells and organoids; - Better knowledge of biomarkers; - Progress in the field of ICT makes learning faster and better. A key challenge for the coming years is to ensure rapid patient access to innovative therapies at socially acceptable costs.	No more unnecessary repeating of research-> lower costs. Availability of different data resources can support medical breakthroughs.
102. How can we develop new drugs and modes in order to stay vital and healthy as possible?	It is possible to deal with age-related diseases as a group rather than as individual diseases. Early diagnosis is essential. In addition, new drugs and treatments are needed to make the population healthy and age actively. Molecular understanding of disease is at the heart of new treatments. The future lies in translational research into human beings and their environment. The interaction between heredity, environment and lifestyle of the individual determines health.	Translational research-> access to enormous amounts of data, makes it possible to examine complex relationships between human beings and environment. Minimize the health gap and maintain optimum health.

105. How will Big Data and technological innovation play a role in health?	The big data revolution also provides the ability to accelerate medical research by combining information from all the possible data files with each other. A major challenge is to make these data in patient care and research FAIR: Findable, Accessible, Interoperable and Reusable. This requires issues such as standardization, ease of use, durable storage, property and privacy are well organized throughout the health sector. With these developments, it is necessary to develop new concepts, methods and software to analyse and interpret the multitude of health information and knowledge well, and can translate into personal health advice.	*Health-RI* offers the mechanism to link crucial research resources that that are highly scattered today and makes them more easily findable, accessible, interoperable and reusable (FAIR) through collective data portals: clinical biobanks and population cohorts, high-end lab facilities and sensory networks (eHealth), local, national and international scientific reference data resources, as well as high-capacity compute & storage facilities
135. How can we have a better understanding of the features, functionalities and the interaction of molecules in living systems?	We still do not understand how interactions between molecules can lead to living organisms. However, we do know that the molecules of life recognize each other, react with each other to new molecules, enter into interaction with each other and together forming structures by means of many complex processes. Knowledge of such complex molecular systems and the ability to steer it in a desired direction, offer clues to address social issues in the fields of environment, energy and health.	*Health-RI* will offer the possibility to get knowledge of i.e. Complex molecular processes due to the availability of different research resources.