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# Material Resignification in the Amazon. A way to construct sustainability scenarios

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**Abstract:** This article analyzes local development processes in forest areas in the Amazon. It presents the emergence of a number of nuclei that represent social innovation processes, motivated by the introduction of craft technologies for rubber vulcanization. Based mainly on the "Design for Social Innovation and Sustainability" approach (MANZINI, 2008), initiatives, as well as some challenges observed in the field, were examined to ensure that sustainable actions could result from these processes. Possible interactions with designers aligned in this context, and processes that enable valorization of biological, social and cultural diversity were also considered.

**Keywords:** Design for sustainability, Amazon local development, rubber innovation, and forest conservation

## 1. Introduction

Considering the contemporary challenges caused especially by climate change, among other issues, it has become essential to study and re-evaluate the origins, life cycle and production of materials and their impacts. At the same time this leads us to the need to deepen the knowledge of processes that can optimize the conservation of our natural resources. In this perspective, the development of local processes in the Amazon forest deserves particular attention in the field of design in order to enable greater integration between the possibilities this area offers and the initiatives developed by the People and Traditional Communities.

It is important to highlight that the rural environment plays an extremely important role in the contemporary scenario. Natural forests represent 53% of Brazil's national territory, which may be an opportunity to bring the design area closer to the processes of local resource valorization.

This article presents initiatives that emerge through the new use of local vulcanized<sup>1</sup> rubber, defining a scenario in which local communities, together with institutions that support them, begin to organize themselves to offer products and services derived from biodiversity resources and local

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<sup>1</sup> Vulcanization is the process that allows the rubber to stabilize with the addition of sulfur and heat to this material. It was discovered by the American Charles Goodyear in 1839.

culture. The idea of empowering traditional populations<sup>2</sup> inhabiting forest areas destined to environmental conservation and the development of alternatives for generating income, brings the local communities new challenges that speak directly to issues related to the spectrum of design projects and research, especially the approaches aimed at sustainability.

Thus, the objective of this work is to present the process of re-signification of rubber in forest areas in the Amazon, and to discuss, through this experience, how design strategies can contribute to optimize processes of innovation and social development, especially in Conservation Units of Sustainable Use<sup>3</sup>.

## 1.2. Methodological Procedures

This research adopted a qualitative approach and uses the techniques of bibliographic review, field research and the application of participatory design. The research was structured to analyze the problem in three stages based on the adopted procedures. The first presents reflections on design and its connections and interrelations with the Amazonian context. The second analyzes the transformations detected in the Amazon today and the aspects related to sustainability and local development and their repercussions in the forest context. The third step is focused on the use of rubber by local communities as a concrete example of the challenges and opportunities related to the design based on two distinct strategies: the first, the analysis of different aspects regarding latex extraction, its characteristics and history and the importance of rubber in the Amazonian socio-environmental context. The second strategy is based on research in the field and the field diary of the experiences developed in the design workshops aimed at the production of rubber artifacts in two communities in the Tapajós National Forest.

The theoretical framework adopted concepts presented by Manzini (2008) in *Design for Social Innovation and Sustainability*; in the approach of *Design and Territory*, by Krucken (2009); the view of economists Sachs (2008), Sen (2010) and geographers Becker (2009) and Schmink (2005). The relationships between ecosystem services, traditional populations and forest resource conservation in this territory are based on anthropologists Ribeiro (2006), Diegues (2005) and Almeida (2012). Furthermore, design knowledge related to sustainability and the design practice was introduced as necessary input for the reflection developed in the article. The aim was to elucidate questions related to the transformations underway in the Amazon in order to give visibility to aspects related to the design area, sustainability and social innovation.

## 2. Forests and Traditional Populations

The recent change in legislation concerning public forests for sustainable use in the Amazon allowed local communities the right to the sustainable use of the territory's resources (BECKER, 2008; 2009). This has opened new perspectives for the populations living in these areas, generating the possibility

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<sup>2</sup> According to Diegues (1999, p.17), traditional populations can be considered "peoples living in particular geographic areas that demonstrate, to varying degrees, the following commonly accepted characteristics: intense linkage to ancestral territories; Self-identification and identification by others as distinct cultural groups; Own language, often not national; Presence of their own and traditional social and political institutions and production systems mainly focused on subsistence".

<sup>3</sup> The National System of Conservation Units (SNUC) was established by the Brazil Ministry of the Environment in 2000 and "defines categories for conservation units and management systems applicable to each one" (BECKER, 2009, p.109). The Conservation Units are organized into two groups: the Integral Protection Units, whose purpose is to preserve nature, with only the indirect use of natural resources admitted; And the Sustainable Use Units, which include National Forests, Extractive Reserves, Sustainable Development Reserves, Environmental Protection Areas, among others, and reconciles the conservation of nature with the sustainable use of part of the natural resources established in a management plan.

of locally developing models of sustainable forest economy to supply the demands of the region and the country. While constituting a means of promoting the quality of life in resource extraction communities, it is considered a strategy to protect these areas from illegal deforestation (ZARIN, 2005).

The search for forest productivity models that do not destroy the extractive culture practiced by the inhabitants of the region, that is considered a sustainable model of natural resources exploitation (DIEGUES, 1999; ALMEIDA, 2014) has intensified over the last decades. The great majority of the Amazonian population, known as *caboclos*, is the result of the miscegenation of Indians with Europeans, having a racial type more indigenous than white and "essentially indigenous as an ecological-cultural adaptation" (RIBEIRO, 2006, p.286). Rubber tapper communities in the Amazon are considered the "traditional" extractive populations (RIBEIRO, 2006; DIEGUES, 1999), living mainly on rivers, streams, *igapós* (blackwater-flooded Amazonian forests), lakes and floodplains, and are characterized by their extraction activities of aquatic or terrestrial forest origin, so they depend on the local environment for their subsistence.

## 2.1. Rubber in the Amazon Socio-environmental Context

The multiple use of the forest consists of the management of varied products in diversified scales. Among these products, rubber made from the Rubber tree (*Hevea-Brasiliensis*) has been established for decades as an important component in regional socioeconomic development and is culturally integrated with the Amazon inhabitant's activities. The extraction traditionally made by the rubber tappers consists of making cuts in the trunk of the syringe tree from which the latex flows, and then collected in small bowls and coagulated to be transformed into hard rubber.

Natural rubber is a very versatile material and has physical-chemical characteristics such as elasticity, malleability, water and gas impermeability, impact resistance, electrical insulation and non-slip properties, among others. These characteristics have meant that this raw material has been used in many artifacts made by indigenous populations and rubber tappers, and later by the industry, mainly for the production of tires (DEAN, 1989; HEMMING, 2011; Campinas Agronomic Institute/IAC, 2012).

As an organic substance, latex is susceptible to attack by bacteria. It is therefore necessary to treat it with chemical processes and components such as vulcanization to stabilize and prevent it from rotting or oxidizing. (BASSAN, 2012).

The extraction of latex contributes to generating income for many families inhabiting the Amazon forests. In addition, rubber trees and rubber are major sources of carbon sequestration (JACOVINE, 2006), a key process to mitigate greenhouse gases. Productive activities from non-timber forest products, such as latex, are considered to be very important for the balance of ecosystems, since it is not necessary to knock down trees to obtain this input. Furthermore, in the current scenario it is equally important to consider the substitution of synthetic polymers for non-renewable sources, such as petroleum, for others produced from renewable materials, such as natural rubber.

The latex extraction in the Amazon for industrial purposes is one of the possibilities for generating income for the population. However, for various reasons, the highest productivity rates come from the cultivated rubber plantations in other regions of Brazil, which therefore have a greater capacity to meet industrial demands. The three main rubber-producing states in Brazil – São Paulo, Mato Grosso do Sul and Bahia – hold 92.2% of production (IAC, 2012), while production in all the other states does not reach 8%. Considering the importance of maintaining latex extractivism in the Amazon, it is also interesting to invest in the production quality through the development of techniques that can add value to rubber and explore different possibilities for use in the local sphere.

### 3. Design for Sustainability in Amazon Forest Areas

Fry (2009, p. 51) reminds us that we must consider new fields for design research and practice, such as "the design for the means of protection and extension of biodiversity" and "the creation of new materials, processes and products that help to protect the biophysical and social environment", including the important "links between ecological and social systems".

In the same way, the idea of fomenting sustainability scenarios defended by Manzini (2008) in the Design for Social Innovation and Sustainability approach opens a rich dialogue with the contemporary challenges of populations living in areas destined to environmental conservation in the Amazon. These communities, dispersed over large landholdings, find it difficult to find income sources that guarantee their basic needs and are imbued with the "mission" to conserve their territories and at the same time to develop new productivity models from forest resources and services.

Manzini (2008) argues that the perception of the growing scarcity of natural resources has led the design culture to engaging with strategies capable of supporting production models, services and behaviors necessary for a sustainable society capable of conserving resources for its survival. The author states that inheriting knowledge can represent a valuable building material for the future. Upgrading the past can be used as a new social and cultural resource. The use and reinterpretation of simple technologies in an original way can collaborate to generate new kinds of products or services, constituting potentialities not yet imagined. It is also appropriate to develop integrated systems of products, services and communications supported by an approach linked to quality socio-environmental concepts.

In turn, the Design and Territory approach integrates the idea of territory and its biodiversity valorization with the products and services that arise from a certain region's vocation. Design acts strategically from this perspective, aiding in the reconfiguration or organization of the productive processes. It also seeks to understand the possible ways to strengthen and communicate local identities and products (KRUCKEN, 2009).

#### 3.1. Technologies to Benefit Rubber in the Forest

New ideas for the conservation and valorization of biodiversity were consolidated based on Rio de Janeiro's Biological Diversity Convention in 1992, which fomented the emergence of projects targeted at the local processing of Amazonian rubber. Four technologies were developed and outlined to generate income for rubber tappers, three of which are based on the local vulcanization of latex. Transmitted to various local communities through training workshops promoted by the project's creators, these technologies enabled the creation of rubber intermediate materials and artifacts.

The first important initiative was in 1995, when two entrepreneurs from Rio de Janeiro created the Couro Vegetal da Amazônia (Amazon Vegetal Leather) company. They developed a production line of rubberized fabrics in the forest in the state of Acre (Figure 1). These fabrics were used to manufacture and market handbags in Rio de Janeiro and sold at a high added value in several countries around the world, although some groups in Acre criticized the initiative for using the traditional smoking technique in the vulcanization process (FIUZA, 2008).



Figure 1: Handbags made with rubberized fabric produced in Acre. Source: FIUZA, 2008.

Very similar to vegetable leather, another process emerged known as Ecological Leather, created by a polymer researcher in Acre in 1997. The process also consists of rubberized fabric to produce mainly handbags; the difference being that it uses a chemical formulation to vulcanize the latex that must be taken to the fire for cooking, which avoids the smoking. This process, called *ecocouro* (Figure 2) was taken to the community of Maguari, in the Tapajós National Forest, in the state of Pará between 2002 and 2004.





Figure 2: Rubber artifacts production with rubberized fabric in the Maguari Community in the Tapajós National Forest. Source: SARMENTO, 2014.



Figure 3: Some local artisans also produce molded bags based on the traditional model used by rubber tappers in the forests. This allows for serial production and less manufacturing work.

Created by the Chemistry Laboratory of the Brasília University in 1997, the Tecbor project was implemented in rubber tapper communities between 2002 and 2004 in several states of the Amazon. It offers two types of results: items with the highest value added are the natural rubber sheets, called the Semi Artifact Sheet (Tecbor / FSA). In this process the latex receives pigments, water and a vulcanizing solution with coagulants. The coagulated rubber passes through a handcrafted calender to reduce the water and is then dried on a clothesline at room temperature. The result is small, thin sheets of colored rubber Figure 4), with which it is possible to develop artifacts (Figure 7). The project did not provide this material for creating artifacts to the communities. This fact led the Jamaraquá community group to seek support from designers to aid them creating products that could be sold to the local tourism market. Design workshops for the development of visual languages and solutions to work with vulcanized rubber were held between 2007 and 2012 (Figure 5 – 8) with the Maguari and Jamaraquá communities.



Figure 4: Rubber sheet production in the Jamaraquá community in the Tapajós National Forest. Source: SARMENTO, 2014.





Figure 5: Traces of Nature workshop, 2007. Maguari Community, Tapajós National Forest. SARMENTO, 2014.



Figure 6: Traces of Nature workshop result, 2007. Maguari Community, Tapajós National Forest.





Figure 7: The different textures developed in the Traces of Nature workshop, 2007. Source: SARMENTO, 2014.



Figure 8: "Cuts and Holes workshop, 2012.



*Figure 9: Other products created from the techniques utilized in the workshops. Discards are used in the production of necklaces. Souce: SARMENTO, 2014.*

Other innovative processes with vulcanized rubber have been developing in the Amazon. One of the most interesting experiences are the shoes and sandals (Figure 9) created by rubber tapper and craftsman José Rodrigues, in Assis Brasil, in Acre. He works with TECBOR / FSA colored strips applied to shoe molds while they are still wet.



*Figure 10: Sandals made with TECBOR / FSA colored strips.*

### 3.2. Analysis of the Productive Model

The linear, open and unidirectional production chain, typical of extractive rubber production targeted for rubber industry, cannot be considered a sustainable productive system due mainly to the large amount of waste generated. Rubber has low added value in the forests and allows few possibilities for social inclusion (Figure 11).

New technologies generate the extension of the rubber life cycle. The circular production model (Figure 13) for regional consumption, based on the implementation of new technologies for the local vulcanization of rubber, add value to the latex (Figure 12), opening new possibilities for social inclusion, which also leads to the expansion of the rubber production chain. In this model, rubber properly treated can be recycled in numerous applications, or decompose in a couple of years when in contact with the soil. More than high productivity, the local context suggests experiments involving new qualities in the artifact production by local communities.

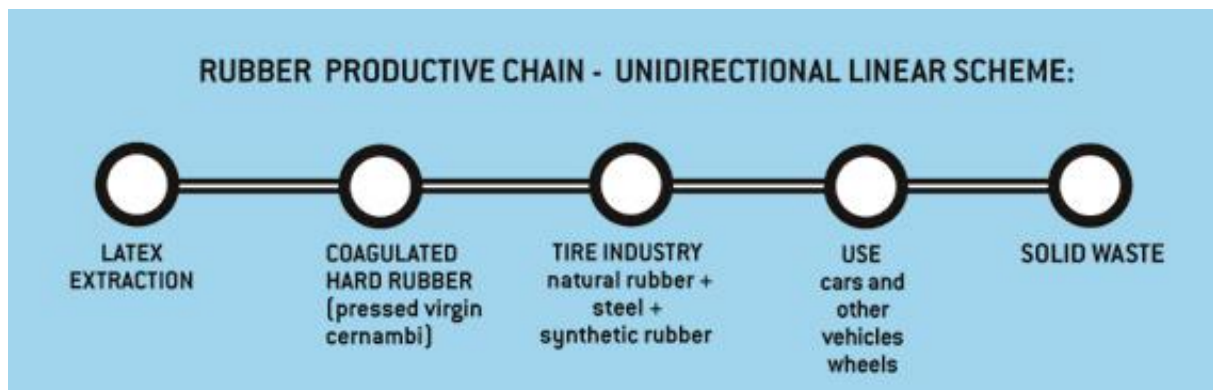


Figure 11: Unidirectional linear scheme: open circuit. Source: SARMENTO, 2014.



Figure 12: Added value in the production of artifacts. Source: SARMENTO, 2014.



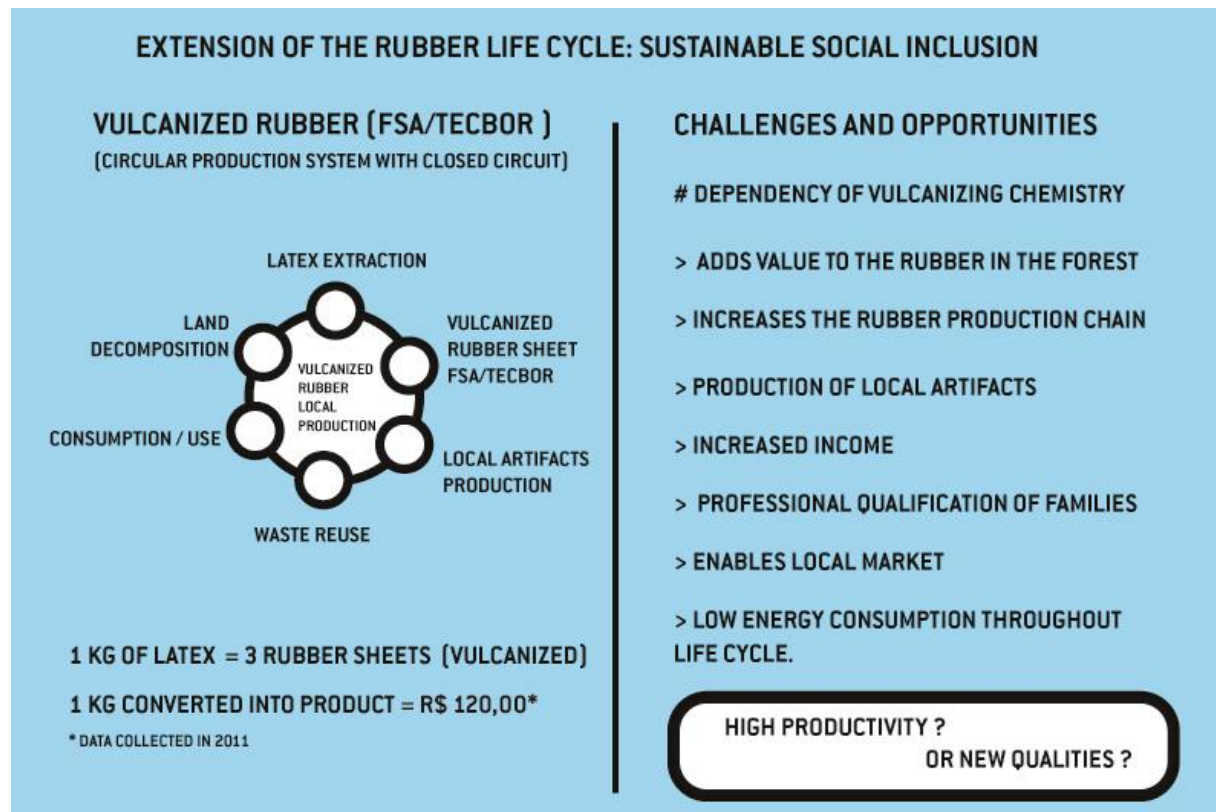


Figure 13: Circular production model. Source: SARMENTO, 2014.

## 4. The new possibilities for the use and valorization of biodiversity

The economy of the Amazon, based on long cycles of commodity extraction, now initiates a process for the creation of new possibilities for the use and valorization of biodiversity products, which can be understood as a tendency to be developed with the local groups.

Technologies to vulcanize rubber in the forest have brought other activities to rubber tapper families, causing alterations in the social structure of local communities. The intermediate materials or end products, gain a higher added value and are sold to new markets.

These technologies enabled the emergence of local activities, constituting a new stage in the value of the local rubber, thus increasing the income of participating groups (Figure 12-13). They also generated a systemic change in the traditional relation towards latex extraction, affecting local culture and behavior, expressed in the form of social innovation.

This process brought new perspectives to the extractivists, but also left some gaps: the dependence on vulcanizing chemistry to stabilize rubber and the institutions that provide the input. Moreover, the institutions that implemented these projects made no effort to promote the diffusion of broader knowledge concerning the latex stabilization processes (SARMENTO, 2014).

At the same time, a lack of in-depth reflection on the type of production to be encouraged, or on the impacts generated in the marketing of intermediate materials, or final products, was observed. On the other hand, the possibility of marketing their own products motivated local populations to seek



approximations with the consumer market. Designers were brought closer to this context by the need for production development, as well as the existence of a local market in the tourism sector, particularly in the Tapajós National Forest. This scenario gave rise to a new situation: the need to investigate the possibility of using vulcanized rubber and adapt it to local production and market conditions in a sustainable way.

Much is known about the possibilities for the industrial use of rubber, but what would the possibilities of production and local use be in the Amazon?

How to define this in a participatory way, what criteria should be adopted to guide this production?

If among the main objectives for creating forest areas destined to environmental protection are “economic and social valuation of biological diversity and protection of natural resources necessary to the sustenance of traditional populations” (MMA, 2013), we must ask what is understood by economic and social valuation: does valuation mean extracting wood, or to increase the forest products value, and market them? Does it mean to encourage technologies that would make the local populations’ manner of extraction easier? To innovate, as in offering differentiated forest products and services, stating their tangible and intangible values?

Initiatives with rubber, in some of these communities, have seen a tentative support from designers for developing production and communications with the market. These interactions were not planned at the beginning of the process, and many issues need further study.

Exchanging experiences between the local population, designer and markets involves cultural hybridization processes (CANCLINI, 2011). If on one side creating depends on local input, consumerism logic builds interfaces with globalized markets, such as tourism, which result in constant cultural and local identity transformation processes. If the design produced locally is a means of reinforcing the Amazon communities’ autonomy and identity, what would be the best direction to take in marketing?

On the understanding that the territorial capital of a place is made up of material and immaterial resources, it is interesting to reflect on what would be the best way to access and potentialize them.

#### **4.1. Designer Activities in a Socio-biodiversity Context: planning, innovation and communication**

The activities of the designer in this context are based mainly on three pillars: planning, innovation and communication, in order to foster local activities, as well as economic and cultural exchanges through sustainable processes.

We can highlight three types of relationships involving local activities that could be strengthened by design processes. The first concerns production relations, such as the extraction of forest products, their processing and the various ways of adding value to them, with a focus on their use and commercialization. The second targets service relationships, responsible for most of the income in the communities that receive large numbers of tourists, involving transportation, lodging, tour guides, food, environmental interpretation and commercializing products, among others. And lastly, communication relations that interact in all these spheres to strengthen and disseminate the various aspects related to local socio-biodiversity. This dimension still needs more work, and includes the creation of a brand, packaging, signage of the local attractions and a communication system to disclose the characteristics and intangible values of services and local products. The designer interacts with these processes, seeking qualities in different combinations of materials, processes and knowledge.

We must also consider that innovations are not only geared towards the creation of products destined to the market. They are processes that include technical, conceptual and management activities, resulting in new products, services or processes for a variety of ends, including education, culture, infrastructure and such.

Manzini affirms that it is necessary to increment opportunities and ideas that “operate with a social appeal capable of encouraging and directing actions on both the demand and services offered sides” (2008, p. 27). The designer may trigger for social development processes in public forests of the Amazon. Based on the analysis of the problem to be solved (sustainable perspectives for empowering communities that live in the Amazon Forest), it proposes design strategies to optimize the construction of innovating scenarios that can become consolidated over time.

This is a very different approach from the traditional ones, in which the designer works for a company, or industry, following a briefing provided by the client to design a product or service. This new approach involves a change in the designer’s social role when working with local communities, as the goal is now different: to develop processes based on local cultures, which may contribute towards a new economic organization.

Regarding planning aspects, Manzini (2008) reminds us that it is recommended to consider sustainability criteria, principles and directives before initiating a project, the most important being:

“develop products with low energy and material intensity; plan controls over the lifecycle of new artifacts; produce zero residues; use the wind, sun and biomass to reduce dependence on fuel; propose solutions with a regenerative potential, integrated into the context of their use; promote variety and generate new forms; protect and develop the biological, sociocultural and technological diversity; reduce the demand for products; connect things and people, reduce the demand for transportation; develop networks; promote a decentralized form of organization; develop educating systems; generate autonomy, empower people and create favorable conditions for the birth of creative communities”. (MANZINI, 2008, p.30-34)

As Frascara (2004) reminds us, projects of a high social complexity require a long time for preliminary research, and this was confirmed during the fieldwork for this research. The author emphasizes that the real problem in design resides in the identification of needs and definition of paradigms. If there is no participation on these levels, the designer’s job is reduced to an elegant executor of another person’s conception and, consequently, becomes dependent on the power structure in which he/she participates professionally.

In this way, a conceptual alignment between the designer and local actors in the social biodiversity context is essential as a way to avoid perceptions that are too different regarding processes indicated in the building of new empowering possibilities for the local population.

Field experience with artisans and rubber tappers in the Tapajós National Forest showed that the expectations of local groups is to find professionals who bring a readymade solution to generate revenue through the production of something that can be marketed immediately. In order to develop differentiated activities, product or service however, a long process of learning is needed.

We also point out the need to create detectable, discriminable and attractive messages that support basic human values that bring a positive contribution to society, favoring local cultures, as well as the project's operational goals (FRASCARA, 2004).

## 5. Final Considerations

The processes described indicate a broader scenario, one in which the resignification of forest materials is one of the possible paths for the development of a new forest economy model. From a marketing point of view, the symbolic value of this production contributed to add value to the rubber products. However, issues related to the sustainability of these projects can be further studied, and it is interesting to consider the development of new applications in the local sphere, which could guarantee the maintenance of the projects, as well as avoiding costs and energy consumption with distant markets.

The process underway is not yet fully developed and requires greater diffusion of knowledge about latex treatment processes and use. Initiatives such as the training of groups to use different craft techniques, as well as the development of market access communication tools, still need improvement. Field experience suggests that the best way to strengthen rubber resignification processes in the Amazon is integrated training, with a special focus on education, providing access to fresh knowledge, techniques and visual languages to work with latex. The experiment with new visual languages in rubber artifacts can act as a driving force for innovation processes, which constitutes a dynamic for valorization, protection and promotion of diverse cultural expressions.

Markets change constantly due to the most varied factors and financing for projects dries up. It is therefore not appropriate to structure local production only on initiatives that depend on external mediating institutions to make inputs available for production and commercialization. A community with available inputs and knowledge of multiple latex working techniques can adapt to the different opportunities and oscillations of the market with the tools, techniques and languages to propose innovative products and solutions.

With learning, recognition, registration and valuation of different cultural practices, refined over years of tradition, may also indicate ways to empower the local population in a way that could guarantee a differentiated identity for local initiatives, with the inclusion of solutions for lower impacts on the environment.

The promotion of activities that value local creative production and increase the value chain of forest products have a great potential for expansion, while generating more income for the local population. These experiences, based on local population skills and training, fit the idea of development as a process of expanding the capacity of individuals to make choices, which presupposes greater attention to basic educational aspects. Design can therefore be an important tool for developing the qualification process of local groups in order to add value during the stages of production, communication and marketing of local products and services.

Innovations directed to socio-environmental aspects require designers to be able to support the groups involved in order to jointly develop techniques and values that enable innovative and sustainable solutions, aiming at opening markets and reducing the impacts generated in production and consumption. Innovation is encouraged to increase competitiveness, or to bring new solutions to a given problem. It is therefore important to note whether current initiatives add new combinations to a given production system, and whether they are consistent with the local context and market for which they are intended.

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