

# Assessing Government Design Practices from a Human-Centered Perspective: Case Study of an Improved Cookstoves Program in Colombia

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## ABSTRACT

Governments and non-governmental organizations worldwide are promoting the transition to improved cookstoves (ICS), which aim to reduce household air pollution and decrease the use of biomass. This article follows a case-study approach to characterize and assess the design practices applied in a Colombian government-led program to foster the transition to ICS in rural households between 2010-2018 in the department of Nariño. Data was collected from direct observation, 23 semi-structured interviews (with program beneficiaries, civil servants, and external stakeholders) and documentary evidence. We assessed the degree to which the program's formulation, implementation, and evaluation considered the beneficiaries' specific needs, values, contexts and human experience. We found that the government program design followed a top-down approach focused on a single design principle, efficiency. Moreover, the government's design methods did not appear to sufficiently involve its potential beneficiaries or consider their actual human experiences and realities. We argue that if the government had applied a more human-centered design approach, it could have enhanced the integration of the socio-cultural backgrounds of the program's beneficiaries. Overall, the results of this study underscore the importance of integrating human-centered design approaches to identify new paths to improve governments' responsiveness and effectiveness.

**Keywords:** Government program design; human-centered design; design practices; design thinking; policy processes; household air pollution; energy transition; improved cookstoves; Colombia.

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## Analizando las prácticas de diseño gubernamentales desde una perspectiva centrada en las personas: Caso de estudio sobre un programa de estufas mejoradas en Colombia

### RESUMEN

Gobiernos y organizaciones no gubernamentales alrededor del mundo están promoviendo la transición a estufas mejoradas con el objetivo de reducir la contaminación del aire doméstico y disminuir el uso de biomasa. Este artículo desarrolla un caso de estudio para caracterizar y analizar las prácticas de diseño aplicadas en un programa estatal que buscaba promover la transición a estufas mejoradas en hogares rurales del departamento de Nariño, Colombia, entre 2010 y 2018. La información fue recolectada a partir de observación directa, 23 entrevistas semi-estructuradas (con beneficiarios del programa, funcionarios públicos, otros actores externos involucrados), y evidencia documental. Examinamos el grado en el que la formulación, implementación y evaluación del programa tuvo en cuenta las necesidades, valores y contextos de los beneficiarios, así como la experiencia humana. Encontramos que el diseño del programa estatal siguió una aproximación desde-arriba-abajo, que se enfocó en un solo principio de diseño, la eficiencia. Además, los métodos de diseño que la entidad pública utilizó no parecen haber involucrado suficientemente a los potenciales beneficiarios ni tampoco a sus experiencias humanas y realidades. Argumentamos que, si la entidad pública hubiera utilizado un enfoque de diseño centrado en las personas, podría haber mejorado la integración de los contextos socioculturales de los beneficiarios del programa. Los resultados de este estudio subrayan la importancia de integrar enfoques de diseño centrados en las personas para identificar nuevos caminos que mejoren la receptividad y efectividad de los gobiernos.

**Palabras clave:** diseño de programas de Gobierno; diseño centrado en las personas; prácticas de diseño; pensamiento de diseño; procesos de política pública; contaminación del aire doméstico; transición energética; estufas mejoradas; Colombia.

## Analizando as práticas de desenho do governo a partir de uma perspectiva centrada nas pessoas: estudo de caso de um programa de fogões melhorados na Colômbia

### RESUMO

Governos e organizações não governamentais em todo o mundo estão promovendo a transição para fogões melhorados com o objetivo de reduzir a poluição do ar doméstico e diminuir o uso de biomassa. Este artigo desenvolve um estudo de caso para caracterizar e analisar as práticas de desenho aplicadas em um programa estadual que buscou promover a transição para fogões melhorados em domicílios rurais no departamento de Nariño, Colômbia, entre 2010 e 2018. A informação foi coletada a partir de observação direta, 23 entrevistas semi-estruturadas (com beneficiários do programa, funcionários públicos, outras partes interessadas envolvidas) e provas documentais. Examinamos até que ponto a formulação, implementação e avaliação do programa levaram em conta as necessidades, valores e

contextos dos beneficiários, bem como a experiência humana. Descobrimos que a concepção do programa estadual seguiu uma abordagem de cima para baixo, que se concentrou em um único princípio de desenho, a eficiência. Além disso, os métodos de desenho que a entidade pública utilizou não parecem ter envolvido suficientemente os potenciais beneficiários ou suas experiências e realidades humanas. Argumentamos que se o ente público tivesse utilizado uma abordagem de desenho centrada nas pessoas, poderia ter melhorado a integração dos contextos socioculturais dos beneficiários do programa. No geral, os resultados deste estudo ressaltam a importância de integrar abordagens de desenho centradas nas pessoas para identificar novos caminhos para melhorar a capacidade de resposta e eficácia do governo.

**Palavras-chave:** desenho de programa de governo; desenho centrado nas pessoas; práticas de desenho; pensamento de desenho; processos de políticas públicas; poluição do ar doméstico; transição energética; fogões melhorados; Colômbia.

## Introduction<sup>1</sup>

Household air pollution (HAP) from biomass fuels in inefficient cookstoves negatively affects the health of 2.6 billion people —especially women and children under five years old in rural areas in developing countries— and has an adverse incidence on climate change —e.g., via deforestation— (World Health Organization [WHO], 2014, 2016, 2021a, 2021b).<sup>2</sup> In fact, “air pollution is now recognized as the single biggest environmental threat to human health, along with climate change” (WHO, 2021b). In Colombia, according to the latest public data from the 2018 Quality-of-Life Survey, 46% of rural households use biomass for cooking their food; in the department of Nariño, this percentage reaches almost 49% (DANE, 2019).

Governments and non-governmental organizations (NGO) worldwide are promoting the transition to new cooking technologies that prevent HAP, namely energy-efficient and fuel-saving cookstoves. In Latin America, programs promoting the adoption of improved cookstoves (ICS)<sup>3</sup> have been implemented in Andean and Central American countries to reduce health and environmental problems caused by cooking with ‘dirty’ fuels (Ravillard et al., 2020).

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- 1 The authors thank the attendants of the seminars and conferences organized by Universidad del Rosario, Universidad Adolfo Ibáñez, International Research Society for Public Management (IRSPM), *Red Interamericana de Educación en Administración Pública* (INPAE), the 2023 Conference on Policy Process Research and the 2023 International Conference on Public Policy Design for their useful queries and feedback. We also thank professors Sabine Junginger and Sarah Ellen Wagner for their valuable reflections and suggestions.
  - 2 According to WHO’s estimates, about 45% of all pneumonia deaths in children under five years old are caused by exposure to household air pollution (WHO, 2021a).
  - 3 We understand improved cookstoves as “those that more completely combust fuels, simultaneously requiring less fuel and producing fewer emissions” (Lindgren, 2020).

This article follows a case-study approach to characterize and assess the “design practices” applied in a Colombian government-led program<sup>4</sup> that fostered the transition to ICS intending to reduce firewood consumption and the emissions of indoor air pollution. We follow Villa Álvarez et al. (2022, p. 93), who define design practice as a “set of activities interconnecting approaches, methodologies, methods and tools, which partitioners apply to run projects, work together and shape objects of design”.

The studied case is a program of the Autonomous Corporation of Nariño (Corponariño), a Colombian subnational environmental agency, implemented between 2010-2018 in the department of Nariño. We assessed the degree to which the different stages of the program considered the specific needs, values, and contexts of the beneficiaries, as well as human experience. We collected qualitative data through direct observation and 23 semi-structured interviews with civil servants, program beneficiaries, and external stakeholders. We also reviewed official documents associated with the program’s strategic planning and procurement processes.

The research does not intend to offer an outcome or impact evaluation of Corponariño’s ICS program. Instead, the study is a process-oriented evaluation.<sup>5</sup> More specifically, the research presents a retrospective characterization and assessment of a specific aspect of the program’s processes: the design practices applied by the subnational government environmental agency to formulate, implement, and evaluate its program.

We found that the program design followed a top-down approach focused on a single design principle, efficiency. Moreover, the design methods used by the government did not appear to sufficiently involve its potential beneficiaries nor consider their actual human experiences and realities. We argue that if the government had applied a more human-centered design approach, it could have improved the integration of the socio-cultural backgrounds of the program’s beneficiaries. Overall, the results of this study underscore the

4 We follow Howlett et al. (2017, p. 129), who define government programs “as an intermediary level of policy-making situated between broad policy goals on the one hand and specific settings of policy instruments combinations on the other”.

5 “A focus on process involves looking at how something happens rather than or in addition to examining outputs and outcomes” (Patton, 2012, p. 159).

importance of integrating human-centered design approaches to identify new paths to improve governments' responsiveness and effectiveness.

The article proceeds as follows: Section 2 presents the literature on government-led “clean cookstoves” programs and the literature on human-centered design in government programs and policies. Then, the data and methods section describes the research's methodological approach. Section 4 presents the main findings of our case study. Finally, Section 5 discusses the paper's conclusions and underlines the implications of our case study.

## Review of the Literature

### Programs that Promote ICS and Factors that Determine ICS Adoption by Household

Governments and NGOs worldwide are promoting the transition to ICS, which aim to reduce household air pollution and decrease the use of biomass. However, after decades of programs that have aimed at disseminating ICS in Asia, Africa and Latin America, the adoption rate has not met expectations (Jan et al., 2017; Jan & Lohano, 2021; Menghwani et al., 2019). Governments have fallen short of effectively promoting the adoption of these new technologies by beneficiary households (Guta, 2020; Hanna et al., 2016; Jan et al., 2017; Jan & Lohano, 2021; Jeuland & Tan Soo, 2016; Jewitt et al., 2020; Menghwani et al., 2019; Rehfuess et al., 2014; Ruiz-Mercado & Masera, 2015).

The literature has identified a wide range of factors that influence the adoption of ICS by households and that may illuminate why some ICS programs are more successful than others. First, the distribution and marketing efforts regarding the ICS appear to influence its practical adoption (Jan & Lohano, 2021). Similarly, the more information potential users of the new technology receive about its benefits, the more likely they will use it once they acquire it (Guta, 2020; Jewitt et al., 2020; Jürisoo et al., 2018; Kanangire & Mbabazize, 2016; Karanja & Gasparatos, 2019).

Second, cooking time is also necessary because “if an ICS saves fuelwood, but takes a lot more time to operate, it is not clear cooks would be willing to adopt and regularly use that technology” (Bluffstone et al., 2022, p. 282). Third, some investigations suggest that the use of ICS tends to decline over time due to problems with maintenance (Furszyfer del Rio et al., 2020; Jürisoo et al., 2018).

Fourth, recent studies suggest that the design of the stove is fundamental (Furszyfer del Rio et al., 2020; Jagger & Jumbe, 2016; Jan & Lohano, 2021; Jürisoo et al., 2018; Karanja & Gasparatos, 2019). The main reason is that the model of the ICS must, in addition to allowing food to be cooked, adjust to users' needs and requirements. In other words, it must be convenient, easy to use and clean.

Finally, some studies have found that some people might prefer a traditional version of stoves (an open fire) over an ICS due to cultural customs (Bielecki & Wingenbach, 2014; Guta, 2020; Jan & Lohano, 2021; Karanja & Gasparatos, 2019; Tidze & Tchouamo, 2018). The fact that an ICS uses less wood might not be as important for potential users as cultural factors are—if it allows them to prepare traditional foods (Bielecki & Wingenbach, 2014; Karanja & Gasparatos, 2019); the food taste (Jan & Lohano, 2021; Jewitt et al., 2020; Malla & Timilsina, 2014; Tidze & Tchouamo, 2018); if pots of different sizes can be placed on it and it can cook for many people (Jewitt et al., 2020; Malla & Timilsina, 2014; Tidze & Tchouamo, 2018); if it provides heat and light (Guta, 2020), and if it serves as a social gathering point (Bielecki & Wingenbach, 2014; Guta, 2020, p. 2).

While energy efficiency is one of the main attributes that explain why governments promote the transition to ICS, “higher efficiency stoves are not necessarily user-friendly and, hence, do not make cooking/food preparation easy” (Jan & Lohano, 2021, p. 2). Cookstove programs should involve potential users, particularly women, at the design stage to ensure cookstoves' design and attributes meet the users' needs, expectations and values (Karanja & Gasparatos, 2019). Furthermore, the stoves with the highest absorption rates are those “stoves that are similar to a traditional stove, designed according to consumer preference, easy to light, use different wood sizes, and are produced by local artisans using local materials” (Jagger & Jumbe, 2016, p. 410).

Most studies on the factors that explain the adoption of this type of clean cooking technology by the beneficiaries have been conducted in Asian (Carter et al., 2020; Menghwani et al., 2019; Shan et al., 2017) and African (Bensch et al., 2015; Beyene & Koch, 2013; Bluffstone et al., 2022; Fingleton-Smith, 2022; Molla Adane et al., 2020; Pakravan & MacCarty, 2020b; Tidze & Tchouamo, 2018; Yayeh et al., 2021) countries and Latin America to a lesser extent (Bielecki & Wingenbach, 2014; Gómez et al., 2014; Pakravan & MacCarty, 2020a; Ruiz-Mercado & Masera, 2015).

The article’s main contributions regarding literature on ICS programs are two-fold. First, it contributes by examining ICS programs in Colombia, which has been understudied compared to other world regions.<sup>6</sup> Second, our results align with those of other studies in that they underscore the nexus between the sociocultural realities of potential beneficiaries and the effective adoption of ICS.

### Policy Design and Human-Centered Approaches

The use of design in government and the study of the application of different design approaches to policy is not new. Mintrom and Luetjens (2016, p. 391) claim that in the field of public policy theory, “design has long been as a component of policy development.” Similarly, Clarke and Craft (2019, p. 5) contend that the concept of “policy design” emerged in the 1950s and, since then, it “has been contested, reimaged, ignored and revived.”<sup>7</sup> Moreover, Howlett et al. (2017, p. 129) argue that policy design is a “major theme in contemporary policy research” (p. 129) and define it as governments’ attempt to improve “the understanding of how the processes, methods and tools of policy-making are employed to better formulate effective policies and programs” (p. 129).

The policy design scholarship, part of the policy studies literature, has been traditionally underpinned by a “rational-instrumental logic.” In the last years, an alternative approach has incorporated elements of design studies into public sector processes (Clarke & Craft, 2019).<sup>8</sup> The emerging field denominated “design for policy” addresses new approaches for designing government policies and programs. According to Bason (2020), “design for policy” offers three promises: 1) new means to understand public problems through diverse analytical (e.g., systems thinking) and methodological tools (e.g., user-centered research); 2) a broader array of methods for conducting collaborative processes (e.g., co-design), and 3), novel devices that help articulate policies in tangible ways.

6 Fundación Natura, an environmental non-governmental organization, conducted one of the few studies published in Colombia on ICS programs. The study acknowledged that the adoption levels could substantially increase if there were a better understanding of how new cooking technologies meet the preferences and needs of the beneficiaries (Aristizábal Hernández, 2018, p. 243). This study evaluated 70 families out of 3,000 beneficiaries of an efficient stove program in the department of Santander.

7 For an account of the origins and trajectories of the policy design studies, see Howlett et al. (2015).

8 Clarke and Craft (2019) use a broader category: “public sector design” (p. 5), that encompasses different approaches to policy design to refer to “the growing suite of design logics, traditions, and practices that are currently being applied to matters of governance” (Clarke & Craft, 2019, p. 6).

One of the main approaches that inform the “design for policy” field is “design thinking,” a set of tools aimed at placing people at the center of design processes—a human-centered approach— (Lewis et al., 2019; Mintrom & Luetjens, 2016). For that purpose, design thinking offers instruments that help designers include the users’ perspectives, engage with end-users and other stakeholders, and empathize with users’ experiences and viewpoints.<sup>9</sup> In this vein, Junginger (2020) contends that viewing policymaking as designing “can shift our focus from being problem-centered to being human-centered: from trying to solve a problem in isolation from the human experience to considering the actual human experience as a starting point” (p. 58).

While the literature on policy design evaluation is abundant, “less work has focused on program design” (Howlett et al., 2017, p. 129). The term “government program design” can be understood in two senses. On the one hand, “program design,” as a *noun*, refers to the outcome of a process or a product of a designing activity (Howlett et al., 2017, p. 130; Junginger, 2020, p. 57). On the other hand, “program design,” as a *verb*, describes “the manner in which the policy formulation process creates a program that is sensitive to context-specific constraints” (Howlett et al., 2017, p. 130).<sup>10</sup> This article will focus on the latter meaning of “program design,” as a set of design practices that shape the components and stages of a government’s program. Table 1 lists and defines the dimensions of government design practices assessed in this case study.

9 Design thinking is described as “a ‘bottom-up’ approach where the gap between designers and citizens is narrowed through decisions being informed and even sometimes driven by those who are affected by policies” (Lewis et al., 2019, p. 112).

10 Howlett et al. (2015) describe the dyad “design-as-verb” and “design-as-noun” in the following terms: “on the one hand the exploration of the procedural aspects of design—the specific types of policy formulation activities which lead to design rather than some other form of policy generation—and the substantive—that is, the substance or content of the design itself” (p. 292).



**Table 1.** Dimensions of Government Design Practices

Dimension	Definition	Examples
Design principles	Ideas, assumptions, and heuristics that shape designing decisions.	Efficiency, effectiveness, equity, transparency, feasibility, etc.
Design methods	Procedures, approaches, and techniques used to plan and carryout designing activities.	Top-down approach vs bottom-up approach. Expert driven design vs. co-creation design.
Sources of data for design	Provenance of the information used for designing.	Centralized collection of data vs. decentralized and joint collection of data.
Design attitude	The “expectations and orientations” brought by a designer to a project (Bason, 2017).	Rational, problem-oriented; embrace uncertainty; willingness to reframe issues and innovate; being responsive and empathetic.

**Source:** Authors.

This article contributes to the literature on policy design and human-centered approaches by studying the design practices in formulating, implementing, and evaluating a government program. The research aims at contributing to the literature gap pointed out by Bason (2020): “even though design is now explicitly entering the public policy and service space, literature that convincingly marries design, public organization, and societal context, and explores their relationships, is extremely sparse” (p. 3).<sup>11</sup>

## Data and Methods

Given this research aims at assessing a specific aspect of a government’s program (the design practices) from a human-centered perspective, we decided to employ a qualitative approach. The study uses qualitative analysis to gain insights into the design practices applied by Corponariño for formulating, implementing, and evaluating its improved cookstoves program between 2010-2018. Patton (2012) argues that a qualitative approach is “highly appropriate for studying process” (p. 159) because of the centrality of participant perceptions. Moreover, he contends that process evaluations are “especially

11 Similarly, Junginger (2012), cited by Howlett et al. (2015, p. 293), argues that little attention has been paid to “the actual activities of designing that brings policies into being — of how people involved in the creation of policies go about identifying design problems and design criteria, about methods they employ in their design process”.

appropriate” to address inquiries regarding how people experience a process and whether it the process is working for people (Patton, 2012, p. 160).

More specifically, a case study approach was used to characterize and assess the design practices applied in Corponariño’s program. Yin and Ridde (2015, p. 171) argue that case studies may be a “very adequate approach to conduct process evaluations” since they “allow us to capture the complexity of a case, as well as the changes it has undergone over time.” We implemented an “extreme case” design which aims at maximizing the “variation in the variable of interest” to make the studied relationships “more transparent” (Gerring, 2017, p. 68). Two variables of interest allow us to identify the Colombian department in which there could be a high need for an ICS program among the households: the percentage of homes that use biomass for cooking in stoves and the prevalence of diseases associated with HAP.

Using data from the DANE’s 2018 Quality of Life Survey, we identified the departments<sup>12</sup> with the highest percentage of households using wood- or firewood-fueled stoves for cooking. In 2018, 25.5% of the families in Nariño used firewood or wood, more than double the national average. In rural areas, the percentage of homes that rely on wood fuels for heating and cooking in Nariño increased to almost 49%, higher than the national average (DANE, 2019). Furthermore, Nariño, Chocó and Cauca have the highest prevalence of certain diseases attributed to indoor air pollution, such as ischemic heart disease and acute respiratory infections (Instituto Nacional de Salud & Observatorio Nacional de Salud, 2018, pp. 96-97). Additionally, Nariño has the highest mortality rate for conditions associated with acute respiratory infections. The populations most affected them are children under five and women between 45 and 60 years old (Instituto Nacional de Salud & Observatorio Nacional de Salud, 2018).

Based in our variables of interest, we selected the ICS program implemented in Nariño as an “extreme case” due to the high number of households that use firewood for cooking and the prevalence of diseases associated with HAP. More precisely, we focused on the ICS program of Nariño’s environmental agency, Corponariño, that promoted the transition to “efficient cookstoves.”

<sup>12</sup> There is no survey or database disaggregated by municipality that records the number of households that use biomass for cooking and heating.

The time frame of our case study is 2010–2018, thus leaving a gap of time that allows to observe whether households effectively adopted the ICS.

Our primary source of qualitative data was 23 semi-structured interviews conducted in the first semester of 2022. The interviewees included beneficiaries of the program located in Nariño, current and former officials of Corponariño, and representatives of civil society organizations that are determinant stakeholders of the programs (see the list of interviewees in Annex 1).

Nariño is characterized by its diverse geography (Pacific plain, Andean region, and Amazonian slope) and agro-climatic conditions ranging from sea level to heights greater than 4,000 m. a. s. l. The department has 64 municipalities, and according to the 2018 national census, it is inhabited by over 1.3 million people (39% in rural areas). Given its great geographic diversity, which determines each region’s weather (e.g., average temperature) and specific household needs (e.g., need for heating sources), we focused our fieldwork and interviews of beneficiaries in a single municipality: Pupiales. Corponariño distributed cookstoves in this municipality between 2010 and 2018. Pupiales is located south of the department of Nariño and 10 km from the border with Ecuador. According to the 2018 national census, it is inhabited by 16,431 people, of whom approximately 60% live in rural areas. The municipality is part of the Guáitara river basin and is the municipality (of seven) with the largest area in the Páramo Paja Blanca Regional Natural Park, equivalent to 23.3% of the park’s area (Delgado et al., 2010).<sup>13</sup>

To avoid bias in selecting the interviewed beneficiaries of Pupiales, we opted to use a snowball strategy so that an interviewee referred us to the next.<sup>14</sup> As a result, we visited eleven households (located in six different villages) and interviewed 19 beneficiaries. We were also able to conduct direct observations of the stoves or what was left of them in ten of the households. We also processed data from the Electronic Public Procurement System’s (SECOP) database to identify the procurement processes related to distributing “efficient cooking stoves.” However, few of Corponariño’s contracts associated with its ICS program are registered at SECOP, and few texts are available online.

13 Pupiales has altitudes ranging from 2,650 m. a.s.l. up to 3600 m. a.s.l., its average temperature varies between 6.8 °C and 12.8 °C and diverse thermal floors (such as cold, very cold, and sub-Andean moor).

14 There are no official reports or databases of the recipients of the ICS distributed by Corponariño; hence we could not randomly select from the beneficiaries’ population.

To retrieve more information, we consulted sources such as Corponariño’s annual reports, audits conducted by third parties and contractors’ websites.

Finally, the primary documentary data consulted included national government guidelines, national and subnational government reports, nine annual management reports of Corponariño (2012a, 2013, 2014, 2015a, 2015b, 2017a, 2017b, 2018, 2019), three four-year institutional action plans of Corponariño (2011b, 2012b, 2016), and six audit reports of Corponariño’s programs carried out by the Contraloría General de la República (2011; 2012; 2013; 2015; 2016; 2017).

## Case Study Application

### Background: ICS Programs in Colombia and Nariño

In Colombia, governments have distributed “clean cookstoves” since the 1980s. Still, only in 2015 did the Ministry of Environment (MADR, for its initials in Spanish) issue its first guidelines for the national program of ICS (MADR, 2015). According to the MADR, between 2009 and 2014, approximately 30000 “efficient stoves” were installed in Colombia (MADR, 2015, p. 25). Furthermore, according to a more recent study published by Fundación Natura, between 2007 and 2017, 55000 ICS units were delivered –mostly– by the government bodies and –to a lesser extent– by civil society organizations (Aristizábal Hernández, 2018).

The average price of an “eco-efficient stove” purchased by government organizations between 2010 and 2018 in Colombia, at constant prices in 2010, was 1007066 COP. Considering that the legal minimum wage in 2010 was 515000 COP, the cost of each stove represented, on average, 1.93 minimum salaries or 530.4 USD.<sup>15</sup> Hence, providing an ICS to a low-income household in Colombia represents a significant in-kind subsidy.

More recently, the national government included the transition to this type of technology as a crucial instrument to mitigate greenhouse gas emissions and reduce coal emissions. According to the updated Nationally Determined Contribution (NDC) document for 2020-2030, the Colombian government committed to replacing one million traditional stoves or open fire pits by 2030 to reduce 2.2 million tons of CO<sub>2</sub> (Comisión Intersectorial de Cambio Climático, 2020).

<sup>15</sup> In 2010 the average exchange rate was 1.898,68 COP per US dollar.

The Regional Autonomous Corporation of the Negro and Nare River Basins (Cornare) was the first subnational environmental agency that implemented “eco-efficient” stove projects in Colombia. According to four interviewees, including public officials and members of civil society organizations, Cornare’s ICS program inspired other regional programs, such as the one implemented by Corponariño.<sup>16</sup> Corponariño used Cornare’s prototype stove (*Huellas*) in its project formulation process.<sup>17</sup>

The ICS program began in Nariño as an incentive for environmental conservation within the “National Forest Ranger Family Program” framework and Corponariño’s strategy of “prevented deforestation.”<sup>18</sup> The initial objective of Corponariño’s project was to reduce wood consumption and ecosystem degradation.<sup>19</sup> While an official of Corponariño acknowledged that the ICS program could also have health-related goals, they were not explicitly pursued because their central role was limited to environmental matters.<sup>20</sup>

Between 2010 and 2018, Corponariño signed at least 16 contracts or inter-administrative agreements related to the purchase and installation of ICS that were delivered to rural households in Nariño.<sup>21</sup> In addition to supplying and installing ICS in rural homes, the program included environmental education workshops and the provision of fast-growing trees that allowed the beneficiaries to reforest part of their property. According to Corponariño’s annual management reports published between 2011 – 2019, the ICS program covered 34 of the 64 municipalities of Nariño (Corponariño, 2011a, 2012a, 2013, 2014, 2015a, 2015b, 2017a, 2018, 2019).<sup>22</sup>

16 Interviews 9, 10, 22 and 23.

17 Interviews 9 and 23.

18 Interview 9, 22 and 23.

19 The main objective of the program was to prevent the deforestation and environmental degradation of hydrographic basins that were considered strategic or sensible for Corponariño (such as the Guáitara, Mayo, Pasto, Juanambú, Guamúez and Guiza River basins).

20 Interview 9.

21 Corponariño does not have an online registry of its contracts, and most of its contracts associated with the ICS program are not registered at SECOP. It was necessary to trace them in different sources to identify the contracts or agreements related to ICS signed by Corponariño: the entity’s management reports, the audit reports published by the Comptroller General of the Republic, SECOP, and web search platforms. The texts of only four of the 16 contracts that were identified are available online: two at the contractor’s website and two at SECOP.

22 Two sources of information reported a higher coverage of the program: an official of the Corporation stated that the ICS program benefitted all the municipalities of Nariño (Interview 9), and according to a report from Corponariño (2017b) report, the improved stoves had been delivered in 51 of the 64 municipalities (p. 30). However, we did not find evidence that supported those claims.

Corponariño established three eligibility criteria for the program: (i) that the beneficiaries lived in targeted areas —the prioritized areas of the hydrographic basins or strategic ecosystems, (ii) that they used firewood for cooking, and (iii) that their landholding had an extension of at least half a hectare<sup>23</sup> which could be destined for conservation or reforestation. Regarding this last point, the beneficiaries had to have an area for conservation where they could plant trees that would allow them to use their stove in the future. Due to the informality of rural landholding and property rights in Nariño, potential beneficiaries had to demonstrate they possessed the land in good faith.<sup>24</sup>

We did not find official sources that specified how many ICS were delivered per municipality nor how many households received stoves from Corponariño. We attempted to retrieve this information and the texts of the contracts through a formal request submitted to Corponariño in June 2022; however, the agency only disclosed the texts of four agreements and stated that “they could not identify others.” However, based on the information of 16 contracts signed by Corponariño between 2010 and 2018, we found the organization contracted the delivery and installation of over 5200 ICS in Nariño.

### Analysis of Corponariño’s Design Practices

This section characterizes government design practices and assesses whether the formulation, implementation, and evaluation of the program by Corponariño considered the specific beneficiaries’ needs, values, contexts, and human experience. Hence, this section identifies the main design principles and methods implemented by Corponariño and traces who participated in design processes and how.<sup>25</sup>

#### *On the Formulation Process*

##### Design of the Stove Model

In 2010, Corponariño conducted a pilot project with five pre-existing stove models used in other regions of Colombia. The five stove models were tested in five schools in Nariño. According to an official of Corponariño, the main objective of the pilot was to identify the most efficient model.<sup>26</sup> In other words,

23 The extension of the land required by Corponariño varied on some occasions. For example, in the case of contract 392 of 2018, the beneficiaries had to have 0.2 hectares for the wood orchard.

24 Interview 9, 22 and 23.

25 Annex 2 summarizes the queries and criteria that guided our inquiry to characterize the government design practices applied in Corponariño’s ICS program.

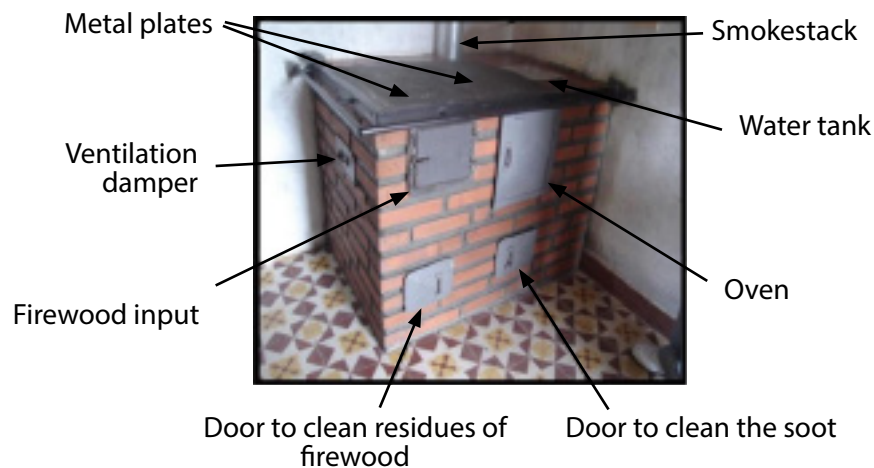
26 Interview 9.

the main goal of the pilot was to test specific technical aspects of the cookstoves, such as energy efficiency (“which stove required less firewood to cook food”). Primarily based on that criterion, Corponariño selected the most energy-efficient model tested in schools and later distributed to households. As explained in the section addressing if design affected ICS adoption, Corponariño’s reliance on this single criterion may have negatively affected adopting the new technology because other usage factors were pertinent for the beneficiaries.

Corponariño did not consider the potential beneficiaries for the selection of the models nor the testing of the models. Moreover, the pilot users were not the same type of users intended by the program: the stoves were tested by cooks who worked at schools, not by potential beneficiaries in rural households. Once the pilot was carried out, the directors of the schools were consulted by Corponariño, and only on two occasions did the officials in charge of the pilot interview people who used the stoves at the schools.<sup>27</sup>

During the study period, Corponariño introduced minor modifications to the stoves,<sup>28</sup> mainly in terms of materials, but, in general, the structure of Cornare’s model was maintained (Figure 1).<sup>29</sup> Hence, the decisions taken by Corponariño based on the piloting of the models determined the design of the cookstove delivered and installed in the following years.

**Figure 1.** Selected “Eco-Efficient” Stove Model



**Source:** Concha Albán (2014, p. 6).

<sup>27</sup> Interview 9.

<sup>28</sup> Interviews 7 and 23.

<sup>29</sup> Interview 23.

In sum, the stove model selection was made under a single criterion: efficiency; potential beneficiaries did not have the opportunity to co-create the intervention and were not even consulted on the stove design or program conditions. The learning from users' experiences in the piloting stage was lost since the models were not tested with potential beneficiaries or in rural households.

#### Design of the Program: Top-Down Approach

The cookstoves project formulation followed a top-down approach. Once the pilot was carried out in schools, Corponariño developed the project through institutional workshops organized with mayors, school principals, presidents of community action boards and leaders. In other words, the program's definition was consulted with people who most likely do not cook with firewood in their homes, are not in charge of cooking, nor constitute potential beneficiaries.

When asked why potential beneficiaries were not included in the pilot process assessing and project design development, an official of Corponariño involved in the program's design claimed this phase was limited to community leaders and representatives because "it would be very difficult to move the people."<sup>30</sup> After a pause in the interview, he remarked "how would you bring all that people? It simply cannot be done".<sup>31</sup>

The interaction of Corponariño with potential beneficiaries was limited to the "socialization" of the fully designed solutions that aimed at incentivizing environmental conservation, which included the cookstoves program and a scheme of payments for environmental services. The key objective of the "socialization" meetings with communities was to explain the benefits offered by the programs and verify whether potential beneficiaries complied with the requirements to access the benefits.<sup>32</sup> In each call of Corponariño, potential beneficiaries had to register beforehand and then carry out training on the conservation of the environment.

Hence, there was no room for co-creation with potential beneficiaries in the formulation stage. Furthermore, even though the people of Nariño inhabit various ecosystems, Corponariño devised a one-size-fits-all program. Notably,

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<sup>30</sup> Interview 9.

<sup>31</sup> Interview 9.

<sup>32</sup> Interview 9 and 22.



despite the diversity of thermal floors in Nariño, neither the program nor the stove model was adapted or changed, considering these differences.

Additionally, the program was exclusionary of the households with the greatest needs by design. The eligibility for receiving cookstoves was linked with minimum requirements of landholding so that the beneficiaries could commit to setting aside an area of their land for conservation.<sup>33</sup>

Since the predominant type of rural inhabitant in Nariño is a smallholder, people who most needed the stove, those with the least resources, could be excluded from the program because they did not have a sufficient area of land to allocate to conservation. One of Corponariño's officials involved in the design of the ICS program acknowledged that "too many people wanted the cookstoves, but not as many met the requirements."<sup>34</sup> The same official recognized that "access to the program should not be tied to environmental conservation because there are very poor peasants who do not access [it] because they do not meet the requirement." In some specific cases, the potential beneficiaries could meet this requirement if the mayor, the indigenous community, or a community group assigned a communal property for conservation; but this was the exception.<sup>35</sup>

Moreover, when the project was designed, Corponariño did not have a municipal census on the number of families that cook with firewood nor information on the households' stoves. In other words, Corponariño did not have basic information about the potential beneficiaries. The municipalities' selection and implementation criteria were based on the area's environmental importance rather than on the needs of the inhabitants. Additionally, the criteria for selecting which households would be offered the stoves were unclear, and the delivery seemed to be guided by an ad-hoc procedure.

In sum, the program was not developed with the active participation of potential beneficiaries. Its components were defined with key political stakeholders. The interaction of Corponariño with potential beneficiaries was limited to communicating the features of the designed program. The program was exclusionary by design since the eligibility criteria disqualified the poorest

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33 Interviews 9, 22 and 23.

34 Interview 9.

35 Interview 23.

rural households who did not have land holdings of the minimum required size. The decisions of Corponariño were not informed by context-specific data from potential beneficiaries nor by insights on the user experience of potential users. Decision-makers were not responsive to the potential beneficiaries' views and experiences. Table 2 summarizes the principal design practices identified in the formulation stage of the program and alternative human-centered design practices that could have been applied instead.

**Table 2.** Design Practices Identified in the Formulation Stage and Alternative Human-Centered Design Practices

Type of design practice	Corponariño's Design Practices	Alternative Human-Centered Design Practices
Main design principle(s)	Efficiency.	Multiple principles based on the needs, uses and experiences of potential beneficiaries.
Design method I – Stove design	Transplant prototype. Pilot that lacked engagement with potential beneficiaries.	Co-create prototype(s) that is/are context specific. Pilot with potential beneficiaries. Iterate.
Design method II – Program Design	Top-down approach. One-way interaction with stakeholders.	Bottom-up approach. Co-design with stakeholders. Facilitate conversations. Visualize futures.
Sources of data for design	Technical expertise and views of political and social leaders.	Context-specific data. Bring voices from a variety of stakeholders.
Design attitude	Rational, problem-oriented	Humility, empathize with people's realities.

**Source:** Authors.

### *On the Implementation Process*

Based on the information collected in 19 interviews with beneficiaries in Pupiales, we divided our findings about the implementation process into three stages: the preparatory phase, installation of the stove, and demonstration of how the stove works.

Regarding the preparatory phase, in some cases, we found eligible beneficiaries were asked to attend environmental education workshops,<sup>36</sup> in which one of the recurring themes was caring for the *paramo*. In other cases, a person (e.g., a council member or representative) looked for and told them there was a project and asked: “if they wanted to be on the list.”<sup>37</sup> The information provided before the sessions with Corponariño officials appeared incomplete occasionally. One of the interviewees recalled that the officials “told us that they were going to give us help, but they never said what the help consisted of.”<sup>38</sup>

Once the lists of eligible beneficiaries were drawn up, the materials for the stove construction were sent to their homes. In some cases, they were asked to pay for their transport<sup>39</sup> or, on the day they were going to build them, to have some materials (for example, mud or crushed).<sup>40</sup>

The stove was constructed in the households in the second stage of the program’s implementation. An expert visited the beneficiary families and built the stove. Once the materials were in place, the construction lasted approximately three hours.

The place where the stove was built in the house was not a decision that beneficiaries could take on their own, and their view was not necessarily considered. The expert usually installed it in a specific kitchen corner<sup>41</sup> even if the users wanted it elsewhere.<sup>42</sup> Moreover, according to the beneficiaries of one household we interviewed, the person who built the ICS forced them to destroy their traditional stove, arguing that he would not build it unless the old one was destroyed.<sup>43</sup> A representative from a civil society organization that operated ICS contracts granted by Corponariño confirmed that beneficiaries were asked to allow the destruction of their traditional stoves.<sup>44</sup> However, none of the contracts we accessed nor Corponariño’s formal response mentioned that it was the

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36 Interviews 1, 2, 3, 20 and 21.

37 Interviews 4, 5, 6, 7 and 12.

38 Interview 2.

39 Interviews 5 and 14

40 Interviews 2 and 4.

41 However, in one case, the ICS was installed outside the house, next to the bathroom and laundry areas. Furthermore, one beneficiary said that she expressly chose where she considered convenient for the stove’s installment (Interview 3).

42 Interviews 13, 14, 15 and 17.

43 Interviews 14 and 15.

44 Interview 23.

beneficiary's duty to destroy their traditional stove. Additionally, beneficiaries did not have the possibility of requesting any change to the stove's model.

After building the stove, the expert recommended the beneficiary wait a month before using it and gave them some basic instructions on the stove's elements, how to use it and what type of elements could not be burned to avoid damage to the stove or accidents.<sup>45</sup> The beneficiaries were also given a brochure with basic information about the stove.<sup>46</sup> One of the interviewed beneficiaries claimed that he wanted to see how the stove was installed, "out of curiosity." Yet, the expert did not accept that anyone saw how he proceeded. It appears that the expert wanted to conceal his "know-how."<sup>47</sup>

In the last stage of the implementation process, the beneficiaries attended a demonstration of how the new stove was used.<sup>48</sup> The activity was conducted in a beneficiary's house. On that day, they prepared different types of food to teach the various stove functionalities: boiling water in another cauldron, baking, and cooking.

In sum, the implementation process followed a top-down approach in which decision-makers and expert implementers failed to apply user-centric perspectives. Furthermore, there were instances where the beneficiaries desired to participate in the implementation stage, but the experts rejected their views and requests. Table 3 summarizes the principal design practices identified in the implementation stage of the program and alternative human-centered design practices that could have been applied instead.

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45 Interviews 4, 5, 7, 11, 13 and 17.

46 Interviews 2 and 3.

47 Interview 15.

48 Interviews 1, 2, and 14.

**Table 3.** Design Practices Identified in the Implementation Stage and Alternative Human-Centered Design Practices

Type of design practice	Design practices applied by Corponariño	Alternative human-centered design practices
Design method	Top-down approach. One-way interaction with stakeholders and partial disclosure of information to potential beneficiaries.	Bottom-up approach. Construction of a journey map with beneficiaries. Co-design and co-deliver with beneficiaries.
Sources of data for design	Technical expertise.	Context-specific data. Bring voices from a variety of stakeholders.
Design attitude	Rational, problem-oriented	Responsiveness, empathize with people's realities.

**Source:** Authors.

### *On the Evaluation Process*

The design practices in the evaluation stage of Corponariño's ICS program were difficult to characterize due to the access limitations to relevant information. Corponariño has not publicly disclosed its ICS program's process, outcomes, or impact evaluations. Moreover, according to two interviewees—a current and a former official of Corponariño, there is no formal evaluation of their ICS program.<sup>49</sup>

We requested Corponariño information about the evaluation of the program. The agency only disclosed a study from 2022 aimed at determining “the average consumption of firewood, the emissions of atmospheric pollutants, costs, species destined for the extraction of firewood, and its consumption for cooking food in the areas prioritized by the project in execution” (Fundación Sacha Llaqta, 2022, p. 2). The civil society organization contracted by Corponariño to execute most of the program's contracts produced the report.<sup>50</sup> The scope of this report confirms the centrality of energy efficiency as a determinant program design principle.

<sup>49</sup> Interviews 9 and 22.

<sup>50</sup> The report concluded that: “thanks to the design and materials with which eco-efficient stoves were built, they reduce firewood consumption by 60% compared to traditional stoves” (Fundación Sacha Llaqta, 2022, p. 17).

The apparent lack of an evaluation of the ICS program and the opacity information about the program’s inputs, processes, outcomes, and potential impacts does not mean there were no government design practices. The omission of formal evaluations and the low transparency of the agency’s activities appear to be conscious design choices. These choices seem to reveal design practices that were also present in the previous stages, such as the top-down approaches (that foreclose accountability), the lack of engagement with key stakeholders, and the fact that beneficiaries did not have the opportunity to participate in co-evaluation exercises.

### Did Program Design Practices Affect the Adoption of the ICS?

The interviewed officials from Corponariño claimed that audit reports on the contracts, prepared by the Contraloría General de la República (CGR), showed that the program was well received and that the communities effectively adopted the ICS. More specifically, the official of Corponariño stated that “only 2% of the beneficiaries did not use the stove”.<sup>51</sup> Moreover, he claimed that the percentage of beneficiaries who did not use the stoves were not sufficiently trained to operate them, inhabited warmer thermic floors, or were part of ethnic groups. In contrast with these views, the documentary evidence and our interviewees suggest that Corponariño’s ICS program generated mixed effects, at best.

We consulted the databases of the CGR and found six general audit reports that assessed Corponariño’s activities (not limited to the ICS program) between 2010 and 2018. In two of the reports, there is no mention of the efficient cookstoves program (2012, 2017). The remaining four reports include brief findings about the contracts associated with the ICS program.<sup>52</sup> The reports’ information does not support the claim that the household’s adoption of the technology was high in Nariño: three of the reports found problems with the execution of the contracts, and only one concluded the contractor fully met the objectives.<sup>53</sup>

51 Interview 9.

52 It is important to mention the CGR conducts random follow-ups of the Corponariño projects; hence, the ICS contracts may not be evaluated yearly.

53 The main findings from the four CGR’s audit reports that mention the ICS programs are the following: (i) Contract 257, 2010: the contractor who was in charge of the construction of 10 “demonstrative” stoves was obliged to build them on grounds of “Ranger Families” (rural smallholders that are part of a national government program), but instead the stoves were built on the contractor’s own property and in a school (2011, p. 108); (ii) Contract 152, 2012: 16 families visited by the CGR (10% of the total number of beneficiaries) stated that they had received the ICS and other elements that corresponded to the

We found mixed perceptions among the beneficiaries in Pupiales about adopting the new technology. Based on the interviews we conducted and the direct observation of the 11 beneficiaries' households, we found three adopted the stove, even though they recognized it had shortcomings; another six beneficiaries did not use it. In two beneficiary homes, the ICS was adapted to their needs (which, in practice, meant that they destroyed it to build a new one with some parts of the ICS).

The beneficiaries who adopted the ICS manifested that the stove fulfilled its purpose: to keep the heat inside for efficient cooking of food and thus save firewood.<sup>54</sup> The three beneficiaries use the gas stove to prepare some meals. However, they explained that it is difficult to learn how to use the ICS at first; it requires patience<sup>55</sup> and does not allow them to get warm at night.<sup>56</sup> Some beneficiaries stated that the stove requires small wood to close the wood gate; however, since they cannot cut it to that size, two families opted to add a support mechanism to the stove and keep the damper open (Figure 2).<sup>57</sup> From a health perspective, this implies a suboptimal use of the stove because keeping the wood damper open allows CO<sub>2</sub> particles to spread throughout the kitchen.

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object of the contract and that they were “satisfied” (2013, p. 105); (iii) Contract 324, 2014: although 80 ICS were delivered by the contractor in the municipality of Barbacoas, 8 of the 13 families visited by the CGR did not use the stove (2015, p. 117); and, (iv) Cooperation agreements 324, 2014 and 230 and 381, 2015: the contractor did not fulfill its financial obligations (paying the workforce required for the construction of the stoves) and Corponariño failed to supervise the contractor's compliance of its financial obligations (2016, pp. 51-52).

54 Interview 3.

55 Interview 3.

56 Interviews 3, 5, 14 and 15.

57 Interviews 5, 14 and 15.

**Figure 2.** Stove in Operation with the Firewood Flap Open

**Source:** Direct observation.

The beneficiaries who did not use the stove stated at least eight reasons. First, they consider the stove hard to light,<sup>58</sup> and, unlike traditional burners, plastic cannot be placed on it to facilitate lighting.<sup>59</sup> Second, the dry and small firewood (40 cm maximum)<sup>60</sup> is inconvenient because traditional ones use long firewood so that once the stove is lit, the person in charge of cooking can go out to do other tasks (such as caring for animals). Third, related to the previous point, if you keep the firewood gate open and long firewood is inserted into the improved stove, the firewood is consumed and then falls to the ground, given the stove's height, which causes it to turn off. In addition, the kitchen gets dirty with the remains of the firewood.<sup>61</sup>

Fourth, they argued that the ICS needs constant supervision,<sup>62</sup> while the traditional stove does not: "I didn't like it because you had to be next to the stove, to keep an eye on putting the wood in, so that the fire did not go out."<sup>63</sup> That is

58 Interviews 1, 2, 3, 4, 8, 11 and 19.

59 Interviews 1, 7 and 19.

60 Interviews 2, 4, 8, 11, 14, 18 and 20.

61 Interview 4.

62 Interviews 4, 16, 17, 19, 20 and 21.

63 Interview 17.



a limitation because, as mentioned before, women, who traditionally spend the most time in the kitchen, could dedicate themselves to other tasks after lighting the fire.

Fifth, almost all the families grow potatoes on their land, so sometimes they need to cook for many people (who work sporadically at their landholdings). Some beneficiaries report that cooking with large pots on the ICS was not easy due to the size of the spaces in which the pans can be placed.<sup>64</sup>

Sixth, all the beneficiaries interviewed stated that the heat is concentrated inside the stove. Given the design and height of the stove compared to a traditional one, it does not heat the kitchen nor allows people to get warm, particularly their feet.<sup>65</sup> Bearing in mind that the beneficiaries of Pupiales live close to the *Páramo Paja Blanca* (a mountainous, cloudy, rainy and humid environment), for them it is vital to wrap up warm at night: “When you arrive from somewhere you say, ‘I’m going to bundle up,’ or it is customary to put your feet near the fire to get warm, but with that stove, there was no way;”<sup>66</sup> “here it was sad without the traditional stove;”<sup>67</sup> “once at night I sat next to the ICS and felt so cold... and I said ‘no, this stove is not good.’”<sup>68</sup> In addition, families gather to have dinner around the fire and share a space to talk about their day. The improved stove does not allow them to do this; therefore, it does not fulfill a cultural function that more traditional stoves and even open-pit fires offer to families.

Seventh, other beneficiaries mentioned that the food taste of some meals prepared in the ICS was not as good as the taste of the ones cooked in traditional ovens. When they tried to prepare typical dishes in the ICS, they could not get the same flavor.<sup>69</sup>

Eighth, some of the problems pointed out by users were related to structure or materials of the ICS: the fact that it is difficult to clean the chimney because it

64 Interviews 7, 17, 20, 21.

65 Interviews 4, 5, 6, 8, 11, 13, 14, 15, 18, 20 and 21.

66 Interview 4.

67 Interview 21.

68 Interview 17.

69 Interview 19.

is very high,<sup>70</sup> some materials of the stove have already oxidized,<sup>71</sup> and the design of the ICS is not pleasing to them: “the ICS took up a lot of space,” said one interviewee,<sup>72</sup> and another one complained: “that stove, in our small kitchen, looked like a grave, ugly and big, all in brick... I didn’t like it.”<sup>73</sup>

Some of the interviewed beneficiaries who did not use the ICS destroyed it and built a traditional stove.<sup>74</sup> One of the families expressed they were terrified someone would ask them why they had destroyed the ICS or even would have legal problems for not using it, but they needed the space that the ICS occupied to build a stove that fulfills their expectations.<sup>75</sup> Meanwhile, other beneficiary families gave another use to the ICS: “When my daughter asked me why I don’t destroy the ICS, I told her ‘if I don’t cook in this stove, at least it works as a side table.’”<sup>76</sup>

Finally, some beneficiaries destroyed the ICS and reused parts, specifically the grill, to build a new version of the traditional stove (Figure 3).<sup>77</sup> One of the beneficiaries explained their adapted version solved several of the shortcomings of the original ICS: “We destroyed the stove because it was very difficult to light, it did not heat us, and the firewood fell out, and with the iron we made a [new] one that did warm us up.”<sup>78</sup>

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70 Interviews 12, 15 and 19.

71 Interviews 13 and 19.

72 Interview 20.

73 Interview 17.

74 Interviews 16 and 17.

75 Interviews 16 and 17.

76 Interview 19.

77 Interviews 4, 20 and 21.

78 Interview 4. Another beneficiary who also adapted the stove explained: “my traditional stove was already very old, the smoke was coming out... so, we destroyed the ICS and with the iron we built a new stove [that looks like the traditional model] ... I am grateful because thanks to the fact that Corponariño gave me the ICS now I have my new [traditional] stove” (Interview 21).

**Figure 3.** Stoves rebuilt with ICS parts

Source: Direct observation.

Two important caveats about the conclusiveness of our claims are pertinent. Although the case study method may contribute to identifying the links between government intervention and its outcomes, a qualitative approach is best suited to complement other empirical strategies, such as randomized-control tests or econometric methods based on panel data (Yin & Ridde, 2015). Furthermore, the information we collected about the views of the beneficiaries regarding the ICS program was limited to one municipality of Nariño. Hence, we cannot claim that our interviewees' statements represent the perceptions of the program's beneficiary population. In sum, our assessment of whether Corponariño's program design practices affected the households' adoption of the ICS is tentative and requires further testing.

## Conclusions

The study's main goal was to characterize and assess the design practices applied in a Colombian government-led program to foster the transition to ICS in rural households in Nariño.

Three major conclusions about the government program design of Corponariño can be drawn from our study. First, the formulation and implementation of the ICS program did not consider the specific needs and contexts of the potential beneficiaries. As stated in the section about Corponariño's

design practices, the potential beneficiaries were not consulted regarding the program's and stove's designs. There were no co-creation spaces that could have helped Corponariño offer a stove that adapted to the households' needs. The program was not flexible, it did not adjust to the different municipalities of the department. The program was exclusionary, given that the potential beneficiaries were eligible only if they had a minimum landholding destined for conservation, disqualifying those who most needed the stoves.

Second, the decision-makers relied mainly on their technical expertise and did not consider the communities' social contexts or cultural customs and traditions. The sole criterion for selecting the stove model to be delivered was efficiency. However, the Pupiales families use stoves for more than cooking. They also warm up at night and gather around it to talk about their day-to-day with their relatives at night. The fact that the improved stove did not allow them to heat up nor offer a space to share with the family led some beneficiaries to continue using a traditional stove that generated indoor pollution, but that met some of their needs.

Third, the fact that the design practices were not user-centered may have negatively affected households' adoption of the new technology. Since the beneficiaries were not even consulted about the stove design, it is not surprising that the decision-makers were not aware of those other needs (in addition to cooking) that the families of Pupiales desired from the stoves.

This case study confirms what the literature on the adoption of ICS has found elsewhere. Although ICS projects aim to offer health and environmental benefits, these cookstoves are subject to factors beyond technology efficiency. Given that it implies a process of change, the socio-behavioral factors of the policy's beneficiary should be considered to favor its implementation and sustainability. The case of the ICS program illustrates how adopting new technologies is conditioned by cultural and social practices that may only be detected and understood by decision-makers if the policy processes consider the needs, values, and specific contexts of the beneficiaries.

The paper also highlights the centrality of design practices in formulating, implementing, and evaluating programs. We share Sabine Junginger's idea that governments can create and implement "more citizen-centric policies"

that help us “achieve more humanizing outcomes” and that “[f]or policymakers and public organizations alike, human-centered design is a mandate, not an option” (Junginger, 2020, p. 63). But we do not claim that using certain design approaches is always superior to others, nor that design thinking should always replace problem-oriented and rational approaches to design. We contend that using a more human-centered approach could complement more traditional design methods to ensure that government policies and programs effectively include the beneficiaries’ views and experiences.

We acknowledge some conclusions of this study were drawn from a relatively small sample size of interviews, which is clearly a limitation for broader generalizations about Corponariño’s program. Moreover, we lack basic data about households in Nariño, such as how many of these households use traditional stoves and wood for cooking and how many stoves were delivered in each municipality of Nariño. We formally requested such information from an official of Corponariño and through a formal request to the Corporation. In its response, the environmental agency stated it does not have an online repository with the contracts, that most of them are only available in a printed version and that others we identified and requested were not found. Consequently, there is no consolidated record of how many ICS-related contracts the entity has signed nor a disaggregated record of how many improved stoves have been delivered. If such information becomes available, there is an excellent opportunity for a more extensive, more deductive study that may confirm or disprove these results. Access to such information would also facilitate the study replication in other municipalities of Nariño or departments in Colombia.

Future action research might further explore the use of human-centered design approaches to formulate, implement and evaluate ICS programs, for example, by elaborating personas and user journey maps, facilitating the account of desirable futures, and co-creating and testing new models of stoves with potential beneficiaries. In Tanzania, for example, the Global Alliance for Clean Cookstoves and IDEO conducted a study in which “a human-centered design approach” was implemented “to examine the habits, motivations, and aspirations of cookstove users” (2012, p. 2).

Finally, further work must be done to study how and why women appear notably excluded from the formulation and implementation processes of ICS

programs in Colombia. Women tend to be more exposed to HAP produced by traditional stoves (Kumar & Mehta, 2016; Lau et al., 2021; Pachauri & Rao, 2013; Pangestu, 2020; World Health Organization, 2016). Also, women’s time collecting firewood for traditional stoves reduce their availability for leisure or economically remunerated activities. Hence, when we talk about HAP and ICS programs, we also talk about poverty and gender and health inequities (World Health Organization, 2016). Thus, the findings of our research that point to the exclusion of women in government’s design processes echo Barrett’s (2021, p. 38) conclusion: “leaving women out of the design process can inhibit and limit social innovations.”

## Annex 1. Interviews

No.	Category	Description	Date
1	Beneficiary	Beneficiary A of household 1.	21/2/2022
2	Beneficiary	Beneficiary B of household 1.	21/2/2022
3	Beneficiary	Beneficiary A of household 2.	21/2/2022
4	Beneficiary	Beneficiary A of household 3.	20/03/2022
5	Beneficiary	Beneficiary A of household 4.	20/03/2022
6	Beneficiary	Beneficiary A of household 5.	20/03/2022
7	Beneficiary	Beneficiary B of household 5.	20/03/2022
8	Beneficiary	Beneficiary C of household 5.	20/03/2022
9	Subnational government official	Deputy Director of Corponariño.	28/03/2022
10	NGO researcher	He has worked on projects with efficient stoves.	06/04/2022
11	Beneficiary	Beneficiary A of household 6.	16/05/2022
12	Beneficiary	Beneficiary A of household 7.	16/05/2022
13	Beneficiary	Beneficiary B of household 7.	16/05/2022
14	Beneficiary	Beneficiary A of household 8.	16/05/2022
15	Beneficiary	Beneficiary B of household 8.	16/05/2022
16	Beneficiary	Beneficiary A of household 9.	23/05/2022
17	Beneficiary	Beneficiary B of household 9.	23/05/2022
18	Beneficiary	Beneficiary A of household 10.	23/05/2022
19	Beneficiary	Beneficiary B of household 10.	23/05/2022
20	Beneficiary	Beneficiary A of household 11.	23/05/2022
21	Beneficiary	Beneficiary B of household 11.	23/05/2022
22	Subnational government official	He is a former deputy director of Corponariño.	02/06/2022
23	Civil society	She works in an organization that develops ics projects for Corponariño.	22/06/2022

## Annex 2. Criteria and queries used for characterizing program design practices

Formulation	Implementation	Evaluation
1. How did the idea of the intervention originate and how were the potential beneficiaries' needs identified?	1. Was the program's formulation detached or separated from its implementation?	1. Was the program's implementation detached or separated from its evaluation?
2. Who participated in the design of the process and at what stage(s)?		
3. What design principle(s) was/were applied?		
4. What design method(s) was/were used?		
5. Were there instances of experimentation, prototyping, or iteration?	5. Were there instances of experimentation, prototyping, or iteration?	4. At what stage was the evaluation strategy designed?
6. Who participated in pilots and/or who was consulted by decision-makers?	6. Was journey mapping or similar methods used to anticipate the beneficiaries' experience?	6. Who conducted the evaluation (self-assessment or evaluation by third parties)?
7. Did potential beneficiaries had the opportunity of participating in the design of the intervention or even co-create it?	7. Did beneficiaries had the opportunity of participating in the implementation of the intervention or even co-deliver it?	7. Did diverse stakeholders participate in the evaluation processes?
8. Did the decision-makers used context-specific data to inform the characteristics of the program?	8. Did the implementers use observation, interviews, focus groups or other methods to monitor the beneficiaries' experiences with the program?	8. What type(s) of evaluation(s) were carried out (e.g., inputs, processes, outcomes, impacts)?
9. Were the decision-makers responsive to the views and experiences of the potential beneficiaries?	9. Were the implementers responsive to the views and experiences of the beneficiaries?	9. Were the evaluators responsive to the views and experiences of the beneficiaries?

**Source:** Authors' own elaboration.



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