

## 4 The sustainable development goals, human rights, and the capability approach in an Arctic context

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This chapter discusses how an industry–university collaboration between ferrosilicon producer Finnjord AS in northern Norway and UiT The Arctic University of Norway contributes to the mission of operationalising the United Nations Sustainable Development Goals (SDGs). The core of the project is to capture CO<sub>2</sub> by means of microalgae cultivation on an industrial scale. The microalgae, rich in omega-3 and other nutrients, is then utilised as a component of locally produced feed for locally bred salmon. Benefits of this project include CO<sub>2</sub> capture, reduction of the need for extensive transportation of feed, access to sustainable, and nutritious feed components that can be produced without depleting the stock of wild fish, or reliance on environmentally problematic production of soy, and without competing with production of food crops.

The project exemplifies a so-called food–energy–water nexus approach to resource governance, which aims at more efficient use of scarce natural resources. The nexus has been advanced as a tool to create synergies and reduce trade-offs between the SDGs, introduced by the United Nations in January 2016 as a “plan of action” to manage core global developmental challenges, including food security, access to clean water, and access to clean and affordable energy. The need to create synergies and reduce trade-offs between the goals has become increasingly more pressing due to resource scarcity intensified by a rapidly growing population with new dietary habits and economic growth built on fossil-based energy sources, all of which drive climate change.

The Intergovernmental Panel on Climate Change (IPCC) published the special report *Global Warming of 1.5 °C* in October of 2018. The report includes projections of possible climate scenarios. The report states that no climate projection that predicts the limitation of global warming to 1.5 °C above pre-industrial levels can accommodate all of the SDGs: “To date, no pathway in the literature proves to achieve all of the SDGs because several targets are not met or not sufficiently covered in the analysis, hence resulting in a sustainability gap” (IPCC, 2018). The United Nations identifies a knowledge gap regarding research aimed at meeting this challenge in specific contexts: “Limited literature has systematically evaluated *context-specific* synergies and trade-offs between and across adaptation and mitigation response measures in 1.5 °C compatible pathways and in the SDGs” (IPCC, 2018, emphasis added).

The SDGs are, according to the United Nations, grounded in the *Declaration of Human Rights*, and the United Nations interprets human rights as protectors of human capabilities. Economist and 1998 Nobel Laureate Amartya Sen pioneered the so-called capability approach. In brief, the capability approach holds that quality of life should be measured in terms of what people are able to do and to be. The capability approach is grounded in criticism of accounts that interpret quality of life in terms of people's perception of their own quality of life, their share of certain resources, or Gross Domestic Product – an approach which needs elaboration. In addition, we need a capability-based account of how to handle the inevitable trade-offs between entitlements to enjoy fulfillment of the human rights-based SDGs. This chapter contributes to the endeavour of responding to these challenges. Particularly, the chapter addresses the need to handle trade-offs between the SDGs in an Arctic context. I will discuss how the aforementioned carbon capture and utilisation project based in the Arctic exemplifies a nexus among water, energy, and food management that can help alleviate conflicts between the human rights-based SDGs.

The chapter is structured as follows: the first section discusses the role of human rights in the SDGs. The second section examines the relationship between human rights and the capability approach. The third section explains what rights conflicts are. The fourth section describes how the water–energy–food nexus approach to the development of algae-based products, such as fish feed and biofuels, can help alleviate conflicts between the human rights-based SDGs. I also argue that an influential version of the capability approach, developed by Jonathan Wolff and Avner De-Shalit in their 2007 book *Disadvantage*, provides fruitful but unexplored theoretical support for such nexus approaches. The chapter finally illustrates how carbon capture and utilisation through the algae-cultivation project, developed in collaboration between UiT The Arctic University of Norway and Finnjord AS, is a pioneering implementation of a water–energy–food nexus approach that creates synergies and reduces trade-offs between the sustainable development goals.

### **The role of human rights in the SDGs**

The sustainable development goals were introduced to fill the gaps of the millennium development goals, which were introduced to manage core human development challenges by 2015. De Man (2019) notes that “the millennium development goals have been criticised for the limited role the human rights have played in their design and implementation.” She emphasises the need to examine “to what extent the 2030 agenda incorporates human rights in all stages of development programming” (Ibid.). She suggests that more work is required to achieve such incorporation and that such incorporation would contribute to “close the gaps left by the MDG’s” (Ibid.). She points out that during the preparation of the SDGs, several parties “called for the post 2015-agenda to be based on international human rights laws and principles” (Ibid.). Particularly, “in 2012 the UN task team called for a formulation of the post 2015-agenda to be based on equality, human rights and sustainability” (Ibid.). Further, “at the 2012 Rio+20 conference UN members

states confirmed their intention to develop post 2015 goals that are in accordance with international human rights law” (Ibid.). De Man suggests that “the human rights framework provides the strongest and most accepted moral basis on which development can be based” (Ibid.). Despite this, she notes that “none of the goals is explicitly framed in terms of human rights” (Ibid.).

According to the *Sustainable Development Agenda 2030*, the SDGs, that comprise “a plan of action” for human development, are “grounded in the Universal Declaration of Human Rights” (UN General Assembly, 2015: 4). The *Human Development Report* of 2016 describes human rights as the “bedrock” of human development (UNDP, 2016: 85). The SDGs make frequent references to human rights. The following quotes comprise all of the references to human rights in the SDGs. The point of citing them in full is to provide a complete picture of the occurrence of human rights in the SDGs. This will enable us to probe into the function of human rights in the SDGs and illustrate how extensive and diverse these rights are. I number these references as follows:

- 1 “[The SDGs aim to] realise the human rights of all” (United Nations: 1) and “to protect human rights” (UNDP: 3).
- 2 The Agenda commits itself “to respect, protect and promote human rights and fundamental freedoms for all” (UNDP: 6).
- 3 “It is grounded in the Universal Declaration of Human Rights, international human rights treaties” (UNDP: 4).
- 4 The agenda recognises a “universal respect for human rights and human dignity” (UNDP: 4).
- 5 The Agenda will “strive to provide children and youth with a nurturing environment for the full realisation of their rights and capabilities” (UNDP: 7).
- 6 It claims to pursue a “human right to safe drinking water” (UNDP: 3).
- 7 “The new Agenda recognises the need to build peaceful, just and inclusive societies that provide equal access to justice and that are based on respect for human rights (including the right to development)” (UNDP: 9).

In these quotes, we can find support for three interpretations of what role human rights play in the SDGs:

- 1 Human rights are *progressive, aspirational goals*, or benchmarks to strive for.
- 2 Human rights are the *moral grounding* of the SDGs.
- 3 The SDGs are a *call for implementation* of the human rights.

I will argue that all interpretations are justifiable, although interpretations 2 and 3 gain the most support from the formulations of the SDGs and the *Human Development Report* of 2016.

Let us examine the references to human rights in the SDGs in order. The first reference “[The SDGs aim to] realise the human rights of all” (UNDP: 1) and “to protect human rights” (United Nations: 3) states that the SDGs will “realise” and “protect” human rights. These formulations support that SDGs are a *call for*

*implementation* of the human rights (interpretation 3). The second reference which states that the Agenda commits itself “to respect, protect and promote human rights and fundamental freedoms for all” (UNDP: 6) states that the SDGs will “protect” human rights, and further supports that SDGs are *calls for implementation* of the human rights (interpretation 3). The third reference “It is grounded in the Universal Declaration of Human Rights, international human rights treaties” (UNDP: 4) describes the SDGs as “grounded” in human rights, which supports the interpretation that human rights are the *moral grounding* of the SDGs (interpretation 2). The fourth reference “The agenda recognises a ‘universal respect for human rights and human dignity’” (UNDP: 4) states that the SDGs recognise “a universal respect for human rights.” This claim is compatible with all interpretations including that human rights are *progressive and aspirational goals* to be strived for (interpretation 1). The fifth reference “The Agenda will ‘strive to provide children and youth with a nurturing environment for the full realisation of their rights and capabilities’” (UNDP: 7). The fifth reference states that the SDGs will “realise” children’s rights, which again supports that SDGs are *calls for implementation* of the human rights (interpretation 3) – as does the sixth reference, which states that SDGs will protect the alleged “human right to safe drinking water.” The seventh reference “The new Agenda recognises the need to build peaceful, just and inclusive societies that provide equal access to justice and that are based on respect for human rights (including the right to development)” (UNDP: 9) describes the SDGs as “based” on human rights, thus supporting that SDGs are *moral grounding* of the human rights (interpretation 2). It is important to note that all of these interpretations are compatible with each other.

It is also important to note that although the SDGs might be interpreted as a call to implement these Human Rights, the United Nations has no legal authority to enforce such implementation.

### **The relationship between human rights and the capability approach**

The United Nations specifies that human rights are entitlements, “claims,” that correlate to duties in agents and institutions to provide certain resources, services, or to abstain from engaging in certain behaviour. The United Nations’ *Human Development Reports* of 2000, 2002, and 2016 explicitly endorse the interpretation of human rights as claim rights. The *Human Development Report* of 2000 and 2016 states, “to have a particular right is to have a claim on other people or institutions that they should help or collaborate in ensuring access to some freedom” (UNDP, 2000: 21; UNDP, 2016: 86). “Duty holders support and enhance human development and are accountable for a social system’s failures to deliver human development” (UNDP, 2016: 8). But merely describing rights as claims that correlate to duties does not tell us what the function of rights are, that is, what rights do for rights-bearers. The United Nations endorses an account of the function of human rights that is aligned with the so-called capability approach.

The capability approach can be used to explain what rights do, for rights-bearers have:

The best way to secure human rights may be to consider rights in terms of capabilities. The right to bodily integrity, to associate freely, to political participation and all other rights are secured when the relevant capabilities are available. To secure a right is to enable people to be or do something that they have reason to value.

(UNDP, 2016: 25, 86)

The United Nations hence explicitly endorses an account of human rights that is founded on a capability approach.

Amartya Sen introduced the capability approach in the *Tanner Lectures* (1979), subsequently published as his pivotal article “Equality of What?” (Sen 1980). The capability approach interprets well-being as real opportunity to exercise capabilities. Capabilities are the combinations of functionings that a person is able to achieve. Functionings are all of the valuable things that a person may do or be. Examples of valuable “doings” include interacting socially, earn one’s living, voting, and participating in a public debate. Examples of valuable “beings” include being healthy, physically mobile, and well educated.

One important motivation for the capability approach was Sen’s dissatisfaction with accounts that measure quality of life in terms of people’s perceptions of their own quality of life, their share of certain resources, or Gross Domestic Product. Measuring quality of life in terms of perceived well-being is problematic because of the so-called adaptive preferences: people who have adapted their aspirations to their low expectations regarding their physical and mental health may regard themselves as satisfied. Measuring quality of life in terms of Gross Domestic Product is problematic both because this measure says nothing about the distribution of wealth within a population and because wealth does not necessarily bring the quality of life in a plausible sense of the term. Measuring quality of life in terms of people’s share of certain resources is also problematic because people differ regarding their ability to convert resources into capabilities. For instance, physically disabled or seriously ill individuals may need to spend a large proportion of their income on equipment to aid their mobility, or on healthcare. Also, these individuals often have diminished earning capacity due to their infirmities.

Martha Nussbaum has provided significant contributions to the capability approach. Importantly, her perspective departs from Sen’s to defend a list of 10 central capabilities that must be made available to every person if they are to lead “fully human” lives and realise their “dignity.” Nussbaum holds that these central capabilities should provide the moral basis of constitutional rights. The list is cited in full in the Appendix. Sen’s capability approach does not endorse any such list, but presents capabilities as a space of comparison with regards to people’s quality of life. All versions of the capability approach include commitment to treating persons as “ends in themselves,” and a commitment to pluralism of values (Nussbaum, 2011). The capability approach compels that we should treat each person “as an end in themselves” in the sense that the well-being of each individual, rather than the aggregation of a group of individuals’ well-being, is of moral importance. Nussbaum’s capability approach, like Sen’s, presents itself as an alternative to

measuring quality of life in terms of Gross National Product or the maximisation of perceived well-being. This message is clearly communicated in several additional formulations in her work (Nussbaum, 2003).

The capability approach is, further, committed to a pluralism of values since capability achievements differ in quality and “cannot without distortion be reduced to a single numerical scale” (Nussbaum, 2011: 19). This clearly communicates dissatisfaction with measurement of quality of life in terms of GDP. Ingrid Robeyns has suggested that a commitment to treating persons as “ends in themselves” and a commitment to pluralism of values comprise the only essential features that encompass all versions of the capability approach (Robeyns, 2016). Robeyns emphasises the distinction between the capability approach, which is a general theoretical framework that can be used for numerous purposes, and the theories or accounts that are partly based on the capability approach. She labels these accounts “capability accounts” (Robeyns, 2016).

The account of human rights advocated by the United Nations is, according to the United Nations, a capability account of human rights. Nussbaum stated in 1997, and again in 2003, that the relationship between rights and capabilities “remains yet unexplored” and that the conceptual relationship between the capabilities approach and rights “needs further scrutiny” (Nussbaum, 1997: 278). An important aspect of her capabilities approach is to “illuminate some of the issues that must be faced when one does attempt to connect the two ideas” (Ibid.: 279). Rights theorists argue about the logical structure, content, and function of rights, as well as about who has rights. Nussbaum holds that users of the rights concept need to “link their references to a theory that answers at least some of these questions” (Ibid.: 279). She holds that because of the need to develop such a theory, “a different language has begun to take hold in talk about people’s basic entitlements. This is the language of capabilities and human functioning” (Ibid.: 275). According to Nussbaum, we need to combine the capabilities approach with an account of rights because “rights language reminds us that people have justified and urgent claims to certain types of urgent treatment, no matter what the world around them has done about that.” “The concept of a right is closely connected with the concept of a capability because to secure a right *is* to put someone in a position of capability” (Ibid.: 295).

According to Nussbaum, a right is “an especially urgent and justified claim that a person has, simply by being a human adult” (Nussbaum, 1997: 293). Although Nussbaum endorses the view that it is uncontroversial to classify human adults as rights bearers, she also endorses the view that children should be provided resources and support needed to develop into adult human beings. The capability provides an account of privileges to which a person might lay claim: “To secure a right to a citizen . . . is to put them in a position of capability to go ahead with choosing that function if they should so desire” (Ibid.: 293). The core connection between human rights and basic capabilities is that “just by virtue of being human, a person has a justified claim to have the capability secured to her; so that a right in that sense would be prior to capability, and a ground for securing a capability” (Ibid.: 293). She then explains how the capability approach can help us “understand that what is involved in securing a right” which “is usually a lot

more than simply putting it down on paper” (Ibid.: 293). Hence, the reference to capabilities indicates that respect for rights requires that people achieve actual access to the prerequisite capability sets for leading a dignified life. The reference to human rights indicates that every human being has a justified claim to these capability sets.

### **Conflicts of rights**

Suppose we accept that all human beings are morally entitled to certain services and resources necessary to access certain capabilities. Suppose also that access to these capabilities is necessary to enjoy one’s human rights. The resources needed to give all humans access to human capabilities are scarce. At the same time, all humans have equal claims to these scarce resources, according to the United Nations. How, then, can we alleviate conflicts of human rights? Equipped with the explanation of the significance of rights outlined in the previous section, we may address the challenge of rights conflicts. I will discuss some very simplified cases which require adjudications because the rights of two or more rights-bearers conflict. In such cases, actualising the rights of both rights-bearers is impossible.

Consider a rights conflict between persons A and B, characterised by the following features: (1) both rights-bearers have equal status as human rights-bearers; (2) both the conflicting rights are justifiably considered equally weighty; (3) no circumstances of the conflict offer reason to infringe on one right rather than the other. There is a clear and urgent tension between the prolific class of allegedly “universal,” “integrated and indivisible” rights to essential resources and services (yet which are scarce) and the increasing pressure on these resources due to human exploitation. The United Nations and the World Health Organisation clearly state that particularly vulnerable groups should be prioritised (UN General Assembly, 2015; World Health Organization, 2017). However, the large number of particularly vulnerable individuals who are equally entitled to scarce resources will also arguably experience rights conflicts. Even if we assume that people are willing to “deliberate and decide, through give and take,” deliberation does not always result in agreement on “common priorities” (Ibid.).

Examples of behaviour that contribute to global warming include burning oil-based fuels, certain industrial activity, certain farming, and certain forestry. Suppose that we can sustainably engage in some of these activities to a certain extent. To abide by the internationally endorsed Paris Agreement to limit the increase of earth’s temperature to 2 °C, and preferably to 1.5 °C above pre-industrial levels, we may only engage in such behaviour to a very limited extent. Suppose that a group of people have moral rights to engage in such behaviour within the limits of the Paris Agreement, in order to earn their living. Rights to earn a living have been proposed as moral rights and are essential in order for people to enjoy numerous human rights. Rights to *work* are listed as human rights. Rights to work could defensibly be considered to imply the rights to earn a living, since work generates most people’s income. But rights to *earn a living* might not *strictly* be interpreted as human rights. Nevertheless, rights to earn a living can certainly conflict with

each other if the means of livelihood are scarce. These rights will arguably become increasingly restricted.

For instance, citizens of the Maldives – who have managed a very delicate ecosystem sustainably for generations, and who are arguably not responsible for the current climate situation, but who are particularly vulnerable to floods and raising sea levels – are arguably entitled to engage in certain activities that contribute to global warming to secure their livelihood. Examples of such activities include the expansion of airports, flight routes, and hotel chains to maintain and expand tourism, which, along with tuna fishing, is one essential source of income for Maldivians. These individuals' rights might conflict with each other. Such rights conflicts will arguably occur even if the entire current “carbon budget” would be disposed of solely by individuals who are not responsible for the current situation. This rights conflict is arguably caused by excessive consumption of the carbon budget by culpable third parties such as citizens of many industrialised countries. The rights conflict is not caused by the individuals involved in this rights conflict. But conflicts between equally weighty entitlements are genuine rights conflicts that require adjudication, even if they are caused by some third culpable party. Even if we assume that certain populations are entitled to the entire carbon budget, rights conflicts will most likely occur *within* each of these groups.

Martha Nussbaum argues that recognition of, and reflection over, genuine rights conflicts – “tragic predicaments” where any available course of action will involve a moral wrongdoing – can help us find ways to arrange societal functions which reduce the potential for future occurrence of such tragic predicaments. When facing such a tragic predicament, Nussbaum recommends that we investigate whether the tragic predicament is a conflict between entitlements to resources that people require in order to lead a “fully human,” “dignified” life. If one of the entitlements is not of this character, and the other is, then the latter entitlement should be given priority. If both groups' entitlements are considered resources that are required to in order to lead a “fully human,” “dignified” life, then any available course of action involves a wrongdoing. Although any available course of action necessarily involves a wrongdoing, reflecting over such predicaments is fruitful because such reflection can lead to insights as to how such predicaments might be avoided in the future.

Next, we focus on strategies to reduce the risk of future conflicts over resources that are necessary in order to lead a “fully human” and “dignified” life. One obvious way to reduce the occurrence of rights conflicts over scarce resources is to produce either more of these resources, or substitutes for these resources. In the next section, we will explore how a nexus between the development of fish feed and biofuel from biomass can reduce rights conflicts over scarce resources by providing substitutes.

### **Carbon capture and usage technology**

Fish protein is a major source of nutrition worldwide. Merz and Main (2014) note that “In 2012 fish provided more than 2.9 billion people with almost 20% of their



average per capita intake of animal protein, and 4.3 billion people with almost 15% of their protein requirement.” The dependence on fish as a source of nutrition is greatest in developing countries. As wild fish stock is being depleted due to industrial overfishing, aquaculture has grown into the largest food industry in the world. A major challenge facing this industry is finding alternative sources of omega-3-rich fish feed, which is essential both for fish health and to ensure omega-3 richness in farmed fish products. The use of fish feed based on wild-caught fish is unsustainable. In addition, a rising demand for fish oil for human consumption further increases the demand on the fish stock, creating even greater needs for alternative sources of omega-3-rich fish feed. The increased use of waste products from wild-caught fish to produce fish feed is also problematic because such fish feed may be of lower quality which can decrease the level of omega-3 fatty acids in farmed fish products. Algae (and algae-based fish feed) is rich in omega-3s and can help address this conundrum. The use of algae-based fish feed also avoids the need to rely on genetically modified terrestrial plants such as soy. Thus, it avoids the climate impact of cutting down rainforest to create land areas for soy production, and the climate impact of transporting the soy around the globe.

Currently, the primary challenge in industrialised cultivation of algae is upscaling, to reach a competitive price point for the products. The similarities between manufacturing the products of algae-based fish feed and algae-based biofuel speak in favour of nexus solutions to reduce costs and decrease technical challenges. The dual challenge of developing fish feed to replace fish feed produced from wild-caught fish, and the development of biofuel to replace fossil fuels, currently receives significant attention, and “water-energy-food nexus synergies between the aquaculture and biofuels sector” are rapidly growing areas of interdisciplinary research focus (34). “Both industries will produce useful by-products in the form of algae oil that can be used to increase profits. Consequently, improvements in microalga production technology will benefit both of these large and important industrial sectors” (Ibid.).

The water–energy–food nexus approach was introduced to promote integrated planning and governance of water, energy, and food, to create synergies and reduce trade-offs between the SDGs. The approach received considerable international attention at the Bonn 2011 Nexus Conference for WEF Security Nexus Solutions for the Green Economy. Yet, despite the intense attention paid to the nexus approach by the interdisciplinary research community, practical implementation of the research output has been described as “lagging” (Byers, 2015; Daher and Mohtar, 2015; Liu et al., 2017; Galaitsi et al., 2018; McGrane et al., 2019; Nhamo et al., 2020; Naidoo et al., 2021).

The United Nations’ 2018 special report explicitly emphasises the potential of nexus approaches to help alleviate conflicts between the SDGs: “Quantifiable pathway studies now better represent ‘nexus’ approaches to assess sustainable development dimensions” (IPCC, 2018). In such approaches, a subset of closely related dimensions in sustainable development are investigated together. The report explicitly states: “The water–energy–food nexus is especially important to growing urban populations” (Ibid.). Although the importance of nexus solutions is widely

acknowledged, “an explicit cognition of its practicability in real-world is still lacking” (Ghodsvali et al., 2019: 266). The development of efficient means of cross-disciplinary communication between stakeholders within science and the industry is a major challenge. Potential responses to this challenge depend on geographical and social contexts. A recent comprehensive review of the nexus research concludes: “Extensive endeavors should be made to identify the key determinants of stakeholders’ interactions, feasible communications, and procedures for advanced cooperative practices through real-world applications” (Ibid.: 276).

I will now examine the specific relationships between the water–energy–food nexus and the sustainable development goals, as well as the specific relationships between the water–energy–food nexus and algae cultivation for carbon capture and utilisation, as exemplified at Finnford AS.

The sustainable development goals are benchmarks for global human development in areas including food security, access to affordable, clean energy, water, and sanitation. These goals relate directly to the food–energy–water nexus: “the food–energy–water nexus is directly linked with SDGs 2 (zero hunger), 6 (clean water and sanitation), and 7 (affordable and clean energy). This nexus also directly or indirectly affects all other SDGs” (Liu et al., 2018: 472). The literature provides additional support for this view.

Liu et al. (2018) repeatedly emphasise the connection between the water–energy–food nexus and the sustainable development goals: “Food, energy and water interact and can affect all the SDGs” (Ibid.: 467). They specify how the nexus affects the entire set of SDGs: “The food – energy – water nexus approach can influence the achievement of all SDGs directly or indirectly by strengthening synergies, reducing trade-offs and creating cascading effects beyond food, energy and water sectors” (Ibid.: 468). They substantiate this claim even further: “Some indices in nexus studies overlap with SDG indicators, such as CO<sub>2</sub> emissions and environmental footprints, facilitating direct connections between nexus research and SDGs” (Ibid.: 471). However, the authors also note a significant research gap, which is the absence of empirical research necessary to support the significance of the nexus for realisation of each of the SDGs: “No quantitative nexus studies have linked with specific SDGs” (Ibid.: 469). They strongly recommend researchers to focus on filling this gap:

It would be useful to apply nexus approaches to SDG implementation. Nexus approaches can help achieve SDGs because SDG goals are interconnected and linked with the sectors of a particular nexus. For example, the food – energy – water nexus is directly linked with SDGs 2 (zero hunger), 6 (clean water and sanitation) and 7 (affordable and clean energy). This nexus also directly or indirectly affects all other SDGs, such as improving human health and well-being (SDG3) by enhancing water quality and quantity, bolstering food safety and nutrition and energy security; advancing economic development (SDG8) through using food system residues to generate bioenergy, treating polluted water using the bioenergy and using treated water to grow food; and mitigating climate change (SDG13) through increasing resource efficiency and reducing CO<sub>2</sub> emissions. As nexus frameworks can make

direct or indirect relationships with and between SDGs clear, they can enable integrated SDG implementation as requested in the Agenda 2030. Accordingly, nexus approaches can also monitor progress towards integrated SDG implementation.

(Liu et al., 2018: 471)

Hoff et al. (2019) also continue the quest to map connections between the water–energy–nexus approach and the sustainable development goals. They use case studies based in Jordan, Lebanon, and Morocco to quantify connections between the water–energy–food nexus and the sustainable development goals (Hoff et al., 2019: 9).

Having substantiated the connection between the water–energy–food nexus and the sustainable development goals, I will now discuss the connection between algae cultivation, particularly at Finnfjord AS, and the water–energy–food nexus. This will demonstrate the connection between the algae cultivation at Finnfjord AS and the sustainable development goals.

Bazilian and colleagues propose

algal bioresources as a lens through which to consider aspects of this nexus. These three spheres [water, energy and food] are especially relevant in the case of algal bioresources. Due to a unique set of attributes, algal bioresources offer a potential for disruptive change through opportunities for increased energy resources, enhanced food supplies, greenhouse gas mitigation, or new routes to wastewater remediation.

(Bazilian et al., 2013: 158)

They emphasise the suitability of algal cultivation as a test case for the study of the nexus: “Algal systems offer a unique opportunity to consider the energy–water–food nexus” (Ibid.: 161). Wibisono and colleagues concur: “Nowadays the world is facing vulnerability problems related to food, energy and water demands. The challenges in those subsystems are intertwined and thus require inter-discipline approaches to address them. Bioresources offer promising solutions of the dilemma” (Wibisono et al., 2019: 166).

The authors recognise the “great potential” of microalgae amongst these bioresources:

“Microalgae therefore have great potential for addressing the challenges in the food-energy-water trilemma, judging from their important roles in the food-energy-water nexus” (Ibid.: 165). Specifically: “Microalgae are considered as bioresource materials which are useful for supplying food, energy and clean water.”

(Ibid.: 166)

Having demonstrated the strong connections between microalgae cultivation, the water–energy–food nexus, and the SDGs, I will now discuss the importance of

algae cultivation for carbon capture and utilisation at Finnjord AS for the water–energy–food nexus and the SDGs. Interdisciplinary Carbon Capture and Utilisation (iCCU) is an interdisciplinary research project in collaboration between UiT The Arctic University of Norway and Finnjord AS. According to the project website (The diatom mass cultivation project – iCCU (uit.no)) the project is “optimising industrially relevant technologies for chemical and biological CO<sub>2</sub> capture and usage (CCU) by taking into account environmental, ethical, and business-related aspects. The microalgae can provide a plethora of valuable products (food, feed, and biofuel), with fish feed currently being the main focus, due to the need of the aquaculture industry for feed with higher omega-3 content.” The CCU project based at Finnjord in northern Norway involves potentially large-scale CO<sub>2</sub> mitigation. It is estimated that algae contribute to approximately 20% of the total amount of carbon capture globally (4). Local production of fish feed could also reduce CO<sub>2</sub> footprint of fish feed due to shorter transport distances of ingredients.

The collaboration between UiT the Arctic University of Norway and Finnjord AS is an example of an Arctic CCU project with the potential to contribute both to sustainable upscaling of aquaculture production and to the development of algae-based biofuels. The project currently hosts the largest algae growth facility in the world and has received substantial funding for continued upscaling of the production. Currently, the project does not involve the development of biofuels, although one potential large environmental benefit of this product is that it would reduce the need for long transports of fish feed.

Carbon capture and usage technology can reduce the risk of human rights conflicts over sources of nutrition and energy, by replacing scarce food and energy resources with bountiful energy resources. Replacement of fossil fuels with biofuels is one of the most efficient methods to reduce carbon emissions. A nexus between algae-based fish-feed production (which reduces the need for depletion of the wild fish stock in the process of fish-feed production) and algae-based biofuel (which reduces climate impact) can reduce human rights conflicts in relation to both nutrition and an environment that can provide resources necessary for sustenance of health. Assessment of the nexus’ efficiency regarding the creation of synergies and reduction of trade-offs between the SDGs would need to include context-specific quantification of various elements including transportation needs, land-area needs, water consumption, and whether the cultivation must be seasonal due to local weather conditions (Miara et al., 2014).

Applying a context-adjusted implementation model to the algae cultivation project at Finnjord would require context-specific mapping and quantification of the links among food, water, and energy on site. It would then require the identification of critical links and leveraging of the results in accordance with the implementation model. The algae cultivation at Finnjord AS provides a unique test case for such an implementation model due to the project’s industrial scale. Currently upgrading the algae cultivation capacity to 3,000,000 L demonstrates an increasing potential to realise a positive impact on the SDGs.

Daher and Mohtar (2015) have developed the most context-adjusted model to date. Nexus Tool 2.0. allows the user to submit information regarding a project’s

water, land, and energy requirements, to thereby assess the carbon footprint of the project. Yet, that model currently only addresses these questions within a national context. An adjusted version of this tool, tailored specifically for the industrial scale carbon capture and utilisation project at Finnfjord AS, would significantly contribute to context-specific quantification of the links between water, energy and food, and local implementation of the water–energy–food nexus. Such implementation provides a pilot study that, if replicated, could have a significant impact on the realisation of the SDGs. Research output related to the algae cultivation has already contributed to life-cycle analysis of the entire production process of algae cultivation, fish-feed production, and local salmon farming (Eilertsen et al., 2022). As trade-offs between environmental benefits (CO<sub>2</sub> capture, CO<sub>2</sub> emission reduction due to minimised need for transportation of feed), financial benefits (due to salmon production), and other types of benefits might be necessary, identifying explicit priorities among these considerations will reveal the normative dimensions of implementing the water–energy–food nexus. Explicit priorities and normative dimensions are needed since the SDGs are not ranked in order of priority, and prioritisation is necessary to avoid practical conflicts between the SDGs.

Novel developments of the capability approach provides theoretical grounding for the water–energy–food nexus approach. Breena Holland (2008) argues that Nussbaum’s list of central human capabilities needs to be complemented by addition of the capability to live in conditions that are characterised by ecological sustainability, as an independent capability that is a precondition for realisation of all other capabilities. Conditions that are characterised by ecological sustainability include a temperature range conducive to human health and the availability of food sources.

Adding ecological sustainability as an independent capability and as a precondition for realisation of all other capabilities provides a new theoretical tool for meeting the knowledge gap regarding local solutions to conflicts between the SDGs identified by the United Nations – while it also suggests a very rough order of priority of Nussbaum’s central human capabilities, and the human rights-based SDGs. Although labelling ecological sustainability as a separate capability might be challengeable, the suggestion that ecological capability is a prerequisite for the realisation of the ten central human capabilities is uncontroversial.

Jonathan Wolff and Avner De-Shalit, in their influential book *Disadvantage*, introduce a novel development of the capability approach that supports this order of priority. According to Wolff and De-Shalit, people are disadvantaged compared to others if they face “clusters” of capability deficits. They argue that scarce resources should be directed towards preventing deficits of capability protection that causes additional deficits of capability protection. Such deficits cause “corrosive disadvantages.” They also argue that scarce resources should be directed towards protecting capabilities that, if protected, contribute to the protection of other capabilities. Such protections promote “fertile functionings” (Wolff and De-Shalit, 2007). Undernourishment and exposure to impacts of climate change arguably cause corrosive disadvantage, and protection of sources of nourishment and limitations of the impacts of climate change arguably protects fertile functionings.

Hence, nexus solutions such as the one between fish-feed production and biofuel production arguably merit high priority because they potentially reduce corrosive disadvantages while they promote fertile functionings.

Mapping of the complex interactions among water, food, and energy governance is a prerequisite for the successful implementation of the nexus. Failure to do so could result in unforeseen corrosive disadvantages such as reduced access to fertile land and excessive consumption of water resources. Due to microalgae's significant capacity to rapidly increase in density, capture CO<sub>2</sub>, and flourish in wastewater, the cultivation does not require extensive amounts of freshwater and land areas. Replacing fish feed based on wild fish with fish feed based on algae, and replacing fossil fuels with biofuel, at least partly contributes to secure the capability for ecological sustainability. Protection of this capability by sustainable upscaling of the aquaculture industry, and potentially of the nexus between the aquaculture and biofuels industry contributes to reduce "clusters" of disadvantage for populations that are particularly exposed to the impacts of climate change, including nutritional deficits. The pioneering upscaling to the industrial scale of microalgae cultivation for fish-feed production could be regarded as a pilot project that, if successfully replicated in different geographical and socio-economic contexts, could contribute significantly to reduction of conflicts between the human rights-based SDGs on a global basis.

## Conclusion

This chapter highlighted an important knowledge gap identified by the United Nations: the need to address inevitable conflicts between the SDGs in different geographical contexts. I focused on strategies to meet this challenge in an Arctic context. The discussion took an explication of the place of human rights in the SDGs as its point of departure, followed by a discussion of the capability approach understood as the moral grounding of human rights. From this normative framework, I defined human rights conflicts and outlined a method to reduce the risk of rights conflicts, which aligns with the capability approach. The chapter finally describes how the capability approach developed by Wolff and De-Shalit supports nexus solutions between the aquaculture industry and the biofuel production. Although the collaboration between UiT The Arctic University of Norway and Finnfjord AS currently focuses on the production of algae-based fish feed, the project has the potential to develop nexus solutions between the aquaculture industry and the biofuel production.

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# Appendix

## The central human capabilities

- 1 Life. Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
- 2 Bodily health. Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
- 3 Bodily integrity. Being able to move freely from place to place; to be secure against violent assault, including sexual assault and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.
- 4 Senses, imagination, and thought. Being able to use the senses, to imagine, think, and reason – and to do these things in a “truly human” way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with experiencing and producing works and events of one's own choice, religious, literary, musical, and so forth. Being able to use one's mind in ways protected by guarantees of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. Being able to have pleasurable experiences and to avoid nonbeneficial pain.
- 5 Emotions. Being able to have attachments to things and people outside ourselves; to love those who love and care for us, to grieve in their absence; in general, to love, to grieve, to experience longing, gratitude, and justified anger. Not having one's emotional development blighted by fear and anxiety. (Supporting this capability means supporting forms of human association that can be shown to be crucial in their development.)
- 6 Practical reason. Being able to form a conception of the good and to engage in critical reflection about the planning of one's life. (This entails protection for the liberty of conscience and religious observance.)
- 7 Affiliation. (A) Being able to live with and toward others, to recognise and show concern for other human beings, to engage in various forms of social interaction; to be able to imagine the situation of another. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.)

- (B) Having the social bases of self-respect and nonhumiliation; being able to be treated as a dignified being whose worth is equal to that of others. This entails provisions of nondiscrimination on the basis of race, sex, sexual orientation, ethnicity, caste, religion, and national origin.
- 8 Other species. Being able to live with concern for and in relation to animals, plants, and the world of nature.
- 9 Play. Being able to laugh, to play, to enjoy recreational activities.
- 10 Control over one's environment. (A) Political. Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association. (B) Material. Being able to hold property (both land and movable goods) and having property rights on an equal basis with others; having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. In work, being able to work as a human being, exercising practical reason and entering into meaningful relationships of mutual recognition with other workers (Nussbaum, 2000: 78–80).

### **The sustainable development goals**

- Goal 1. End poverty in all its forms everywhere.
- Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
- Goal 3. Ensure healthy lives and promote well-being for all at all ages.
- Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
- Goal 5. Achieve gender equality and empower all women and girls.
- Goal 6. Ensure availability and sustainable management of water and sanitation for all.
- Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all.
- Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation, and foster innovation.
- Goal 10. Reduce inequality within and among countries.
- Goal 11. Make cities and human settlements inclusive, safe, resilient, and sustainable.
- Goal 12. Ensure sustainable consumption and production patterns.
- Goal 13. Take urgent action to combat climate change and its impacts.
- Goal 14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
- Goal 15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

- Goal 16. Promote peaceful and inclusive societies for sustainable development; provide access to justice for all; and build effective, accountable, and inclusive institutions at all levels.
- Goal 17. Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development.