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# Skills for Green Jobs in **Brazil**







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First published 2018

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*Skills for Green Jobs in Brazil*

ISBN 978-92-2-132749-3 (print)  
978-92-2-132750-9 (web pdf)

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## Abbreviations and Acronyms

<b>CAN</b>	Brazilian National Agriculture Confederation
<b>COP 21</b>	21 <sup>st</sup> Conference of the Parties
<b>EMS</b>	Environmental management systems
<b>FIES</b>	Fundo de Financiamento Estudanti ( Student Financing Fund)
<b>FIC</b>	Free Initial and Continuing Education
<b>GDP</b>	Gross Domestic Product
<b>GHG</b>	Greenhouse Gases
<b>GMOs</b>	Genetically modified organisms
<b>IBGE</b>	Instituto Nacional de Geografia e Estatística (Brazilian Institute for Geography and Statistics)
<b>ILO</b>	International Labour Organization
<b>MEC</b>	Ministry of Education
<b>MMA</b>	Ministry of Environment
<b>NDCs</b>	Nationally Determined Contributions
<b>ODS</b>	Sustainable Development Objectives
<b>PNC</b>	Programa Nacional de Capacitação de Gestores Ambientais
<b>PRONATEC</b>	National Programme of Access to Technical Education and Employment
<b>PNMC</b>	Política Nacional de Mudança Climática (National Policy on Climate Change)
<b>SENAI</b>	National Industrial Training Service (Serviço Nacional de Aprendizagem Industrial)
<b>SENAC</b>	National Commercial Training Service (Serviço Nacional de Aprendizagem Commercial)
<b>SENAT</b>	National Transportation Training Service (Serviço Nacional de Aprendizagem do Transporte)
<b>SENAR</b>	National Rural Training Service (Serviço Nacional de Aprendizagem Rural)
<b>SEBRAE</b>	Brazilian Support Service to Small and Medium Size Companies (Serviço Brasileiro de Atendimento às Pequenas e Médias Empresas)
<b>SISNAMA</b>	Structuring and strengthening of the National Environmental System
<b>TVET</b>	Technical and Vocational Education and Training
<b>UNICA</b>	Union of Brazilian Sugarcane Industry Association

## Abstract

In the first decade of the 21<sup>st</sup> century there was great expectation that Brazil would become a leader on environmental issues. However, the Brazilian economy in the mid-2010s did not follow the expected trend of transformation as it suffered slowed economic growth, including two years of recession with higher rates of unemployment (in 2014 and 2015) with a rising fiscal deficit that have slowed efforts toward fostering a green economy and skills development linked to green jobs. The crisis undermined the expected positive changes, and the severe fiscal problems and record unemployment crisis reduced opportunities for green jobs. In a broader perspective there was little room for improving demand for enhanced sustainability in the labour market in a context of a reduction, rather than an increase, in the need for employees with skills for green jobs. Empirical data show that there was no upward trend in green jobs in relation to the wider economy between 2010 and 2017. In this context efforts to train or re-train workers with greener skills have remained relatively marginal. But there is room for improvement on this issue in the future. According to the specialists interviewed for this study, the most important strategy for training in “green job skills” in Brazil is to generate an overall capacity for understanding and mainstreaming knowledge of the basic concepts of sustainability and how such activities might affect the environment and the quality of life. This general understanding of sustainability principles has been considered as important as providing “technically-oriented” skills capacity whereby workers are trained to perform correctly in some specific contexts together with a deeper understanding of why this is necessary. This study presents a survey of existing courses associated with Technical and Vocational Education and Training (TVET) in Brazil, at various levels and in various areas, in such a way as to generate a better understanding of the main subjects covered in courses aiming at green jobs in Brazil.

## Acknowledgment

This study was conducted by Carlos Eduardo Frickmann Young, Maria Gabrielle Correa, Marcos Pires Mendes, Lucas de Almeida Nogueira da Costa, as a part of set of national studies on skills for green jobs conducted in some thirty countries globally. The set of studies is the result of collaboration between the ILO and the European Centre for the Development of Vocational Training (Cedefop). Overall methodological guidance was provided by Olga Strietska-Ilina (ILO Employment Policy Department, Skills and Employability Branch). Coordination of country studies and technical backstopping was provided by a team led by Catherine Saget (ILO Research Department), Tahmina Mahmud (ILO Skills and Employability Branch) and Takaaki Kizu (ILO Research Department). Moustapha Kamal Gueye and Marek Harsdorff (ILO Enterprises Department, Green Jobs Programme) contributed to the studies’ implementation on behalf of the ILO Green Jobs Programme. Alena Zunkersteinova and Stelina Chatzichristou from Cedefop’s Department for Skills and Labour Market coordinated studies among the participating EU countries. Valuable inputs were provided by the ILO colleagues: Anne Posthuma, Christine Hoffmann, Laura Brewer, Maria Ilca Lima Webster, Alvaro Ramirez Bogantes, Hassan Ndahi, Fernando Vargas Zuñiga, Patrick Daru, Akiko Sakamoto, Mikhail Pouchkin, Gabriel Bordado, Julien Magnat, Kanae Tada, Tendy Gunawan, Bolotbek Orovov, Gwyneth Anne Pamos, Georginia Pascual, Badiane Cheickh and Kishore Kumar Singh. Solveig Boyer (ILO Green Jobs Programme), Annette Brandstater (ILO Skills and Employability Branch), Massimiliano Leone, Ana Buzdugan (International Training Centre ILO Turin) and Manuela Flamini (Edizioni Retrò s.r.l.) were responsible for editing and design.



# 1. Introduction

This paper summarizes the technical report “Skills for Green Jobs in Brazil”, prepared by Young et al. (2018). The objective of the research was to update the previous ILO report on “Skills for green jobs in Brazil” (ILO, 2010) in order to identify recent trends in the major challenges and priorities related to greening policies and strategies, with emphasis on issues concerning skills development and the national response to climate change (as defined in Nationally Determined Contributions – NDCs).

The paper discusses the changes in the economy and employment since 2010. It briefly covers key Brazilian policies and regulations related to the environment. The paper then addresses green jobs and the skills required for them, including an analysis of the curricula of selected courses and specific case studies. It concludes with recommendations for improving the skills required by the labour force in a future transition to a greener economy.



## 2. Major changes in the economy and employment shifts in the green transition since 2009/10

### 2.1 Up and down: the 2010 ILO Report and the Brazilian economy in the 2010s

The ILO report on “Skills for green jobs in Brazil” (ILO, 2010) analyzed the demand for green occupations and skills in Brazil, and identified what would be the necessary conditions for supplying green skills. The report considered positive aspects that would have facilitated the transition to a low-carbon green economy, viz.:

- The fact that most greenhouse gas (GHG) emissions originated from forestry and land use, rather than from the industrial and energy sectors;
- The presence of very well-structured environmental legislation and institutional mechanisms to implement such a transition;
- New technologies that might be diffused to mitigate GHG emissions and, therefore, create an impact on certain occupations.

The study identified economic activities that contribute directly to reducing GHG emissions: generation, transmission and distribution of cleaner or renewable energy; improvements in the transport sector; improvements in environmental quality; and activities associated with emission of carbon dioxide. Following this approach it was possible to identify green economic activities with greater growth expectations over the next five years and occupations that are expected to expand in the following sectors: administration and management; agriculture, forestry and fisheries; manufacturing assembly activities; electrical equipment installation and repairs; electronics and telecommunications installation and repairs; and engineering activities (excluding electro-technology).

Using a relatively broad classification of green jobs as “belonging to a green economic activity”, ILO (2010) estimated that in 2008 a total of 1.4 million formal green jobs existed in the Brazilian economy, equivalent to 3.6 per cent of all formal jobs in that year. The report emphasized that this result was controversial because of the lack of a consensual definition of green economic activities.

Using an even broader definition that categorises as green “the occupational family that has at least one occupation related to the environment or to recycling, or that has at least one occupational task that bears these characteristics” (ILO 2010), the number of green jobs reached 4.8 million, or 12 per cent of overall formal employment, in 2008. These estimates revealed an already significant amount of workers exercising “green skills” in their professional activities even prior to substantial incorporation of green skills in vocational educational training institutions.

The study emphasized the role of environmental legislation in motivating and organizing skills in vocational educational training, that is helping public and private educational institutions respond to and adopt new procedures and technologies to fulfil legislative requirements. Long-term parameters were then considered in order to anticipate future changes, taking account of the time lag between learning activities and the maturing of investments made by the technical, vocational, educational and training institutions in infrastructure, teaching methods, educational resources and teacher training.

The study listed governmental measures for environmental protection. The general perception was that these programmes would be implemented in such a way as to induce

productive sectors to move more quickly towards a low-carbon and green economy. The study also expected that the private sector would follow the same pattern, even though it acknowledged the necessity of strengthening the institutional exchange of knowledge generated during implementation of such plans and programmes.

The recommendations considered in the Brazilian study report in 2010 included the following:

- Create a mechanism for monitoring national and international environmental legislation, with the objective of identifying economic activities presenting greater opportunities for mitigation; technologies and procedures that firms are willing to adopt; and impacts on occupations resulting from diffusion of such technologies and procedures.
- Identify specific skills for green economic activities presenting substantial possibilities for mitigation and adaptation.
- Recognize which activities involving different actors can be carried out in order to amplify the consensus on what constitutes a green economic activity. Occupations that satisfy the core competences of economic activities likely to expand, such as those associated with cleaner energy and fuels based on renewable sources, could be prioritized in a training strategy. It would also accelerate the transition to a low-carbon economy.
- Recognize that jobs generated by the growth of green economic activities can be filled by different types of worker, especially those displaced from occupations that were or will be affected by the diffusion of cleaner technologies.
- Identify possible impacts based on prospective studies: identify future diffusion of emerging technologies; analyse the impact of such diffusion on occupational profiles and new labour organization formats; establish mechanisms for vocational educational training institutions.

Unfortunately the Brazilian economy in the 2010s did not follow the optimistic trend of transformation expected at the end of the previous decade. Instead of productive

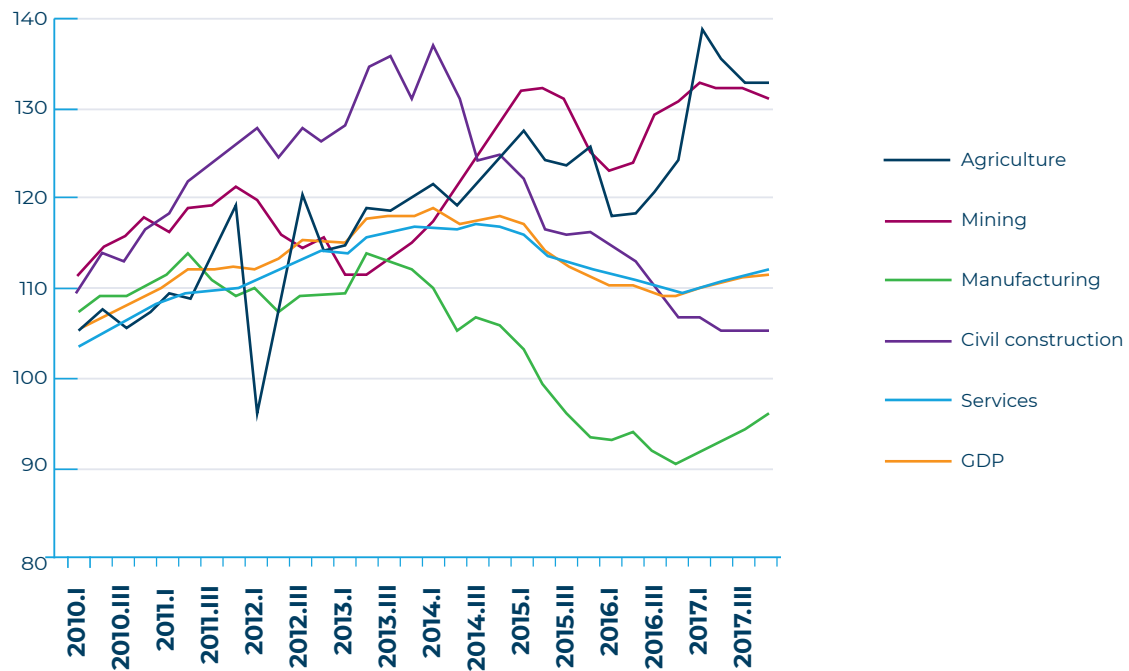
diversification there was further specialization in “brown” activities. Moreover a severe macroeconomic crisis hit the country, with rising unemployment, impacting negatively on green jobs opportunities. In spite of the original intentions of the Brazilian government, including commitments expressed in international fora such as the Rio +20 Conference, limited change has been observed in terms of more green jobs in relation to the wider economy, and therefore efforts to train or re-train workers in skills for a green transition have remained relatively limited.

“Re-primarization” is the concept designed to describe the trend throughout Latin America of expansion of activities associated with the primary sector, such as mining, oil, cattle and soy (Cooney, 2016). In Brazil the structural change is evident from the changes in the composition of gross domestic product (GDP) and exports, with increasing specialization in natural resource intensive products, natural resources and energy, activities with high pollution potential. Dependence on resource intensive economic activities has increased, including deforestation and excessive use of fossil fuels and other natural resource assets.

An economic model based on extraction of natural resources reinforces social exclusion, since the economic gains tend to benefit a relatively small group. These types of sectors involve labour-saving activities which generate only a limited number of jobs, while their worst environmental degradation effects impinge on the poorest sections of the population. In other words, the unequal consequences of the worsening of environmental conditions establish a new dimension of social exclusion in a country already characterized by high income disparities.

The Quarterly National Accounts prepared by the Brazilian Institute for Geography and Statistics (IBGE – *Instituto Nacional de Geografia e Estatística*) show a huge asymmetry in the evolution of GDP when analyzed for its sectoral composition (Graph 1). Seen as a whole, Brazil's GDP grew 11 per cent between 2009 and 2017, and the services sector followed a very similar pattern. However, some activities performed well above the average, notably agriculture (35 per cent growth) and the extractive mining

## Skills for Green Jobs in Brazil

**Graph 1.** Brazilian Economic Growth, 2010-2017, Quaterly GDP (2009 = 100)

Source: Brazilian Geography and Statistics Institute (Instituto Brasileiro de Geografia e Estatística - IBGE)

industry (32 per cent growth). The construction industry grew above the average in the 2010-2013 period, but after that suffered a sharp decline. Manufacturing industry, the largest employer in the secondary sector, demonstrated only a mediocre performance, with a six per cent reduction over the period. As will be discussed later, the recession faced by the Brazilian economy since 2014 has strongly affected unemployment, which in turn has had negative effects on the possibilities for generating new green jobs.

ILO (2010, p. xi) argued that environmental legislation is the main factor contributing to the transition of the Brazilian economy to a low-carbon economy. However, to implement an effective command-and-control system for imposing environmental legislation, it is necessary to upgrade skills and increase the number of workers employed in public environmental management. But especially after 2014 Brazil suffered major cutbacks in the public budget, especially in the environmental protection sector which declined more than the average (Young et al. 2014; Bragança, 2017).

The consequence is increased distancing from the principles of a green economy, with more activities that pressure the environment (in the primary sectors and infrastructure investment such as road building and large energy projects), while spending on environmental protection remains stagnant or declining. Hence instead of being a source of new jobs the Brazilian public environmental protection sector struggles to remain at the same level as in the previous decade.

Moreover, since the command-and-control capacity of the public sector has been weakened by the negative economic scenario, there is little incentive for more proactive pressure in the private sector for greening its activities. The largest environmental disaster in Brazilian recent history, the collapse of a dam of the Samarco mining company in 2015, along with the resurgence of deforestation, are examples of this process, and indicate a gap between the stated intentions of, and actual decisions by, Brazilian companies in terms of environmental protection practices.

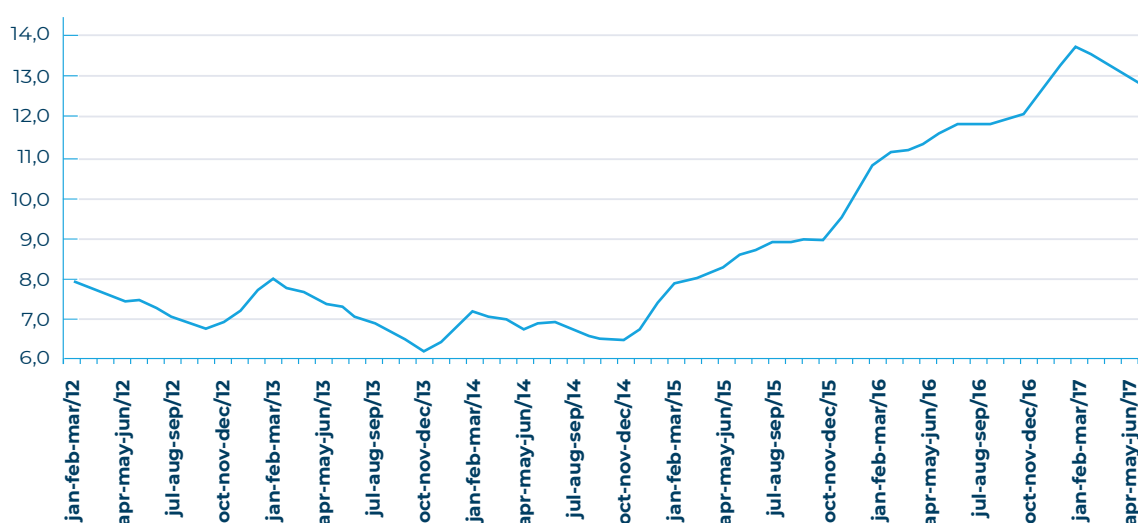
More evidence of re-primarization includes the increase in the percentage of raw agricultural and mineral materials in the total export basket. According to the IBGE National Accounts, in 2000 agricultural cattle-farming products accounted for 6.0 per cent of Brazilian exports, and mineral products 7.4 per cent. In 2015 those percentages rose to 15.5 per cent and 12.4 per cent respectively. Since these activities have considerable impact on the environment, especially on deforestation (Brazil's largest source of GHG emissions) and on water and soil contamination, it is clear that Brazilian participation in the international market is increasingly "brown" rather than "green".

Productive specialization occurs not only in raw materials but also in products whose production processes present high pollution potential (Young, 2011; Gramkow, 2011). In the processing industry the activities with the best performance in recent years are those which emit more pollutants per unit of value generated. In such cases competitiveness is based on cheap access to raw materials and energy, or entails a disregard of negative environmental externalities (Young, 2016).

The return to a primary export model propelled by high environmental impact activities undermines social inclusion owing to its inability to generate high-productivity jobs and to its adverse effects on wages as well as on formal jobs. The agriculture and livestock sector is experiencing a continuous decline in the numbers employed, despite the substantial growth in production. IBGE data show that the broad agriculture sector (including cultivation, livestock forestry and fisheries) was responsible for 24.6 per cent of total jobs in the 1995-1999 period. In 2000 this percentage had fallen to 21.2 per cent (16.7 million jobs), and in 2015 to only 12.9 per cent (13.2 million jobs). In absolute terms this meant a net loss of 3.8 million jobs between 2000 and 2015 in the sector as a whole (farming, forestry, plant extraction, livestock and fisheries), although production grew considerably more than total GDP in the same period.

The extractive mining industry, which is the other prominent sector in terms of GDP and export growth, accounted for 189,240 jobs (0.2 per cent of the total) in 2000, and 287,556 jobs in 2015 (0.3 per cent of the total). Therefore, even though it presented a considerable expansion in relative terms, mining continues to have a marginal role in job creation.

**Graph 2.** Unemployment Rate, Brazil, Quarterly Moving Average (% of the labour force)



Source: IBGE

### Skills for Green Jobs in Brazil

The employment situation has worsened considerably with the macroeconomic crisis. Graph 2 shows the evolution of the unemployment rate since 2012, according to IBGE. It shows that the situation has worsened over time, and unemployment peaked in 2016-2017.

Hence the original expectations that green jobs would expand during the 2010s in Brazil were largely frustrated. The next subsection presents the evolution of “green jobs” over time, in the opposite direction from what Strietska-Ilina et al. (2011) consider as possible ways in which the transformation wrought by greening economies affects skills needs, viz.:

- a) The green transformation changes the balance of activities in the economy (for example from those that are less energy-efficient and generate higher CO<sub>2</sub> emissions towards those that are more efficient and less polluting);
- b) The introduction of new regulations and the development of new technologies and practices result in the emergence of some entirely new occupations;
- c) New skills are needed by workers in many existing occupations and industries in the process of greening existing jobs, requiring very extensive changes in skills requirements along with major efforts to revise existing education curricula and training programmes at all levels.

## 2.2 Evolution of green jobs in Brazil: an empirical approach

ILO (2010) presented two estimates of green jobs in Brazil, in accordance with the methodology proposed by the ILO (2009). The first estimate considered the jobs associated with economic activities classified as “green” (activities which improve environmental conditions, such as emissions mitigation and pollution control), with a total of 1.4 million formal green jobs (3.6 per cent of the total). The second estimate defined green jobs as activities that have at least one occupation related to the environment or to recycling, or that has at least one occupational task that bears these characteristics, with a total of 4.8 million (12 per cent of the total).

However there are important methodological problems with these classifications. The concept of “green employment” is not absolute since it involves many ‘shades’ of green and the concept evolves over time (UNEP, 2008); “green job” is a relative and dynamic concept which varies depending on significant advances made in environmental innovation aiming to minimize the environmental liabilities of each production process. There are many activities that can result in advances or setbacks in sustainability depending on the form of production and management. In order to define green employment it is necessary to recognize within each productive process, in an intra-sectoral way, the measures and inputs that allow a reduction or neutralization of the environmental impacts resulting from each activity. This approach would be more effective if it could define more clearly the intra-sectoral conditions necessary for productive processes to be considered environmentally efficient, impact-reducing and green jobs generating. As it stands now, most activities with the potential to generate green jobs are in the field of pollution and degradation economics.

In addition, the evidence shows that activities identified with green objectives do not necessarily provide decent work, understood as the promotion of opportunities for women and men to be involved in decent and productive activities in conditions of freedom, equity,

security and human dignity, in which people's aspirations in their professional lives are satisfied in terms of opportunities and income; of rights, participation and recognition; of family stability and personal development; and of justice and gender equality (ILO, 2009). In the case of Brazil the situation of sugar-cane cutters is a good example of this problem: ethanol from sugar-cane plantations is a renewable ("green") source of energy that can replace fossil fuel consumption, but considering the poor working conditions and the wide disrespect for legislation and social rights (Rocha et al. 2010), it cannot be classified as "decent work". In order to minimize this problem, Bakker and Young (2011) proposed an alternative system of classification, better adapted to Brazilian conditions, viz.:

- a) Activities related to the preservation of environmental quality and low-carbon potential: water, sewage, waste management and decontamination activities; services for buildings and landscape activities; activities related to cultural and environmental heritage; and the activities of associative organizations.
- b) Clean activities with potential for greening other sectors of the economy: public administration, defence and social security; education and training; research and scientific development.
- c) Activities of which the environmental impacts may be significant and depend on environmental management capacity in production in agriculture, livestock, forestry, fisheries and aquaculture; in extractive industries; in industrial processing; in electricity and gas generation; in construction; and in transport, storage and mail.

This study used the Bakker and Young (2011) classification. Data was extracted from the RAIS register of formal occupations (only including wage workers formally employed) for the 2010-2015 period.

Table 1 shows the trends in formal jobs in activities related to the preservation of environmental quality and low-carbon potential. This classification is close to the first group identified by ILO (2010): activities that contribute to the reduction of GHGs and to the preservation

of environmental quality. It is interesting that they exhibit similar percentages in terms of the total number of occupations (between 3.4 per cent and 3.6 per cent), with little change in the relative participation of these "green" jobs over time.

Table 2 shows the results using the broader classification of activities of which the environmental impacts may be significant and depend on environmental management capacity in production. This has some analogies to the ILO (2010) group of activities that have at least one occupation related to the environment or to recycling, but it is much wider and encompasses far more jobs (approximately half of the total working force). Again, the stability in relative terms reinforces the fact that no effective transition was achieved in the Brazilian economy towards more green-sensitive activities between 2010 and 2015.

Table 3 presents the evolution of formal jobs in activities of which the environmental impacts may be significant and depend on environmental management capacity in production. There are important changes in sectoral terms, with expansion in some activities (mainly in the primary sector and some services) and a decline in others (mostly in the manufacturing sector), but in aggregate terms their proportion remained at around 50 per cent of total jobs. However, it is not clear if this is associated with "green" or "brown" activities since the classification system used in current statistics does not allow identification of whether sustainable practices are adopted.

In conclusion, the empirical results indicate no significant expansion of green jobs in Brazil between 2010 and 2015. Some of the sectors that increased their labour forces are among the "brown" activities associated with the re-primarization process. On the other hand the service sector is progressively more important in terms of labour absorption.



## Skills for Green Jobs in Brazil

**Table 1.** Formal jobs in activities related to the preservation of environmental quality and low carbon activities, Brazil, 2010-2015

ACTIVITY	2010	2011	2012	2013	2014	2015
Water catchment, treatment and distribution	122684	123490	128348	130741	132015	132291
Sewage management	1424	1571	2006	3410	4330	4396
Activities related to sewage, except network management	23192	14712	17341	19809	12154	9924
Collection of non-hazardous waste	101547	111375	115300	125668	136558	131626
Collection of hazardous waste	2898	3182	3777	4786	5746	4982
Treatment and disposal of non-hazardous waste	26075	28432	27893	27721	27386	27018
Treatment and disposal of hazardous waste	2694	2708	4067	4699	5112	4458
Recovery of metal materials	9461	10960	10332	10622	9879	9185
Recovery of plastic materials	7908	8316	8904	9640	10189	9585
Recovery of materials not previously specified	13279	12550	13641	13750	14848	13313
Decontamination and other waste management services	1691	1445	1319	1621	1525	1553
Construction of water supply networks, sewage collection and related constructions	29044	30744	31369	32026	36154	35480
Cleaning in buildings and in homes	612802	682040	668459	666615	706438	671783
Immunization and urban pest control	18568	18179	17366	16811	18120	20507
Cleaning activities not elsewhere classified	51807	64050	59522	77441	72096	82965
Landscape activities	12601	15661	18366	20007	23288	24560
Activities of botanical gardens, zoos, national parks, ecological reserves and environmental protection areas	2318	1922	2853	2575	2536	1908
Activities of associations in defense of social rights	368496	375594	373820	365558	375332	368517
Associative activities not previously specified	148020	143035	131117	127286	120144	124048
<b>Total "green" jobs</b>	<b>1556509</b>	<b>1649966</b>	<b>1635800</b>	<b>1660786</b>	<b>1713850</b>	<b>1678099</b>
<b>% of the total jobs</b>	<b>3,5%</b>	<b>3,6%</b>	<b>3,4%</b>	<b>3,4%</b>	<b>3,5%</b>	<b>3,5%</b>

Source: *Relação Anual de Informações Sociais (RAIS)*

**Table 2.** Formal “green-sensitive jobs” - jobs in activities of which the environmental impacts may be significant and depend on environmental management, Brazil, 2010-2015

	2010	2011	2012	2013	2014	2015
Green sensitive jobs	22349891	23535956	24147831	24766770	24836467	23563440
<b>% of the Total</b>	<b>50,7%</b>	<b>50,8%</b>	<b>50,9%</b>	<b>50,6%</b>	<b>50,1%</b>	<b>49,0%</b>

Source: Authors' own elaboration, based upon RAIS data

**Table 3.** Formal “green-sensitive jobs” - jobs in activities of which the environmental impacts may be significant and depend on environmental management, Brazil, 2010-2015

	2010	2011	2012	2013	2014	2015	% CHANGE 2010/2015
Production of temporary crops	409325	411681	406418	416650	407368	403265	-1,5%
Horticulture and floriculture	41688	41740	43435	45920	46037	47030	12,8%
Production of permanent crops	243299	277195	264013	254121	255946	258752	6,4%
Production of permanent crops	608780	640297	639015	652036	655762	676455	11,1%
Forest production - planted forests	129703	133009	122403	111832	109344	103775	-20,0%
Fishing	17270	18711	17896	18907	20448	19773	14,5%
Extraction of coal	5418	4947	5877	5336	5360	4309	-20,5%
Extraction of oil and natural gas	29294	29597	33160	34020	31810	30941	5,6%
Extraction of iron ore	65572	75731	90195	89944	87874	80748	23,1%
Extraction of stone, sand and clay	85285	91167	95621	97970	97816	94748	11,1%
Support activities for the extraction of oil and natural gas	25647	29947	34444	34113	34746	29742	16,0%
Slaughter and manufacture of meat products	1400852	1452835	1438869	1504798	1531732	1529478	9,2%
Manufacture of alcoholic beverages	126398	130829	144689	139074	138250	129833	2,7%
Industrial smoke processing	15608	15132	14911	14170	13688	13863	-11,2%
Preparation and spinning of textile fibers	312690	302262	298619	302869	296028	260478	-16,7%
Manufacture of wearing apparel and accessories	706125	704033	695172	696085	683752	614614	-13,0%

## Skills for Green Jobs in Brazil

	2010	2011	2012	2013	2014	2015	% CHANGE 2010/2015
Tanning and other leather preparations	419973	408761	401849	395461	372499	341489	-18,7%
Wood splitting	204350	202043	196792	192868	189195	176219	-13,8%
Manufacture of pulp and paper pulp	173219	175122	177230	181634	184767	177323	2,4%
Printing	123095	125213	126152	123924	121979	113243	-8,0%
Coke production	150674	164354	160979	162777	158758	151262	0,4%
Manufacture of inorganic chemicals	271120	273143	274919	281824	282389	269618	-0,6%
Manufacture of pharmaceutical products	92472	93386	96618	99388	103101	103187	11,6%
Manufacture of rubber products	446369	444267	452373	457043	455677	412431	-7,6%
Manufacture of glass and glass products	413722	439271	451568	460712	457034	427447	3,3%
Manufacture of pig iron and ferro-alloys	254037	259737	251651	250700	236904	213790	-15,8%
Manufacture of builders' carpentry and joinery	526202	544703	539641	535015	509829	450799	-14,3%
Manufacture of electronic componentes	165056	177066	175462	179041	167344	136234	-17,5%
Manufacture of generators, transformers and electric motors	212780	223135	228222	225643	224188	198288	-6,8%
Manufacture of engines, pumps, compressors and transmission equipment	373660	402882	410587	428140	408118	361416	-3,3%
Manufacture of cars, vans and SUV's	506160	526099	514483	532364	489279	426107	-15,8%
Construction of boats	93313	97619	105422	115065	111719	98269	5,3%
Manufacture of furniture	256352	269035	279558	284319	283001	256067	-0,1%
Manufacture of jewelery and related articles	135371	142573	149441	156918	157834	147592	9,0%
Maintenance and repair of machinery and equipment	137525	153009	169338	180304	188781	176465	28,3%
Generation, transmission and distribution of electricity	120591	126527	124003	127062	126086	132013	9,5%
Incorporation of real estate projects	1197149	1309243	1339911	1351652	1318124	1117557	-6,6%

	Skills for Green Jobs in Brazil						
	2010	2011	2012	2013	2014	2015	% CHANGE 2010/2015
Construction of highways, railways, urban works and special works of art	847985	920170	945889	955272	889164	730394	-13,9%
Demolition and site preparation	588540	679718	729573	787229	812139	737217	25,3%
Construction Materials	927538	986174	1024329	1027994	1034516	981998	5,9%
Commercial representatives and agents of commerce, except motor vehicles and motorcycles	1380202	1454237	1528234	1584156	1640730	1617214	17,2%
Non-specialized retail trade	6005089	6315917	6590105	6817524	6971130	6853786	14,1%
Railway and subway rail transport	1477938	1584793	1649172	1721479	1776584	1740127	17,7%
Cabotage and long haul shipping	33374	36630	36949	43705	45636	43492	30,3%
Air Freight	67527	72653	71160	70695	71731	68562	1,5%
Storage, loading and unloading	359762	389462	415158	427608	443057	421388	17,1%
Mail Activities	163782	177890	184314	189396	187199	182627	11,5%
<b>Total Jobs</b>	<b>22347881</b>	<b>23533945</b>	<b>24145819</b>	<b>24764757</b>	<b>24834453</b>	<b>23561425</b>	<b>5,4%</b>
<b>% of total formal Jobs</b>	<b>50,7%</b>	<b>50,8%</b>	<b>50,9%</b>	<b>50,6%</b>	<b>50,1%</b>	<b>49,0%</b>	

Source: Authors' own elaboration, based upon RAIS data

## 3. Key policies and regulations

### 3.1 Earth Summit (Rio +20) and climate change policies

In 2012 Brazil hosted the United Nations Conference on Sustainable Development (Rio+20), the aim of which was to enshrine the concept of green economy as a guide to solutions for sustainability, especially for institutions which “act locally” including governments, businesses and civil society organizations. But there was frustration about the lack of legally-binding agreements and other practical measures for accelerating the transition towards sustainable practices.

The Brazilian Government perspective during the Conference was to emphasize that the most important step in developing countries was to improve social justice and inclusion of the poor, and acceptance of environmental objectives was subordinated to this. This was a reflection of the social advances then observed in Brazilian society during the period, versus more limited attention given to explicit environmental policies:

*“The fundamental principle of common but differentiated responsibilities enshrined in Rio-92 has often been rejected in practice. Without it, there is no possible consensus on building a more just and inclusive world in which human beings can be at the center of our concerns. (...) We know that sustainable development is the best response to climate change. (...) Sustainable development implies growth of the economy, so that wealth can be distributed. It means creating formal jobs and expanding the income of workers” (ROUSSEFF, 2012, author’s translation).*

According to Viola and Franchini (2012), the most positive outcome of Rio +20 was a recognition of the role of non-governmental organizations, the business sector and sub-national governments, especially the alliance between the world’s

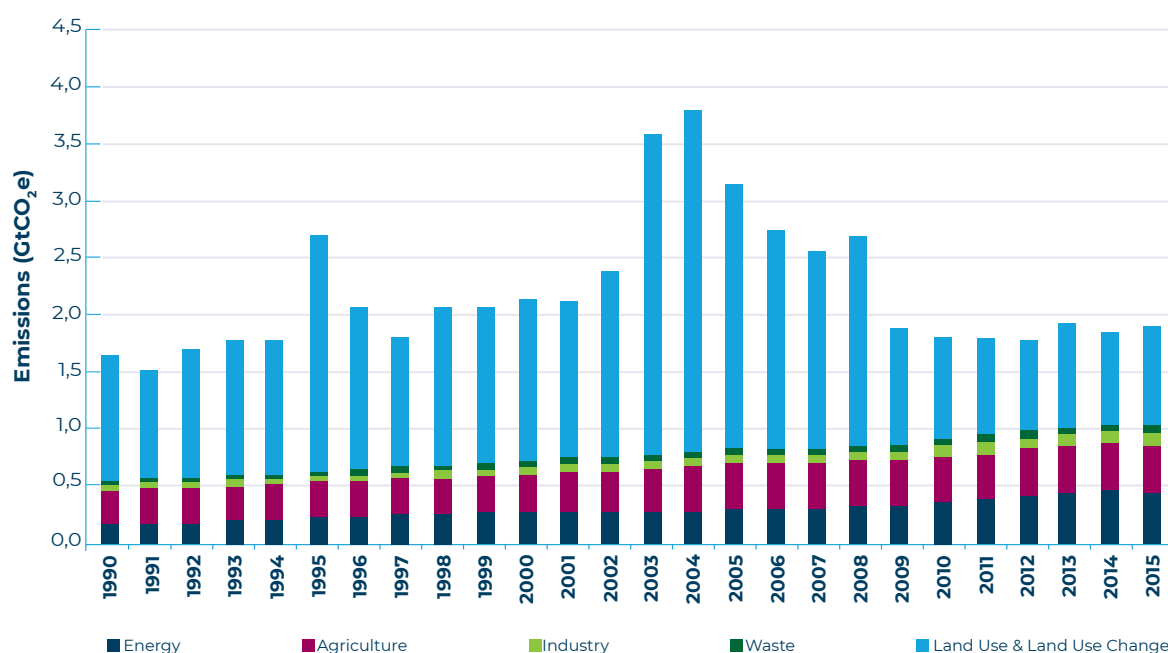
largest cities. But it did not generate the necessary momentum for the transition of the Brazilian economy to a low-carbon, greener pattern of production.

The most important legislative advance was the promulgation of the National Climate Change Law (12,187) in December 2009, which established the National Policy on Climate Change (PNMC – Política Nacional de Mudança Climática). The Nationally Determined Contribution (NDC) incorporated the voluntary commitment to reduce by 37 per cent the GHG emissions trajectory proposed at the 15<sup>th</sup> Conference of the Parties (COP 15) of the UNFCCC in Copenhagen in 2009. To that end the Federal Government of Brazil has established sectoral plans corresponding to its commitments in the areas of deforestation control, energy and agriculture.

These commitments were updated by the Paris Climate Agreement, negotiated by President Rousseff’s government during the 21<sup>st</sup> Conference of the Parties (COP 21) of the UNFCCC in December 2015, and signed by President Temer in June 2017. The original intended commitment to reduce greenhouse gas emissions by 37 per cent below 2005 levels in 2025 (from COP 15) was changed to the new target of reducing greenhouse gas emissions by 43 per cent below 2005 levels in 2030 (the Brazilian NDC signed by President Temer is presented in Appendix B).

The main reason behind this optimistic commitment to reducing Brazilian GHG emissions was the considerable reduction in deforestation, particularly in the Brazilian Amazon, in the 2000s. Emissions from slash-and-burn associated with the land-clearance process in the expansion of the agricultural frontier were historically the main source of GHG emissions.

However, the combination of increasing pressure to expand the agriculture frontier, changes in

**Graph 3.** Brazilian GHG emissions, 1990-2015

Source: *Sistema de Estimativas de Emissões e Remoções de Gases de Efeito Estufa (SEEG)*

environmental legislation, and poor financing and resources for the environmental agencies, resulted in the return of expanding deforestation in the 2010s. Deforestation has also increased in the Atlantic Forest (marginally) and in the tropical savanna ecoregion (i.e. the Brazilian Cerrado) biome in recent years. This is due to the massive conversion of natural habitats to areas of pasture or cultivation (Young and Castro 2017), encouraged by the modification to the Forest Code in 2012. It is the most important legislation concerning forest conservation, and the changes reduced targets and other instruments for inducing deforestation control on private properties. This has been interpreted by landowners as an important signal that more lax measures and enforcement of deforestation controls would become more common, and the conversion of native forest land into pastures and cultivation has regained prominence in Brazil.

There are other signals that environmental legislation is weakening, especially decreasing the pressure on economic agents responsible for environmental impacts in the rural areas. Following the changes in the Forest Code there have been more recent laws

and law proposals reducing the size of protected areas and indigenous peoples' territories. There are also demands for greater flexibility of the requirements for obtaining environmental licences, which in practical terms means reducing the pressure for adopting environmental protection measures in infrastructural and industrial projects. Considering the environmental agencies' reduced capacity for enforcement, growth of green jobs in the country has not expanded as originally expected.

Similar shifts occurred in the energy sector. Brazil announced its aim of increasing the share of renewables — beyond hydropower — in the electricity generation mix to 20 per cent by 2030. There are also important programmes in energy efficiency and considerable expansion in non-conventional renewables, mainly wind power (Parr et al. 2017). However, energy demand in Brazil has increased considerably, with little decoupling between the expansion of GDP and energy consumption, as a consequence of the dependence on energy-intensive activities. Oil remained the primary source and most important supply component in the energy

## Skills for Green Jobs in Brazil

matrix. Thermoelectricity has expanded relative to the total, partially as a consequence of keeping energy prices artificially low for most of the 2010s, and of a lack of incentive for further expansion of renewables.

Subsidies and other incentives for purchasing automobiles were established as a policy strategy for enhancing car industry production after the 2008 world crisis that damaged export markets. The combination of an increase in the number of cars and poor investment in public transport infrastructure resulted in serious mobility problems that affected mainly the poor (Vianna and Young, 2017).

As a consequence of all these effects, there was an expansion of Brazilian GHG emissions in almost all sectors, in addition to deforestation. With the comeback of deforestation, the total level of GHG emissions rose in spite of the economic slowdown (which usually reduces energy consumption and other sources of emissions), in 2015 being 5.6 per cent higher than in 2010. If considered separately, the energy sector increased its emissions by 22.5 per cent in the same period, and agriculture by 4.6 per cent (data from the SEEG GHG emissions forecast system). This clearly indicates that Brazil remains far from engaging in a transition towards a low-carbon economy.

### 3.2 Sustainable Development Goals and other environmental issues<sup>1</sup>

The Brazilian Government supported the proposal for the 17 SDGs, and it is planning measures focusing on infrastructure, innovation, business environment and labour qualifications, among other things (BRASIL, 2017, p.62). This includes building resilient infrastructures, promoting inclusive and sustainable industrialization, and fostering innovation, with the aim of resuming growth with social inclusion.

However there remains a gap between intended goals and action. In addition to global climate

change and the loss of native forests, coupled with endangering its extraordinary biodiversity, there are other serious social-environmental problems associated with the same pattern of specialization in activities with a high impact on natural resources. Changes in the Brazilian Forest Code in 2012 reduced the minimum legal requirements for forest conservation on private properties so as to maximize the available area for cultivation and pastures.

Currently political pressure is focused on the reduction of areas dedicated to conservation units and indigenous lands.

This process of change in land usage is often violent, so that deforestation is statistically correlated with an increase in homicides (Sant'anna & Young, 2010) and the spread of epidemics such as malaria (Olson et al., 2009).

It also draws attention to the high contamination by pesticides in the areas of agricultural production, as well as the increasing incidence of associated diseases (cancer, for example), especially among the most vulnerable rural workers (Abrasco, 2012). This proves that these substances have not been used in accordance with the safety instructions.

There are also consequences for consumers: according to a study conducted by the National Health Surveillance Agency, 36 per cent of 1,628 samples of vegetable products for consumption were considered unsatisfactory due to their content of unauthorized pesticides or pesticide levels above the tolerable upper limit (ANVISA, 2013). Brazil is one of the largest users of pesticides in the world, with alarming risks for human health, especially for rural workers who are the most exposed (Silva et al. 2005, Carneiro et al., 2012).

The use of genetically modified organisms (GMOs) is continuously expanding, a very distant issue from the concerns of regulatory agencies and consumers themselves (Castro, 2012). There is an ongoing bill in the National Congress for legislation, demanding the removal of mandatory identification of foods containing genetically modified products,

<sup>1</sup> This section is partially based on Young (2016)

thereby reducing the fragile public control over the dissemination of these organisms in the country.

Most of the Brazilian population lives in urban areas. However, the inadequate infrastructure and lack of urban services, combined with the concentrating trend of activities in the central areas of cities, allows problems such as traffic jams, pollution, inadequate housing and an increased risk of accidents to bring rising costs to society, even if not all of these losses are directly monetized. Estimates of economic costs resulting from the loss of commuting time caused by traffic jams (Haddad & Vieira, 2015; Vianna & Young, 2015) show that there is a strong regressive feature in urban immobility, since the most affected social groups are the poorest (Pero & Stefanelli, 2015). The inadequacy of the urban infrastructure to handle natural disasters also means greater exposure to damage caused by increasingly frequent flooding, sudden floods and land movements, a result of climate changes. Young et al. (2015) show that the frequency of these disasters has increased consistently over time throughout the country and estimate that they impose significant costs, at around one per cent of GDP considering *only* the resulting material losses.

However the severity of these environmental issues seems not to attract the attention either of Brazil's leaders or even of the general population. The national security policy for the environment was designed and supported by instruments that require active participation by the State in controlling the actions of companies and individuals. Despite the increased social demand for environmental management measures due to the significant increase in pressure on natural resources and public awareness of the issue, the public budget for environmental management has grown at a much slower pace than total public expenditure. A study of the behaviour of discretionary spending on environmental management in the three spheres of government (Young et al., 2015b) shows that the problem is more serious in the federal administration, where spending remained virtually stagnant between 2011 and 2013.

Sub-national administrations are increasingly important in environmental management, at least in terms of volume of resources. State governments are the sphere of greater expenditure on the issue. However, there is great heterogeneity among subnational governments, indicating very strong disparities in their ability to handle environmental problems. The current fiscal crisis in the States and municipalities is expected to accentuate this heterogeneity, with negative consequences for the people affected by negative environmental externalities.

In other words Brazil faces a wide range of environmental challenges, combining typical developing country issues such as deforestation and lack of basic sanitation, along with difficulties more often found in developed nations associated with the reduced quality of life due to industrial pollution and the high degree of urbanization.

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## Skills for Green Jobs in Brazil

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## 4. Skills development measures for the green economy

### 4.1 General perception

In order to obtain greater inputs for the skills required to increase green jobs in Brazil, interviews were conducted with specialists in environmental education in vocational or higher education.

There has been no creation of a mechanism for monitoring national and international environmental legislation capable of identifying economic activities presenting greater opportunities for mitigation, for technologies and procedures adopted by firms, and for impacts in occupations resulting from the diffusion of such technologies and procedures. Also there was no formulation or effective adoption of policies for identifying and prioritizing green economic activities that present extensive possibilities for mitigation or that could induce an acceleration of the transition to a low-carbon economy.

The overall unemployment crisis, coupled with the growing specialization in “brown” activities in the primary and secondary sectors, have concentrated most of the “uncontroversial” green jobs (i.e. activities for which there is little doubt as to whether their effects on the environment are positive or negative) in the services sector, especially those linked to the maintenance of housing and urban conditions.

It was highlighted that most economic activities that are sensitive to environmental issues, or have great potential to damage the environment, are performed by low-skilled workers. Vocational educational institutions and training experts have to include these categories in the occupational groups to be prioritized for training activities.

Strietska-Ilina et al. (2011) consider that short tailor-made courses, directly linked to specific job openings, are the most useful approach to

retraining workers and upgrading skills towards greener jobs. The specialists in labour education interviewed in Caruso (2010) argued that the capacity of workers to take advantage of the opportunities for learning new skills goes far beyond specific training in new occupations or technologies, but depends on more “general” competences (communication and basic knowledge of science, for example) and, more specifically, on a better understanding of why the environmental impacts of their activities are so important for society.

The new round of interviews with specialists confirmed these perceptions, which correctly conclude that the many problems in the quality of the Brazilian schooling system are reflected in the difficulties workers have in assimilating new skills. Therefore, adult education should receive high priority, and this issue does not receive the required attention by decision-makers.

The interviews confirmed many perceptions presented in the previous ILO reports (ILO, 2010, and Strietska-Ilina et al., 2011), viz.:

- The skills response component in most of the documentation on adaptation and mitigation measures, policies, strategies, action plans and programmes initiated in response to climate change and environmental degradation is either limited or non-existent.
- Lack of human and financial resources, unclear mandates of the institutions involved and a lack of awareness of training issues among environmental policy-makers are among the obstacles that hamper integration of human resource development into environmental strategies.
- There have been efforts by the Brazilian Ministries of the Environment and of Science and Technology to improve the activities of vocational education training institutions, mainly in the “S System” and especially by

SENAI (National Industrial Training Service) and SENAC (National Commercial Training Service). But there is little coordination of implementation, and the situation has worsened considerably since 2015, when the fiscal crisis imposed severe cutbacks in public sector budgets targeted on social issues, and the economic crisis induced a similar trend in the private sector.

- Therefore Brazilian procedures adjust existing mechanisms and systems to emerging skills and needs on a more *ad hoc* basis. There is no effective long-term planning to this end, even though there are many “paper plans” that address the issue of green jobs skills training, established individually by some of the institutions involved.
- There was no advance in the classification and monitoring of national and international environmental legislation. This reinforces the “*ad hoc*” approach to green skills training.
- The Brazilian specialists interviewed agree with the idea that every job can potentially become greener, but also that it is necessary to integrate sustainable development and environmental awareness into education and training at all levels.
- Currently, there is a trend in deregulating labour rules and practices, and there is strong pressure for more “flexibility” in the labour market. In the context of the present economic crisis, both trends represent further disincentives for investment by the private sector in training their own labour force, and “green skills” were not set as a priority. The exceptions seem to be concentrated in activities with potentially high environmental impacts, and are usually more associated with “health, damage control and safety” strategies as a response to command-and-control actions than with the perception of potential gains from a proactive environmental policy that increases business competitiveness.
- The most important programmes established by the Federal Government to improve professional skills are Pronatec, ProUni and FIES (*Fundo de Financiamento Estudantil*, or Student Financing Fund). The fiscal crisis has caused severe cutbacks in all of these

educational programmes during the last three or four years. The FIES, a financial mechanism that provides loans to students to pay for their university costs, has suffered severe cutbacks in recent years. There were 734,000 new student loan contracts in 2014, but the resources available for FIES began to decline in 2015. In the first semester of 2016 (most loan contracts are signed at the beginning of the year), new contracts totalled only 192,000 and in the first semester of 2017 the offer for new contracts declined to 150,000 (Moretti, 2017).

There are examples of policies, programmes and companies that are proactive in their activities towards promoting green skills. Some of these cases are discussed in the following sections.

## 4.2 Skills needs identification

This section presents the identified skills dimension and an understanding of the institutional contexts for promoting green jobs. The views expressed reflect the perceptions of specialists with experience in environmental education in vocational and higher education who were interviewed during the preparation of this report.

Regarding the skills that should be emphasized in the formation of green jobs, two general groups of skills stand out: specific skills for which workers develop their abilities in accordance with the required function; and general skills, acknowledging that green jobs are performed by professionals who need to understand the environmental imbalances and liabilities associated with their activities.

A broad consensus emerged among those interviewed that specific skills must be developed in their respective production sectors, taking account of the environmental liabilities of each sector, along with the demands of the company and of the market itself. Therefore it is more difficult to establish general guidelines to that end and, according to many experts, this could be a fruitless exercise considering the high mobility of the workforce and the constant technical changes in some sectors.

## Skills for Green Jobs in Brazil

In contrast there was strong emphasis on the importance of improving workers' understanding of the general principles of sustainability and why this is increasingly important in the labour market. Even though interviewees' comments were diverse and often cross-cutting, they agreed to highlight the following issues in the general labour qualifications for a green economy:

- a) Better understanding of environmental legislation, not only because of the legal requirements imposed on companies, but also (and according to many, most importantly) in order to comprehend the reasons why these rules and laws are imposed as a response to environmental issues.
- b) Better communication capacity, aimed at creating environmental awareness and a cooperative sense among workers in such a way that the perception of a "greener" concern in the production process is developed in a "bottom-up" way, rather than imposed "top-down" (one of the specialists referred to the concept of "non-violent communication" skills in order to establish cooperative behaviour among workers).
- c) A general capacity to understand science, in order to understand the process of degradation of the environment as a whole and develop a full environmental education. The poor quality of Brazilian general education was referred to as a main obstacle in this process, but it was emphasized that "bringing the scientific issue closer to the worker's reality" was a more effective means to assimilation of specific skills than merely trying to impose them without imparting further understanding as to why this has to be done.
- d) Specific scientific issues were raised, especially on the environmental impacts of anthropological actions and the economic, social and health consequences of processes that lead to environmental degradation.
- e) A clearer notion of the concept of citizenship was also emphasized, since environmental citizenship precedes sustainable work. Some of the specialists argued that these concepts should not only be introduced in vocational or

higher education but also in basic education (in elementary and secondary schools), as a process of raising awareness and promoting environmental citizenship.

The specialists believe that the training of qualified professionals to occupy green jobs is important precisely because of the lack of environmental qualifications and environmental management in Brazil. However labour supply often receives no attention: it is inefficient to have professional qualification policies and green education if sustainable labour is not valued. Thus it is also necessary to stimulate sustainable and responsible production in both the public and private sectors. The combination of qualified professionals and companies with a green mindset is the ideal environment in which to identify and stimulate clean and sustainable solutions.

In other words, in addition to educational measures at different levels it is important to emphasize the value of workers who obtain green skills and incorporate sustainability principles in their production activities.

Both in the supply of green jobs and in the demand for these professionals, it is extremely important that the public and private sectors act in a balanced manner, drawing the greatest efficiency from policies aimed at strengthening a green economy.

According to the interviewees, climate change is insufficiently addressed in the general education system. This exposes a series of challenges that must be faced in different spheres, permeating the classroom and even the mainstream media. In several regions of the country the media transmit messages regarding agribusiness and the expansion of agricultural frontiers in ways that could be considered "climate denial", without maintaining a balanced perspective that also recognizes the liabilities generated by the growth of agribusiness for climatic and other environmental aspects.

First it is important to highlight the consequences of the modes of production and economic development for climate change, not only for workers who occupy green jobs, but

for all citizens. Second, it is also important to introduce notions of natural history, in order that workers may understand the anthropological and natural processes in climate change, their own individual contributions to the process, and how they will be affected in the future by the expected effects. Third, another issue involves the understanding that climate change is a global phenomenon that has no boundaries and often does not let individuals feel involved in the process. Therefore to overcome these barriers and improve the handling of these issues, there must be a sense of community and environmental awareness, enabling communities to understand and avoid the causes of climate change. From this knowledge, specific skills and technologies must also be developed in each sector for the treatment of anthropological consequences, generating effective and abundant clean technology and skilled workers.

The interviewees believe that vocational training should play a major role in promoting green jobs in many dimensions, including professional qualifications, citizenship awareness, critical insight, and private and public supply of skilled green labour. It is not a process to be considered in only one line of action (e.g. working conditions), but within a broader framework of complementary lines of action with the objective of establishing a new green work paradigm (e.g. the worker as a citizen and as a social agent).

In general terms the interviews follow the same line as other studies by educational specialists on labour skills in the contemporary world. For example, Wagner (2014) identifies six general skills required for successful insertion in the labour market: critical thinking and problem solving; collaboration across networks and adaptability; initiative and entrepreneurship; effective oral and written communication; assessment and analysis of information; and curiosity and imagination. Adams Becker et al. (2016, p.1) follow the same logic: a panel of experts on primary and secondary education agreed that it is necessary to redesign “learning spaces to accommodate more immersive, hands-on activities, as well as rethinking how schools work in order to keep pace with the demands of the 21<sup>st</sup> century workforce and equip students with future-focused skills.”

### 4.3 TVET provision for new green occupations and for greening established jobs and occupations

As described in the previous ILO study (ILO, 2010), the most important public vocational educational institutions are universities and Federal Educational Institutes, Science and Technology administered by the Federal Government, while the private sector contributes through the “S System” of training institutions funded from contributions based on percentages of companies’ payrolls. The “S System” is composed of:

- SENAI – The National Industrial Training Service (Serviço Nacional de Aprendizagem Industrial);
- SENAC – The National Commercial Training Service (Serviço Nacional de Aprendizagem Commercial);
- SENAT – The National Transportation Training Service (Serviço Nacional de Aprendizagem do Transporte);
- SENAR – The National Rural Training Service (Serviço Nacional de Aprendizagem Rural);
- SEBRAE – The Brazilian Support Service to Small and Medium Size Companies (Serviço Brasileiro de Atendimento às Pequenas e Médias Empresas).

SENAI and SENAC are responsible for meeting most of the demand for vocational education in industry and commerce, while SEBRAE is the most important institution developing activities to encourage “greening” entrepreneurship. It supports environmental courses and consulting, and environmental preservation measures, including the development of alternative renewable energy sources.

Brazil has intensified TVET provision in the 2010s, driven by the creation of the National Programme of Access to Technical Education and Employment (PRONATEC), a programme created in 2011 by the Federal Government aimed at expanding and democratizing access to TVET provision in the country.

## Skills for Green Jobs in Brazil

PRONATEC offers free courses nationwide, in partnership with the federal, State and municipal networks of vocational and technological education, with the “S System” and with private institutions. Technological courses are offered as part of the Federal Network, which has applications in the development of new career training, including green occupations (for example, recyclable material collection and renewable energy systems installation).

PRONATEC has the following objectives:

- a) expand, internalize and democratize the offer of courses in professional technical education at the intermediate-level, in both classroom and distance-learning modalities, and of courses and programmes of initial and continuous training or for professional qualifications;
- b) promote and support the expansion of the physical network for the provision of vocational and technological education;
- c) contribute to improved quality of public secondary education through linkages with professional education;
- d) increase educational opportunities for workers through vocational and professional training;
- e) stimulate dissemination of pedagogical resources to support provision of vocational and technological education courses;
- f) stimulate linkages between policies for professional and technological education and those for work, employment and income generation.

From 2011 to 2014 more than 8.1 million applicants were registered in PRONATEC, including technical and professional qualification courses, in more than 4,300 municipalities (out of Brazil's total of 5,700 municipalities). However, the fiscal crisis resulted in sizeable budget cuts in the Ministry of Education (MEC), with negative consequences for PRONATEC. In 2015 the number of new registries fell to 1.3 million, representing a reduction of 58 per cent from 2014. The budget constraints became even more drastic in subsequent years: the PRONATEC budget for 2017 was reduced to almost half that for 2016 (Menezes, 2016), with further reductions

in the total number of places and courses.

PRONATEC had a large impact in TVET, but technical education for greening jobs remained overall relatively marginal in the technological courses: in the Federal Network courses catalogue, issued in 2014 (third edition, the first being issued in 2008), only 18 out of 227 technological courses were identified as offering training subjects associated with skills for greener production.

In order to change this situation the Ministry of Environment (MMA) began an association with PRONATEC in 2014 with the intention of increasing the supply of professionally-oriented education in areas linked to environmental policies. The initiative provides training scholarships (“Bolsa Formação”), offering free Initial and Continuing Education (FIC) or professional training for those enrolled in or having already completed high school, in three major programmes:

- ▶ Environmental PRONATEC (“PRONATEC Ambiental”), with the objective of supporting sustainable production chains and meeting specific labour market demand in environmental areas;
- ▶ Extractivist Sector PRONATEC (“PRONATEC Bolsa Verde – Extrativismo”), aiming at strengthening the productive chain of extractivist activities, aiming to promote sustainable practices (such as introducing more sustainable practices in the extraction of forest-based products such as rubber and Brazil nuts) simultaneously reducing the illiteracy and increasing the formal education (“schooling”) of these populations, usually settled in remote areas;
- ▶ Waste Collector PRONATEC (PRONATEC Catador), with the objective of improving professional qualifications among recyclable material collectors and recognizing their latent skills, together with developing their knowledge of social technologies.

In addition there are 72 FIC courses in the MMA catalogue available through PRONATEC that try to close the gaps in greener professional education. Data on how many of these FIC courses were effectively offered could not be

found, although these courses may have been affected by budget cutbacks since 2015.

The great emphasis on general skills does not imply neglect of specific skills. Development of specific skills is fundamental to the promotion of a green economy and is the object of analysis of this study. Part of this study also takes into account the current Brazilian context and the expectations of professionals in this context.

In the next section we provide detailed descriptions of the main subjects considered in selected TVET courses, at different levels of training, from courses offered in partnership with public institutions and private organizations, to professional, undergraduate and postgraduate courses.

#### 4.4 The role of the private sector and institutional set-up in skills training

The “S System” is the most important example of an institutional contribution to skills training. It is important to note that the “S System” is funded by the private sector but has considerable independence. In addition, individual activities by the private sector, through initiatives by the companies themselves, are also of great importance in the process of professional training.

Businesses identify market demand quickly and, in some cases, change their own views on the green economy, on empowering of workers and on adapting to a new productive paradigm. Training and re-training through the private sector, internally or externally, is also important in retaining jobs that are undergoing processes of mechanization of production, for example. It is possible that companies, anticipating a tendency to underutilize the workforce due to changes in production, offer opportunities for retraining and transferring workers to green occupations. In this way it is possible to characterize a sustainable mode of production that minimizes environmental liabilities and increases productivity as well as mitigating social

damage due to unemployment.

One interesting example is provided by the Sugarcane Industry Association of São Paulo (UNICA), an organization representing the State’s sugar-cane industries. UNICA launched the Renewal Project in 2009 in partnership with SENAI/São Paulo and other organizations. The objective of the project was to offer vocational courses for sugar-cane cutters who were losing their jobs owing to mechanization of production. Several courses related to the new productive paradigm of the sector were offered, as well as retraining courses in other sectors of the economy, given that manual sugar-cane harvesting would be gradually replaced by mechanized activities (further details are provided in the sugar-cane cutters case study). In addition to mitigating environmental damage (reduction of the use of fires in the production process), the project aimed at reallocation of workers to less degrading and higher value-added occupations.

This is a good practice that demonstrates the role of the private sector in the development of new skills that could serve as inspiration for the promotion of green jobs. However, the substitution of manual for mechanized operations in sugar-cane harvesting reduced the number of occupations in this activity. In an ideal scenario policies would have to be established aimed at absorbing these workers more satisfactorily, either in the sector itself or elsewhere, in addition to the implementation of more technical and vocational courses.



## 5. Analysis of selected courses in Brazil

The study examined qualification, professionalization, specialization and post-graduate courses of varying duration, focusing on how environment and sustainability issues are represented in the range of available courses in the websites of the most important institutions concerned with vocational and technical training. Four major “areas of learning” were highlighted, with the objective of verifying the approach to education offered for teaching and expanding green jobs in Brazil. They are:

- Sustainable Development, understood as learning about economic development with a focus on sustainability;
- Assessment of Environmental Impacts, which involves teaching of analysis and evaluation of environmental impacts;
- Legislation, for the study both of general environmental legislation and of legislation applied to specific fields of knowledge; *and*
- Environmental Management and Control, for activities to contain and control environmental impacts.

### 5.1 Federal Network of Technical Courses

The Federal Network of Vocational, Scientific and Technological Education (“Rede Federal de Educação Profissional, Científica e Tecnológica”) was originally established in 1909 with the objective of qualifying professionals for the various sectors of the Brazilian economy, and for the conduct of research and development of new processes, products and services in collaboration with the productive sector. The Brazilian Ministry of Education coordinates the Federal Network, composed of 38 Federal Institutes and 29 other institutions present in all States, offering qualification courses, integrated high-school courses, advanced technology courses and undergraduate degrees.

Periodically the Ministry of Education issues a National Catalogue of Technical Courses, the latest version (third edition) of which was made available in 2014. From this catalogue 240 technical courses were analyzed, with workloads ranging from 800 to 1,200 hours. The analysis was based on the Learning Objectives (Perfil Profissional de Conclusão), with the objective of verifying the educational approach offered for the teaching and expansion of green jobs in Brazil.

The 240 available courses in the Catalogue were examined to determine whether or not they present components related to “green economy”. Of the available courses only 8.3 per cent (20 courses) were highlighted as addressing one or more of the above-mentioned areas, classified as follows:

- 15 courses characterized with a focus on Sustainable Development;
- 11 courses identified with an Environmental Impact Assessment approach;
- 8 courses including Environmental Management and Control in their coverage;
- 4 courses identified as presenting Environmental Legislation issues.

Only five of the courses observed serve three or more areas of knowledge. Most courses address sustainability in a manner associated with the production process, and there is much less emphasis on environmental legislation. Considering that the total number of courses available is considerably larger, one can conclude that the concern for providing “green job skills” in the Federal Network of Technical Courses remains relatively limited.

### 5.2 Postgraduate programmes

Postgraduate courses in the area of environmental studies strongly expanded in the

2010s. A specific search was conducted, aimed at identification of these courses. The postgraduate programmes were identified by a Google search using the following keywords: environment; environmental education; environmental management; climate change; water resources; and sustainability. If a course was identified, then its coverage or syllabus was analyzed in the specific domains of educational institutions, through the catalogues of postgraduate courses offered.

Forty postgraduate courses *lato sensu* and *stricto sensu* were identified, then separated into seven groups by area of activity, namely Environment/Sustainable Development; Environmental Education; Environmental Management; Environmental Sciences; Environmental Audit and Survey; Environmental Engineering; and Water Resources/Environmental Sanitation. The selected courses were then analyzed in terms of knowledge and skills directly linked to “green” activities, or that provide skills that compete for the “greening” of activities with potential impact on environmental quality and natural resources provision.

Most of the analyzed programmes cover areas of general management of waste and effluents, environmental legislation, sustainability and sustainable development, biodiversity and environmental management systems (EMS). The areas of water resources management and sanitation, environmental education and environmental auditing, survey and licensing are also common, although with a smaller share of the programmes. There is a relatively minor presence of courses addressing efficiency or clean or renewable energy, climate change and protected areas or conservation units. Hence it is possible that specific subjects may be addressed at some point in the course, even though they are not separately described in the syllabus. For example, it is possible that “protected areas” are discussed in an environmental law discipline, or that “climate change” is covered in a sustainable development discipline. Therefore we recommend specific research on the incorporation of sustainability and “green” issues at both undergraduate and postgraduate levels.

### 5.3 SENAC

Based on the list of courses offered by SENAC in several teaching units, 23 courses were identified as addressing green jobs, totalling 1,209 hours, with considerable variation among them in terms of their workload. Thirteen of the analyzed courses offer subjects relating to Environmental Legislation, representing approximately 60 per cent of the total observed workload. The Sustainable Development area is present in 12 courses, and approximately 60 per cent of the total workload is related to subjects in this area.

There are far fewer courses on subjects related to Environmental Impact Assessment (8) and Environmental Management and Control (6).

Hence it is possible to say that among the courses offered by SENAC, the main emphasis is in the areas of Environmental Legislation and Sustainable Development. The areas of Environmental Impact Assessment and Environmental Management and Control receive less attention. Table 6 presents the selected courses.

### 5.4 SENAI

Based on the list of free courses in different teaching units, courses of qualifications, professionalization and specialization of variable duration were observed, with a focus on Environment and Sustainability. Using the list available on the SENAI website, 19 courses were analyzed that have a focus on green jobs, totalling 1,350 hours of instruction.

Among these courses the most frequent subject-area was Sustainable Development, totalling 13 courses and representing 76 per cent of the total workload. The area of Environmental Management and Control was less represented in the curricula, yet this area accounted for 77 per cent of the total number of instruction hours. Environmental Legislation was present in 10 courses, representing approximately 63 per cent of total course offerings. Finally, the area of Environmental Impact Assessment

was present in eight of the analyzed courses, representing 41 per cent of the total course offerings in the area Table 7 presents the results of this research (see Annex 1).

## 5.5 SENAR and CNA

SENAR offers training related to the agriculture sector. As such, courses tend to emphasize environmental management and control, and fewer courses are offered on more general issues related to sustainable development and environmental legislation. Meanwhile courses offered by the Brazilian National Agriculture Confederation (CNA) emphasize management issues, including human resources.

## 5.6 Profile of TVET students

Two characteristics of TVET students in Brazil were also considered in the analysis. It was not possible to identify which students were attending the selected courses described above. It is interesting to note that female students outnumber male students very consistently. This is related to the high number of courses dedicated to service sector activities with a high proportion of women workers. It is also interesting to note that the difference remains relatively constant over time, indicating no change in trends.



## 6. Analysis of case studies

Three case studies were analyzed in greater detail, with a view to understanding the key features and lessons learned from these good practices.

### 6.1 Sugar-cane Cutters

The change in the productive paradigm of the sugar-cane sector was included as one of the case studies of ILO (2010). It is an important issue because this sector employs a relatively large number of workers, which is usually perceived as a “positive” social benefit. However, in this labour-intensive sector most jobs involve heavy work and manual cutting, which is both physically exhausting and damaging to the environment. This work involves pre-burning of the sugar-cane plantations prior to harvesting, causing serious atmospheric pollution problems, and not fitting the definition of decent work capable of social inclusion and poverty eradication. Labour-saving mechanization has eliminated pre-burning and generates a smaller number of jobs, but with better working conditions and wages.

São Paulo State contains approximately one-half of Brazil’s sugar-cane production. Environmental problems caused by smoke from pre-burning resulted in State Law 11,241 (September 2002), which established 2012 as the deadline for the elimination of fires in sugar production in the State. In 2007 the Agro-Environmental Protocol of the Sugar and Energy Sector was issued and was agreed by the Secretariats of the Environment and Agriculture of São Paulo, as well as by leaders of the sugar sector, represented by UNICA (Union of the Sugar Cane Industry). In this agreement, in addition to other planned green changes, the parties wished to anticipate the deadline for compliance with the law to end burnings in the production process.

The termination of fires in sugar-cane plantations prior to the harvest accentuates the trend in replacing manual cutters with mechanized equipment, involving considerable loss of manual

jobs. To minimize this social impact the Agro-Environmental Protocol of the Sugar and Energy Sector required retraining of this workforce to enable them to take on new roles. The sugar-cane sector has promoted activities to train tractor drivers, operators of various mechanical equipment, electrical technicians and equipment maintenance mechanics.

From 2007 to 2014 there was a 41 per cent drop in the total personnel employed in the sugar energy sector. Even though the number of workers responsible for mechanized production increased by about 75 per cent (from 24,000 to 42,000), there was a 59 per cent reduction in the number of sugar-cane cutters (from 178,000 workers to 73,000). These figures show that, despite the existence of measures to train and reallocate workers, the measures taken by the sector to absorb this labour force were deficient.

Approximately 94 per cent of the sugar-cane harvest of the signatory companies to the protocol, responsible for 95 per cent of São Paulo State’s production and 47 per cent of national production, is no longer carried out with the use of fires. The reduction in GHG emissions totalled 9.3 million tons of CO<sub>2</sub> equivalent, or the annual emissions of about 162,000 diesel buses, in addition to the load avoided from a number of other pollutants (UNICA and FERAESP, 2015).

The most important training initiative in the sector is the RenovAção Programme, launched in 2009 through an agreement between UNICA, SENAI-São Paulo and several other educational institutions and collaborators. The objective was to retrain sugar-cane cutters in São Paulo State to adapt to current changes, offering courses based on local demand. The courses offered can be divided into two groups: courses aimed at training professionals from the sugar energy sector itself, and various courses aimed at generating income for workers in other sectors.

In the RenovAção project workers were able to dedicate themselves fully to the courses, receiving monthly wages and other benefits

(such as social contributions) as if they were in production activities. The course participants were appointed by the plants in which they were already employed, or by the local unions of sugarcane municipalities in which the project was active.

There were specific concerns about gender issues (for example, a target was set that a minimum of 20 per cent of participants should be women) and community involvement: the courses offered in each city are the result of a dialogue between the organizers of the project, employees and key players in each location (government, businesses, plants, religious and community leaders), and skills demands are defined during this process.

There are specific teaching modules for illiterate and semi-literate workers (the “Pre-RenovAção”), a training course comprised of basic subjects (i.e. reading, writing, mathematics, general knowledge, citizenship) that could provide conditions to enable these workers later to participate in Project RenovAção training courses. Most of the courses have a workload of more than 300 hours. A total of 6,650 workers were trained between 2010 and 2015 (UNICA and FERAESP, 2015).

The RenovAção Programme also includes training qualification policies aimed at preparing workers for jobs in other sectors. Table 12 presents the number of students in “income generation courses” which qualify the student for activities not related to sugar and ethanol production.

## 6.2 Recycling

Recycling is an activity in which win-win solutions are possible, since it has many environmental benefits (especially reduction of waste disposal along with energy and raw materials savings), economic paybacks (waste disposal costs represent a major burden on local authority expenditures) and social inclusion (waste collectors are typically among the poorest and least qualified workers in urban areas).

Silva et al. (2013) described the social profile of

waste collectors in Brazil, based on demographic data from IBGE. The number of collectors was estimated at 388,000, with an average age of 39.4 years, and 66.1 per cent black or mixed race, that is higher than the relative percentage of black and mixed race in the overall Brazilian population, which was 53.6 per cent in 2014 according to IBGE (the study does not state the precise year of the data, but they should refer to the 2010 Census and 2012 National Household Survey). Almost all waste collectors (93.3 per cent) reside in urban areas, and a total of 1.4 million people live in households in which at least one person is a collector. Only 38.6 per cent of the collectors have formal jobs (note that any one person can have a formal occupation and also act as an autonomous collector), and the average remuneration (R\$ 571/month) was very close to the official minimum wage (R\$ 545/month in 2011). Formal educational levels are very low: 20.5 per cent are illiterate and only 24.6 per cent have completed basic education (11.4 per cent completed secondary school). 50.2 per cent of households with at least one resident collector do not have adequate sanitation facilities, and there are computers in only 17.7 per cent of households. Only a minority of the workers belong to associations or cooperatives, or have social security coverage.

Waste collection is not a homogeneous category but involves many different social agents, ranging from homeless people to regular workers with fixed residences, associated in cooperatives. This heterogeneity is recognized by the most important public policy in the sector, the National Policy on Solid Waste (2010), which highlights the strategic role of waste collectors and the need to establish selective collection programmes in municipalities with the broad involvement of these workers.

Capacity development is possible, but it should be noted that the behaviour of these agents varies. Therefore, a project aimed at street-dwellers who informally collect waste is different from a project aimed at registered collectors who reside in their own home and that is structured in a manner similar to that of other professional activities.

There are training courses available but there is

### Skills for Green Jobs in Brazil

resistance on the part of waste collectors, partly because of their low level of education, lack of esteem and desire for entrepreneurship. Owing to their low levels of formal education, one cannot consider training and skills development separately from elements of general education, including notions of citizenship and sustainability, expressed in a form consistent with the reality of these social groups.

In particular the issue of entrepreneurship should be developed with emphasis on transforming this activity into a form of decent work. This includes technical knowledge of the collected material through the basics of collection practices (e.g. not mixing the colours and types of material as this will reduce the selling price of the material collected) and hygiene and safety standards. It is vital that safety equipment is used, even if the cost of collection is higher, but there is resistance on the part of collectors to the wearing of gloves, masks and other working practices.

The collector must also have knowledge of the economics of solid waste, to know the value of the material collected, to seek better quality in the material collected and to know how to negotiate with the buyer, since there is a tendency for buyers to offer prices below a fair market price. In short, the collector has to learn the real value of the waste for resale and the service they provide, namely the transformation of waste discarded through physical-chemical processes into a new raw material.

It is important to note that environmental management and social assistance institutions (especially in the case of homeless and other socially marginalized groups) must follow this process. That is, the process of qualifying for this type of activity must also be a process of social inclusion that goes beyond merely education.

The qualification for related activities related to the collection of garbage should also be worked on. For example, pickup truck drivers and other support professionals, such as the janitors of residential buildings who are responsible for making garbage available for collection, should also be trained in establishing an efficient collection network. It is a complex

chain (households → collection / transportation → separation → re-selling), which involves many categories of workers, in addition to the collector of recyclable waste who also need to be trained to work with these materials and the associated procedures. That is, the qualification cannot be restricted only to the waste collector, but also should include other stages of the process, including residential and transport personnel. There is no training offered for the other people involved: understanding must be systemic (for example in companies that provide services for condos), and training for these other workers should also be provided.

The future of this activity, and its potential to become a valid green job, requires professionalization of the members of the work chain. It is necessary to change the way in which public institutions handle garbage collection, including in the bidding process, in which municipalities err in seeking lower-cost solutions in the short term while ignoring negative externalities. Solid waste management should be considered as an environmental issue, and the public manager should play an active role in coordinating this activity with other areas of public policy: specific training should be considered (see case study on environmental managers).

The following aspects should be considered for a long-term professional qualification policy for the industry:

- Insertion and adoption of environmental management processes;
- Emphasis on changing consumer habits;
- Greater rigour in the control of pollutants;
- Prioritization of clean technology research, with its implantation and cheapness making possible acquisition by the small consumer who has the largest residual production capacity.

In short, the qualification for this activity should include a comprehensive view of an innovative market within the perspective of territorial development of the consumer market, through partnerships between public institutions.

### 6.3 Environmental Managers

The Brazilian Ministry for the Environment created in 2005 the National Programme of Training of Environmental Managers (PNC – “Programa Nacional de Capacitação de Gestores Ambientais”). The objective was to train professionals capable of planning and implementing local policies aimed at environmental conservation. Even though coordinated by the Federal Government, it also targets local instruments of intervention and management, strengthening municipal and State environmental protection institutions.

Currently the course is offered with 80 hours of distance learning and 16 hours of face-to-face meetings. The idea is to reach remote locations, since much of the demand for environmental managers is dispersed throughout the territory, and many protected areas are located far from urban centres. The course consists of two main axes: institutional training to enable professionals understand the environmental bodies, and general training involving development of thematic skills and competences that contribute to implementation of the National Environmental Policy. The didactic process of the course focuses on knowledge from diverse experience and transmitted reports, provoking reflections and questions and building a sense of local belonging,

During the first period of the PNC (2005-2012), the course was offered only face-to-face, and **7,642 professionals** were trained among municipal managers and other civil servants, benefiting 1,688 municipalities. In 2007 the present “mixed” course format (blend of face-to-face classes and distance-learning materials) began to be offered, reaching 938 municipalities from 25 States up until 2014 and qualifying 10,277 civil servants and employees of public agencies as environmental managers.

The environmental qualification offered by the course allows the strengthening of a green economy through environmental management, observing and attributing the values of natural wealth, covering all Brazilian regions. In this way the experience with the qualification of

green workers has proved successful and vital for reducing the damage to the productive processes and to a sustainable economy.

The subjects in each course change according to specific local and institutional requirements. The 80-hour course on “Structuring of Municipal Environmental Management” is one of the most important, targeted on municipal environmental managers. Its four modules aim to develop a systemic approach and a set of intervention instruments in the local reality, focusing on the structuring and strengthening of the National Environmental System (SISNAMA) with the following subjects:

- a) Decentralizing and qualifying environmental management: structuring environmental management through a systemic approach, considering the National Environmental System (Sisnama) as a way of responding to the challenges, working on implementation of the Sustainable Development Objectives (ODS) at local, national and international levels.
- b) Structuring the SISNAMA at municipal level: guidelines on how to structure and strengthen municipal environmental bodies, explaining environmental management instruments: environmental impact assessment and licensing; monitoring of environmental quality and inspection; environmental education and information management.
- c) Planning the transition to sustainability: different ways of planning environmental management in the municipality with a view to sustainability.
- d) Emerging themes for the integrated environmental management of municipal sustainability: sustainable rural development; solid waste; integrated management of water resources; conservation of biodiversity; and the addressing of climate change in the municipality.



## 7. Conclusions and recommendations

The recommendations and overall perceptions presented in the previous ILO study (ILO, 2010) remain valid, even though the macroeconomic and sectoral perspectives are very different from those of seven years ago.

The updating of the workers' training apparatus and provision of "green skills" remain a priority according to the experts, but the main challenge in this current period has been rising unemployment as a result of the economic crisis. Many of the activities previously identified as having great potential have either been downscaled or have grown only slowly. In particular, manufacturing industry and civil construction were heavily hit by the recession, and most of the sectors with higher economic growth are related to "brown" activities with little demand for labour, since they tend to be more capital-intensive and dependent on the availability of cheap raw materials and energy. Training for skills for the green transition in manufacturing and construction activities remains important, as these are large employment-generating sectors, although most new jobs are now generated in the service sector.

The challenge is enhanced by the fact that environmental legislation and the governments' enforcement capacity have suffered many setbacks in the 2010s. Limited incentives exist for increasing demand for workers with green skills. As a counterpart, vocational education and training institutions argue that they respond to demand from the productive sector. Empirical analysis indicates that there has been no expansion of green jobs in the Brazilian economy during the period since 2010, and the process of reprimarization has been accentuated throughout this past decade.

Important sectoral exceptions exist, and the three case studies presented in this report for sugar-cane cutters, recycling and environmental managers are positive examples of activities being implemented in such a way as to incorporate sustainability issues in worker training and skills development. However, these

initiatives remain relatively isolated, and the analysis of the catalogue of courses provided by the National Network of Technical Courses and the "S System" indicates that the expansion in the supply of green skills training has been much smaller than originally expected.

The study suggests that strong emphasis is required on the importance of improving workers' understanding of the general principles of sustainability and why this is increasingly important in the labour market, as well as focusing on more specific technical aspects of qualifications.

Reductions in public budgets for education, environment and science and technology are additional obstacles to the diffusion of green skills. Redirecting development towards a green economy will require increasing involvement from the public sector, and transition to more sustainable and inclusive practices will not happen spontaneously through market forces alone. A key piece in the solution to this challenge would involve changes in the current trend of "re-primarization" which involves in Brazil the increasing specialization in natural resource intensive products and use of pesticides towards a new model based on low-carbon and sustainable ecosystem management.



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## 9. Annex 1

**Table 7.** Courses offered by the Serviço Nacional de Aprendizagem Industrial (SENAI – National Service of Industrial Apprenticeship)

### ENVIRONMENTAL MANAGEMENT SYSTEM

<b>Minimum age</b>	-
<b>Educational Level</b>	-
<b>Workload</b>	60 hours
<b>Programme</b>	World and Brazilian historical panorama on environment and environmental management
	Environmental management systems (EMS)
	World and Brazilian historical panorama on environment and environmental management
	Environmental management systems (EMS)
	Advantages and disadvantages of EMS deployment
	The standard NBR ISO 14.001: 2004
	Environmental audit - ISO 19011: 2002
	Trends for environmental management systems.

### SOLID WASTE MANAGEMENT

<b>Minimum age</b>	-
<b>Educational Level</b>	High School
<b>Workload</b>	40 hours
<b>Programme</b>	Solid Waste
	Types of waste
	Waste and environment
	Main pollutants found in solid waste
	Characterization of solid waste
	Classification of solid wastes
	Legal Support
	Principles of management: Reduction, Reuse and Recycling
	Technologies of Solid Waste Treatment
	Reuse Technology

### WATER AND EFFLUENT MANAGEMENT SYSTEM

<b>Minimum age</b>	-
<b>Educational Level</b>	High School
<b>Workload</b>	40 hours

<b>Programme</b>	National Water Resources Policy
	Physical-Chemical Processes of Treatment
	Biological Processes
	Combination of Treatment Processes
	Water and Effluent Management Plan.

#### NOTIONS OF ENERGY EFFICIENCY PROJECTS

<b>Minimum age</b>	-
<b>Educational Level</b>	Technical education
<b>Workload</b>	32 hours
<b>Programme</b>	Fundamentals of Energy
	Energy Cost Management
	Diagnosis of Energy Efficiency
	Engines & Pumps
	Compressed air
	Refrigeration and Air Conditioning
	Lighting
	Heating Systems
	Instrumentation
	Renewable energy
	Economic Feasibility of Projects
	Practical class of handling of measuring equipment and monitoring of Energy Efficiency.
Presentation of examples energy efficiency case studies / Proof for verification and assimilation of the content.	

#### CONTAMINATED AREA MANAGEMENT TECHNIQUES

<b>Minimum age</b>	-
<b>Educational Level</b>	Technical education
<b>Workload</b>	24 hours
<b>Programme</b>	Introduction to contaminated areas.
	Basic Hydrogeology
	General Concepts on Contaminated Area Management
	Stages of management of contaminated areas
	Theory and practice about equipment used in the environmental sector for the management of contaminated areas.

#### CLEANING AND MAINTENANCE AGENT

<b>Minimum age</b>	15
<b>Educational Level</b>	Elementary School
<b>Workload</b>	160 hours

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<b>Programme</b>	Language and communication (30h)
	Cleaning services (130h)

**CONSCIOUS ENERGY CONSUMPTION**

<b>Minimum age</b>	14
<b>Educational Level</b>	Elementary School
<b>Workload</b>	14 hours
<b>Programme</b>	Electricity? Volts? Watts?
	Electricity Consumption in Brazil
	Hydroelectric Power Plants
	Small Hydroelectric Plants (SHPPs)
	UHEs - The Hydroelectric Power Plants
	Thermoelectric
	Wind Power
	Nuclear power plants
	Standard of Electrical Voltage by Region
	Environmental impacts
	Renewable energy
	Sustainable consumption
	Brazilian Labeling Programme
	Good Housekeeping

**ENVIRONMENTAL DEVELOPMENT AND GARDENING AND LANDSCAPING**

<b>Minimum age</b>	16
<b>Educational Level</b>	High School
<b>Workload</b>	400 hours
<b>Programme</b>	Sustainable development
	Clean and Renewable Energies
	Ways of mitigation and environmental compensation
	Creation of form for data collection.
	Selection of evaluation instruments, where applicable
	Identification of procedures to assess environmental impacts
	Identification of procedures to control and minimize environmental impacts
	Legislation and technical standards (NBR ISO 17025, etc.)
	Machines, tools and equipment used in the landscaping industry
	Plant Morphology
	Vegetal physiology
	Alone
	Soil Fertility

**ENVIRONMENTAL EDUCATION**

<b>Minimum age</b>	14
<b>Educational Level</b>	-
<b>Workload</b>	14 hours
<b>Programme</b>	Environment Ecology Ecological Imbalance Environmental Conservation Biodiversity and Sustainable Development Human Integration with the Environment Education for Environmental Quality

**WASTE MANAGEMENT**

<b>Minimum age</b>	18
<b>Educational Level</b>	Elementary School
<b>Workload</b>	16 hours
<b>Programme</b>	What are waste, generation of waste Impacts generated by waste Characterization and classification of waste (NBR 10.004) Awareness: why bother with waste? Laws, rules and regulations Solutions and alternatives for waste generation When does the residue end? Waste treatment and disposal technology

**WATER AND EFFLUENT TREATMENT OPERATOR**

<b>Minimum age</b>	16
<b>Educational Level</b>	Elementary School
<b>Workload</b>	160 hours
<b>Programme</b>	The water cycle (16h) Organization and control (10h) Applied chemistry for ETA and ETE (20h) Environmental sanitation (4h) Security at ETAs (20h) Water treatment system (40h) Water and effluent treatment (50h)

**ENVIRONMENTAL MONITORING**

<b>Minimum age</b>	16
<b>Educational Level</b>	Elementary School
<b>Workload</b>	160 hours



## Skills for Green Jobs in Brazil

<b>Programme</b>	Basic Environment
	Basic concepts and regional knowledge;
	Geography and regional hydrography;
	Regional culture and historical heritage;
	Basic ecology and Brazilian biomes;
	Environmental legislation and its regulations;
	Basic concepts in tourism;
	Tourism and sustainability
	Tourism legislation and regulations;
	Notions of tourism legislation and regulations.
	Environmental Monitoring:
	Conduction of groups in natural areas;
	Leisure and educational activities in nature;
	Monitoring and management in natural areas;
	Monitoring of public visitation;

**ENVIRONMENTAL LEGISLATION APPLIED TO THE IMPLEMENTATION OF WIND FARMS**

<b>Minimum age</b>	-
<b>Educational Level</b>	Technical education
<b>Workload</b>	20 hours
<b>Programme</b>	Legal definition of Environment Classification of Environment
	Legal definition of sustainable development Development and its application
	Introduction Environmental Legislation Environmental Law Regulatory Species
	Principles of Environmental Law
	Introduction Environmental Damage
	Types of Civil Liability
	Related searches
	Introduction Legal definition
	National Environmental System - SISNAMA Environmental control instrument
	Introduction Environmental Legislation
	Administrative procedure Environmental studies
	Types of environmental licenses Public Hearing
	Introduction
	Permanent Preservation Area - APP Forest Code
	Resolution CONAMA 303/02 Resolution CONAMA 302/2002 Legal Reserve
	Intervention in PPAs
	Introduction Land issue
	Soil use and occupation

**ENERGY EFFICIENCY**

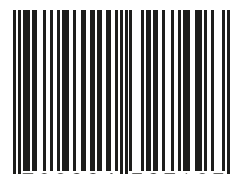
<b>Minimum age</b>	-
<b>Educational Level</b>	-
<b>Workload</b>	40 hours
<b>Programme</b>	Supply Voltages
	Monitoring and analysis of consumption
	Analysis of loss in electrical installations
	Refrigeration, Compressed Air, Air Conditioning and Ventilation Systems
	Correction of the power factor
	Demand control
	Administration of electrical energy consumption

**WIND ENERGY - TECHNOLOGY AND FUNDAMENTALS**

<b>Minimum age</b>	18
<b>Educational Level</b>	Elementary School
<b>Workload</b>	24 hours
<b>Programme</b>	Current situation, worldwide, of wind energy
	Brazil - Current situation and prospects for wind energy
	Wind potential? Applied Meteorology
	Wind Turbines - Technology
	Aerodynamics applied to wind turbines
	Environmental impacts
	Environmental legislation

*Source: Author's own elaboration based upon data in the SENAI website*

ISBN 978-92-2-132749-3



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