5.1 Comprehensive indicators dashboard (Complementary Accounting Network) CAN

In their historical evolution, national accounts have always included a degree of pragmatism. Therefore, it can be argued that what is included or excluded from the accounts is open to debate (Lepenies 2016). On the basis of this line of reasoning, we propose that the on-going efforts to expand the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) accounting framework largely within the protocol of the Standard National Account (SNA), and which has produced some significant advances, should be continued over the medium to long term.

The constraints imposed by the need to present data in monetary exchange value terms will continue to exclude the true economic value of some ecosystem services, and the holistic role played by biodiversity in the sustainable supply of services from the accounts. Therefore, we argue that there is a present and urgent requirement (given the state of the natural world) for a more comprehensive set of ecosystem/biodiversity change indicators. Rather than seeking a full integration of environmental data into the SNA framework, we argue pragmatically, for the establishment of protocols as a Complementary Accounting Network (CAN), or similar setups, to sit alongside the economic accounts and on the same timescale (Turner et al., 2019). The complementary network needs to be populated by a range of data/indicators, building on the thematic accounts work supported by the SEEA EA (2021). This path offers an immediate way forward, rather than trying to adjust the measures of production, consumption, income and the value of assets in the SNA to fully reflect biodiversity losses or gains. Some pilot work with the CAN framework has been undertaken using data for the East Anglian region in the UK. Some recreation accounts and a carbon account have been constructed and set alongside a GDP (gross domestic product) proxy indicator GVA (gross value added) (Badura et al., 2020). Figure 5.1 below illustrates the joint role of SEEA EA and a CAN.

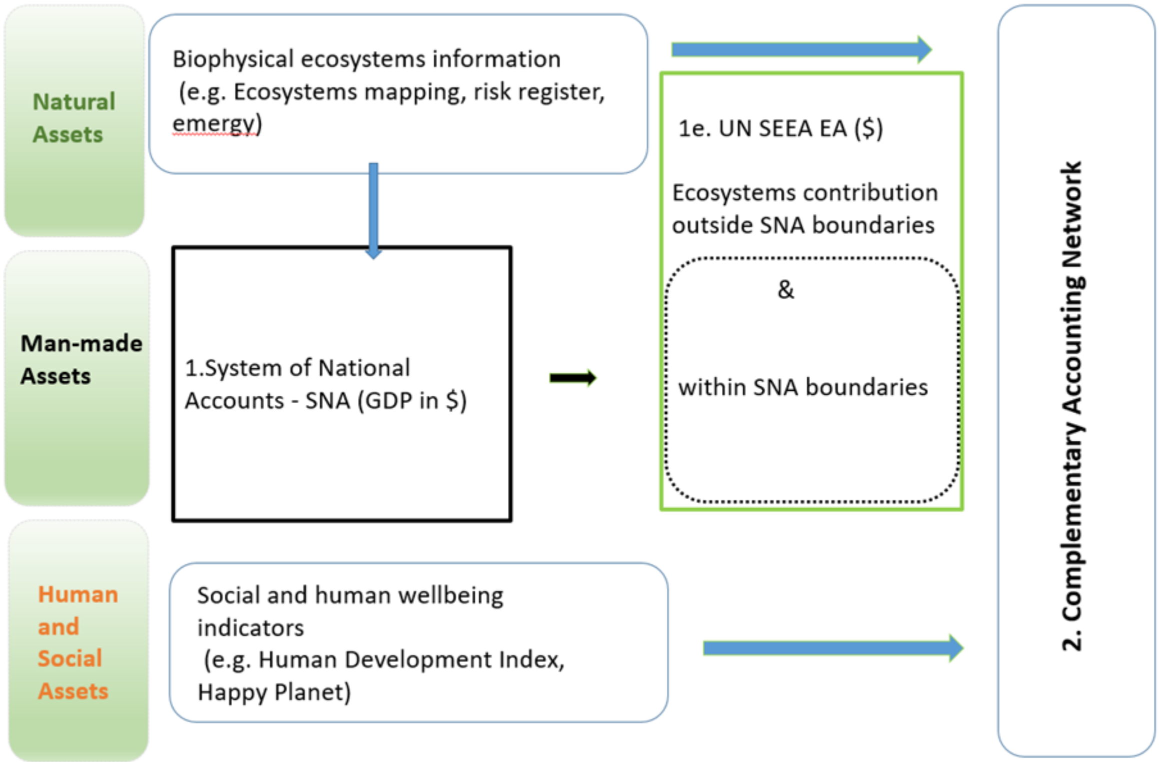

FIGURE 5.1 COMPLEMENTARY ACCOUNT NETWORK SETTING

A CAN should contain a number of relevant nodes, each of which encompasses a set of indicators and metrics, see Figure 5.2 below. Individual but networked nodes could contain the SNA/SEEA EA account; an adjusted SEEA EA account including shadow price values (i.e. stated preference values) for those ecosystem services outside of the exchange value calculus (see Section 3.5); further nodes containing, for example, biodiversity indicators; ecosystem resilience indicators; naturalness indicators; and sustainable ecosystem functioning indicators; and cultural ecosystem services indicators. Guide 1 contains a full list of indicator variables that BBTs can select from and match to their specific environmental and socio-economic context.

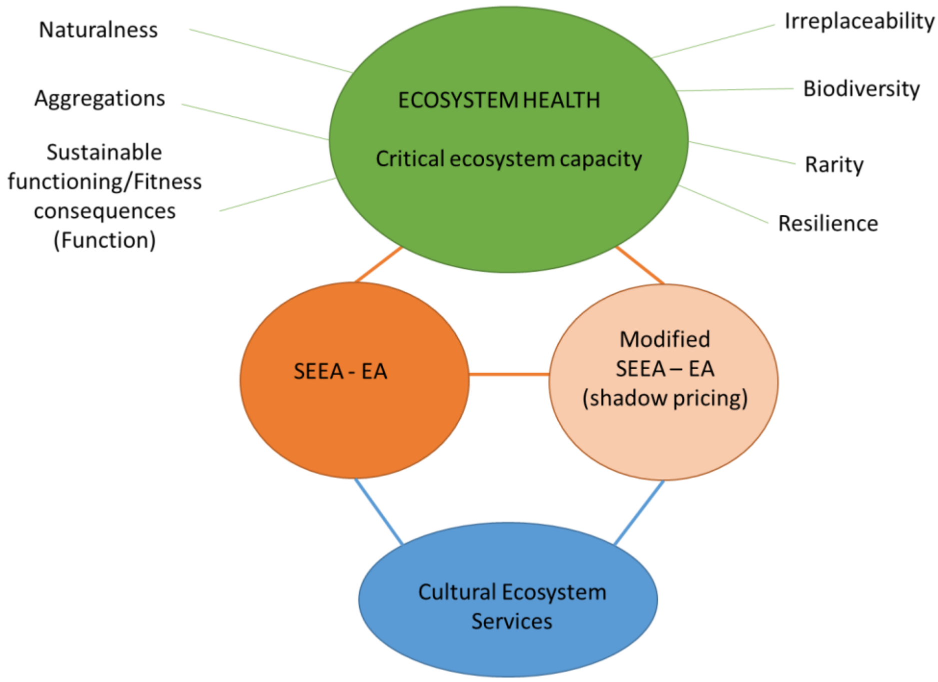

FIGURE 5.2 COMPLEMENTARY ACCOUNT NETWORK (CAN) AND INFORMATION NODES

Within the nodes the indicator 'accounts' would need to be standardised in terms of timescale and all have an 'opening point' condition/extent and a 'closing point' condition/extent linked by time series data. The network concept serves to highlight the links between biodiversity and other ecosystem health characteristics, as well as to socio-cultural assets and services. Luisetti and Schratzberger (2022), for example, have proposed five sets of biodiversity related indicators for the marine environment covering physical condition (state index), composition (state index), structure (state index), function (state index), and seascape index.

Taking the compositional state index as an example, data requirements pose several challenges, including the need for representative data across ecosystems, space, time and species taxonomy. If direct observations on species are not available an alternative approach is needed. Ferrier (2011) has proposed that observations based on changes in the spatial extent and configuration of habitat by species can meet this need. Further research is needed in particular to explore the links between thematic biodiversity accounts (for measuring and valuing biodiversity as an asset) and ecosystem services (King et al., 2021). But there is currently a tension between the CBD (Convention on Biological Diversity) and SEEA EA over how biodiversity is reported. For the former, ecosystem diversity is a subset of biological diversity, while in the latter biodiversity accounting is a subset of ecosystem accounting. In the SEEA, the ecosystem asset accounts do not link directly to an 'explicit' ecosystem diversity account or fully to condition and services supply. Whether or not biodiversity is an asset in its own right has been debated (Mace et al., 2015), but we argue that, it is, as it represents an emergent property of a set of ecosystem assets that interact and support multiple ecosystem processes. These processes in turn support the resilience of ecosystem service delivery at larger scales (Folke et al., 2004; Oliver et al., 2016). Research efforts need to highlight the dependencies and trade-offs between the use of ecosystem services and the depreciation of the biodiversity asset base or integrate such depreciation into service values. The motivation behind this approach can be anchored as much to instrumental utilitarian concerns (i.e., long term maintenance of ecosystem service flows – option and insurance values) as to an intrinsic/existence value perspective (King et al., 2021).

In terms of the compositional state of a marine ecosystem for example, it can be argued that improved measurement of 'species diversity' would provide a key indicator to characterise the condition of ecosystem assets. The species accounts could also provide information at landscape scales for different countries, if they reflected diversity in species assemblages between ecosystem assets (King et al., 2021). However, currently the SEEA species abundance accounts do not adequately reflect variability in distribution and abundance. King et al. (2021) present some case studies from across the world to demonstrate how work on species accounts could proceed.

The CAN network and nodes could encompass a number of ecological indicators for the measurement of different aspects of 'ecosystem health' i.e. resilience, naturalness, sustainable functioning, rarity, irrepressibility, aggregations and biodiversity (see Guide 1).

A diagram of how the CAN will encompass the ecological indicators, SNA, SEEA EA and the welfare value estimates is shown in the Figure 5.3 below.

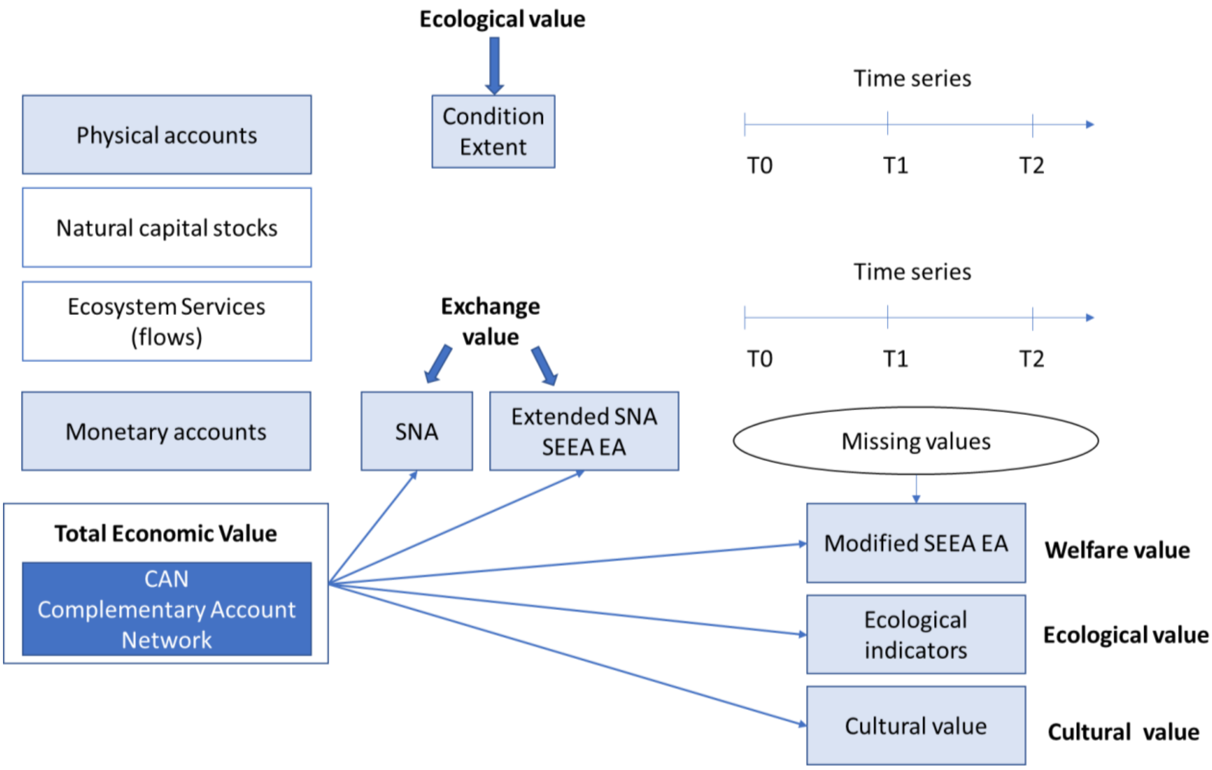

FIGURE 5.3 COMPLEMENTARY ACCOUNT NETWORK (CAN) AND INFORMATION NODES

An additional node is also needed to incorporate socio-cultural ecosystem services given the difficulty posed in terms of any meaningful monetary valuation. The diagram proposed for the ecological value can also be adapted for socio-cultural values.

Finally, making the link between SEEA EA and other auxiliary accounts, such as CAN, to decision support systems should also be a key requirement. The accounts would provide a key tool in scoping baselines and for the monitoring of environmental change and its consequences (Admiral et al., 2013; Turner, 2016). The CAN, while not providing a fully integrated array of information, might still encourage greater 'buy-in' from the competing interests/stakeholders that typically arise in complex environmental change contexts.

Given the large amount of diverse data that each BBT will probably have available, we need a standardized approach to filling the CAN for those indicators of environmental change that do not fit into either the SNA, extended SNA, modified SEEA EA welfare accounts or cultural value account. The so-called DPSI(W)R framework can play a role in this indicator assembly. This framework and method (which is logic chain based) can be used in two different ways; in the published literature it was first used as a **SCOPING** device to integrate data into a logic chain process, see Turner et al. (1998) and Karageorgis et al., (2004) for applications to coastal/marine management. In this mode the DPSI(W)R was deployed at the front end (starting point) of a decision support system (DSS).

In the CAN we propose that the framework is used as a **MONITORING** device at the end of a DSS process once all the BBT relevant data and tools have been assembled and used. More recently the original DPSI(W)R framework has been amended and extended with particular reference to marine contexts (Elliott et al., 2017). This updated version, DAPSI(W)R(M), allows for a comprehensive data set to be assembled and used to monitor environmental change (via the different accounts) in the BBTs over time. It can also be used in the scoping approach and underpins the logic chain analysis (see Section 1 for details).

In summary, the diagram below, Figure 5.4, puts the various accounting approaches into the work package plan for MARBEFES, and indicates how the various components of Work Package 4 fit together, with links to other work packages.

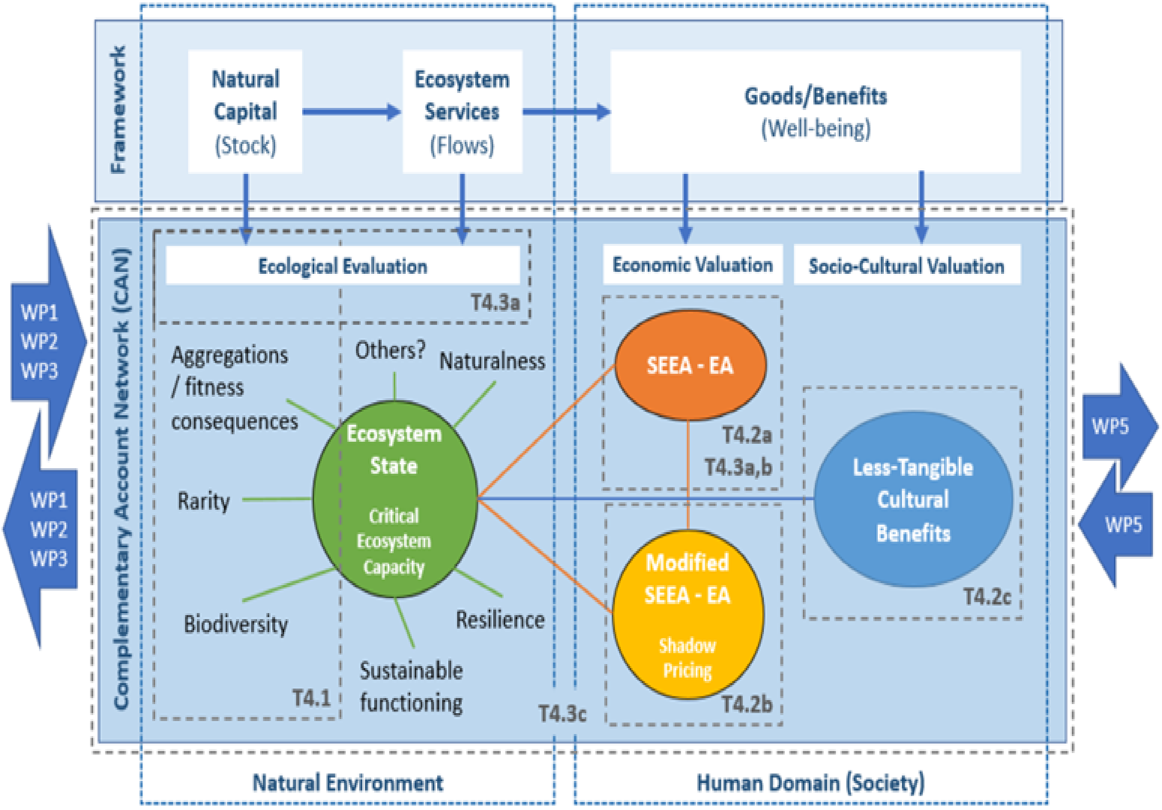

FIGURE 5.4 ACCOUNTING APPROACHES FITTING INTO THE WORK PACKAGE PLAN FOR MARBEFES

To expand Natural Capital Accounts for MARBEFES BBTs, the reader needs to have in mind what are the basis of the SNA, SEEA EA and CAN approach. For example, Figure 5.5 summarises the three approaches in relation to the economic value, in particular the conceptual value and methods described in Section 3.6.; as a more detailed illustration, Table 3 below provides an overview of methods that can be applied to different types of ecosystem services in relation to users, conceptual value and approach. In particular, the SEEA EA accounts framework is fully compatible with SNA conventions and restrictions, while the Complementary Account Network accounts can provide complementary information to SNA accounts and hence allow a certain flexibility and fit-for-purpose design.

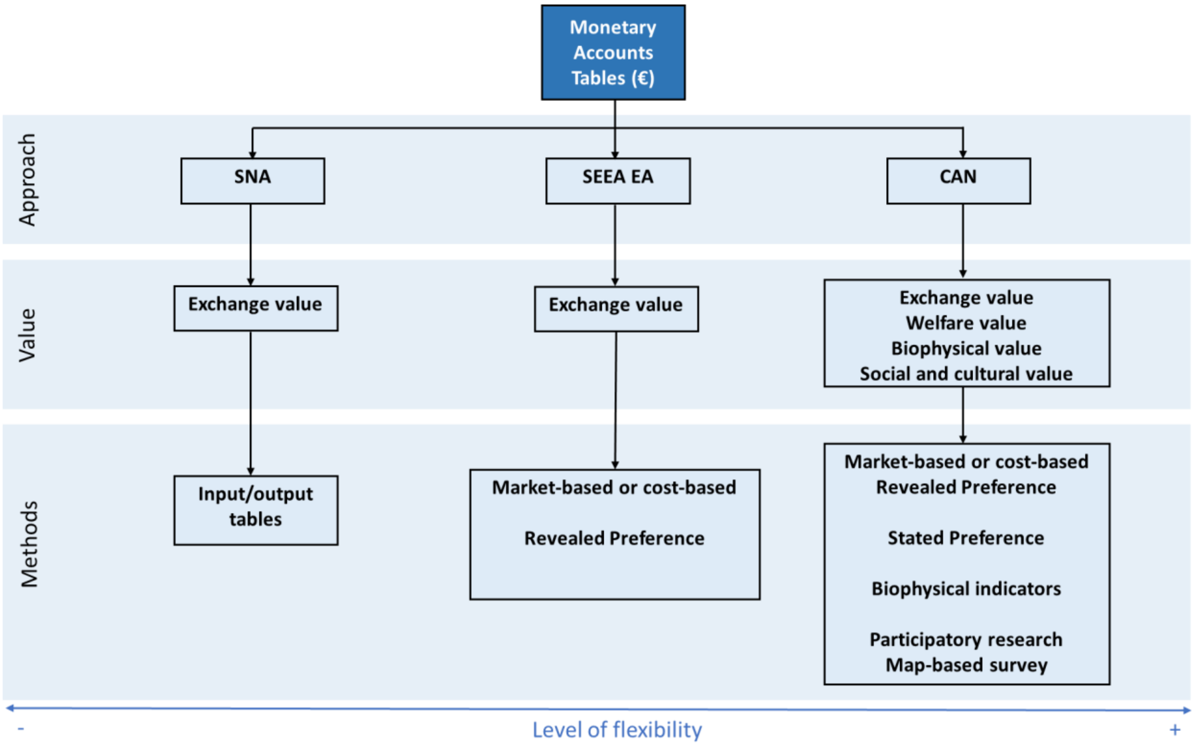

FIGURE 5.5 EXPANDING NATURAL CAPITAL ACCOUNTS FOR MARBEFES BBTS IN CAN