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A One-Health approach to tackle tick-borne diseases: analysis of European surveillance initiatives



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INTRODUCTION

In Europe, Ixodid ticks are expanding their geographical range, but in some areas the awareness level on the risk of tick bites and tick-borne diseases (TBD) is low, and no surveillance activities are in place.

In order to identify **ideal elements for disease monitoring and prevention**, we are analysing TBD surveillance plans existing in some European countries where ticks and TBD are long since a public health concern. As a starting point, we analyzed the system in place in **The Netherlands**, a country that has implemented a One Health (OH) approach to tackle zoonoses and has built a consultation structure for their monitoring and signaling.

MATERIALS AND METHODS

We applied the semi-quantitative evaluation protocol developed by the Network for Evaluation of One Health (NEOH) to evaluate the TBD surveillance system implemented in The Netherlands [1]. The analysis was based on published literature and information provided by National Institute of Public Health and Environment (RIVM).

RESULTS AND DISCUSSION

The incidence of TBD, in particular Lyme disease (LD), has been increasing in The Netherlands since the '90es. TBD are not considered as notifiable diseases in the country, however a surveillance system based on multiple projects has been implemented (Fig.1), including monitoring, research, education and control activities. All actions are coordinated by RIVM, which is in charge of the prevention and control of infectious diseases. As shown in Fig.2, the initiative has resulted in outputs (e.g. production of risk maps [2]), measurable outcomes (e.g. reduction in tick bites, stabilization in the number of LD cases [3]) and on detection of unexpected outcomes (e.g. discovery of new pathogens such as the tick-borne encephalitis virus -TBEV).

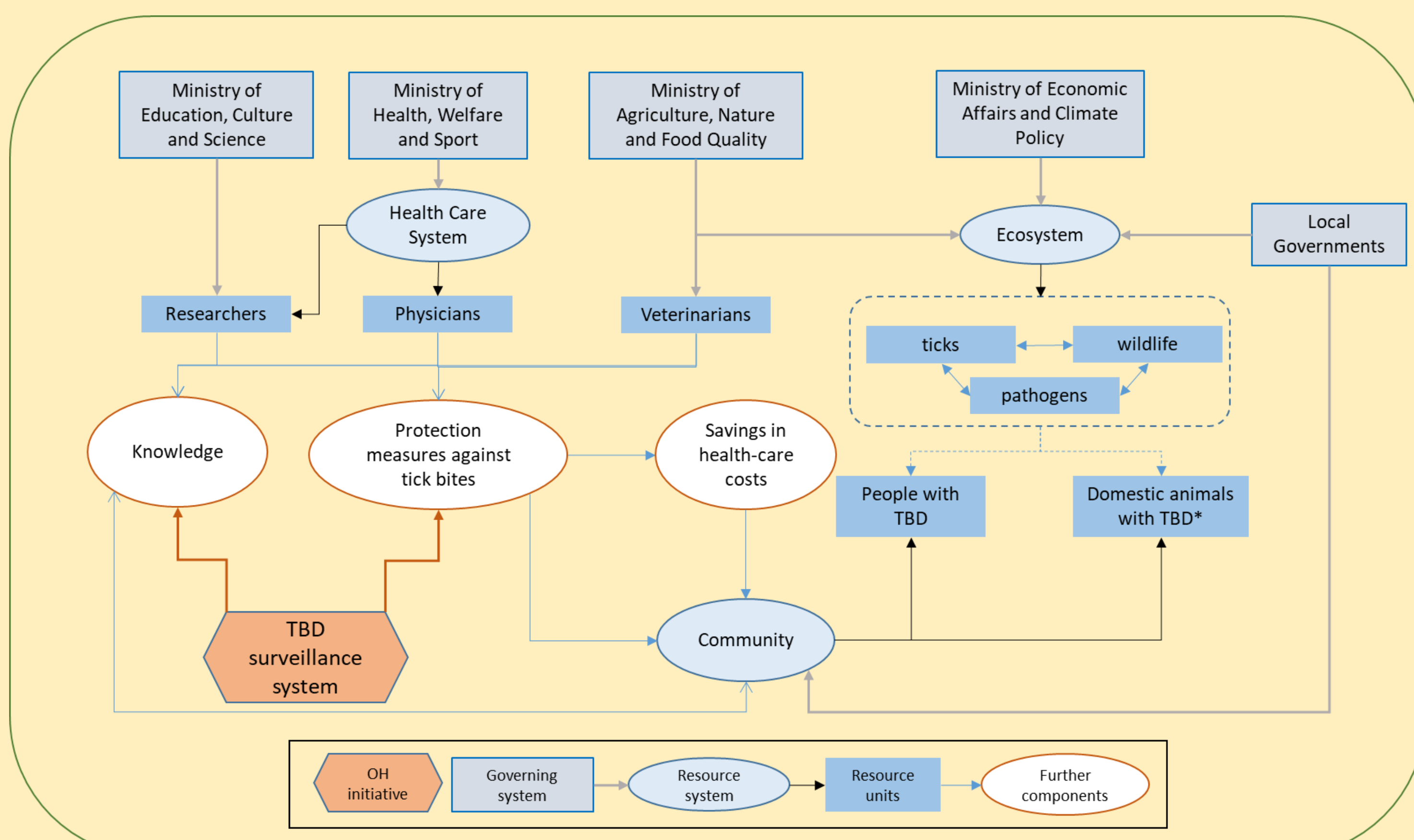


Fig. 1. Visual representation of the TBD surveillance initiative in The Netherlands within its system. Relationships (arrows) are classified as governance (grey), membership (black), and causal interactions (blue). The red hexagon represents the initiative with arrows where it impacts the system. *TBD in pets and livestock are only partially considered by the initiative.

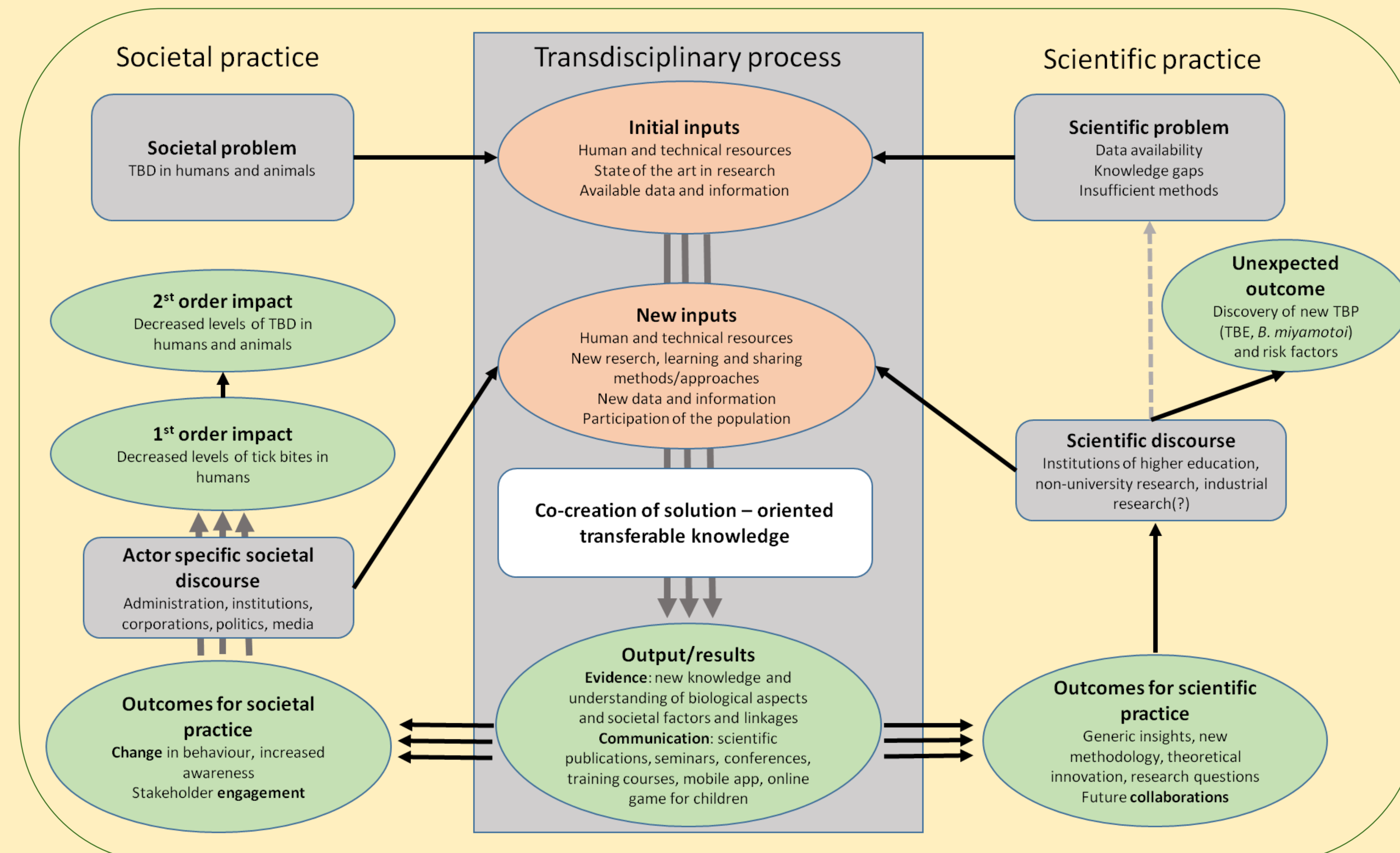


Fig.2. The change pathway for the TBD surveillance system in The Netherlands: inputs from science and society to co-produce outputs taken up by society and the scientific community and disseminated to result in first- and second- impacts and scientific progress.

The surveillance system is characterized by a high degree of OH implementation and a good balance of operational and infrastructure support (Fig.3). Indeed, it is part of the national program for the control of zoonoses, which foresees a high level of transdisciplinary and trans-sectoral collaboration between public, animal, and environmental health. Nevertheless, TBD are not seen as a 'veterinary' concern, so data and expertise in the animal domain are only partially considered (scarce information on TBD in domestic animals).

The initiative has demonstrated a high level of flexibility and adaption over the years. Although it is adequately supported from a structural and financial point of view, the various project-based activities depend from different institutions and funding sources. So, some actions may not be sustainable in the long term, and reduced economic resources can affect the collaboration of stakeholders and limit adaptive and generative learning. Data sharing is limited among the different projects/institutions, but communication flows (e.g. regular meetings among actors and with stakeholders, on-line communication platforms [4]) enable an efficient sharing of information and support decision making. The active participation of stakeholders and *citizen science* activities (e.g. the mobile phone app 'Tekenbeet' [5]) improved the surveillance.

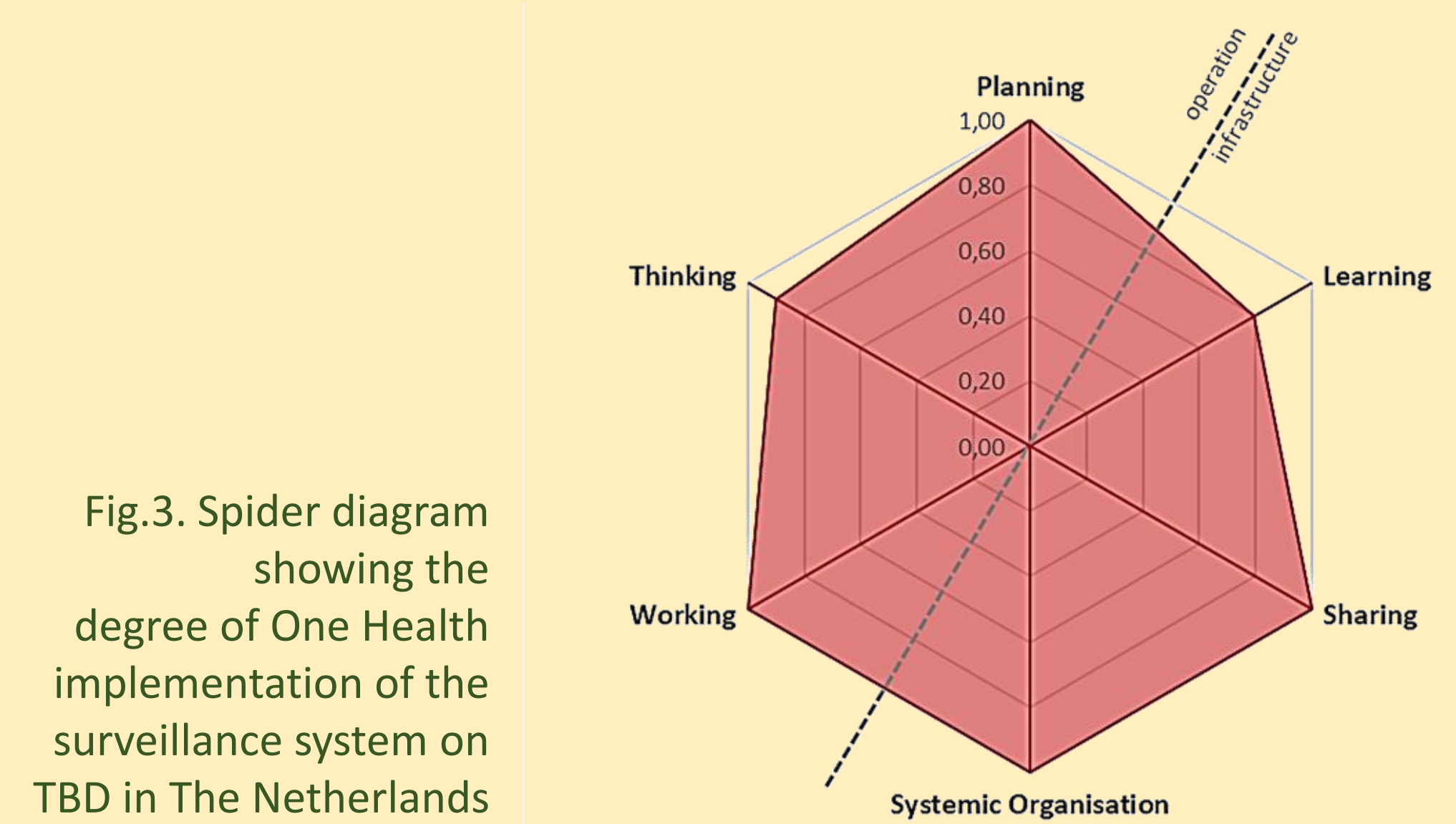


Fig.3. Spider diagram showing the degree of One Health implementation of the surveillance system on TBD in The Netherlands

CONCLUSIONS

The Dutch initiative represents a **reference model** for an effective surveillance on TBD. Several of its operation and infrastructure aspects could be adopted in other contexts, especially in areas of recent tick spread, where no surveillance is carried out and the risk of TBD has to be assessed.