TC ABSTRACT

▪ Country/Region:	CCB: CID (Belize)
▪ TC Name:	Promoting STEAM for Innovation in the Caribbean: (Code Caribbean)
▪ TC Number:	RG-T3278
▪ Team Leader/Members:	Sabine Rieble-Aubourg (SCL/EDU) Team Leader; Krista Lucenti (INT/TIN) ALT Team Leader; Elena Arias, Maria Fernanda Prada Patino, Emma Naslund-Hadley (SCL/EDU) ,Juan Carlos Navarro (IFD/CTI); Takiyah De Four (INE/TSP); Annelle Bellony (EDU/CJA); Fernando Pavon (LMK/CJA,); Rafael Anta (EVP/EVP); Maritza Vela, Vashtie Dookiesingh (MIF), Michael Nelson (CCB/CBH); Musheer Kamau (CCB/CJA).
▪ Taxonomy:	Client Support
▪ Date of TC Abstract:	October 17, 2018
▪ Beneficiary:	CCB Member States. Belize
▪ Executing Agency:	Inter-American Development Bank through Education Division (SCL/EDU)
▪ Donors providing funding:	The Japan Fund
▪ IDB Funding Requested:	US$700,000[1]
▪ Co-financing:	US$450,000[2] (Porticus Foundation)
▪ Disbursement period:	48 months
▪ Required start date:	January 2019
▪ Types of consultants:	Individual consultant(s), firms
▪ Prepared by Unit:	SCL/EDU and INT/TIN in collaboration with IFD/CTI, EDU/CJA, SCL/LMK, MIF and EVP/EVP, CCB/CJA; CCB/CBH.
▪ Unit of Disbursement Responsibility:	COF/CBH
▪ TC included in Country Strategy (y/n):	No
▪ TC included in CPD (y/n):	No
▪ Alignment to the Update to the Institutional Strategy 2010-2020:	Productivity and Innovation, Competitive Global and Regional Integration

I. Objectives and Justification of the TC

2.1 Macroeconomic conditions are testing Latin America's and the Caribbean's (LAC) recent socio-economic progress. Despite current growth, the medium-term international context remains uncertain: the sustainability of the world economic recovery is unclear as are the challenges to traditional trade posed by the Fourth Industrial Revolution (4IR). New digital technologies including robotics, artificial intelligence, blockchain, the internet of things and biotechnology can boost economic growth, create employment and generate net productivity increases, through increased production, exports and employment in higher value-added and digitized activities.

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[1]   The Japan Fund will target Guyana, Jamaica, Suriname, and Belize.
[2]   The co-financing from the Porticus Foundation will target The Bahamas, Barbados, and Trinidad and Tobago.

2.2   The internet and technology facilitate communications, shorten value chains through additive manufacturing, offer digital services opportunities that do not require economies of scale and redefine the traditional boundaries between goods and services. Accordingly, global trade in the twenty-first century covers physical goods and services that are: (i) conveyed through traditional channels, (ii) produced, consumed and delivered by means of digital platforms, and (iii) by nature entirely digital and intangible.[3]

2.3   The digital economy accounted for 15 percent of global productivity in 2005 and is expected to reach 25 percent by 2025.[4] However, the impact of digitization by country is uneven: developed economies tend to lag emerging economies in job creation by almost 25 percent since emerging markets are more export-oriented and driven by tradable sectors. Therefore, developing countries tend to gain more from digitization's effect on employment than from its influence on growth, creating an opportunity for LAC. The World Economic Forum (WEF) estimates that for every 10-point increase in a country's digitization score,[5] there is a 1.02 percent drop in the unemployment rate.[6] The overall impact of digital transformation across industries creates a net gain of 2.1 million jobs by 2025,[7] as jobs gained by new subsectors offset those lost to automation. Countries can mitigate rises in unemployment by providing the appropriate education.

2.4   The implications of the progress in the digital economy are therefore very relevant for policy decisions. The impact of innovative technologies, particularly robotics and artificial intelligence, on the level and quality of employment can be seen in areas ranging from compensatory mechanisms for affected sectors to the design of new education plans. The repercussions will be particularly important in contexts characterized by slow employment growth or a rapidly expanding working age population.[8]

2.5   Readiness of the Caribbean education system for the digital economy. Although the Governments in the Caribbean have long prioritized education, learning outcomes in the region are low. That is, "passing rates in the Caribbean Secondary Education Certificate (CSEC) in Math and English are around 45% on average and it is not better in other subjects like Chemistry, or Information Technology."[9] Education is also unequal. Available data for Trinidad and Tobago (PISA 2015) indicates that learning in science among the rich and poor students differs by 82 points; that is, about 2.5 years as 30 points difference translate into 1 year of schooling.[10] Youth unemployment is high in the Caribbean reaching 31% of 15-24 year olds in 2015 compared to 16% in

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3   http://repositorio.cepal.org/bitstream/handle/11362/42316/1/S1700860_en.pdf
4   https://www.weforum.org/agenda/2017/01/the-skills-you-need-to-succeed-in-the-digital-economy-and-how-to-get-them/
5   The Digitization Index is a composite score that calculates the level of a country's digitization using 23 indicators to measure the following six key attributes: ubiquity, affordability, reliability, speed, usability and skill. The Digitization Index measures a country's level of digitization on a scale of 0 to 100, with 100 signifying the most advanced, to identify its distinct stage of digital development: constrained, emerging, transitional, or advanced.
6   http://www3.weforum.org/docs/GITR/2013/GITR_Chapter1.2_2013.pdf
7   http://reports.weforum.org/digital-transformation/creating-a-workforce-for-the-machine-age/
8   http://repositorio.cepal.org/bitstream/handle/11362/42316/1/S1700860_en.pdf
9   Monica Parra-Torrado. 2014. Youth Unemployment in the Caribbean. World Bank. Caribbean Knowledge Series. Page
10   OECD. PISA 2015. Vol1, Table 1.6.4a.

Latin America (see Table 1). Existing literature points to both individual and systemic factors as explanations for the high unemployment rate including: (i) lack of relevant skills for the job market and educational deficiencies; (ii) lack of job experiences and limited knowledge of how to apply for jobs or how to behave in a work environment (lack of life skills); (iii) supply driven nature of many technical and vocational training programs that are considered irrelevant by employers; and (iv) limited job opportunities due an economic context characterized by low economic growth, high fiscal deficits and high levels of public debt.[11]

15 to 24 years old unemployed population (%)
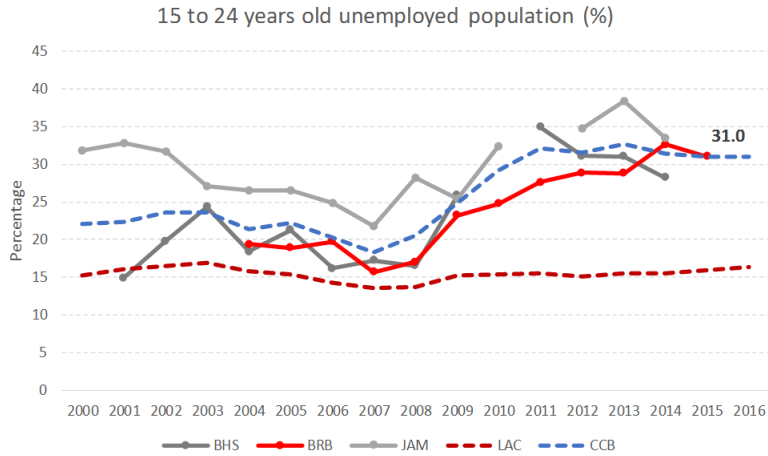
Source: IDB own calculations Labor market and Social Security Information System, SIMS.

2.6   STEAM in the Caribbean. The Caribbean region still lags behind in Science, Technology, Engineering, Arts, and Mathematics (STEAM). For example, enrolment in science at the secondary level is low: current enrolment rates range between 2-7 percent, compared to an average of 10 percent in OECD countries, and of 13 – 18 percent in strong research and innovation economies such as Germany, France, Ireland, United Kingdom and also the People's Republic of China.[12] In the Caribbean, weak research and development infrastructure, combined with little collaboration with the private sector and universities, have caused a dearth in STEAM skills for innovation. This is creating a mismatch between the needs of the private sector for innovation – 59 percent intend to innovate in the next three years, up from only 26 percent in the past three years[13] - and the knowledge and skills being developed in the educational system. It is however interesting to note that girls outperform boys in science in the Caribbean. Available assessment data from secondary education show that performance in Math has become more equal, whereas in science, girls tend to outperform boys (with the exception of Guyana in 2013).

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[11]   Caribbean Development Bank. 2015. Youth are the Future. The imperative of youth employment for sustainable development in the Caribbean.

[12]   https://www.oecd.org/dev/americas/Overview_LEO2017.pdf

[13]   https://blogs.iadb.org/caribbean-dev-trends/private-sector-and-entrepeneurship/2017/04/05/5-obstacles-to-overcome-for-a-more-productive-caribbean/

Students' passing rate (%) in Math: Total

Pais	2013			2014			2015		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
BRB	40.222	44.058	41.818	52.354	61.932	56.357	61.963	61.963	62.130
GUY	26.797	30.416	28.139						
JAM	31.624	32.185	31.842						
TTO	31.696	32.886	32.197	42.693	43.118	42.875	50.033	50.033	51.041
Region	32.585	34.886	33.499	47.524	52.525	49.616	55.998	55.998	56.586

Students' passing rate (%) in Science: Total

Pais	2013			2014			2015		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
BRB	68.122	74.46	71.598	60.563	64.344	62.582	59.919	50.579	55.138
GUY	69.92	76.582	72.43						
JAM	71.827	65.129	68.802						
TTO	68.303	51.597	60.158	64.627	49.502	57.216	65.610	53.246	59.773
Region	69.543	66.942	68.247	62.595	56.923	59.899	62.765	51.913	57.456

Sources:

1. BRB & TTO DATA FROM CCB MICRODATA

2. GUY & JAM DATA FROM CXC COUNTS

Source: IDB/CIMA own calculations. CXC data, various years.

2.7   Considering the overall shortage of human capital for the digital economy in the Caribbean, existing tech companies lack gender and racial diversity. Companies have recognized that a more diverse workplace means a better grasp of customer needs which translates into increased sales and bigger profits. For the past three years, more than a dozen technology companies including Google, Apple, Facebook, Microsoft and Twitter, have reported that the industry remains overwhelmingly white and male. Women make up about 30 percent of the tech workforce and hold an average of just 18.5 percent of tech-related roles in those five companies. According to a report from software company Atlassian, black and Latino employees respectively account for about 2 percent and 3 percent of the tech workforce.[14] Consequently more efforts are needed to attract young women to STEAM subjects in school but also in technical education to make them more prominent in the technology sector in the future; but in the Caribbean more young men have to be motivated to participate in science allowing them to enter the tech industry.

2.8   In recent years, several initiatives have been developed to expand access to computer science and coding in schools around the world (code.org, hour of code, and many others) to increase female participation in STEAM areas, but also to enhance creativity, thinking structure and fluidity. One of these initiatives is the Code Next program, developed by the MIT Media Lab - in collaboration with Google.[15] The program initially created a curricula of STEAM activities that was taught at a select group of the historically black and Latino colleges and universities in the United States. Code Next provides learning experiences and curricula content with the aim of creating the next generation of Computer Scientists, Inventors, Innovators and Engineers. To this end, students are taught a variety of topics that are organized in modules. The topics include: Computer Science and Programming, Computational Design and Animation, Microcontroller Systems, Game Design, Digital Fabrication, Music, Wearable Technology, Engineering, Mathematics. In addition, CODE NEXT teaches life skills, such as, Leadership, College Preparatory Skills, teamwork, critical thinking and problem solving, and communication skills. The courses are taught using MIT's world class pedagogical and methodological approaches combining technical skills

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[14] https://www.cnet.com/news/startups-could-be-key-to-fixing-silicon-valleys-diversity-problem/

[15] See https://www.media.mit.edu/groups/code-next/overview/.

with the teaching of life skills. Code Next[16] and its personnel have both experience in content development and training of trainers and are committed to providing comprehensive and culturally resonant curricular experiences.

2.9 **Enhancing STEAM in the Caribbean in secondary and tertiary education**. **The goal of this technical cooperation grant (TC) is to contribute to expanding technological skills (such as coding), life and entrepreneurial skills, which are key to innovation and diversification in the secondary education system; and improve the transition of youth (ages 13-15) from school to work (S2W) and increase their employability and overall ability to achieve their potential by developing technological and life skills that foster the whole development of the person/youth.** The objectives of this Technical Cooperation Grant (TC) are threefold: (i) to demonstrate an effective approach in secondary education to address the needs of disadvantaged youth in the CARICOM countries and strengthen their STEAM, life and entrepreneurial skills which could eventually be integrated into the education system of the participating countries. To ensure that the required capacity is created in schools, the proposed operation will train a pool of coaches from tertiary education who in turn will teach secondary school students in the STEAM topics listed above, exposing them early on to technology coupled with life-skills[17] and entrepreneurial skills to foster the development of the whole child/youth. This objective strives to demonstrate how STEAM and life and entrepreneurial skills development can be integrated into secondary school, and create a mechanism for strengthening in-country capacity to help implement the approach; (ii) to establish a mechanism between the Ministries of Education and the private sector to ensure that chosen areas are driven by and well aligned with job opportunities in the participating countries; and (iii) to affect systemic changes at the participating Ministries of Education by producing a plan for scaling up the initiative and to have more policy dialogue on STEAM and the integration of technological, life and entrepreneurial skills in secondary schools. To address the gender issues mentioned above, particularly focus will be given to a mentorship program to ensure that there is a gender balance with girls being able to enter the technology industry and boys to complete schooling and enter the labour market.

2.10 The TC is consistent with the Ninth General Capital Increase and the Updated Institutional Strategy 2010-2020 (GN-2788-5): to increase innovation and competitiveness; Social Development Strategy in terms of training labour markets; and the Education and Early Childhood Development Framework (GN-2708-5) and Integration Strategy of promoting integration of the CARICOM countries. This TC addresses two of three structural constraints laid out in the Updated Institutional Strategy 2010-2020: productivity and innovation and economic integration.

II. Description of Activities and Results

3.1 **Component 1: Preparation of Assessment of existing Regional STEAM Programs.** The objective of Component 1 is to undertake an assessment of existing STEAM programs at both the secondary and tertiary education level[18] in the seven

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16 Code Next will be customized to the Caribbean region and will then be called "Code Caribbean".
17 Life skills include: leadership, college mentoring, responsibility, creativity, communication, public speaking and presentation, teamwork and collaboration, critical thinking and problem solving.
18 At the tertiary level, a particular focus will be given to engineering and computer science programs to ensure that they meet requirements of the 4th industrial revolution.

countries. TC resources will be used to obtain Technical Assistance (TA) to conduct the assessment in each country. CODE Next will provide a framework for the assessment and consolidate the results. The gap assessment will focus on the following aspects: (i) mapping of existing programs in each country at both the secondary and tertiary education level and subsequent gap assessment; (ii) an assessment of the structure and content and implementation of the existing programs; and (iii) survey of businesses to assess demands for current and future digital skills to help the education system to better respond to these emerging demands. Pending the results of these assessments, the final analysis would suggest new programs for implementation tailored to the specific context of the participating countries[19] and/or additional areas to make current programs more comprehensive.[20] The results of the Gap analysis will then be used to make a final decision of the countries to be included in the implementation of the CODE Caribbean program on a pilot basis.[21] Possible selection criteria will include: (i) existence, scope and scale of existing STEAM programs; (ii) readiness of the education system to implement the initiative; and (iii) availability of national partner organizations that can collaborate with the Ministries of Education in the implementation of the program.

3.2 **Component 2: Development of Regional Strategic Framework for Implementation.** The objective of Component 2 would be for Code Next to develop a framework for implementing the program Code Caribbean in the Caribbean region considering country specific aspects of the four countries chosen. TC resources will be used to contract TA to develop the framework in partnership with local schools, universities and training institutions which would include: (i) recommendations on which four (4) countries to include I for the implementation of the Code Caribbean program based on the results of the gap assessment[22]; (ii) development of the Train the trainers program where University students would be trained to educate high school students; (iii) integration of entrepreneurship modules into the Code Caribbean program allowing youth to develop an entrepreneurial mindset; (iv) creation of a mentorship model for the youth targeting both boys and girls[23]; (v) preparation of activities for parents to help them appreciate careers in technology; and (vi) proposal of a mechanism to ensure close collaboration with the private sector and Ministries of Education and guidelines for making it operational.

3.3 **Component 3: Implementation of the CODE Caribbean pilot program in at least four countries.** Component 3 would utilize the results of the assessment and regional framework to implement the Code Caribbean program in (4) selected countries during

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[19] All countries expressed interest to participate.

[20] As part of a regional Technical Cooperation Grant (ATN/CO-16694-RG) from the Competitiveness, Technology and Innovation division of the IDB (IFD/CTI), a survey of 13 Caribbean countries will be conducted to gather firm-level data on innovation, use of digital technologies, firm performance, gender. It is expected that results from the survey will inform the gap analysis under component 1.

[21] The current project is considered Phase I as the Multi-lateral Investment Fund (MIF) is preparing an additional grant proposal to ensure that eventually all 7 countries will benefit from the initiative. The MIF financing is then considered Phase II.

[22] Criteria for readiness could include: (i) existing STEAM activities in education system; (ii) presence of a national implementation agency/partner; (iii) willingness of private sector / business to play an active role in the implementation of the CODE Next program and to participate in discussions with Ministries of Education of how to foster STEM in the education sector.

[23] The TC will coordinate with MIF projects that have focused on entrepreneurship such as the Youth Business Trusts in JA, BA, TT. The MIF is also planning to conduct a digital assessment of these organizations.

Phase I. To this end, TC resources will be used to contract a national organization responsible for the implementation of the program in close collaboration with the Ministry of Education (MOE). The implementation agency will be responsible for: (i) acquiring required resources and materials to successfully implement the CODE Caribbean program; (ii) training the trainers for the Code Caribbean program[24]; (iii) selecting the participating secondary schools with the MOE; (iv) collecting baseline and administrative data of participants; (v) implementing the mentor program for girls; (vi) establishing a mechanism for continued collaboration between MOE and business/private sector; and (vii) developing a plan to scale up the initiative to additional schools / national system ensuring sustainability of the program in the respective country.

3.4 **Component 4: Regional Coordination, Evaluation and Dissemination of Results.** TC resources will be used to contract TA to ensure that goals of the project are met but also to work with the participating countries on eventually scaling up the initiative to additional schools and institutions and additional countries in the region. This would include; (i) contracting a consultant to oversee the implementation of the TC and the development of a transition plan to scale-up the initiative to more schools at the national level of each country, creating ownership and sustainability in country; (ii) organizing National Workshops to launch the initiative and to present launch workshops; (iii) coordination of an impact evaluation to measure the medium-term effect of the interventions for participants; and (iv) organization of one regional workshop where the results of the impact evaluation can be presented to all countries. International TA will be contracted that will be responsible to design and implement an impact evaluation of the program including a longitudinal study comparing Code Caribbean participants with peers who did not participate in the program to assess the effect of the program on the youth's self-assessments and employability (see detailed proposal).

III. Budget

3.1 **Budget.** The total cost of this TC will be US$1,150,000 of which the Japan Special Fund will contribute US$700,00 and the Porticus Foundation US$450,000.

Indicative Budget (US$)

Activity/Component	Description	IDB/Fund Funding	Co-financing Porticus	Total Funding
Component 1	Preparation of Assessment of existing Regional STEM Programs	54,400	39,400	93,800
Component 2	Development of Regional Strategic Framework for Implementation	20,800	15,200	36,000
Component 3	Implementation of pilot programs in	382,902	310,902	693,804

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[24] The CODE Next US program has trained "Master trainers" who in turn taught students to serve as teachers to younger students. The approach is called "Learn to teach and teach to learn."

	at least 4 selected CARICOM countries			
Component 4	Regional Coordination, National Dissemination, National. Workshops, Evaluation; regional workshop.	202160	61,998	264,158
Administrative fee to IDB			22,500	22,500
Contingency		39,738		39,738
	TOTAL	**700,000**	**450,000**	**1,150,000**

IV.   Executing Agency and Execution Structure

4.1   The Bank will be the project's executing agency, through the Education Division (EDU), given the regional character of the project and the fact that it needs elevated level of coordination and interdependence. Likewise, the Bank has the technical experience and capacity to ensure a high quality of products and activities to be carried out for this project. Given the cross-sectoral nature of the initiative, a Steering Committee would be established to ensure continued and active participation of VPS specialists as well as CCB, MIF, and EVP.

V.   Project Risks and Issues

5.1   Implementation of a regional project implies a higher level of complexity, as well as risks related to inter-institutional coordination and asymmetries in information. It is expected that these risks will be mitigated by having the IDB as the executing agency, especially considering that the Bank has and will continue coordinating relevant and related activities with the different public institutions responsible for education, trade and innovation in the CARICOM region. This risk will also be mitigated by the active participation of the relevant VPS specialists whose counterparts are stakeholders to the program.

VI.   Environmental and Social Classification

6.1   As this TC involves the procurement of consulting services, it does not pose environmental and social implications. Therefore, classification under Category C is suggested, per the Environment and Safeguard Compliance Policy (OP-703).