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# Personal Carbon Trading—Lost in the Policy Primeval Soup?

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**Abstract:** The number of emission trading and carbon taxation schemes implemented has grown rapidly over the past decade. Together, they cover approximately 16% of global greenhouse gas (GHG) emissions. Although more than two-thirds of global GHG emissions are related to household consumption, approaches that directly target households, such as personal carbon trading (PCT), do not play a role in the fight against climate change. This is especially puzzling as measures taken so far are not sufficient to reach the 2 °C target. One clue to solving this puzzle comes from political science in the form of the multiple streams approach, which defines criteria that a policy proposal must meet to become part of the political agenda. Based on these criteria, this article conducts a systematic review on PCT to clarify why PCT does not play a role in the reduction of GHG emissions. The results show that there are three main problems with the PCT proposal. First, scholars often criticize the set-up costs as well as the running costs of such a system. Second, there is no clear consensus within the research community on public acceptance of PCT. Third, it is still unclear whether politicians are receptive to PCT or not.

**Keywords:** personal carbon trading; multiple streams approach; carbon pricing; PRISMA



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## 1. Introduction

The present decade is essential in the fight against global warming. According to the IPCC, the peak in annual greenhouse gas (GHG) emissions must be reached in the period between 2020 and 2030, so that the international community has a real chance of meeting the 1.5 °C target [1,2]. Although initial efforts to reduce GHG emissions have been made with the implementation of the Kyoto Protocol and the ratification of the Paris Agreement, the successes achieved so far remain sobering. In the period between 2000 and 2010, annual global GHG emissions increased by an average of 2.5 percent per year [1] (p. 46). Even though a lower average growth rate of 1.3 percent was recorded for the following years, the peak of annual GHG emissions does not seem to have been reached yet. For the year 2018, a renewed increase in the growth rate to 2.0 percent was registered [3] (p. 14). The international community must therefore drastically reduce global annual GHG emissions in the coming years in order not to miss the 1.5 °C target [4].

While there are many options for reducing greenhouse gases, in recent years carbon pricing has become not only a preferred option but a global norm in the fight against global warming [5]. As a result, the number of implemented pricing systems has increased rapidly. By December 2020, 60 carbon price initiatives were implemented, covering 16% of global greenhouse gas emissions [6]. The most common forms of carbon pricing are either carbon taxation or emission trading. Thirty-two of the implemented systems are carbon taxes and twenty-eight are emission trading schemes (ETS). However, in the shadow of these well-known pricing systems, many experimental systems have developed which can be subsumed under the label "personal carbon trading" (PCT). PCT transfers the idea of emissions trading to the level of private households. Each household receives an annual GHG budget in the form of GHG certificates. These certificates must be used for

GHG-intensive activities (such as air travel). Households that have used up their budget must buy certificates from households that have not used their budget [7]. Compared to a carbon tax or ETS, which indirectly affects households because producers pass on the additional cost of a tax or ETS to consumers [8] (pp. 70–72), [9] (p. 341), PCT addresses households directly through a personal GHG budget and thus has a different and new incentive structure (please note that both a carbon tax and an ETS can be implemented as downstream or upstream systems. While in a downstream system, fossil fuel consumers, i.e., GHG emitters, must pay the tax or purchase allowances, in an upstream system, fossil fuel (oil, gas, and coal) producers and importers must pay the tax or hold the required allowances [10]. However, under both schemes, there is a price increase for GHG-intensive products, which affects private households [8]. PCT is also characterized as a downstream system, but unlike an ETS, a PCT system (PCTS) is based at the household level rather than the corporate level). Many scientists agree that the incentive structure of PCT is superior to current systems when it comes to household emissions [11–15]. Nevertheless, so far, no PCT system has been introduced. This is particularly surprising against the background that, according to Hertwich and Peters [16], private households, with their consumption behavior, are responsible for about 72% of global greenhouse gas (GHG) emissions. Hence, this article addresses the following research question: *Why does PCT not play a role in the reduction of GHG emissions although carbon pricing in general has become increasingly important in recent years?*

To answer this question, I rely on the multiple streams framework (MSF), a theoretical framework highly popular in policy analysis [17]. The aim of the MSF is to answer the question of when a policy idea's time has come [18] (p. 1). In order to do this, the MSF divides the political system into three streams: the problem stream, the policy stream, and the political stream [18–20]. The advancement of a policy idea to the political agenda becomes likely when the three streams are "ripe", a policy window is open and a policy entrepreneur succeeds in coupling the three streams [18] (pp. 196–208), [19,20]. In this study, I focus on the policy stream which incorporates five "criteria of survival" (technical feasibility, financial feasibility, public acceptance, normative acceptance, and receptivity among decision-makers) that must be met by a policy idea to "survive" in the policy stream and to have a chance to enter the political agenda [20,21] (p. 21). The selection criteria incorporated in the MSF are a good starting point for a systematic literature review conducted on the basis of the systematic protocol of "Preferred Items for Systematic Review Recommendations" (PRISMA). The review provides an explanation for why PCT does not play an important role in the reduction of greenhouse gases by showing that PCT does not meet the criteria of financial feasibility as well as public acceptance.

## 2. Personal Carbon Trading—A Short Overview

The idea of PCT came up at the end of the 20th century with articles published by Fleming [22] and Hillman [23]. Both presented ideas in which private households would receive a personal GHG budget. While Hillman presents a system of personal carbon allowances (PCAs) that explicitly focuses on households, Fleming's idea of tradeable energy quotas (TEQs) also involves businesses and government organizations to create a comprehensive GHG market [7]. Those ideas formed the basis for serious policy proposals [24,25].

However, the detailed design of a PCT system (PCTS) is variable and depends on the scope, total number, and distribution of allowances, as well as the system for monitoring and trading. As with the implementation of an ETS, the scope of a PCTS must initially be defined. From a theoretical point of view, it seems desirable to cover all GHG emissions, but this is hardly feasible due to administrative constraints. Therefore, there are different proposals [26] (pp. 330–331). For example, the PCAs system only covers GHG emissions from household energy use and personal transportation, while Fleming's TEQs have a broader scope and attempt to cover GHG emissions from the entire economy by including the corporate level [7,26]. In this context, it is also necessary to clarify whether only $CO_2$ or all common GHG emissions should be included in the system. The next step is to

determine the total number of allowances and their distribution among private households. Since the environmental effectiveness of a PCTS depends on the correct determination and measurement of GHG emissions, it is necessary to establish an appropriate scheme for measuring and determining GHG emissions. This is especially true in the private household context [27–29]. There must also be a plan to reduce allowances over time. This plan is often based on national climate mitigation targets. The distribution of allowances to households is highly controversial and contains some normative issues [30–33]. The simplest solution seems to be an equal distribution to all residents. However, some groups might then be disadvantaged because of their circumstances. Therefore, there are ideas to increase the number of allowances for people with difficult living conditions (diseases, disabilities, etc.) [30] (p. 15). In addition, the number of allowances could also be linked to the climatic conditions of the place of residence, i.e., people living in colder areas would receive more allowances [30] (p. 15). The heart of any PCTS is a system for monitoring and trading allowances. Here, as well, there are different approaches [26,34]. The most popular idea seems to be a $CO_2$ debit card or app linked to a kind of bank account where individual allowances are stored [25,26,34,35]. Under such an approach, the government would transfer allowances to households on an annual or monthly basis. These allowances could be bought or sold through the exchange system or a similar platform. The great advantage of such a system is that the allowances are debited directly at the time of purchase. Thus, GHG-intensive products or services could only be consumed if a person holds the required number of allowances, making an additional penalty mechanism for non-compliance unnecessary. However, there are other ideas for monitoring and trading allowances, such as those based on compliance periods, as is the case with some ETSs [26] (pp. 330–331).

As shown, there are several ways to vary the design of a PCTS, hence it is not surprising that many ideas for budgeting household GHG emissions are circulating in the research community [36]. However, all PCT proposals have the following characteristics [37] (p. 354), [38,39]:

1. Each household or individual receives a limited GHG budget that allows GHG-intensive activities.
2. The individual budget consists of tradeable allowances. If a household exceeds its budget, it must buy additional allowances from someone who has a surplus of allowances. This leads to the introduction of a price for carbon.
3. The budget is reduced over time.
4. The scheme is mandatory, not voluntary.

Unlike other pricing instruments, PCT directly targets individuals and their GHG emissions. Given that approximately 72% of global GHG emissions are due to household consumption [16], PCT seems to be a promising way to reduce GHG emissions. Pointing out that individuals are the primary driver of emissions, some scholars argue that PCT trumps current pricing schemes because it provides a different incentive structure that directly targets households [12,14]. In addition, research has shown that there are some additional benefits of PCT, such as redistributive effects or the avoidance of carbon leakage [40,41].

Nevertheless, to my knowledge, there is no PCTS that has been implemented yet. This is particularly interesting as the number of carbon pricing initiatives has grown rapidly over the last two decades. The MSF provides us with criteria to analyze the reasons for this non-consideration of PCT in the fight against climate change.

## 3. The Multiple Streams Approach

First introduced by Kingdon [42], the MSF is a theoretical framework that has become increasingly popular in political science [43]. The original idea of the MSF is to explain why some policy ideas receive attention from policymakers and advance to the political agenda, while other policy ideas are ignored. The MSF assumes that the political system is organized anarchy, and is divided into three streams: the problem stream, the political stream, and the policy stream. If a policy window opens and a policy entrepreneur uses it

to couple the three "ripe" streams, a policy is likely to advance to the policy agenda and thus has good chances to actually be implemented [19,20].

The problem stream consists of all potential issues that can be considered a problem and become ripe when an issue is perceived as a problem. According to Kingdon [42] (p. 116), this could be the case if there is a "mismatch between the observed conditions and one's conception of an ideal state". Such a mismatch can be caused by changes in crucial indicators, such as the rise of temperature levels, or by focusing on events, such as heatwaves or wildfires [19] (p. 436). The political stream addresses the question of a policy is in line with the interests of policymakers, powerful organized interests, and public opinion (national mood). For the political stream, it is difficult to assess whether it is ready for coupling because it is much more procedural compared to the other streams and the indicators do not necessarily point in the same direction [20] (pp. 25–26). Empirical studies therefore often rely on the examination of the political-administrative system [44]. The policy stream contains the so-called "policy primeval soup" which consists of all policy proposals floating around somewhere in the political system. Not every proposal is likely to make it onto the policy agenda. Rather, the survival of a proposal depends on five selection criteria within the policy stream [18] (p. 131). If there is an acceptable policy proposal that meets the criteria of survival, the policy stream can be considered ripe.

Although the MSF is frequently used in policy research, policy scholars rarely use all elements of the MSF due to the complexity of the approach [17] (p. 912). While this is seen as a problem in parts of the MSF community, the flexibility of the MSF allows for the adaptation of the framework to the research question at hand. In the context of this systematic review, the policy stream is particularly relevant, as the rapid growth of carbon pricing systems suggests that the problem and the political stream are generally ripe in the case of carbon pricing. However, neither the problem stream nor the political stream can explain why some pricing instruments are considered, and others are not. While the problem stream is obviously ripe in the case of climate change, the political stream becomes crucial when it comes to the adoption of a policy that has reached the governmental agenda [19]. Thus, to explain why PCT has not even been seriously considered so far, we have to take a deeper look at the policy stream.

As mentioned earlier, at the heart of the policy stream is a pool of different policy ideas and proposals competing for political attention (the policy primeval soup). Through an evolutionary process, the proposals that meet the selection criteria prevail [20] (pp. 22–24). In this regard, policy experts which form the policy community play a crucial role, as they develop, discuss, and promote policy ideas [20] (p. 23). For a policy proposal to reach the political agenda it is thus necessary that the policy community supports the proposal. Within the MSA, this is the case if the proposal meets five selection criteria: technical feasibility, financial feasibility, public acceptability, normative acceptability, and receptivity among decision-makers [20] (p. 24), [45] (p. 33).

Technical feasibility addresses the question of whether a proposal is implementable based on the current state of technology, while the financial feasibility criterion addresses the question of whether the proposal is generally financeable but also whether its benefit-cost ratio is acceptable. Although a proposal may be both technically and financially feasible, it is unlikely to be seriously considered if the anticipated public resistance to the policy proposal is overwhelming. Therefore, public acceptance is another criterion for survival. Related to public acceptance is receptivity among decision-makers. Since politicians are first and foremost vote-seekers, these two criteria are generally closely correlated [19] (pp. 439–440). The last criterion is the normative acceptance within the policy community. This criterion describes the policy community's general acceptance of a policy proposal. For example, a Keynesian policy proposal might meet all of the other selection criteria, but it will still be neglected in a monetarist policy community.

Based on these theoretical considerations, I argue that PCT has thus far not been seriously considered because it fails to meet one or more of the outlined selection criteria.

To test this hypothesis, I conducted a systematic literature review of peer-reviewed articles from the policy community.

## 4. Materials and Methods

Following Kundu et al. [46] and Bandau and Ahrens [47], I am conducting a systematic literature review with PRISMA. Introduced by Moher et al. [48], PRISMA aims to harmonize and ensure the quality of literature reviews. For this purpose, PRISMA provides a 27-part checklist and a four-phase flow diagram [49]. Since PRISMA was originally developed for the health care sector, "some modifications of the checklist items or flow diagram will be necessary in particular circumstances" [48] (p. 3). With a systematic literature review on adaptation to climate change and the resilience of coastal agriculture in Bangladesh, Kundu et al. [46] provide a good example for the use of PRISMA in empirical research. Therefore, this study relies strongly on their approach.

In a first step, it is necessary to clarify the overall topic of the article as well as the research question, followed by the identification of the relevant keywords (see Table 1). Afterward I define inclusion and exclusion criteria. Since PCT was originally developed and widely discussed in the UK, I only select articles written in English. Moreover, English is the main language used in academia [50]. To ensure the quality of the selected articles, only peer-reviewed articles will be considered for this review [46,47].

**Table 1.** Summary review protocol.

| Review Steps | Information |
| --- | --- |
| Title | Personal Carbon Trading—Lost in the policy primeval soup? |
| Research question | Why does PCT not play a role in the reduction of GHG emissions although carbon pricing in general has become increasingly important in recent years?<br>Which criteria of survival are not met by the PCT approach? |
| Keyword search | Personal Carbon Trading, Personal Carbon Allowances, Personal Carbon Scheme, Tradeable Energy Quotas |
| Search protocol | "Personal Carbon Trading" OR "Personal Carbon Allowances" OR "Personal Carbon Scheme" OR "Tradeable Energy Quotas" |
| Search strategy and initial selection | Title, keywords, abstracts |
| Database | Web of Science, Science Direct |
| Inclusion and exclusion criteria | Inclusion: Articles that address one of the five criteria of survival (technical feasibility, financial feasibility, public acceptance, normative acceptance, receptivity among decision-makers), articles written in English, peer-reviewed papers.<br>Exclusion: Non-English and non-peer-reviewed articles |

The "Web of Science" and "Science Direct" serve as databases. I use these two web search engines because they contain two of the largest multidisciplinary and trustworthy scientific databases. Since the original idea of PCT was developed by Fleming and Hillman in 1997 and 1998 respectively, the time period chosen for the search is between 1997 and 2020.

The initial search via the "Web of Science" and "Science Direct" yields 222 potentially relevant articles. To select articles for systematic review, a four-step process is followed [46,48]. A summary is given in Figure 1. In the first step (identification), the duplicate papers, as well as the papers not written in English and the non-peer-reviewed papers, are excluded. After this step, 154 articles remain. For the screening step, I rely on the title, the keywords, and the abstract to identify papers that have a focus on at least one of the five survival criteria related to PCT. While 31 papers have such a focus, 123 are excluded from the review. For the remaining 31 papers, eligibility is assessed by studying their full

text. A standardized framework is used to collect information about the bibliography and the methods (qualitative or quantitative) as well as the survival criteria addressed in an article (see Appendix A.1. Framework for Data Collection). To be relevant to this review, an article must address at least one of the five survival criteria. The evaluation of the criteria must be part of the research, which excludes articles that mention criteria only in passing and do not investigate them systematically. The eligibility step excludes 13 articles because they do not make any statements about PCT with regard to the survival criteria. The final review thus contains 18 articles, however, following Kundu et al. [46] (p. 3) an additional snowball procedure is used to find articles that may be overlooked in common databases. The snowball search is performed during the full-text review of the 31 articles that reach the third stage. I consider the cited articles that explicitly refer to one or more survival criteria. The articles identified by the snowball search are reviewed again. Six more articles can be identified, so 24 articles are used for the analysis (The list of articles used for the review can be found in Appendix A see Table A1. List of articles used).

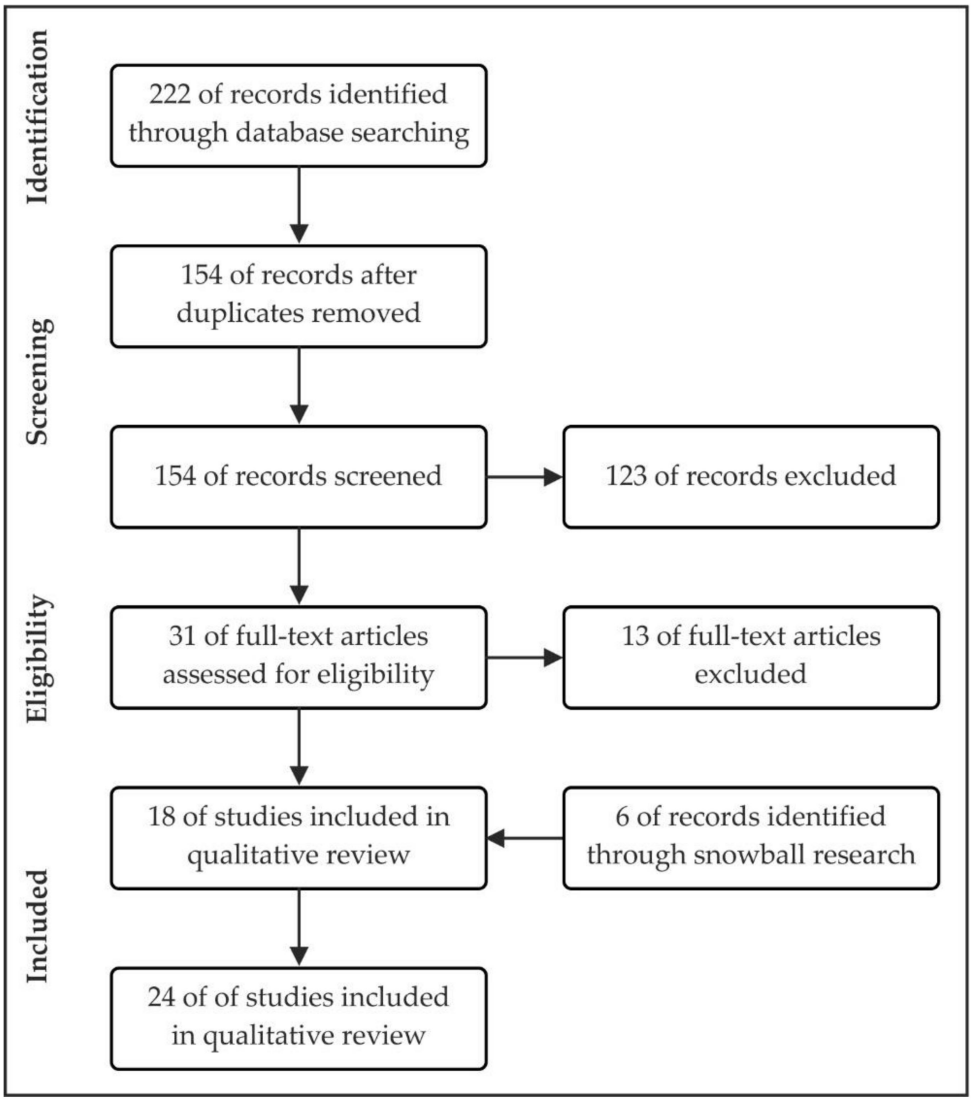


**Figure 1.** Flow diagram (according to Moher et al. [48]).

The objective of this review is to indicate which of the survival criteria are met or not met by the PCT approach. Therefore, it is necessary to establish rules on how to interpret the findings of an article. The assessment of the criteria is evaluated as follows:

1. Negative: The author expresses concern about the introduction of a PCT because of the criterion mentioned or sees the criterion as a general problem. Likewise, a criterion is considered negative if it is seen as disadvantageous compared to other policy alternatives.
2. Neutral: The author makes differentiated or contradictory comments on a criterion, so that no clear assignment to the negative or positive category can be made.
3. Positive: The author comments positively on a criterion or sees it as an advantage over other policy alternatives. A criterion is also considered positive if the author explicitly expresses no reservations about the criterion and its impact on implementation.

The evaluation of normative acceptance follows a slightly different scheme (in Appendix A.2. an overview can be found). After describing the method and data, I will now present and discuss the results of the review in the following chapters.

## 5. Results

As mentioned above, this review contains 24 articles. However, not every article addresses each survival criterion. While 14 articles provide assessments of technical feasibility, 14 papers address financial feasibility, and 16 deal with public acceptance (see Table 2). This is consistent with the observation of Fawcett [38] who mentioned that most research is done on public acceptance of PCT. The scientific community rarely addresses two of the survival criteria. First, normative acceptance, on which I could find only one article, and second, receptivity among decision-makers, which is addressed by three articles. Therefore, this review can hardly make reliable statements about these two criteria but shows that there is a research gap that needs to be filled. This is of particular interest to policy scholars, but also to practitioners (e.g., NGOs) trying to push PCT forward. While research interest in PCT has increased in recent years (even outside the UK), systematic research on implementation (and barriers) is still at an early stage.

**Table 2.** Overview of survival criteria and assessment.

| Survival Criteria | Review Assessment [1] | Number of Reviewed Articles | Article Assessments |
|---|---|---|---|
| Technical Feasibility | ✓ | 14 | Positive: 79%<br>Neutral: 0%<br>Negative: 21% |
| Financial Feasibility | X | 14 | Positive: 29%<br>Neutral: 0%<br>Negative: 71% |
| Public Acceptance | - | 16 | Positive: 50%<br>Neutral: 19%<br>Negative: 31% |
| Normative Acceptance | - | 24 | Positive: 38%<br>Neutral: 42%<br>Negative: 21% |
| Receptivity among Decision-Makers | ? | 3 | Positive: 33%<br>Negative: 67% |

[1] "✓" indicates that PCT meets a criterion, "X" indicates that PCT does not meet a criterion, "-" indicates that clear assessment is not possible, and "?" indicates that there is not enough empirical data for evaluation.

In addition to these findings, the review indicates that the majority of research on PCT is qualitative. Of the 24 articles reviewed, 16 use qualitative methods, 5 use quantitative methods, and 3 conducted a mixed-method design. It is worth noting that the methods used differ depending on the survival criterion; while researchers often rely on qualitative case studies or reviews for technical and financial feasibility, statistical models are more common for the public acceptance criteria (I return to this later). It should also be noted that many of the studies are conducted in the context of the United Kingdom. This is not surprising, as PCT has only been seriously discussed in the UK so far [26,38].

### *5.1. Technical Feasibility*

As Table 2 shows, the assessment of technical feasibility (the technical feasibility criterion refers only to technical barriers to implementation. Legal or moral considerations are not taken into account) seems to be quite clear, 79% of the reviewed articles do not see technical aspects as a general problem for the implementation of a (PCTS). Often, researchers conclude that there are generally no technological barriers to the implementation of PCT for example [7] (p. 6871), [12,51]. However, most of these articles use qualitative methods, particularly literature reviews (8 from 14 articles). It is noticeable that the studies often refer to a central study by the Department for Environment, Food and Rural Affairs (DEFRA) of the United Kingdom. In 2006, Secretary of State David Miliband began promoting the idea of personal carbon allowances. As a result, DEFRA was commissioned to conduct a pre-feasibility study on PCT [12,38]. This comprehensive study was completed in 2008 and addressed a variety of issues related to PCT, including: equity and distributional impacts, social acceptability, economic and technical feasibility as well as effectiveness. [12]. While the DEFRA overall concludes that PCT is a policy "ahead of its time", it also mentions that "no insurmountable technical barriers were identified to the introduction of a personal carbon trading scheme [ . . . ]" [52] (p. 3). When it comes to assessing the technical feasibility of PCT, many authors refer to DEFRA's opinion. An exception is the article by Al-Guthmy and Yan [53], which uses road transport in Kenya as an example to show how a PCTS could be integrated into existing infrastructure, highlighting potential opportunities and barriers. Overall, they conclude that both infrastructure and cost are not significant barriers to implementing a PCTS [53] (p. 1152). To be clear, the research is focused on Kenya and thus it is difficult to generalize the result. Nevertheless, the authors mentioned, "Even though our work focused on Kenyan road transport, it provides a reasonable starting point for consideration by other developing countries and would benefit from complementary research in other major sectors, such as agriculture (for example through policies such as Payment for Environmental Services)" [53] (p. 1156).

However, there are also studies that are more critical. For example, Brohé [54] points out that it is technically difficult to capture transboundary emissions when a PCTS is implemented nationally or regionally. This seems especially important for border regions in the EU where people are able to bypass a PCTS by buying products in the neighboring countries that do not have a PCTS. Moreover, Guzman and Clapp [55], who conducted interviews with experts in various fields (e.g., financial services, climate policy, clean technology) on carbon pricing instruments, show that there are concerns about the time needed to develop a technically feasible solution.

To sum up, while there are some critical voices about technical feasibility, the majority of researchers do not see technical issues as the main problem for implementing a PCTS. However, one point that is often mentioned in connection with technical feasibility is the administrative complexity and associated financial costs of a PCTS. This seems to be a major concern of many researchers, as I show in the next chapter.

### *5.2. Financial Feasibility*

The survival criterion "financial feasibility" is mentioned by 14 articles. A total of 71% of them express concerns about the financial feasibility of a PCTS (see Table 2). The main argument for this is the administrative complexity of PCT. For example, Lockwood [56] (p. 458) points out "probably the biggest challenge for PCT in practice is its transaction costs, which are likely to be large because of an irreducible core of administrative needs". However, most of the reviewed articles are identical to those for technical feasibility, meaning that researchers often address both criteria within the same article. However, this also means that most articles use qualitative literature reviews and again rely heavily on DEFRA's [52] assessment. The DEFRA [52] (p. 4) concludes that: "[ . . . ] the costs identified are very significant. Estimates of the likely set-up costs of the type of scheme explored ranged between £700 million and £2 billion, and the running costs £1–2 billion per annum". While some of the researchers question the level of costs estimated by DEFRA [7,34], most

agree that the costs of operating a PCTS are much higher than for alternative schemes such as a carbon tax or an ETS. Still, there are other opinions, Al-Guthmy and Yan [53] do not see financial costs as a major problem for operating a PCTS in Kenya. However, as mentioned above, these results are hard to generalize. Furthermore, Eyre [34] (p. 443) agrees that the costs for a PCTS are higher than for alternative systems, but does not see financial arguments as the major barrier for the implementation:

> *"[ . . . ] The former are very large costs, but still small compared with the losses of welfare predicted if climate change is unabated—several percentage points of GDP (see, e.g., Stern, 2006). This implies that the critical test for PCT is whether its effectiveness is significantly higher than alternative policy designs rather than the size of administration and transaction costs".*

In summary, many of the articles reviewed argue that the financial costs of a PCTS are one of the biggest barriers to implementation. Thus, this could be at least one reason why PCT has not gained success in the policy stream so far.

### *5.3. Public Acceptance*

Public acceptance is one of the most popular research areas when it comes to PCT. Therefore, it is also the criterion addressed by the largest number of articles. In addition, the methodological variance is much higher than for the other criteria. While about 38% of the articles use surveys or interviews, some use mixed-methods approaches (19%) and others conduct literature reviews (43%). In contrast to the previous survival criteria, there is no clear opinion on the public acceptance of PCT. As Table 2 shows, eight of the 16 reviewed articles do not see public acceptance as a barrier to the adoption of a PCTS or even argue that public acceptance is an advantage of PCT compared to other pricing systems. However, three articles address the point of public acceptance but do not provide a clear assessment, and at least five articles show concerns about PCT and its public acceptance.

During the review, it became increasingly clear that the assessment of public acceptance depends very much on the research design and the country in which a study was conducted. For example, with only one exception, every article that does not see public acceptance as a barrier to adoption either relies on studies conducted in the United Kingdom (in the case of literature reviews) or uses a sample of UK citizens (in the case of survey studies). In contrast, the articles that have concerns about PCT have been conducted primarily outside the United Kingdom. For example, two articles were based on Swedish samples showing that the Swedish population favors a carbon tax over a PCT [57,58]. As the authors of both studies noted, the results may be biased by the fact that Sweden already introduced a carbon tax in 1991 and people are more willing to rely on instruments that have already been implemented. Of the studies with a negative assessment, only the study by Parag and Eyre [37] refers to the UK. In addition, there have been some studies that do not make a clear statement about public acceptance. These articles often use literature reviews to show results from different studies. For example, Starkey [51] who reviewed five studies on PCT acceptance, showed that there is no clear evidence on public acceptance of PCT.

Hence, with respect to public acceptance, this review cannot provide a clear evaluation, but it shows that the assessment of public acceptance strongly depends on the research design. In particular, the Swedish cases show that it is necessary to take national circumstances, such as already implemented climate mitigation measures, into account. Therefore, it seems necessary to evaluate public acceptance in the context of the country where PCT should be implemented.

### *5.4. Normative Acceptance*

Normative acceptance has been poorly addressed in the research community. Of the articles reviewed, only Parag and Eyre [37] deal with this survival criterion by explicitly examining the barriers to personal carbon trading in the political arena. In their study, they look at the so-called advocacy coalition (a concept that is much like the policy community

in the MSA). They identify two advocacy coalitions with different attitudes toward climate change. The first coalition wants to address climate change through behavioral change, while the other focuses on technological innovation. For the behavioral change supporters, PCT seems more conceivable than for supporters of a technological solution [37] (p. 364). Looking at these two groups, Parag and Eyre [37] (p. 364) conclude: "judging by the current instrument mix, the advocacy coalitions of technology supporters and market solutions, although not overwhelmingly predominant, are currently stronger. For them, PCT does not address the key problem". Based on their findings, normative acceptance within the policy community does not appear to be very strong. However, the study focuses on the United Kingdom and is therefore not generalizable.

In the absence of other studies on this survival criterion, I decided to look for general statements about PCT within the reviewed articles. This approach gives an indication of the normative acceptance of researchers studying PCT. It should be noted that there could be a bias, as people tend to engage with topics they are convinced about. Therefore, these researchers may be more positive about PCT than the general research and policy community. As Table 2 shows, 38% of authors feel positive about PCT, as evidenced by statements such as: "The conclusion is that PCT is a promising and timely policy idea" [7] (p. 6868) or "Consequently, as the highly ambitious commitment deadlines made in the Paris Agreement draw closer, policy instruments such as PCT are becoming more worthy of a thorough exploration and will become even more relevant on a global scale" [53] (p. 1156). To the same extent, there are also researchers who have a more differentiated opinion or do not make general statements about PCT. At least 21% of the authors have a critical perspective on PCT. For example, Starkey [51] (p. 28) states: "However, to date, proponents [of PCT] have not, at least in the view of this author, made a compelling case for the implementation of PCT".

Since these scholars should have, in general, a more positive view of PCT, it appears that PCT does not have a majority of supporters throughout the whole research community, making it difficult to gain acceptance in the policy community.

### *5.5. Receptivity among Decision-Makers*

Similar to the normative acceptability criterion, receptivity among decision-makers has not yet been systematically studied. Three articles address this criterion. First and foremost is the article by Parag and Eyre (2010). In their article they link the acceptance of politicians to the engagement of prominent social groups, arguing "[ . . . ] that PCT would be perceived by politicians as politically acceptable if it were put on the agenda by prominent social groups that have no opportunistic interest in the idea [ . . . ]" [37] (p. 358). Such groups may include NGOs, think tanks, or academic institutions. The two authors do not see strong support from such social groups and conclude that there will not be strong support for PCT from politicians either. The second study by Fawcett and Parag [26] comes to a similar assessment and draws the conclusion that: "Critics of PCT could fairly argue [ . . . ] that it is not currently popular politically and that PCT has no major interest groups lobbying in its favour" [26] (p. 334). In examining the adoption of a PCTS for California, however, Niemeier et al. [59] (p. 3446) are somewhat more positive, arguing that the political feasibility, and thus popularity, of a policy proposal, depends largely on the cost, fairness, and distributional effects of the policy. They conclude that the PCTS they propose could be more efficient, fairer, and more progressive than other systems and should therefore be politically more feasible.

Nevertheless, this review cannot make any assumptions about the political acceptability of PCT due to the lack of empirical evidence, but it clearly shows that there is a large research gap that should be addressed through further research.

## 6. Discussion

Before interpreting the results, it should be noted that this review does not include country-specific results published in country-specific, non-English journals. Therefore, it

cannot be ruled out that some of the identified problems of PCT may occur to a greater or lesser extent in some countries. Country-specific characteristics could make PCTS more or less feasible [60]. These could be technical limitations, which can be an issue for the least developed and developing countries, but also cultural aspects of the general opinion on climate change [61]. In addition, the type of regime (democracy or autocracy) can have an impact on a country's ability to take climate mitigation action [62]. However, this review can only provide a general overview of the problems of PCT.

Apart from this limitation, the review shows that PCT is indeed a political proposal that seems to be stuck in the policy stream. Many scientists point out that the administrative complexity and associated financial costs of a PCTS are the main obstacles to implementation. Estimates range from ten to forty times higher annual running costs compared to upstream systems such as carbon taxation and emission trading [7] (p. 6871), [34] (p. 442). However, new digital approaches with technologies such as blockchain, apps, etc. could be a way to at least reduce the running costs of such a system [63,64]. This is particularly interesting in light of the fact that the COVID-19 pandemic is a driver for increasing digitalization [65,66]. So, it could be that the administrative burden, and thus the costs, will drop sharply as governments begin to digitize citizen data. A further issue is public acceptance of a PCTS. Although many researchers do not see public acceptance as a major problem or even see it as an advantage of PCT over carbon taxation and emission trading, there are an almost equal number of researchers who doubt that PCT will be supported by the majority of the population. Therefore, policymakers are dealing with a divided research community, which is not helpful for implementation. This is particularly critical because personal acceptance is linked to the receptivity of decision-makers. As Herweg et al. [19] point out, politicians are vote- and office-seekers and therefore sensitive to public opinion, particularly in the case of redistributive policies such as PCT [67] (p. 299). Public acceptance is thus also an indication of receptivity among decision-makers, for which I could find only three studies. However, as mentioned earlier, the research design, as well as the country in which a study is conducted, seems to be particularly important for the criterion of public acceptance. Therefore, practitioners who wish to advance a national PCT should consider national circumstances and their effects on public opinion. The research community itself is unclear about PCT, as evidenced by the criteria for normative acceptance. While there are some researchers who really push the idea of PCT, others are critical. The results suggest that there is not an overwhelming majority within the policy community that shows acceptance for PCT.

In general, there is less research on PCT compared to other pricing systems like carbon taxation and emission trading. This could be an additional point why PCT has not been implemented to date. Research is particularly needed on normative acceptance and the receptiveness of decision-makers. In summary, the results of the review suggest that the policy stream is not "ripe", which may be one reason why PCT has not played a role in reducing GHG emissions to date.

## 7. Conclusions

The aim of this study was to conduct a policy evaluation on PCT using the survival criteria of the MSF approach. To do this, I conducted a systematic literature review according to the PRISMA guidelines. The results of the review show that the PCT proposal is indeed stuck in the policy stream. The main reasons for this seem to be the financial costs of a PCT and the disagreement of the research community about the criterion of public acceptance. As mentioned above, public acceptance seems to be particularly important for a radically new idea such as PCT, as it also influences the receptiveness of decision-makers. Furthermore, the limited research on PCT could be another obstacle. PCT, therefore, does not seem to reach the political agenda in the near future, but this does not mean that it is impossible in the long term. Nevertheless, practitioners and NGOs could also do something to push PCT forward. Based on the results of this review, I have the following suggestions. First, it is necessary to develop a specific PCT proposal for the implementation

area that considers the unique characteristics of this area. Second, I propose working with experts in the field of carbon pricing to develop the PCT proposal and gain acceptance from the research community. Third, it must be shown that the majority of residents support the idea of the PCT, or at least that there is no major opposition to it. This is especially important to gain the support of politicians. One way to achieve this public support could be to introduce a voluntary pilot system. Fourth, it must be demonstrated that the costs of the PCTS are not disproportionately higher than for other pricing systems, or at least that the effectiveness of the PCT justifies the higher implementation and operating costs.

In general, the introduction of a PCTS will only be possible if many researchers, practitioners, and politicians support the idea. This could be the case, especially in pioneer countries. If we see implementation in a frontrunner country, it is possible that we will see a similar evolution as in the case of carbon taxation, which was first introduced by the Nordic pioneers (such as Finland, Norway, Denmark, and Sweden) before becoming a global norm to combat climate change.

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## Appendix A

*Appendix A.1. Framework for Data Collection*

1. Bibliographic information
2. Does the paper address any of the five criteria and if so which ones? Technical Feasibility Financial Feasibility Public Acceptance Normative Acceptance Receptivity among Decision-Makers
3. Which research methods are used and to which methodological category can they be assigned (qualitative or quantitative)?
4. Which assessments are made regarding the criteria mentioned (negative, positive, neutral)?
5. Can the assessments made be generalized or do they relate only to a particular object of study?
6. Are there any general comments on PCT (positive or negative)?
7. Other things worth mentioning?

**Table A1.** List of articles used.

| Nr. | Bibliographic Information |
|---|---|
| 1 | Al-Guthmy, F.M.O.; Yan, W. Mind the gap: personal carbon trading for road transport in Kenya. *Climate Policy* **2020**, *20*, 1141–1160. |
| 2 | Bristow, A.L.; Wardman, M.; Zanni, A.M.; Chintakayala, P.K. Public acceptability of personal carbon trading and carbon tax. *Ecological Economics* **2010**, *69*, 1824–1837. |
| 3 | Brohé, A. Personal carbon trading in the context of the EU Emissions Trading Scheme. *Climate Policy* **2010**, *10*, 462–476. |
| 4 | Eyre, N. Policing carbon: design and enforcement options for personal carbon trading. *Climate Policy* **2010**, *10*, 432–446. |

**Table A1.** *Cont.*

| Nr. | Bibliographic Information |
|---|---|
| 5 | Fawcett, T. Carbon Rationing and Personal Energy Use. *Energy & Environment* **2004**, *15*, 1067–1083. |
| 6 | Fawcett, T. Personal carbon trading: A policy ahead of its time? *Energy Policy* **2010**, *38*, 6868–6876. |
| 7 | Fawcett, T. Personal carbon trading: is now the right time? *Carbon Management* **2012**, *3*, 283–291. |
| 8 | Fawcett, T.; Parag, Y. An introduction to personal carbon trading. *Climate Policy* **2010**, *10*, 329–338. |
| 9 | Fleming, D. Tradable quotas: using information technology to cap national carbon emissions. *Eur. Env.* **1997**, *7*, 139–148. |
| 10 | Guzman, L.I.; Clapp, A. Applying personal carbon trading: a proposed 'Carbon, Health and Savings System' for British Columbia, Canada. *Climate Policy* **2017**, *17*, 616–633. |
| 11 | Harwatt, H.; Tight, M.; Bristow, A.L.; Gühnemann, A. Personal carbon trading and fuel price increases in the transport sector: An exploratory study of public response in the UK. *European transport: international journal of transport economics, engineering and law* **2011**, *16*, 47–70. |
| 12 | Hobbs, B.F.; Bushnell, J.; Wolak, F.A. Upstream vs. downstream $CO_2$ trading: A comparison for the electricity context. *Energy Policy* **2010**, *38*, 3632–3643. |
| 13 | Hou, F.; Ma, J.; Shabbir, M.; Fu, Y. The Social Acceptability of Personal Carbon Trading in China. *Public Policy and Administration Research* **2014**, *4*, 39–47. |
| 14 | Howell, R.A. Living with a carbon allowance: The experiences of Carbon Rationing Action Groups and implications for policy. *Energy Policy* **2012**, *41*, 250–258. |
| 15 | Jagers, S.C.; Löfgren, Å.S.A.; Stripple, J. Attitudes to personal carbon allowances: political trust, fairness and ideology. *Climate Policy* **2010**, *10*, 410–431. |
| 16 | Larsson, J.; Matti, S.; Nässén, J. Public support for aviation policy measures in Sweden. *Climate Policy* **2020**, *20*, 1305–1321. |
| 17 | Lockwood, M. The economics of personal carbon trading. *Climate Policy* **2010**, *10*, 447–461. |
| 18 | Niemeier, D.; Gould, G.; Karner, A.; Hixson, M.; Bachmann, B.; Okma, C.; Lang, Z.; Heres Del Valle, D. Rethinking downstream regulation: California's opportunity to engage households in reducing greenhouse gases. *Energy Policy* **2008**, *36*, 3436–3447. |
| 19 | Parag, Y.; Eyre, N. Barriers to personal carbon trading in the policy arena. *Climate Policy* **2010**, *10*, 353–368. |
| 20 | Parag, Y.; Strickland, D. Personal Carbon Trading: A Radical Policy Option for Reducing Emissions from the Domestic Sector. *Environment: Science and Policy for Sustainable Development* **2010**, *53*, 29–37. |
| 21 | Starkey, R. Personal carbon trading: A critical survey Part 2: Efficiency and effectiveness. *Ecological Economics* **2012**, *73*, 19–28. |
| 22 | Wadud, Z. Personal tradable carbon permits for road transport: Why, why not and who wins? *Transportation Research Part A: Policy and Practice* **2011**, *45*, 1052–1065. |
| 23 | Wallace, A.A.; Irvine, K.N.; Wright, A.J.; Fleming, P.D. Public attitudes to personal carbon allowances: findings from a mixed-method study. *Climate Policy* **2010**, *10*, 385–409. |
| 24 | Xie, Q.; Wu, J.; Shabbir, M.; Fu, Y. Public Acceptability of Personal Carbon Trading in China: an Empirical Research. *Journal of Energy Technologies and Policy*, *12*. |

*Appendix A.2. Evaluation Scheme Normative Acceptance*

1. Negative: An author makes an explicitly negative statement about PCT or its introduction.
2. Neutral: An author takes a differentiated view of PCT or makes no further statements beyond the research interest.
3. Positive: An author makes an explicitly positive statement about PCT (e.g., by highlighting benefits beyond the actual research interest) or its introduction.

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