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MEDUWA

Alternative societal solutions to pharmaceuticals in the aquatic environment

Lara Wöhler
University of Twente

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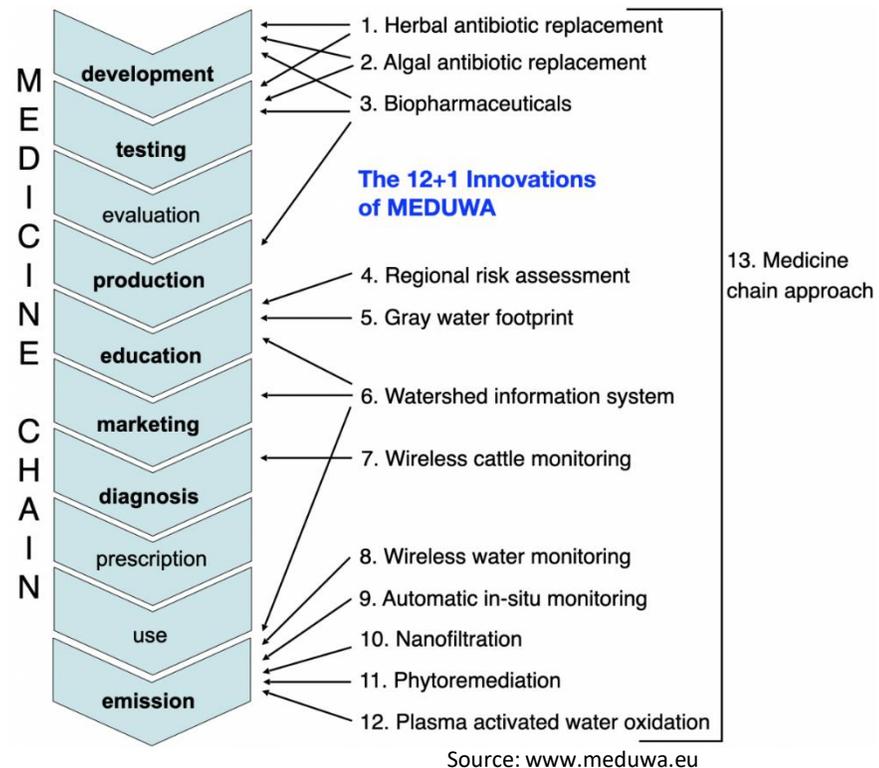
Introducing us!

- The MEDUWA team of the University of Twente
 - We are part of the Multidisciplinary Water Management group in the faculty of Engineering Technology
 - Staff involved in MEDUWA research were:
 - Prof. Dr. Arjen Hoekstra
 - Dr. Marcela Brugnach
 - Dr. Maarten Krol
 - Dr. Rick Hogeboom
 - Myself, Lara Wöhler, PhD candidate employed by the MEDUWA project



The idea to assess pharmaceuticals in the environment from a broader, societal perspective

- The topic's complexity and facets

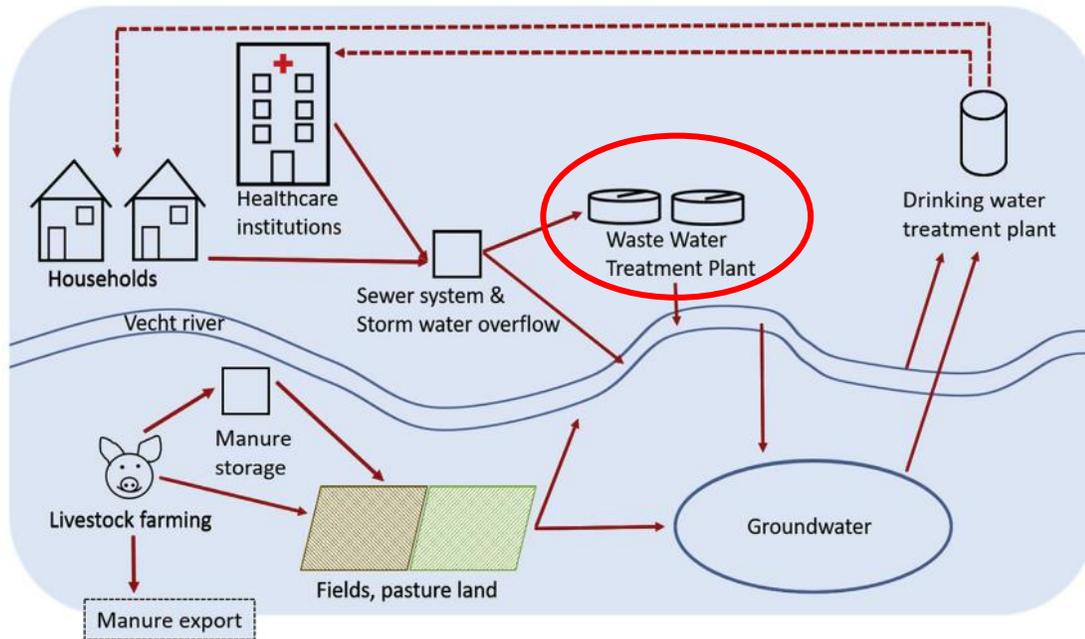


BUT: Previous research focussed on environmental, chemical and technological aspects of pharmaceuticals in the environment, rather than societal ones

(Daughton (2016): Pharmaceuticals and the Environment (PiE): evolution and impact of the published literature revealed by bibliometric analysis. Sci. Total Environ.)

The idea to assess pharmaceuticals in the environment from a broader, societal perspective

- The topic's complexity and facets



Source: Wöhler et al. (2020): The grey water footprint of human and veterinary pharmaceuticals, Water Research X.

BUT:

- no individual end-of-pipe technology has proven to sufficiently eliminate all substances
- no adequate knowledge about (long term) ecotoxicological risks for remaining effluent concentrations
- doubts over added costs, feasibility and reasonability
- unclear if current technologies can remove prospectively developed substances
- technological end-of-pipe solutions do not address pharmaceuticals in the environment over the entire lifecycle and neglect approaches that relate to societal aspects of how pharmaceuticals are prescribed, used, and disposed.

Result was the study presented today

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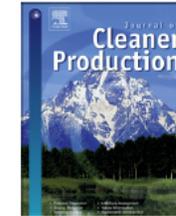


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Alternative societal solutions to pharmaceuticals in the aquatic environment

Lara Wöhler ^{a, b, *}, Arjen Y. Hoekstra ^{a, c, 1}, Rick J. Hogeboom ^{a, b}, Marcela Brugnach ^{a, d, e}, Maarten S. Krol ^a

^a Twente Water Centre, Faculty of Engineering Technology, University of Twente, Horst Complex Z223, P.O. Box 217, 7500, AE Enschede, the Netherlands

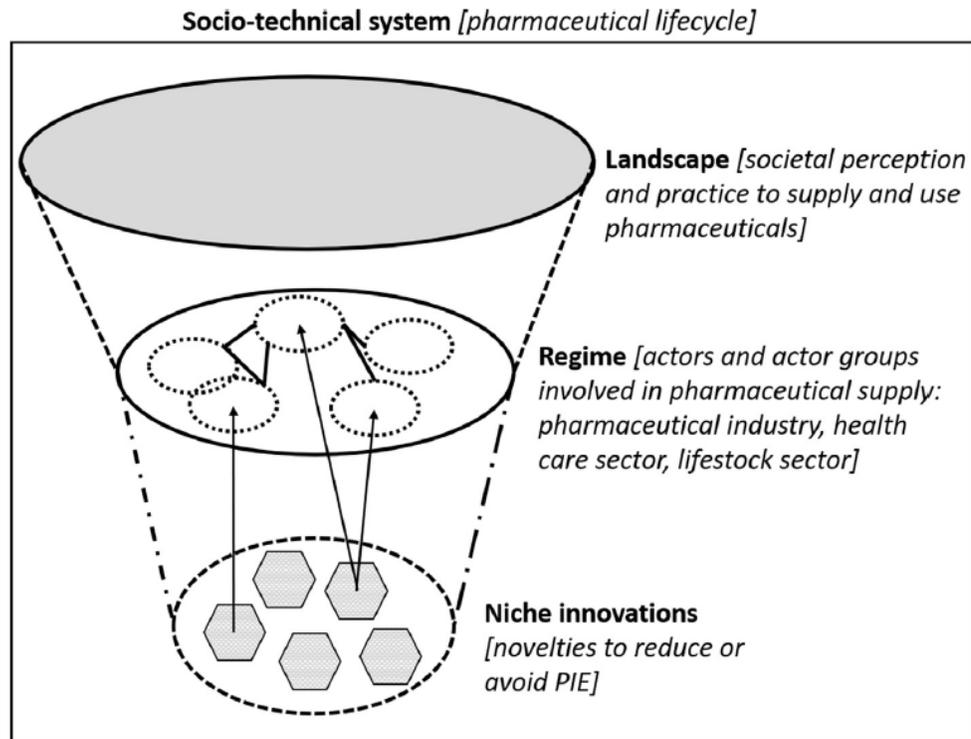
^b Water Footprint Network, Drienerloaan 5, 7522NB, Enschede, the Netherlands

^c Institute of Water Policy, Lee Kuan Yew School of Public Policy, National University of Singapore, 469C Bukit Timah Road, 259772, Singapore

^d Basque Centre for Climate Change (BC3), Leioa, Spain

^e Basque Foundation for Science Ikerbasque, Bilbao, Spain

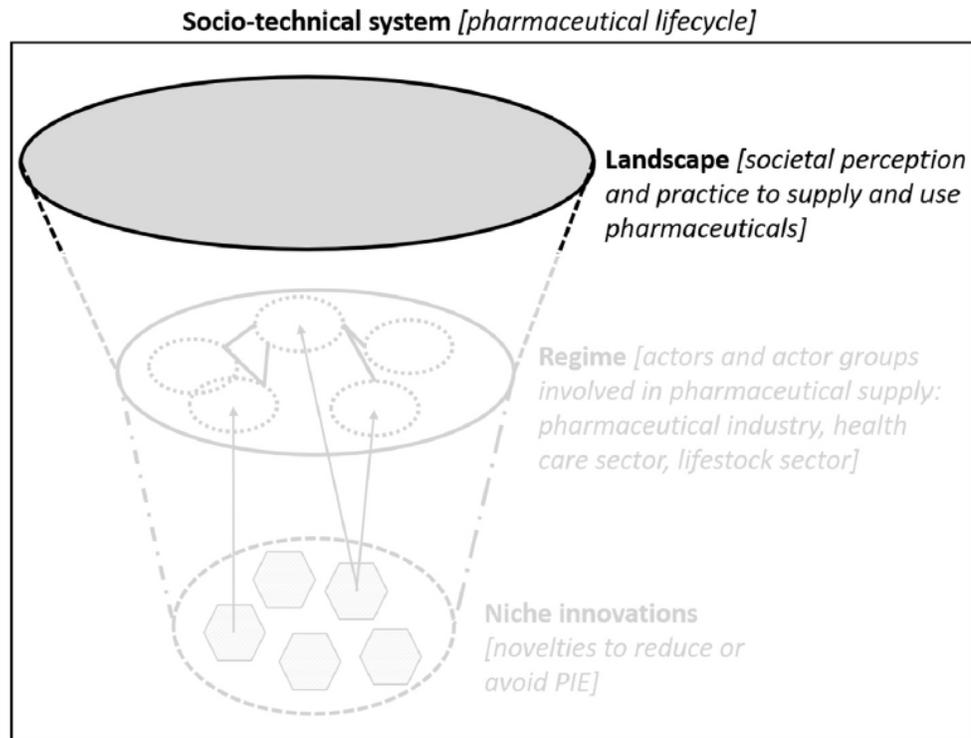
Theoretical framework: Multi Level Perspective (MLP)



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

- Theory results from transition research
- Transitions are shifts from one regime to another whereby landscape and niche are derived concepts in relation to the regime
- Our research uses the MLP to structure what alignments of changes at the different levels can lead to distinct futures regarding pharmaceuticals in the environment
- Data was collected from literature as well as through 15 semistructured interviews
- The first part of our results present an analysis of the current socio-technical system
- For the second part we used the theory of transition pathways by Geels and Schot (2007) to identify different societal solutions to pharmaceuticals in the environment

Results: The current socio-technical system of pharmaceutical lifecycle

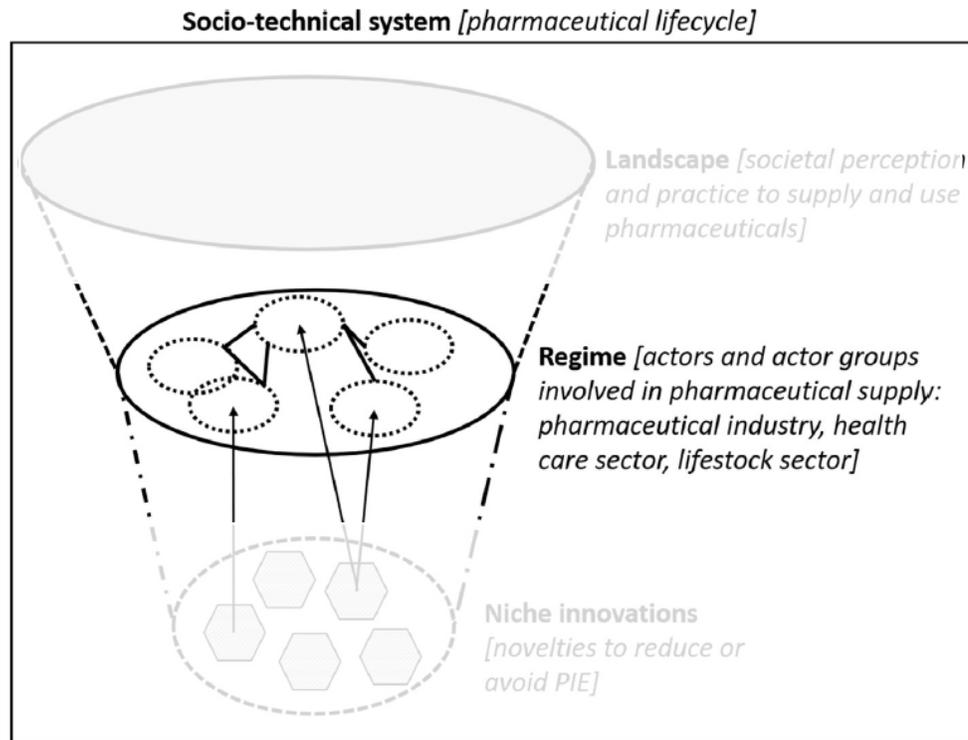


Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Landscape characteristics and changes affecting pharmaceuticals in the environment

- Priority is given to human health (and partially also animal health) over environmental health
- Regulative/legislative developments (several examples, but no limit values)
- Societal structures (e.g. demographics)
- Societal trend to percept livestock production critically

Results: The current socio-technical system of pharmaceutical lifecycle

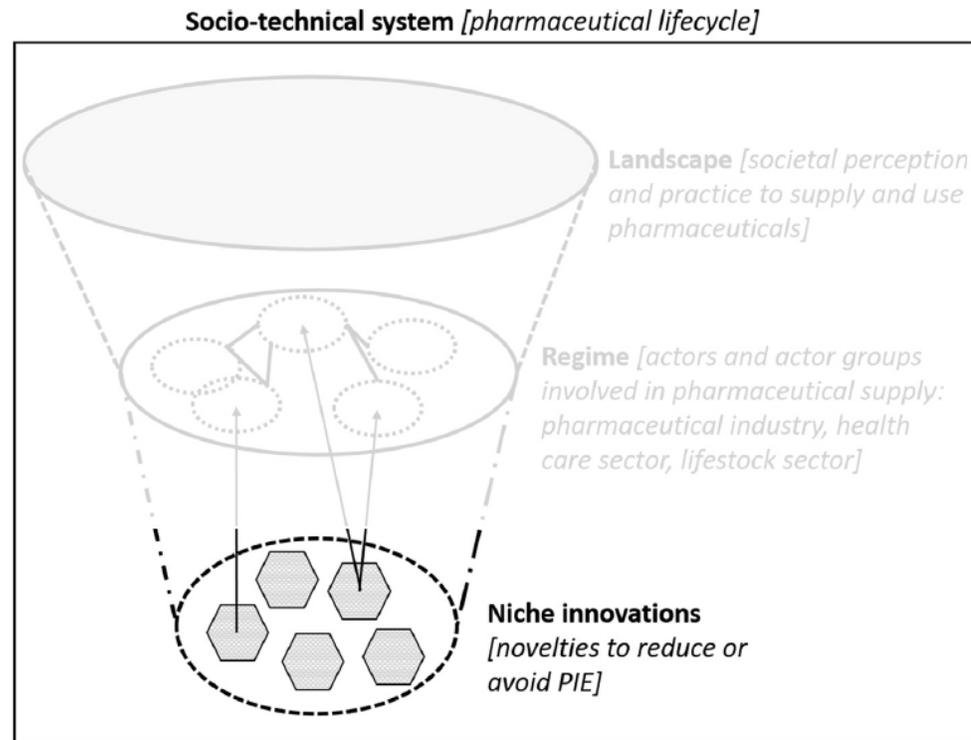


Regime dynamics affecting pharmaceuticals in the environment

- Pharmaceutical development and manufacturing: innovations on the one hand, lock-ins on the other
- Human health sector: core priority is on curing humans, medical treatment as "routine"
- Agricultural sector: efficiency and economic profitability is the focal point, driving pharmaceutical emissions; hotspots; focus on antibiotics

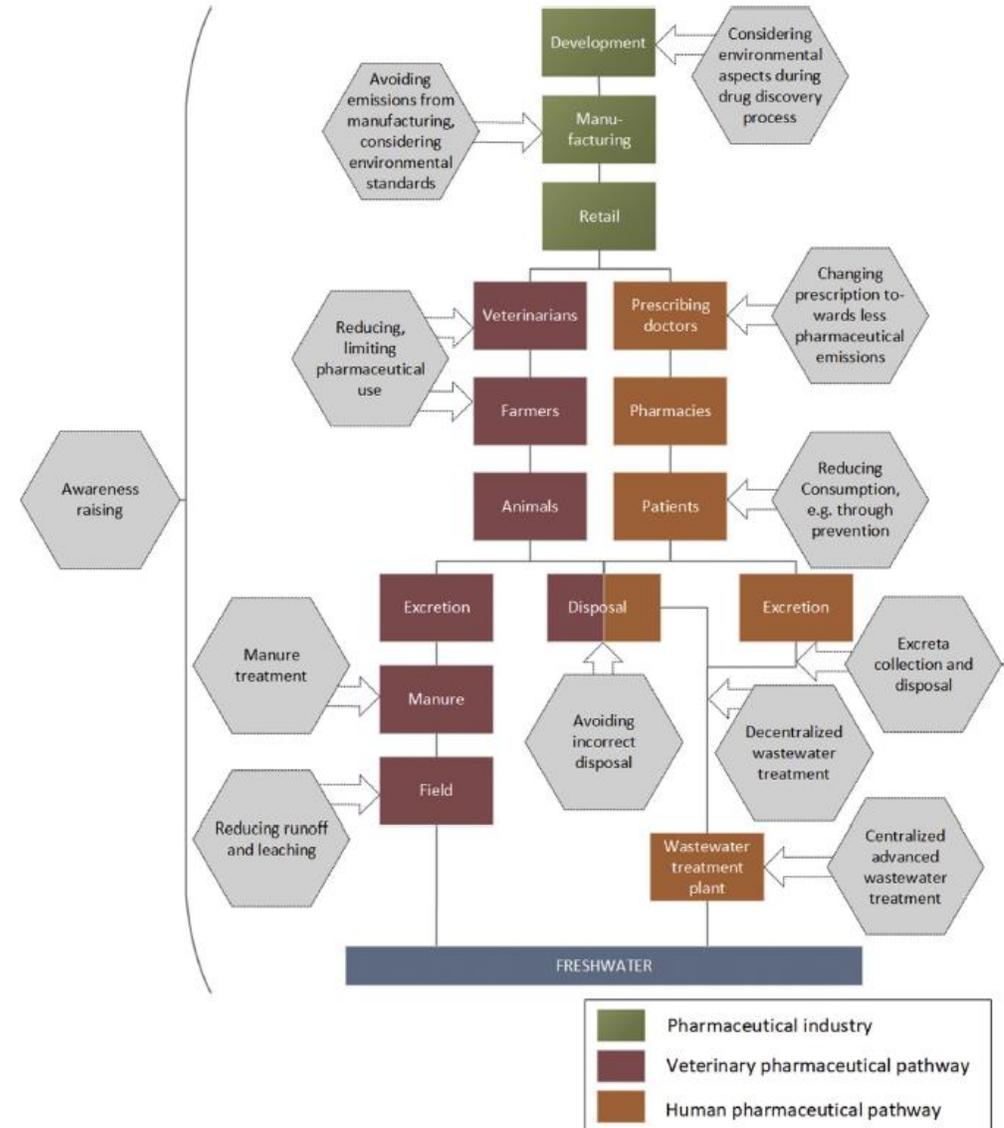
Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Results: The current socio-technical system of pharmaceutical lifecycle



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

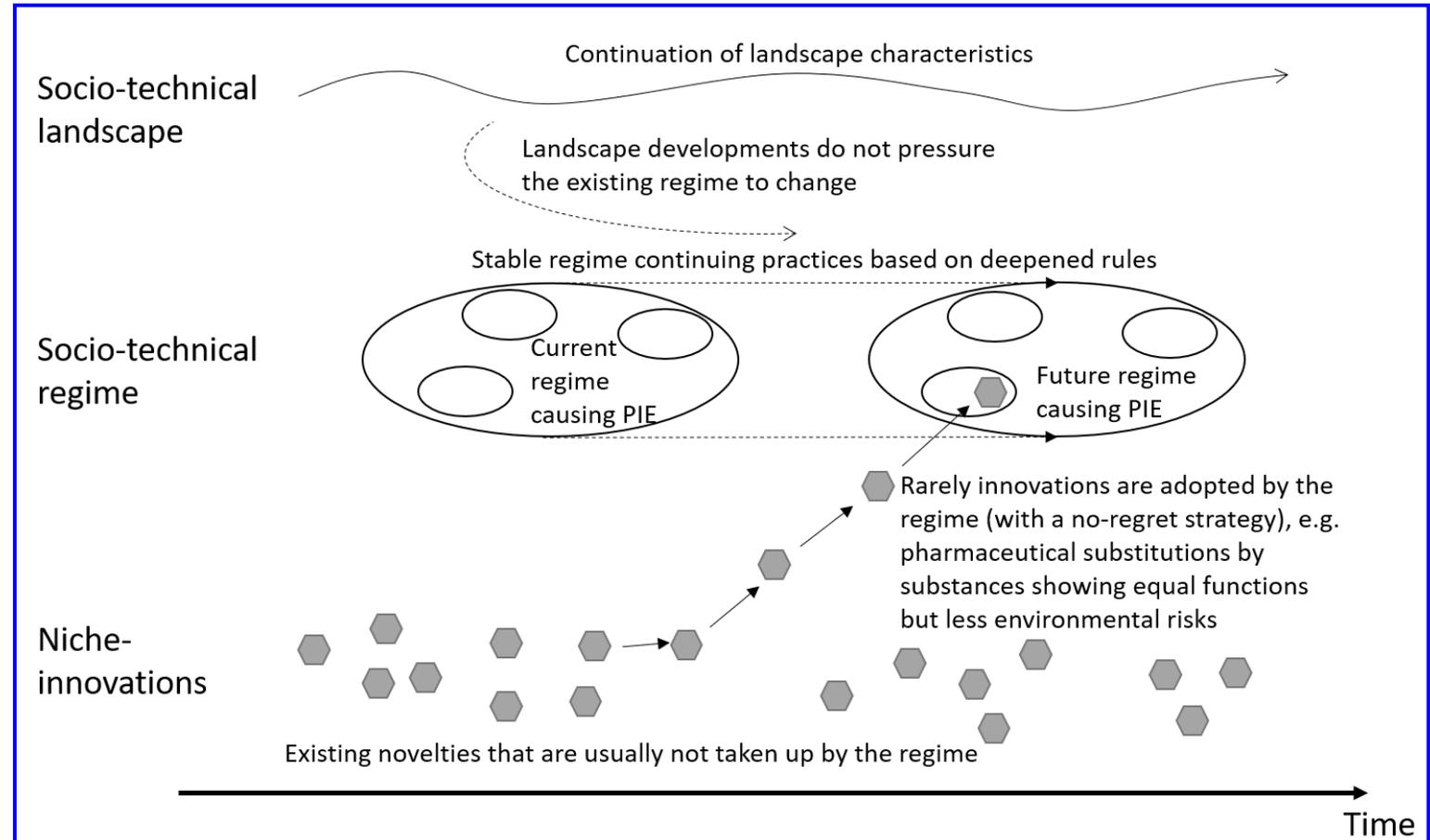
Niche Innovations



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Results: Societal solution 1

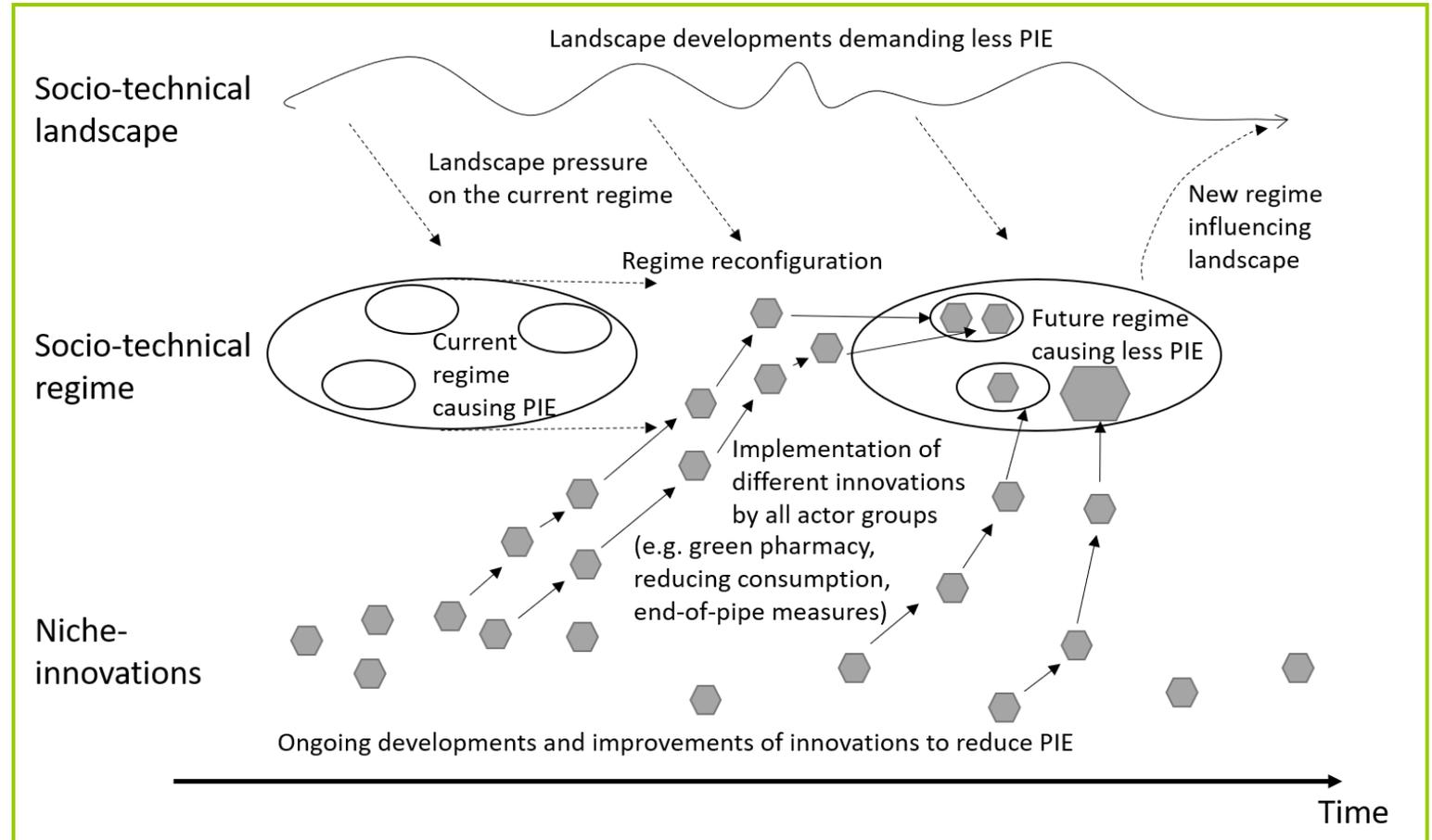
Accepting pharmaceuticals in the environment



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Results: Societal solution 2

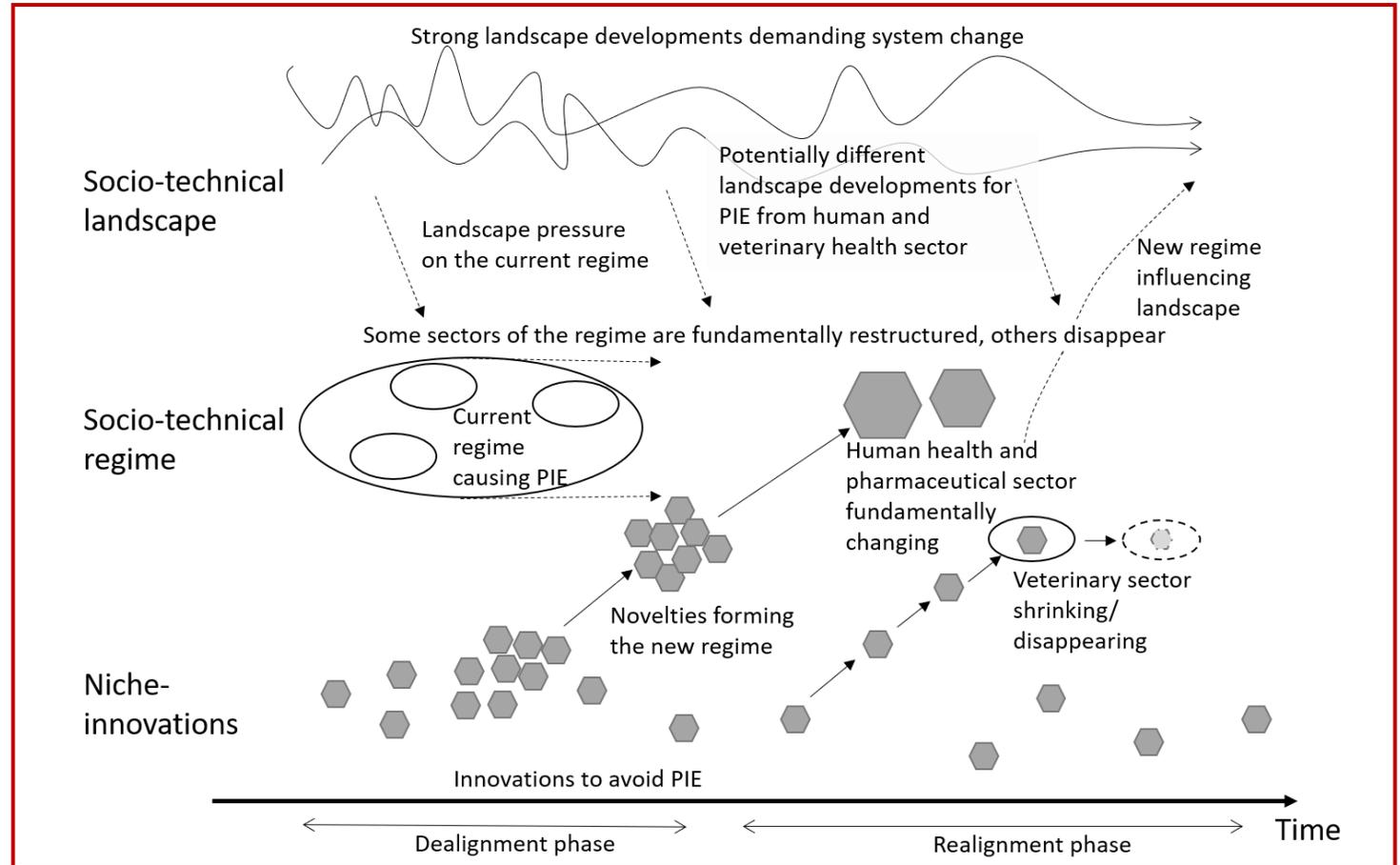
Implementing niche innovations



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Results: Societal solution 3

System change



Source: Wöhler et al. (2020): Alternative societal solutions to pharmaceuticals in the environment, Journal of Cleaner Production.

Conclusion/Recommendations

- Wide spectrum of futures in terms of pharmaceutical emissions, regime dynamics and societal changes
 - 1) Accepting PIE does not require changes, but pharmaceutical pollution will at best remain, but likely worsen
 - 2) Most likely solution → innovation development occurs, current regime actors describe dynamics towards niche implementation, landscape dynamics such as policy changes push towards this direction, but it is unclear how this will affect PIE.
 - 3) Transition to new regime, with highly restricted human pharmaceutical use and decimated livestock sector, is expected to result in a substantial effect on PIE. The major system and sectoral changes needed however, will require societal pressure, governmental enforcement and financial incentives.
- Study illustrates how, in the Dutch-German context, society unequivocally prioritises human wellbeing over environmental risks → fundamental system change for human pharmaceuticals is therefore not to be expected until this deeply rooted perception changes.
- For the veterinary sector this hierarchy is less pronounced. If these developments result in the societal decision to reduce or renounce livestock production as well as the consumption of animal products, this is expected to reduce animal related PIE.
- Diverse requirements and responsibilities for and barriers to changes

Discussion

