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Working paper

A systems description of the national well-being system. Version 2.0: attaching data sources and identifying leverage points and responsible institutions

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Abstract

As governments begin to focus their attention on national well-being, there is an increasing need for enhanced analysis tools that help understand the multifold synergies and trade-offs of policies aiming at well-being. Systems Mapping is one such systems analysis tool. To be useful for policymaking, a systems map (causal loop diagram) should reflect the actual context of the system it models. This working paper discusses further validation and analysis of the National-Well-Being System (NWS) systems map introduced (Ilmola-Sheppard et al., 2020).

The original NWS systems map is enhanced in three ways: (i) quantification of the systems map components, (ii) update of the systems map structure depending on the data availability, and (iii) identification of potential leverage points in the system and attachment of responsible institutions to them.

Attaching quantitative arguments to the systems map components validates them and can be seen as an intermediate step between a systems map and a system dynamics model. The structure of the systems map is updated based on the availability of viable data sources. Additionally, proxies are introduced if no suitable data sources can be found. This leads to a new version of the systems map, with the number of components reduced from 68 to 65. As the outcome of this procedure, a list of viable OECD and non-OECD data sources covering all systems map components is produced. Such quantification opens up further analysis options, e.g., quantitative assessment of the links between components of the system

Identification of potential leverage points in the system and attachment of responsible institutions to them highlights the key components of the system. It offers a better understanding of where institutions might influence national well-being most effectively. In this working paper, responsible institutions in Israel and Austria are used as an example. This exemplifies the practicality of the systems map and shows how a systems map can be adapted to the governmental structure of a country.

By identifying data sources behind every component of the systems map, revising the map based on the availability of data, and identifying leverage points as well as possible responsible institutions and decision-makers, this working paper improves on the NWS systems map and highlights its potential to serve as a policy simulation tool.

Introduction

The primary motivation behind this working paper is to enhance the National Well-Being System (NWS) systems map suggested by (Ilmola-Sheppard et al., 2020). This is achieved threefold: (i) by adding quantitative arguments to the systems map, (ii) by updating the systems map depending on the availability of data, and (iii) by identifying possible leverage points in the system and attaching responsible institutions to them.

Conventionally, data are used to build a system dynamics (SD) model based on a systems map or causal loop diagram (CLD). In this case, the identified data sources are employed to validate the components of the systems map and adapt it if necessary. As a next step, one could also use the data sources to validate the links between the systems map components using machine learning methods; however, this is beyond the scope of this working paper. Nevertheless, this working paper can also be an intermediate step between the CLD and an SD model.

The general importance of using the rich amount of data and our increasing ability to manage that data is pointed out by Pruyt (Pruyt, 2014). Additionally, Lin emphasizes capitalizing on the data-rich ecosystems we live in to improve CLD and SD models (Lin, 2020). The identified data sources for the systems map and our revision of the first version of the NWS systems map based on data availability represent the first step in that direction.

Identifying leverage points in a system and attaching responsible institutions to it turned out to be an under-researched area. Although Meadows clearly points out the importance of leverage points (Meadows, 1999) and Roxas gives a framework to identify potential leverage points (Roxas, 2019), less is to be found when it comes to attaching decision-makers to these leverage points. One promising example by Gibbons on Corporate Social Responsibility (CSR) points out the relevance of identifying responsible decision-making interrelationships to act on insights provided by a CLD (Gibbons, 2014). In this working paper, after identifying potential leverage points, possible responsible institutions from Israel and Austria are attached to them to show and further improve the practicality of the systems map.

By identifying data sources behind every component of the systems map, revising the map based on the availability of data, and identifying leverage points as well as possible responsible institutions and decision-makers, this working paper enhances the NWS systems map and shows further potential to fine-tune the policy simulation tool.

Identification of Data Sources

Relation to the first version of the NWS systems map and motivation for identifying data sources

From the first version of the NWS systems map developed in the working paper (Ilmola-Sheppard et al., 2020), it became evident that the comprehensive systems map needs fine-tuning so as to develop an in-depth policy simulation tool. One approach to improve the representation of the NWS is to add quantitative arguments to the systems map. This can only be done if sufficient data is available for the components of the NWS. Following this, data sources for each component were identified.

Process of Identification of Data Sources

The definition of each component was analyzed to identify a data source, and data sources that fit the definition were searched for. For each component, the source, the link to the data, and the latest available year were recorded.

The primary source of data was supplied by OECD Statistics from the website www.stats.oecd.org (OECD.Stat, 2020). In particular, the OECD How's Life report 2020 offered a comprehensive collection of data sources as well as detailed explanations of their indicators (OECD, 2020). Through the high-quality and well-structured OECD data, the majority of components could be backed up with data.

As expected, not every component of the NWS could be mapped with OECD data. In these cases, the following process was conducted:

First, an alternative source was searched. For example, for the component "Work-life balance" the OECD How's Life report 2020 just listed "Time off" and "Long unpaid working hours" while in the NWS, it is defined as a combination of "Working hours" and "Time off". In this case, statistics from Eurostat (regarding Harmonized European Time Use and Income and Living Conditions) were used to meet the definition and ensure correct data mapping for the component "Work-life balance" (Eurostat, 2018).

Second, if no alternative source could be found, a proxy for the component was searched for. For example, for the component "Social Stability" no OECD or alternative source could be found. In this case, the Fragile State Index from the Fund for Peace was identified as a proxy for social stability and added to the data collection (The Fund For Peace, 2020).

Third, if no proxy could be identified, a possible transformation of the component was analyzed. For example, for the component "Untouched nature" there was no data source or high-quality proxy found. In this case, the component was transformed into two new components, "Protected Areas" and "Access to green space". For the new components, OECD data could be identified and added to the data collection. In addition to that, the NWS systems map was updated with the new components and the corresponding linkages to already existing components.

Lastly, if no transformation was possible, the component was removed from the NWS. For example, the component "Human Capital" could not be transformed. In this case, the component was removed, and the

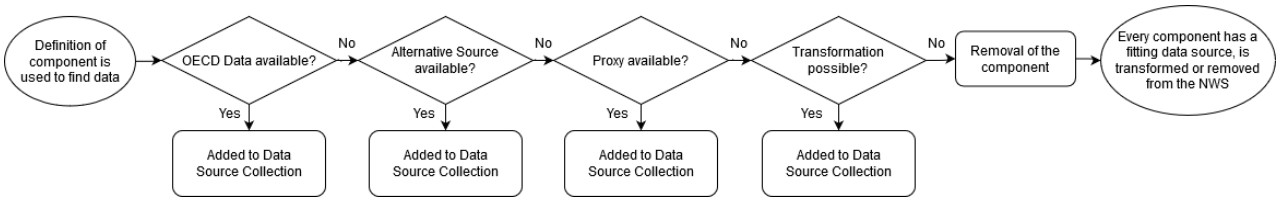

Figure 1. Process description of Identification of Data Sources for each component of the NWS

linkages were replaced with connections to the components "Human Skills" and "Educational Expectancy". Accordingly, the NWS systems map was updated. For easier understanding, the process is depicted in Figure 1.

After this process, every component of the NWS had a fitting data source or was transformed or removed. The full list of data sources is provided in Appendix 1. With this, the basis for adding quantitative arguments to the systems map is laid. Additionally, the data collection offers a comprehensive summary of available data for national well-being related research.

Overview of Data Sources

To provide a brief overview, Table 1 below gives a broad summary of the collected sources. The two main groups are OECD Sources and Non-OECD Sources.

With OECD Sources, high-quality data is ensured, and updated data collection methods or the most recent data are always indicated on the website. In some cases, the component does not list data for every OECD country or contain missing data in the past. Almost all components list data from OECD Sources after 2017 for a high percentage of OECD countries.

Non-OECD Sources come from different institutions, e.g., European Union Statistics, Gallup World Poll, Our World in Data, The Fund for Peace. These sources were used when no OECD Source could provide data that follows the definition of the components or when using a proxy was necessary. Like OECD Sources, high-quality data is available from these sources, and the data collection methods, as well as the time coverages, are listed on the websites. As already mentioned, the whole data sources outlined can be found in Appendix 1.

Table 1. A broad overview of data sources

	Number	Spatial Coverage	Time Coverage	Examples
OECD Sources	52	OECD Countries	2012-2019 (mostly 2017-2018)	OECD National Account Statistics, OECD Job Quality
Non-OECD Sources	13	EU Countries, Worldwide (Mostly EU)	2015-2019 (mostly 2018)	EU Statistics on Income and Living, Fragile State Index

Revised systems map

During the process of identifying data sources, it turned out that for some components, no data source could be found. Following the procedure outlined in the previous section, these components were transformed or, if that was not possible, removed from the systems map. This leads to an updated map, which is depicted in Figure 2.

The following adaptions were made:

- Component "Untouched Nature" is transformed to "Protected areas"
- Component "Residuals from the rest of the world" is removed from the systems map
- Component "Biodiversity" is removed and represented by "Protected areas" and "Threatened wild species"
- Component "Human Capital" is removed and represented by "Human Skills" and "Educational Expectancy"

After implementing these changes, the systems map consists of 65 components – 52 covered with OECD sources and 13 with non-OECD Sources. In the revised systems map, each component has a quantitative metric behind it, which can be observed and analyzed.

Furthermore, the systems map inherits four subsystems, which were not changed during the revision: (i) economic, (ii) human capacity, (iii) environmental, and (iv) social. Overall, it proved to be more difficult to find fitting data for the social and natural subsystem than the economic and human capacity subsystem.

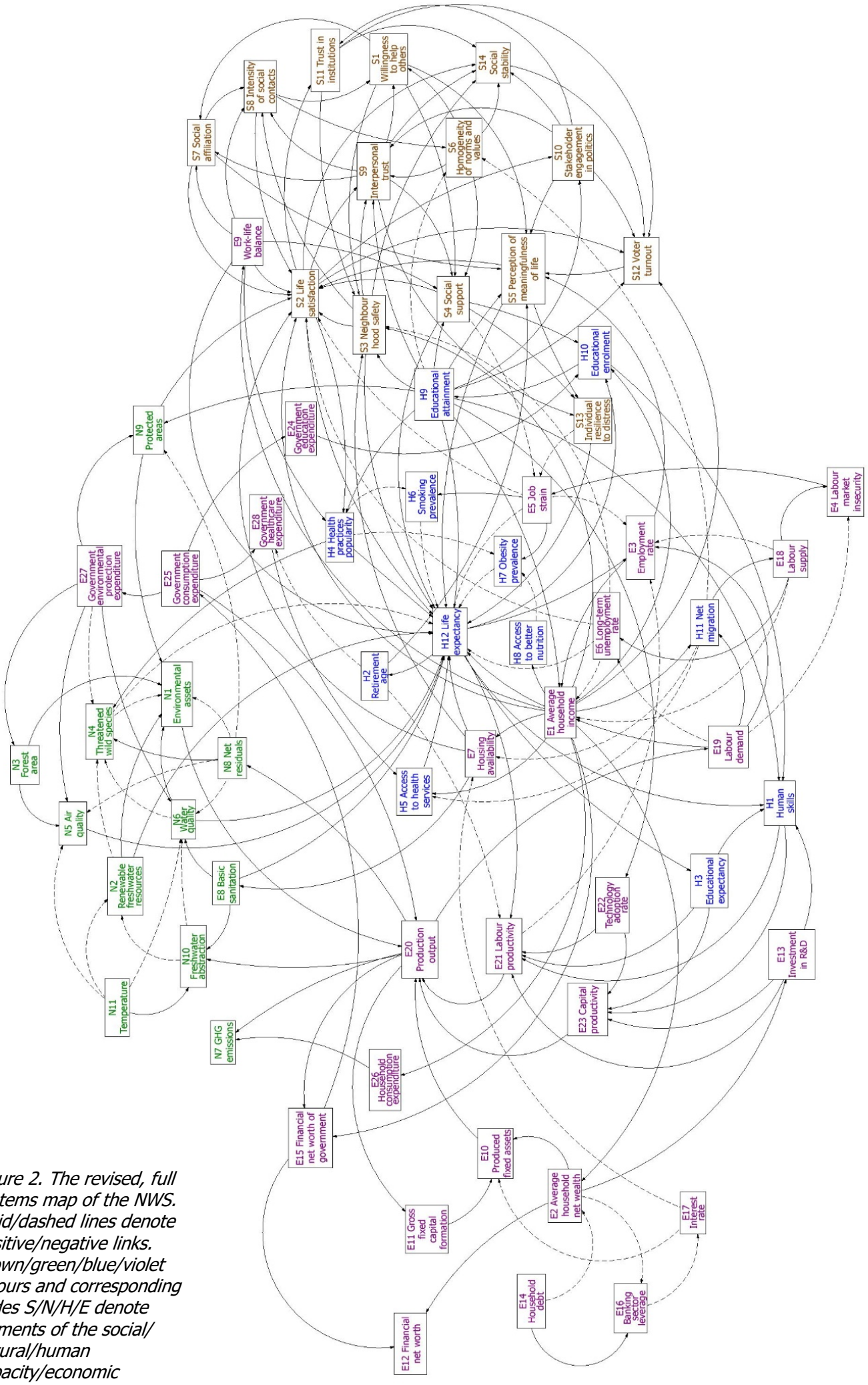

Figure 2. The revised, full systems map of the NWS. Solid/dashed lines denote positive/negative links. Brown/green/blue/violet colours and corresponding codes S/N/H/E denote elements of the social/ natural/human capacity/economic subsystems.

Identification of Responsible institutions

Relation to the first version of the NWS systems map and motivation for identifying responsible institutions

As mentioned in (Ilmola-Sheppard et al., 2020), to further develop the NWS systems map, expert validation, as well as customizing the systems map to particular national and policy contexts, is essential. To achieve that, the approach of identifying possible responsible institutions for a particular country was chosen. This clarifies which institutions affect the most components of the map and may play an essential role in a particular country. For this working paper, Austria and Israel were used as examples to identify the most relevant institutions in a multi-step process.

Process of Identification of Responsible Institutions

Classification between active and passive components

Adopting the rationale of Frederic Vester (Vester, 1997, p.220), the first step to identify potential control levers (in this case, responsible institutions) is to differentiate between active and passive components. While Vester uses the strength of linkages between components, the focus lies on the number of components incoming and outgoing of a described component in this working paper. In particular, this was done by counting how many components are affected by the described component vs. how many components affect the described component. If a component affects more components than it is affected by, it is defined as 'Active'; otherwise, they are 'Passive'. If the numbers are the same, the component is classified as 'Undefined' for now. For example, the component "Life expectancy" has 20 incoming and five outgoing components, which leads to the classification 'Passive'. Conversely, the component "Average household income" has five incoming and 13 outgoing components, which defines it as 'Active'. The full classification is presented in Appendix 2.

Figure 3 shows that the Active Components with Incoming and Outgoing Links are listed in descending order after Total Degrees.

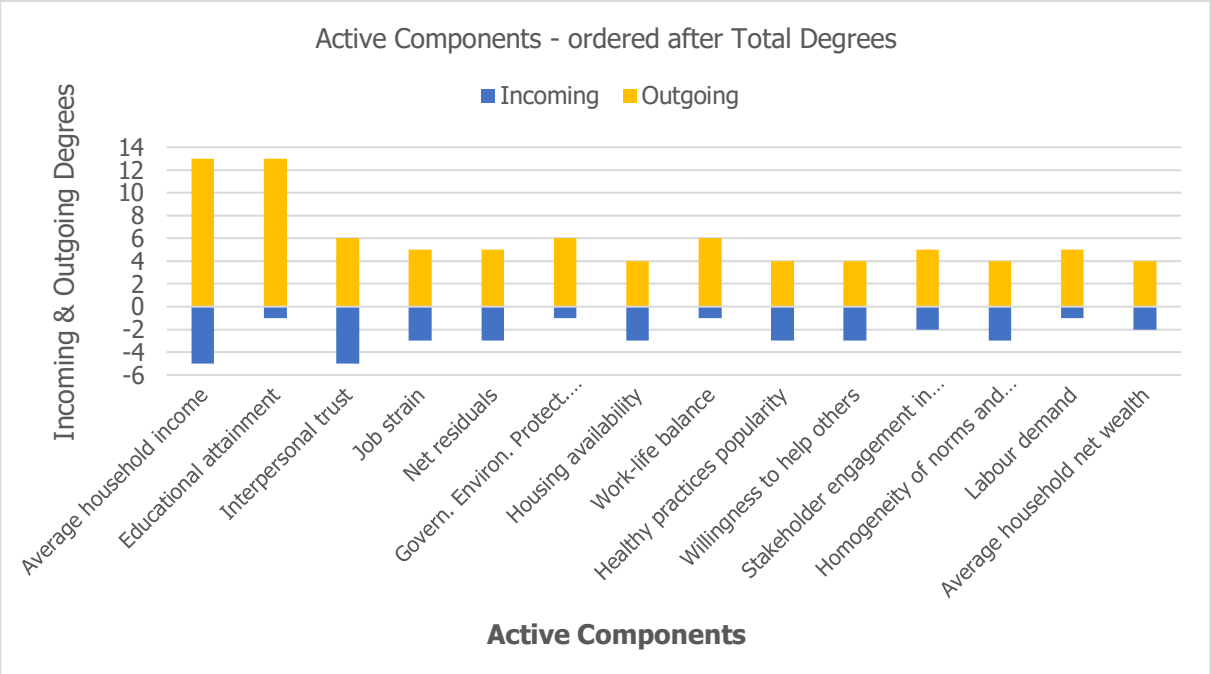

Figure 3. Active Components listed in descending order after Total Degrees

Equivalently, in Figure 4, the Passive Components with Incoming and Outgoing Links are listed in descending order after Total Degrees.

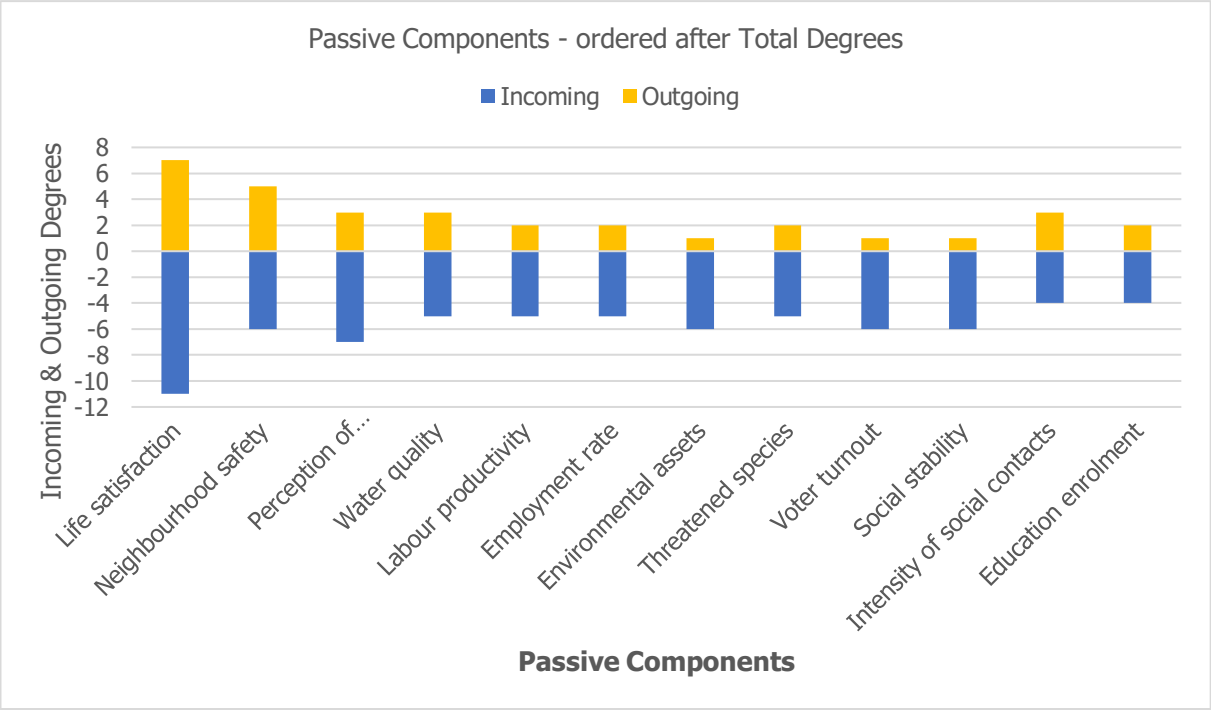

Figure 4. Passive Components listed in descending order after Total Degrees.

Following Donella H. Meadows, identifying leverage points is crucial to change a system effectively. To identify these leverage points, several steps were carried out (Meadows, 1999).

Analyzing active components and identifying responsible institutions

First, the active components were analyzed in detail. For this, the definition of the component was used to identify a possible, responsible institution in general. After that, concrete examples for Israel and Austria were researched and added to the analysis. Taking "Work-life balance" as an example, the analysis looked as followed:

> Work-life balance is defined by the share of the total number of employees of all ages whose usual working hours are less than 50 hours or more per week, multiplied by the number of hours that people in full-time employment devote to leisure and personal care. The most likely responsible institution is the one that regulates working hours.

- Israel: Ministry of Economy and Industry; Ministry of Labor, Social Affairs and Social Services
- Austria: Federal Ministry of Labour, Family, and Youth

This can be extended to every country after an analysis of the country's governmental structure.

Analyzing the effect of institutions on active and passive components

Second, several matrices were created to analyze the effects of responsible institutions on active and passive components.

The first matrix was created with the identified responsible institutions for Israel and Austria and the active components. Every case in which an institution is responsible for an active component was marked. In some cases, no responsible institution for an active component could be found. Taking the "Work-life balance" example, the identified institutions for Israel: Ministry of Economy and Industry, Israel: Ministry of Labor, Social Affairs and Social Services, and Austria: Federal Ministry of Labour, Family, and Youth were marked.

The second matrix was created with active components and passive components. A causes tree was extracted for each passive component from the existing NWS using the Vensim software. From the causes tree, each active component indirect linkage to the passive component was identified and marked in the matrix. For example, the passive component "Perception of meaningfulness of life" has seven directly linked components. From these seven components, four are 'Active' and were marked in the second matrix. The process is visualized in Figure 5, in which blue frames indicate active components directly linked with passive components.

Furthermore, in Figure 5, the passive component 'Perception of Meaningfulness in life' gives a good example of the reason for the identification of active components. While it is difficult to find responsible institutions for passive components, there is often a straightforward mapping of institutions responsible for active components, which can then influence the passive ones. This can be seen with the included institutions in the green frames. For active components, it can also be challenging to attach an institution. However, in collaboration with a particular government, it might be easier to find responsible authorities for active components than for passive ones.

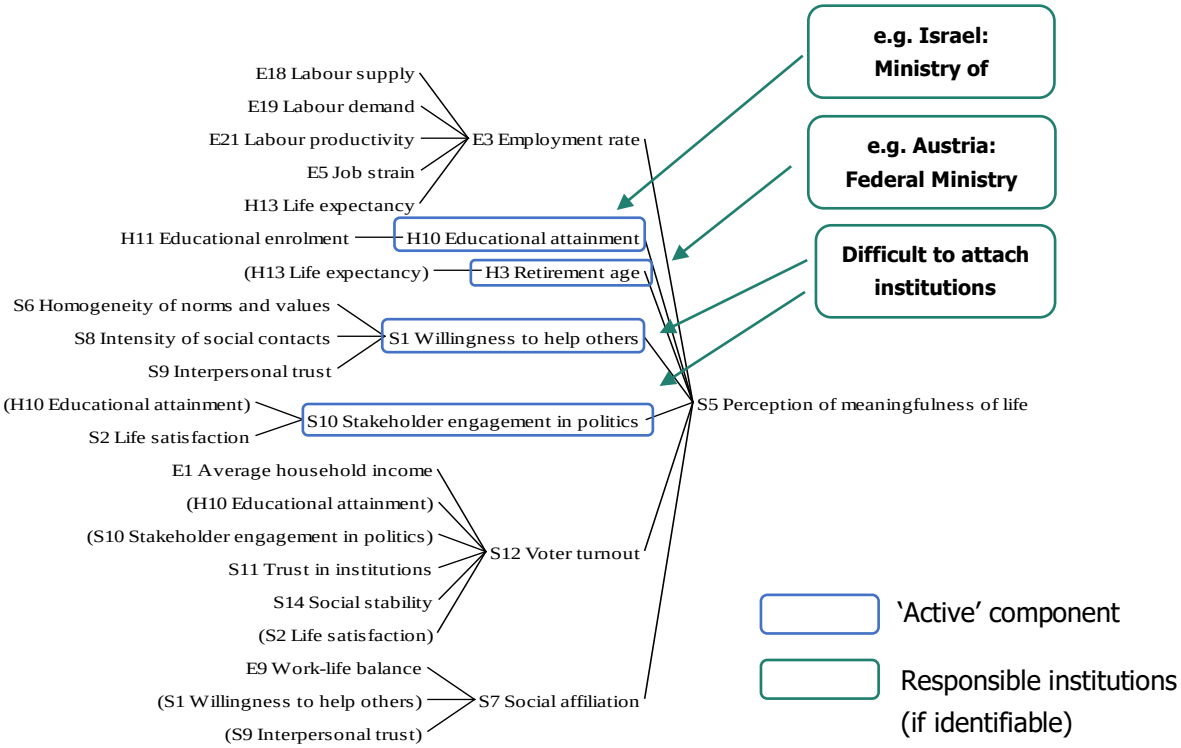

Figure 5. Example of extracting 'Active' components from a Causes tree to identify responsible institutions in the next step.

The third matrix combines the other matrices to determine the degree to which the responsible institutions affect the passive components. This was done by matrix multiplication of the first and second matrix. This matrix lists passive components as columns and responsible institutions as rows.

As the last step, the responsible institutions were listed in descending order for active and passive components to identify the institutions that affect the most components and, therefore, may be potential leverage points. The lists and all matrices can be observed in Appendix 3.

For better understanding, the whole process is depicted in Figure 6:

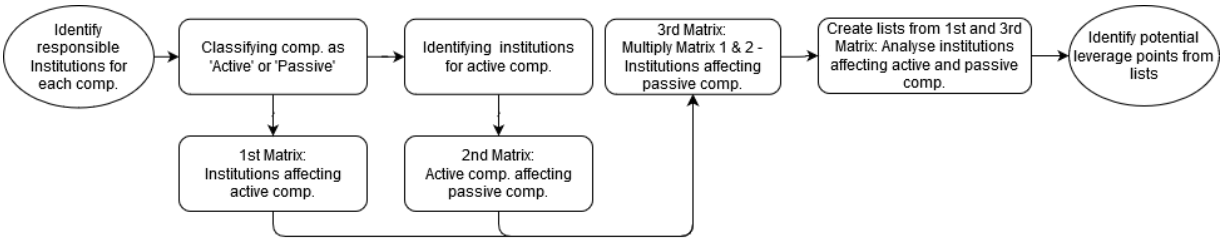

Figure 6. Process description of Identifying potential leverage points from the systems map

The main element of identifying the key institutions is understanding the government structure of a country thoroughly and using this knowledge in the first matrix to build the next matrices. This is obviously a tedious task, and a lot of effort might be necessary to comprehensively understand the responsibility division in a particular country. This is exactly the point where the advantages of a systems map can be utilized. By

involving key stakeholders of a government into assessing which institution influences which component, the NWS can be refined and customized to a particular country.

Reflection on the identified responsible institutions

The aforementioned process to identify responsible institutions results in two lists: responsible institutions affecting active components and responsible institutions affecting passive components.

As an example, the top three institutions affecting passive components are shown in Table 2. The list shows that the ministries related to labor affect the most passive components in Israel and Austria. This shows that specific institutions affect multiple passive components, which indicates that they play a key role in governmental actions. Especially as an identified leverage point, changes in policies from these ministries will have a wide-reaching effect.

Table 2. Top three possible, responsible institutions in order after the sum of passive components affected

Possible responsible institutions	**Sum of passive components affected**
Israel: Ministry of Labor, Social Affairs and Social Services	18
Austria: Federal Ministry of Labour, Family, and Youth	12
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation, and Technology	12

These findings need to be looked at cautiously, as they highly depend on the allocation of which ministry affects which active component. While this information can often be found in standing orders of the ministry, the actual influence of each ministry often differs. Ideally, the allocation should be done together with stakeholders from the country that applies the NWS to paint a realistic picture of the current governmental structure and political influence.

Conclusion

In this working paper, a refined version of the National Well-Being System systems map was presented. The improvements include added data sources for each component, transformed or removed components without an appropriate source, identified potential leverage points, and attached responsible institutions.

Summarizing, adding data sources to the system components improves its validity and opens new avenues, e.g., identifying links' strength using correlation analysis or possible extensions to an SD model. Furthermore, identifying leverage points and then attaching potentially responsible institutions ("decision-makers") increases the usefulness of the systems map for real policymaking.

Concluding, with the above improvements, this Working Paper develops the national well-being system one step further to a comprehensive policy simulation tool while adding to the research about enhancing citizens' well-being worldwide.

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Appendix 1. Data Sources Outline for Components of the NWS

Code	Indicator	Data Source Name	Data Source Link	Latest available year
E1	Average household income	OECD National Accounts Statistics (database)	https://stats.oecd.org/Index.aspx?DataSetCode=IDD#	2017-2019
E2	Average household net wealth	OECD Wealth Distribution (database),	http://stats.oecd.org/Index.aspx?DataSetCode=WEALTH	2016
E3	Employment rate	OECD Labour Force Statistics by Sex and Age – Indicators (database),	https://stats.oecd.org/Index.aspx?DataSetCode=LFS_SEXAGE_I_R	2018
E4	Labour market insecurity	OECD Job Quality (database)	http://stats.oecd.org/Index.aspx?DataSetCode=JOBQ	2016
E5	Job strain	OECD Job Quality (database)	http://stats.oecd.org/Index.aspx?DataSetCode=JOBQ	2015
E6	Long-term unemployment rate	OECD Unemployment by duration (database)	https://stats.oecd.org/Index.aspx?DataSetCode=DUR_I	2019
E7	Housing availability	OECD National Accounts Statistics (database)	http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE5 and http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE14A and http://dx.doi.org/10.1787/888933597408	2018
E8	Basic sanitation	OECD Affordable Housing Database	http://oecd.org/social/affordable-housing-database	2018
E9	Work-life balance	Eurostat's Harmonised European Time Use Surveys and European Union Statistics on Income and Living Conditions (EU-SILC) (database)	https://ec.europa.eu/eurostat/web/time-use-surveys and https://ec.europa.eu/eurostat/web/income-and-living-conditions	2018
E10	Produced fixed assets	OECD National Accounts Statistics (database),	http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B	2018

E11	Gross fixed capital formation	OECD National Accounts Statistics (database): 1. Gross domestic product,	http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE1.	2017-2018
E12	Financial net worth	OECD Financial Indicators – Stocks (database),	http://stats.oecd.org/Index.aspx?DataSetCode=FIN_IND_FBS	2018
E13	Investment in R&D	OECD National Accounts Statistics (database): 8A. Capital formation by activity ISIC rev4,	http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE8A	2016-2018
E14	Household debt	OECD Financial Indicators – Stocks (database),	http://stats.oecd.org/Index.aspx?DataSetCode=FIN_IND_FBS	2018
E15	Financial net worth of government	OECD Financial Indicators – Stocks (database),	http://stats.oecd.org/Index.aspx?DataSetCode=FIN_IND_FBS	2015-2017
E16	Banking sector leverage	OECD Financial Indicators – Stocks (database),	http://stats.oecd.org/Index.aspx?DataSetCode=FIN_IND_FBS	2014-2017
E17	Interest rate	OECD Financial Indicators – Stocks (database),	https://stats.oecd.org/Index.aspx?DataSetCode=KEI	2018
E18	Labour Supply	OECD Labour Force Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=ALFS_SUMTAB	2018
E19	Labour Demand	OECD Labour Force Statistics	People Employed (filter correctly): https://stats.oecd.org/Index.aspx?DataSetCode=ALFS_SUMTAB and Job Vacancies(filter correctly) https://stats.oecd.org/Index.aspx?DataSetCode=LAB_REG_VAC and Background info: https://ec.europa.eu/eurostat/statistics-explained/index.php/Employment_and_labour_demand#Labour_force_dymanics	2019
E20	Production output	OECD National Accounts Statistics (database)	https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE31	2018
E21	Labour productivity	OECD Productivity Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=PDB_LV	2018

E22	Technology adoption rate	Our World in Data - Technology Adoption	https://ourworldindata.org/technology-adoption#all-charts-preview	2017
E23	Capital productivity	OECD Productivity Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=PDB_GR	2018
E24	Government education expenditure	OECD Education and Training Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=EAG_FIN_RATIO	2018
E25	Government consumption expenditure	OECD National Accounts Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE11_ARCHIVE	2015-2018
E26	Household consumption expenditure	OECD Financial Indicators – Stocks (database),	https://stats.oecd.org/index.aspx?queryid=21765	2018
E27	Government environmental protection expenditure	OECD National Accounts Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE11_ARCHIVE	2018
E28	Government healthcare expenditure	OECD National Accounts Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE11_ARCHIVE	2018
H1	Human Skills	OECD, 2019, PISA 2018 Results (Volume I): What Students Know and Can Do, PISA, OECD Publishing, Paris and OECD, 2016[2]), Skills Matter: Further Results from the Survey of Adult Skills, OECD Skills Studies, OECD Publishing, Paris	https://www.oecd-ilibrary.org/education/pisa-2018-results-volume-i_5f07c754-en and https://www.oecd-ilibrary.org/education/skills-matter_9789264258051-en	2016, 2018
H2	Retirement age	OECD Ageing and Employment Policies - Statistics on average effective age of retirement	http://www.oecd.org/els/emp/average-effective-age-of-retirement.html	2018
H3	Educational expectancy	OECD Education at a Glance database	http://dx.doi.org/10.1787/eag-2017-en	2017
H4	Healthy practices popularity	OECD Health Status (database),	https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_HCQI and https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_LVNG	2015
H5	Access to health services	OECD. (2017b). Health at a Glance 2017	https://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-2017/population-coverage-for-a-core-set-of-services-2015-or-nearest-	2015

			year_health_glance-2017-graph52-en	
H6	Smoking prevalence	OECD Health Status (database)	https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_LVNG	2018
H7	Obesity prevalence	OECD Health Status (database)	https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_LVNG	2018
H8	Access to better nutrition	OECD Health Status (database)	https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_LVNG	2018
H9	Educational attainment	OECD Educational attainment and labour-force status (database)	http://stats.oecd.org/Index.aspx?DataSetCode=EAG_NEAC	2018
H10	Education enrolment	OECD Education and Training Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=EAG_AL	2018
H11	Net migration	OECD Demography and Population	https://stats.oecd.org/Index.aspx?DataSetCode=MIG	2018
H12	Life expectancy	OECD Health Status (database),	http://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_STAT	2017
S1	Willingness to help others	OECD Social Indicators Society at a Glance 2014	http://dx.doi.org/10.1787/888932966732	2012
S2	Life satisfaction	European Union Statistics on Income and Living Conditions (EU-SILC) (database),	From (Filter correctly): https://ec.europa.eu/eurostat/data/database Short link: https://bit.ly/36hnTNo	2018
S3	Neighbourhood safety	OECD How's Life 2017 report	https://dx.doi.org/10.1787/888933597921 and https://dx.doi.org/10.1787/888933597883	2015
S4	Social support	Gallup World Poll (database),	https://doi.org/10.1787/888934082176	2016-2018
S5	Perception of meaningfulness of life	Graham & Nikolova Bentham or Aristotle in the Development Process and OECD Social Protection and Well-being Statistics	https://www.sciencedirect.com/science/article/abs/pii/S0305750X14003830?via%3Dihub and https://stats.oecd.org/Index.aspx?DataSetCode=HSL	2015
S6	Homogeneity of norms and values	Social and Ethnic Segregation in Europe, Sako Musterd and Trade-Offs between Equality and Difference: Immigrant Integration, Multiculturalism and the Welfare State in Cross-National Perspective, Ruud Koopmans	https://onlinelibrary.wiley.com/doi/abs/10.1111/j.0735-2166.2005.00239.x and https://www.tandfonline.com/doi/full/10.1080/13691830903250881	2005

S7	Social affiliation	OECD Social Indicators Society at a Glance 2014	http://dx.doi.org/10.1787/888932966732	2012
S8	Intensity of social contacts	European Union Statistics on Income and Living Conditions (EU-SILC) (database)	From (Filter correctly): https://ec.europa.eu/eurostat/data/database Short link to exact data: https://bit.ly/348SyK4	2015
S9	Interpersonal trust	European Union Statistics on Income and Living Conditions (EU-SILC) (database)	https://ec.europa.eu/eurostat/web/income-and-living-conditions	2013
S10	Stakeholder engagement in politics	OECD Survey of Adult Skills (PIAAC) (database),	https://doi.org/10.1787/888934082366	2012
S11	Trust in institutions	Gallup World Poll (database),	https://gallup.com/analytics/232838/world-poll.aspx	2016-2018
S12	Voter turnout	Institute for Democracy and Electoral Assistance (IDEA) (database),	https://www.idea.int/data-tools/question-view/521 and https://doi.org/10.1787/888934082347	2016-2019
S13	Individual resilience to distress	EU Open Data Portal - Special Eurobarometer 471	https://data.europa.eu/euodp/en/data/dataset/S2166_88_4_471_ENG	2018
S14	Social stability	Fragile State Index - The Fund for Peace	https://fragilestatesindex.org/data/	2019
N1	Environmental assets	Environment at a Glance (OECD, 2019).	https://www.oecd-ilibrary.org/environment/environment-at-a-glance-indicators_ac4b8b89-en	2017
N2	Renewable freshwater resources	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=WATER_RESOURCES	-
N3	Forest area	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=FOREST	2018
N4	Threatened species	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=WILD_LIFE	2020
N5	Air quality	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=AEA	2017
N6	Water quality	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=WATER_RESOURCES and https://stats.oecd.org/Index.aspx?DataSetCode=AEI_OTHER	2010
N7	GHG emissions	OECD Greenhouse gas emissions (database),	https://stats.oecd.org/Index.aspx?DataSetCode=AIR_GHG	2017
N8	Net residuals	OECD Environment Statistics (Waste and Environmental	https://stats.oecd.org/Index.aspx?DataSetCode=WSECTOR and https://stats.oecd.org/Index.asp	2017

		Risks and Health) and Environment at a Glance (OECD, 2019).	x?DataSetCode=MUNW and https://stats.oecd.org/Index.aspx?DataSetCode=EXP_PM2_5_FUA	
N9	Protected Areas	OECD Environment Statistics	https://stats.oecd.org/Index.aspx?DataSetCode=PROTECTED_AREAS	
N10	Freshwater abstraction	OECD Freshwater abstractions (million m3) (database)	https://stats.oecd.org/Index.aspx?DataSetCode=WATER_ABSTRACT.	2014-2016
N11	Temperature	Copernicus Climate Datasets	https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means?tab=form	2018

Appendix 2. Classification of Active and Passive Components Table

Node Name	Node Key	Incoming	Outgoing	Sum	Status
Life expectancy	H13	20	5	25	Passive
Average household income	E1	5	13	18	Active
Life satisfaction	S2	11	7	18	Passive
Educational attainment	H10	1	13	14	Active
Production output	E20	6	6	12	Undefined
Interpersonal trust	S9	5	6	11	Active
Neighbourhood safety	S3	6	5	11	Passive
Perception of meaningfulness of life	S5	7	3	10	Passive
Social support	S4	5	5	10	Undefined
Job strain	E5	3	5	8	Active
Net residuals	N8	3	5	8	Active
Water quality	N6	5	3	8	Passive
Govern. Environ. Protect. Expendit.	E27	1	6	7	Active
Housing availability	E7	3	4	7	Active
Work-life balance	E9	1	6	7	Active
Healthy practices popularity	H5	3	4	7	Active
Willingness to help others	S1	3	4	7	Active
Stakeholder engagement in politics	S10	2	5	7	Active
Homogeneity of norms and values	S6	3	4	7	Active
Labour productivity	E21	5	2	7	Passive
Employment rate	E3	5	2	7	Passive
Environmental assets	N1	6	1	7	Passive
Threatened species	N4	5	2	7	Passive
Voter turnout	S12	6	1	7	Passive
Social stability	S14	6	1	7	Passive
Intensity of social contacts	S8	4	3	7	Passive
Labour demand	E19	1	5	6	Active
Average household net wealth	E2	2	4	6	Active
Long-term unemployment rate	E6	2	4	6	Active
Net migration	H12	2	4	6	Active
Education enrolment	H11	4	2	6	Passive
Social affiliation	S7	3	3	6	Undefined
Labour supply	E18	1	4	5	Active
Government consumption expenditure	E25	1	4	5	Active
Household consumption expenditure	E26	1	4	5	Active
Renewable freshwater resources	N2	2	3	5	Active
Trust in institutions	S11	2	3	5	Active
Human Skills	H2	4	1	5	Passive
Untouched nature	N10	3	2	5	Passive

Freshwater abstraction	N11	3	2	5	**Passive**
Air quality	N5	4	1	5	**Passive**
Individual resilience to distress	S13	3	2	5	**Passive**
Basic sanitation	E8	1	3	4	**Active**
Retirement age	H3	1	3	4	**Active**
Temperature	N12	0	4	4	**Active**
Produced fixed assets	E10	3	1	4	**Passive**
Capital productivity	E23	3	1	4	**Passive**
Access to health services	H6	3	1	4	**Passive**
Obesity prevalence	H8	3	1	4	**Passive**
Financial net worth of government	E15	2	2	4	**Undefined**
Interest rate	E17	2	2	4	**Undefined**
Human capital	H1	2	2	4	**Undefined**
Investment in R&D	E13	0	3	3	**Active**
Household debt	E14	1	2	3	**Active**
Technology adoption rate	E22	1	2	3	**Active**
Forest area	N3	1	2	3	**Active**
Banking sector leverage	E16	2	1	3	**Passive**
Government healthcare expenditure	E28	2	1	3	**Passive**
Labour market insecurity	E4	2	1	3	**Passive**
Smoking prevalence	H7	2	1	3	**Passive**
Biodiversity	N13	2	1	3	**Passive**
Financial net worth	E12	2	0	2	**Passive**
GHG emissions	N7	2	0	2	**Passive**
Gross fixed capital formation	E11	1	1	2	**Undefined**
Government education expenditure	E24	1	1	2	**Undefined**
Access to better nutrition	H9	1	1	2	**Undefined**
Educational expectancy	H4	0	1	1	**Active**
Residuals from the rest of the world	N9	0	1	1	**Active**

Appendix 3. Matrices and Lists to identify possible responsible institution

Appendix 3.1. Matrix: Responsible institutions affecting active components

	Average household income	Educational attainment	Inter-personal trust	Job strain	Net residuals	Government environmental protection expenditure	Housing avail-ability	Work-life balance	Healthy practices popularity	Willing-ness to help others	Stakeholder engagement in politics	Homo-geneity of norms and values	Labour demand	Average household net wealth	Long-term unemploy-ment rate	Net migration	Labour supply	Government consumption expenditure	Household consumption expenditure	Renewable freshwater resources	Trust in institutions	Basic sanitation	Retire-ment age	Temper-ature	Invest-ment in R&D	Household debt	Technology adoption rate	Forest area	Educational expectancy
Austria: Federal Ministry for Agriculture, Regions and Tourism																											1	
Austria: Federal Ministry for Digital and Economic Affairs																								1		1		
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology					1	1													1					1		1		
Austria: Federal Ministry of Education, Science and Research		1																						1				1
Austria: Federal Ministry of Finance	1																					1						
Austria: Federal Ministry of the Interior																1	1											
Austria: Federal Ministry of Labour, Family and Youth				1				1							1		1											
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	1						1		1									1										
Austria: Austrian Institute for Constructional Engineering (OIB)																					1							
Israel: Ministry for Construction and Housing							1														1							
Israel: Ministry of Agriculture and Rural Development																											1	
Israel: Ministry of Aliyah and Integration																1												
Israel: Ministry of Economy and Industry	1			1				1																1				
Israel: Ministry of Education		1																						1				1
Israel: Ministry of Energy																			1									
Israel: Ministry of Environmental Protection					1	1													1									
Israel: Ministry of Finance																						1						
Israel: Ministry of Health									1																			
Israel: Ministry of Labor, Social Affairs and Social Services				1				1	1						1		1	1										
Israel: Ministry of Science and Technology																								1		1		

Appendix 3.2. Matrix: Active components affecting passive components

	Life expectancy	Life satisfaction	Neighbourhood safety	Perception of meaningfulness of life	Water quality	Labour productivity	Employment rate	Environmental assets	Threatened species	Voter turnout	Social stability	Intensity of social contacts	Education enrolment	Human Skills	Protected Areas	Freshwater abstraction	Air quality	Individual resilience to distress	Produced fixed assets	Capital productivity	Access to health services	Obesity prevalence	Banking sector leverage	Government healthcare expenditure	Labour market insecurity	Smoking prevalence	Financial net worth	GHG emissions
Average household income	1	1	1							1			1								1							
Educational attainment	1		1	1						1				1	1													
Interpersonal trust																												
Job strain	1	1					1															1				1		
Net residuals					1			1	1						1		1											
Government environmental protection expenditure					1				1						1		1											
Housing availability	1	1	1																									
Work-life balance	1	1										1																
Healthy practices popularity	1								1													1				1		
Willingness to help others			1	1																								
Stakeholder engagement in politics				1						1	1																	
Homogeneity of norms and values											1																	
Labour demand							1																		1			
Average household net wealth																			1				1				1	
Long-term unemployment rate	1	1	1																									
Net migration																					1							
Labour supply							1																		1			
Government consumption expenditure																								1				
Household consumption expenditure																												1
Renewable freshwater resources	1							1	1																			
Trust in institutions			1							1	1																	
Basic sanitation	1				1											1												
Retirement age				1		1																		1				
Temperature																1	1											
Investment in R&D						1								1						1								
Household debt																							1					
Technology adoption rate						1														1								
Forest area								1									1											
Educational expectancy														1														

Appendix 3.3. Matrix: Responsible institutions affecting passive components

	Life expectancy	Life satisfaction	Neighbourhood safety	Perception of meaningfulness of life	Water quality	Labour productivity	Employment rate	Environmental assets	Threatened species	Voter turnout	Social stability	Intensity of social contacts	Education enrolment	Human Skills	Protected Areas	Freshwater abstraction	Air quality	Individual resilience to distress	Produced fixed assets	Capital productivity	Access to health services	Obesity prevalence	Banking sector leverage	Government healthcare expenditure	Labour market insecurity	Smoking prevalence	Financial net worth	GHG emissions
Austria: Federal Ministry for Agriculture, Regions and Tourism	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Austria: Federal Ministry for Digital and Economic Affairs	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology	1	0	0	0	2	2	0	2	3	0	0	0	0	1	2	0	2	0	0	2	0	0	0	0	0	0	0	0
Austria: Federal Ministry of Education, Science and Research	1	0	1	1	0	1	0	0	0	1	0	0	0	3	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Austria: Federal Ministry of Finance	1	1	1	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Austria: Federal Ministry of the Interior	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Austria: Federal Ministry of Labour, Family and Youth	3	3	1	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	3	2	2	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0
Austria: Austrian Institute for Constructional Engineering (OIB)	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Israel: Ministry for Construction and Housing	2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Israel: Ministry of Agriculture and Rural Development	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Israel: Ministry of Aliyah and Integration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Israel: Ministry of Economy and Industry	3	3	1	0	0	1	1	0	0	1	0	1	1	1	0	0	0	0	0	1	1	1	0	0	0	1	0	0
Israel: Ministry of Education	1	0	1	1	0	1	0	0	0	1	0	0	0	3	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Israel: Ministry of Energy	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Israel: Ministry of Environmental Protection	1	0	0	0	2	0	0	2	3	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0
Israel: Ministry of Finance	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Israel: Ministry of Health	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Israel: Ministry of Labor, Social Affairs and Social Services	4	3	1	0	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	2	0	1	1	2	0	0	0
Israel: Ministry of Science and Technology	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0

Appendix 3.4. Responsible institutions listed in descending order after sum of passive components affected – Split between Austria and Israel

Possible, Responsible Institutions affecting PASSIVE Components - Ranked by Sum of passive Components

Possible, Responsible Institutions	Sum of passive Components affected
Israel: Ministry of Labor, Social Affairs and Social Services	18
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology	17
Israel: Ministry of Economy and Industry	17
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	14
Austria: Federal Ministry of Labour, Family and Youth	13
Israel: Ministry of Environmental Protection	12
Austria: Federal Ministry of Education, Science and Research	10
Israel: Ministry of Education	10
Austria: Federal Ministry of Finance	9
Israel: Ministry for Construction and Housing	6
Austria: Federal Ministry for Digital and Economic Affairs	5
Israel: Ministry of Science and Technology	5
Israel: Ministry of Health	4
Austria: Federal Ministry of the Interior	3
Austria: Austrian Institute for Constructional Engineering (OIB)	3
Israel: Ministry of Energy	3
Israel: Ministry of Finance	3
Austria: Federal Ministry for Agriculture, Regions and Tourism	2
Israel: Ministry of Agriculture and Rural Development	2
Israel: Ministry of Aliyah and Integration	1

Possible, Responsible Institutions affecting PASSIVE Components - Ranked by Sum of passive Components and Country

Israel

Possible, Responsible Institutions	Sum of passive Components affected
Israel: Ministry of Labor, Social Affairs and Social Services	18
Israel: Ministry of Economy and Industry	17
Israel: Ministry of Environmental Protection	12
Israel: Ministry of Education	10
Israel: Ministry for Construction and Housing	6
Israel: Ministry of Science and Technology	5
Israel: Ministry of Health	4
Israel: Ministry of Energy	3
Israel: Ministry of Finance	3
Israel: Ministry of Agriculture and Rural Development	2
Israel: Ministry of Aliyah and Integration	1

Austria

Possible, Responsible Institutions	Sum of passive Components affected
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology	17
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	14
Austria: Federal Ministry of Labour, Family and Youth	13
Austria: Federal Ministry of Education, Science and Research	10
Austria: Federal Ministry of Finance	9
Austria: Federal Ministry for Digital and Economic Affairs	5
Austria: Austrian Institute for Constructional Engineering (OIB)	3
Austria: Federal Ministry of the Interior	3
Austria: Federal Ministry for Agriculture, Regions and Tourism	2

Appendix 3.5. Responsible institutions listed in descending order after sum of active components affected – Split between Austria and Israel

Possible, Responsible Institutions affecting ACTIVE Components - Ranked by Sum of active Components

Possible, Responsible Institutions	Sum of active Components affected
Israel: Ministry of Labor, Social Affairs and Social Services	6
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology	5
Austria: Federal Ministry of Labour, Family and Youth	4
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	4
Israel: Ministry of Economy and Industry	4
Austria: Federal Ministry of Education, Science and Research	3
Israel: Ministry of Education	3
Israel: Ministry of Environmental Protection	3
Austria: Federal Ministry for Digital and Economic Affairs	2
Austria: Federal Ministry of Finance	2
Austria: Federal Ministry of the Interior	2
Israel: Ministry for Construction and Housing	2
Israel: Ministry of Science and Technology	2
Austria: Federal Ministry for Agriculture, Regions and Tourism	1
Austria: Austrian Institute for Constructional Engineering (OIB)	1
Israel: Ministry of Agriculture and Rural Development	1
Israel: Ministry of Aliyah and Integration	1
Israel: Ministry of Energy	1
Israel: Ministry of Finance	1
Israel: Ministry of Health	1

Possible, Responsible Institutions affecting ACTIVE Components - Ranked by Sum of active Components and Country

Israel

Possible, Responsible Institutions	Sum of active Components affected
Israel: Ministry of Labor, Social Affairs and Social Services	6
Israel: Ministry of Economy and Industry	4
Israel: Ministry of Environmental Protection	3
Israel: Ministry of Education	3
Israel: Ministry of Science and Technology	2
Israel: Ministry for Construction and Housing	2
Israel: Ministry of Health	1
Israel: Ministry of Finance	1
Israel: Ministry of Energy	1
Israel: Ministry of Aliyah and Integration	1
Israel: Ministry of Agriculture and Rural Development	1

Austria

Possible, Responsible Institutions	Sum of active Components affected
Austria: Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology	5
Austria: Federal Ministry of Social Affairs, Health, Care and Consumer Protection	4
Austria: Federal Ministry of Labour, Family and Youth	4
Austria: Federal Ministry of Education, Science and Research	3
Austria: Federal Ministry of the Interior	2
Austria: Federal Ministry of Finance	2
Austria: Federal Ministry for Digital and Economic Affairs	2
Austria: Federal Ministry for Agriculture, Regions and Tourism	1
Austria: Austrian Institute for Constructional Engineering (OIB)	1