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Chains of Social Sustainability and the Potential of the DPSIR Framework

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ABSTRACT

For more than 20 years, the Driver-Pressure-State-Impact-Response (DPSIR) framework has contributed to clarifying causal chains for environmental sustainability issues. This study aims to answer the question of whether the framework can extend its usefulness to structuring social sustainability issues, to which it has not been applied so far. It shows that based on some simple conceptual foundations, it is possible to distinguish between drivers of social problems, pressure, social states, impacts and responses. Using the case of child labour, the study demonstrates how the DPSIR framework and the social pillar of sustainability can structure and clarify causal chains. The findings highlight the untapped potential of applying the DPSIR framework to social issues.

1 | Introduction

Distinguishing between causes and effects has proven useful for the analysis of environmental problems. After Friends and Rapport (1979) distinguished between environmental stress and response, this mental model was extended into the Pressure-State-Response framework by the OECD (1994). Today's common Driver-Pressure-State-Impact-Response (DPSIR) framework was eventually developed by the European Environment Agency (EEA 1999) and has been widely adopted, most notably by the Food and Agriculture Organization (FAO 2011). Today, the number of scientific publications applying the DPSIR framework exceeds 20000.

To our knowledge, the environmental dimension is the only sustainability dimension to which the DPSIR framework has been applied, even though many social scientists have contributed to this application of DPSIR in environmental contexts (e.g., Atkins et al. 2011; Carr et al. 2007; Mandić 2020), while others have amalgamated the framework with general sustainability assessment tools (Goswami et al. 2017). This conceptual paper hypothesises that the DPSIR framework not only generates

added value for questions of environmental sustainability but is also useful for the entire realm of social sustainability. To make this point, two preparatory steps are necessary. In Section 2, the added value of the DPSIR framework is described in detail. Section 3 introduces the entire debate about the social dimension of sustainability. In Section 4, we describe the single categories of the DPSIR framework in an assessment of its potential and the limits of its applicability for social sustainability issues. In Section 5, we use a simple causal chain to illustrate the usefulness of the framework for the realm of social sustainability. Section 6 concludes the paper.

2 | The Added Value of the DPSIR Framework

There is a rich literature about the potential as well as the limitations of the DPSIR framework. Most authors agree that it is a powerful tool for illustrating and communicating the causalities of environmental issues (Kelble et al. 2013; Kohsaka 2010; Spangenberg et al. 2015). However, several authors have described the causalities inherent in the framework as a simplification of complex realities (Anandhi et al. 2020; Smaling and

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Dixon 2006; Zhao et al. 2021). Maxim et al. (2009, 21) illustrated this point, stating, ‘A specific impact can be caused by a number of state conditions and, indirectly, by responses to other impacts’.

Does this remark question the value of the DPSIR framework? In fact, none of its content makes the DPSIR framework redundant. To the contrary, both of the points by Maxim et al. (2009) can not only be easily brought in line with the framework but are even prone to illustrating its strength—that is, every stage of the framework can be filled by more than one variable. The loss of biodiversity, for example, can be attributed to economic and demographic factors (Maillard and Gonzalez 2006), as well as to the way land is managed, including tillage and heavy application of fertilisers (Hachtmann 2024). It is not the disadvantage of the DPSIR model that it necessarily reduces the number of causes to one, but it is its advantage that it places the two explanation approaches of the example of biodiversity loss into different categories: the economic and demographic factors are drivers, whereas the tillage and the application of fertilisers are pressure variables.

It is certainly true that responses to other impacts can have effects on other parts of the causal chain. For example, climate change mitigation measures usually have significant biodiversity impacts (Hirata et al. 2024). However, this only describes the need to link different DPSIR models, eventually necessitating the use of system dynamics to move beyond the simplifications of single causal chains, as successfully exemplified by Camanho et al. (2010), Zare et al. (2019) and Wang and Fu (2023).

Therefore, this premise argues for the DPSIR framework as a tool that provides additional clarity in the management of environmental problems (Robele Gari et al. 2015) and is able to generate a common understanding of complex ecological phenomena (Patricio et al. 2016). We hypothesise that this strength can also be applicable to social issues.

3 | A Summary of the Discourse on Social Sustainability

In the years when sustainability became one of the key terms that shaped the scientific debate, the environmental dimension gained the most attention. For many years, scholars focusing on the social pillar of sustainability could not move far beyond the notion that there were many alternative understandings of the concept and no common definition (Chatzinikolaou et al. 2012; Chiu 2003; Littig and Griessler 2005). Recently, the different views have mostly converged, and some joint understanding of social sustainability has been attained, which Skivko et al. (2021, 595) summarised as an ‘interaction between social habits and social well-being’. A somewhat more elaborate formulation originated from Rasouli and Kumarasurinyar (2016, 31), who wrote that ‘social sustainability can be interpreted as a condition and process within the community that fulfils the basic human needs in addition to the principles of social justice and equity, homogeneity, and cohesion, integration, diversity, sense of place, social amenity, and social security for the present generation, while guaranteeing them for the future generations.’

These quotes illustrate the two essential pillars that the concept of social sustainability should have. One is individual well-being. Although this has been operationalised using the concept of resilience (Cuesta et al. 2024) or Maslow’s pyramid of needs (Janker et al. 2019), it has become clear that one of the most important focal points has to be the physical and emotional state of humans (and perhaps non-human animals, as suggested by Gunnarsson et al. 2020). A system in which people are increasingly unhappy is not socially sustainable.

The other pillar is the one of social cohesion or, as many economists like to frame it, of social capital. Ballet et al. (2020) emphasised the aspects of social cohesion, equity and safety, whereas Cope et al. (2022) described the ‘sense of belonging, attachment, and equity’ as the core of social sustainability. The individual can only prosper in an environment where communities function and people enjoy mutual respect and appreciation. Over-individualistic societies and communities with overly large differences in resource endowments will be unable to preserve the quality of life of their residents and therefore are not socially sustainable either. Humans have rights, and only societies that warrant these rights to all citizens are socially sustainable (Popovich et al. 2018).

Given this background of increasing definitional clarity of individual wellbeing and social cohesion as the backbones of social sustainability, it is probably unfair to still describe the concept of social sustainability as an ‘empty signifier’, as Davidson (2019) did. The social pillar of sustainability is in the process of emancipating itself from the environmental dimension and attaining a similarly clear meaning.

4 | The Elements of the DPSIR Framework in Relation to Social Sustainability

To examine the use of the DPSIR framework for social sustainability, it is crucial to examine the applicability of the single stages of the framework. This is the only way to obtain clarity about both the potential and the limitations of the framework’s transfer from environmental to social issues.

4.1 | Drivers

Most drivers of environmental problems are macro trends that can hardly be tackled at the micro level. One good example is population pressure, which has been identified as an important driver for environmental issues ranging from mangrove deforestation (Sarmin et al. 2016) to local flooding (Sangchini et al. 2022) to smog in cities (Soltani et al. 2021). However, this very population pressure is a sociodemographic trend that also affects social variables. A seminal paper by O’Sullivan (2020) shows the whole range of social variables on which population pressure has a strong effect, including inequality, unemployment, debt, social cohesion and conflict.

In fact, most variables considered as drivers in environmental DPSIR models are not environmental but social phenomena, paying tribute to the fact that environmental problems are usually caused by recent developments in human society. Climate

change, for example, is usually not considered as a driver but typically as a pressure variable driven by human economic activities (Obubu et al. 2022; Omann et al. 2009; Zhou et al. 2015).

All of this necessitates the conclusion that the differences between the applicability of the DPSIR model in the environmental and social realms do not begin on the level of drivers. Apparently, our socioeconomic system has created drivers that have detrimental effects for both environmental and social issues.

4.2 | Pressures

Emissions are a typical environmental pressure variable (Troian et al. 2021; Xue et al. 2015), and water demand is another (Alexakis 2021; Rasi Nezami et al. 2013). Pressure variables do not do the damage themselves, but inevitably, they may lead to damage to the environmental system. Pressure variables are often used as indicators for sustainability assessments, for which nitrogen use efficiency would be an example (Guo et al. 2022).

Education, or rather the lack of it, would be a typical parallel in the realm of social sustainability. It has been shown that low educational standards make it easier for governments to deprive populations of their basic political and civic rights (MacDougall 2016). Low educational standards also lead to missing employment opportunities, which, in turn, lead to poverty (Efe 2014; Wilson 2011). The quality of healthcare is another typical pressure variable that does not generate a value as such but which, in many cases, is a precondition for a good state of public health. Similar to education, good health has been shown to facilitate good employment opportunities (Orentlicher 2018). The entire literature about poverty in general and capabilities in particular should also be considered as research about pressures. Sen's (1983, 159) remark that 'poverty is not just a lack of money; it is not having the capability to realise one's full potential as a human being' describes a significant pressure on human wellbeing and therefore on social sustainability.

As for the environment, pressure-related variables are frequently used in sustainability assessments. Simoes et al. (2016), for example, used 'education and personal skills' as one of their midpoint categories for social sustainability. This raises the question of the 'states' to which the pressures serve.

4.3 | State

The 'state' of the environment, be it inside (Karakos et al. 2003) or outside (EEA 2010) DPSIR models, is usually measured through the concentration of certain elements in the air, the soil or the water by describing sea levels or temperatures. But what is the 'state' of the social pillar of sustainability if there is any reasonable definition at all?

Section 3 provides answers to this question. Regarding the component of individual well-being, happiness researchers in particular have made important contributions to its operationalisation: Krueger and Stone (2014), for example, provided a good overview of reliable estimates of subjective well-being. There is consensus that the present scales are well suited to

grasping this important component of social sustainability (Diener et al. 2018). Happiness is a classical 'state' indicator in models of social sustainability.

The other dimension of social sustainability refers to interaction levels within societies and contains elements such as social cohesion and equity. With the Gini coefficient, there is a straightforward and meaningful indicator of the latter (Catalano et al. 2009). However, social scientists have also made considerable advances in finding coherent measurements of social capital (Chetty et al. 2022; Villalonga-Olives and Kawachi 2015). In fact, such measures have often been brought into the narrative of social sustainability (Cachón-Rodríguez et al. 2022; Ly and Cope 2023; Pillai et al. 2021). At this societal level, many scientists judge the level of social sustainability through an analysis of infringements of human rights (Colantonio 2009; Palthe 2012; Treviño-Lozano 2022).

Regarding the environment, the 'state' variables can be considered the core of social sustainability, and the focal points are similarly clear for both dimensions. Our desire for coherent, just societies in which people can fulfil their needs provides a good framework for identifying state-related indicators of social sustainability.

4.4 | Impact

In environmental DPSIR models, the impact of environmental issues has been described in terms of the uptake of toxic substances (Prata 2024) or the loss of biodiversity (Cortesi and Hepperle 2010) but often also in terms of health (Relvas and Miranda 2018; Robele Gari et al. 2018; Kaur et al. 2020). The latter aspect is an obvious parallel to the social dimension of sustainability: many social problems are also likely to deteriorate human health. Burnout, for example, has been described as a consequence of unfair treatment (Fountouki and Theofanidis 2022), the absence of support at the workplace (Saloviita and Pakarinen 2021) and long work hours (Shirom et al. 2010), all variables that could be used as pressure or state variables in a social DPSIR model.

However, the impact of social distress goes beyond psychological illnesses and reaches well into the somatic realm. Life expectancy has been shown to have causes both in individual well-being (Kageyama 2012) and poverty (Singh and Lee 2021). Wilkinson and Pickett (2009) wrote an influential book on the impact of inequality. They offered a large body of evidence, ranging from the impact of inequality on obesity rates to the impact on violence and crime to the impact on teenage birth rates. Their collection of scientifically proven effects of inequality shows how wide-ranging the impact of social problems can be.

4.5 | Response

For both environmental and social issues, responses are made by two different categories of actors: private entities, such as companies or households, can react as can public authorities by changing the legal framework. To start with, policies for biodiversity conservation have been used as a typical example (Maxim et al. 2009) of such policy responses. Of course, governments similarly react to social problems. Kourachanis (2018), for

example, described how an influx of refugees led to anti-social policy responses by the Greek government. Yudi (2023) provided a more exemplary case when outlining how the Indonesian government responded to the financial crisis and, 10 years later, to COVID-19 through multi-level responses to its social policy.

The business response to environmental issues is often innovation, as Hertin et al. (2001) emphasised. Although this may also be an option for some cases of social problems, business closure may be a more frequent response. For example, researchers have often described how farms are not taken over by the next generation in cases where the business does not provide sufficient income opportunities or face other social threats (Mann 2021; Rodriguez-Lizano et al. 2020; Suess-Reyes and Fuetsch 2016).

5 | The Case of Child Labour

Child labour is not only one of the most frequent indicators of social sustainability (Mann 2018), but it is also a subject on which scientists have collected a solid amount of evidence. It is therefore used as the centrepiece for the DPSIR framework in Figure 1. This figure is supposed to provide causal circles following the DPSIR logic through two steps. The first is the classification of the phenomenon of child labour itself and the second is to identify the relative position of other social phenomena being causally connected to child labour in one way or another. Within this framework, child labour is considered a pressure variable, as well as to indicate causal links between child labour and other variables, even if they go beyond the strict DPSIR logic. Causal relationships outside child labour and the DPSIR framework were not taken into account in the figure, although it is likely that there are direct links between, for example, the infringement of the right of

education and empowerment by non-government organisations (NGOs). Such possible links were ignored because they neither follow the DPSIR logic nor do they have a link to child labour.

Alternatives to the variables chosen in Figure 1 would have been possible. Sharma and Kiran (2017), for example, have shown that the self-esteem of children at school is higher than that of children working in the car industry. However, as this is the only study on this subject and has methodological weaknesses, the link from child labour to the 'state' of a lack of education appears sounder than the reference to happiness.

Some social scientists take the opposite stance and claim that the right to work should also be protected for children (Liebel 2012). In this perspective, the ban of child labour leads to less financial means and a lack of self-sufficiency for children. Although this may be a minority position, it also underlines the systematic view of the issue one achieves through the use of the DPSIR framework. The ban of child labour would be a pressure variable leading to a lower household income—the state. And the impact would be lower degrees of material freedom for the children.

Some variables could play a different role. Poverty, for example, while considered a driver, may be a pressure variable in some other contexts. However, this is not unique to social sustainability. In environmental DPSIR models, climate change, for example, is sometimes considered a driver (Moss et al. 2021), sometimes a pressure (Omann et al. 2009) and sometimes a state (Kristiadi et al. 2022) variable.

Figure 1 also indicates the limitations of the model. The causal chains are not restricted to flows in the DPSIR order. As described by Frimpong et al. (2021), although child labour can be

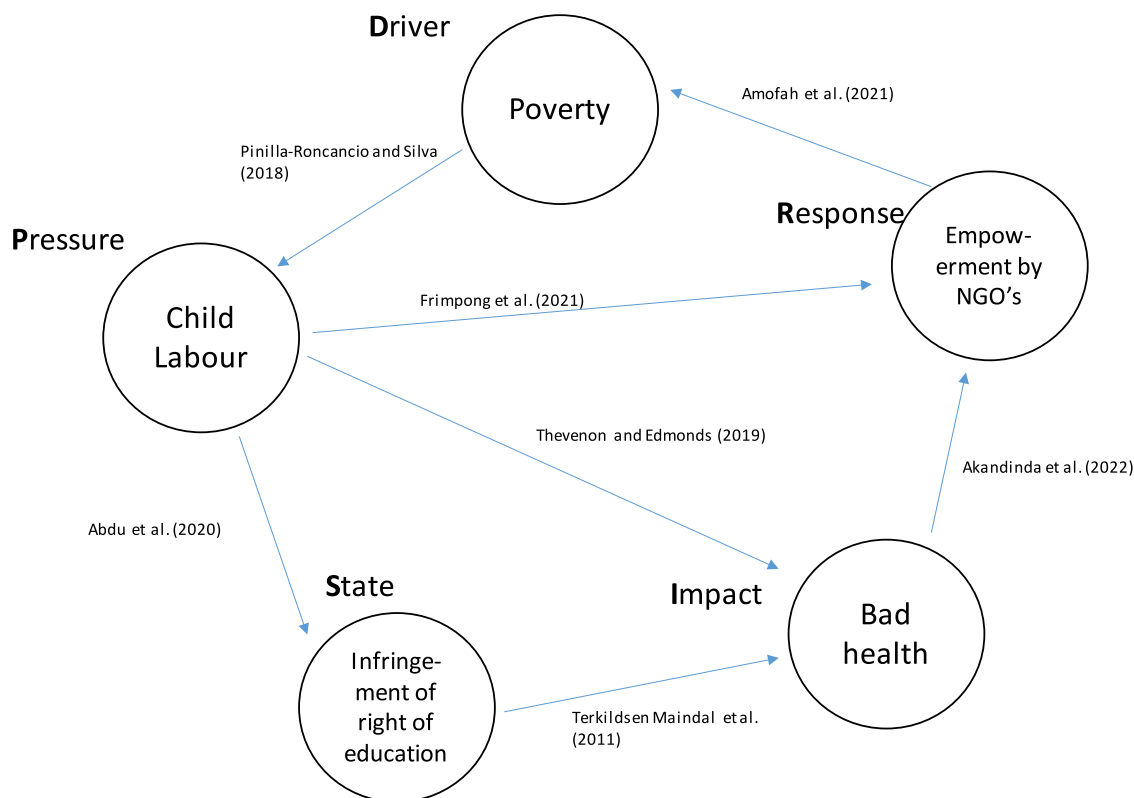


FIGURE 1 | A DPSIR system of child labour. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

considered a pressure variable, it generates direct responses from NGOs. They do not have to wait for the pressure to generate impact but are sufficiently aware of these impacts to act beforehand.

The other 'shortcut' in the model points to its added value. It has been entirely legitimate, of course, to show the impact of child labour on health, as done by Thevenon and Edmonds (2019). However, the DPSIR model indicates that this link is probably not direct. There are probably intermediate state variables, such as the negative impact of the right to education or damaged self-esteem, that lead to this measurable effect of child labour on health. Therefore, it can be shown that the DPSIR framework adds structure to the complex debate about the causes and effects of child labour.

6 | Conclusion

The DPSIR framework has, for the past several years, proven its value in structuring the nature of environmental problems. Why has its potential not been harnessed in the realms of human exploitation, overwork and other issues of social sustainability?

One factor is probably the relative neglect of social sustainability compared with the environmental dimension. Another limitation may be the clarity of the definitions. Many people can easily describe the 'state' of the environment, whereas more philosophical foundations may be needed to describe the 'state' of the social world with the same rigour.

It can also be taken for granted that DPSIR models have shortcomings and limitations. The literature criticising DPSIR models as oversimplistic has been cited above. This also applies to the realm of social sustainability. The model gains legitimacy from the fact that drivers often translate into pressures, pressures into states, and so on. However, there are always exceptions to these rules, and by applying DPSIR methodologies, the threat of overlooking such exceptions increases. This also applies to social issues as much as to environmental ones.

Both the attempts to reach a consensus definition and the case study of child labour have shown that the DPSIR model can be extended to the social pillar of sustainability. The distinction between the different stages of a problem, linked through identifiable causalities, has the potential to contribute to fruitful transitions of the social system. There is certainly some untapped potential to improve the understanding of social problems by using the DPSIR framework, and future research may also choose this route to identify smart strategies to tackle the grave social problems under which societies suffer.

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