

IC Brazil Program Training Centers: 8 Years Empowering Latin American Engineers To Work With Microelectronics

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# IC Brazil Program Training Centers: 8 Years Empowering Latin American Engineers To Work With Microelectronics

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**Abstract**—This paper presents the results obtained by the Training Centers (TCs) of Integrated Circuits (IC) Brazil Program over the last eight years. All the necessary infrastructure to run the training is introduced, as well as the required human resource, which is undoubtedly the key element responsible for maintaining the high quality of the program. A survey presented here tracks the professional development of former students regarding their current expertise and activity field. Based on this survey, realized on August 2016, and the program history reports, the IC Brazil Program has already trained 758 IC Designers (440 - Digital, 164 - Analog Mixed Signal (AMS) and 164 - Radio & Frequency (RF)) of which around 70% of them had the opportunity of an internship in the semiconductor business after the first two phases of the training. These collected data also exhibit that companies in Brazilian territory such as Chipus, DFchip, CPqD, NXP, Cadence, Unitec, and CEITEC-SA have hired 295 IC designers after the internship period and many of them are still employed. Also, this survey highlights that, up to end of 2016, 60% of former trainees are doing or have done post-graduation in several microelectronics fields, showing that the IC Brazil still provides several talents for the growth of national research in microelectronics.

**Index Terms**—IC Brazil Program, microelectronics, human resources.

## I. INTRODUCTION

Brazil has always experienced a high deficit in the electronics trade balance. Current data (2016) show US\$ 6 billion deficit only in the semiconductors area. Regarding the electrical and electronic products, the scenario is even more worrying. The electrical and electronic trade deficit has amounted to US\$ 19.97 billion in 2016 [1]. This unbalance is a well-known fact, and these indexes began to increase more rapidly since the early 2000's, when the government decided to create the National Plan for Microelectronics (PNM) aiming to mitigate this situation [2]. The PNM encompasses several actions. One of them is the Integrated Circuit (IC) Brazil Program. The IC Brazil Program was started under the PNM to stimulate the IC design activity and to include the country in the worldwide semiconductor market. Figure 1 shows the program organizational structure. Within this context are the Training Centers (TCs).



Fig. 1. Program Organizational Structure.

The TCs main role is strictly focused on Human Resource (HR) training specializing in chip design. The current technical training profile covers the three major areas of IC design: Analog Mixed Signal (AMS), Radio Frequency (RF) and Digital. Two training centers were created at first, one located in Porto Alegre (TC1) and another one in Campinas (TC2). After the TC2 closure in 2015, the TC3 was launched in USP - Sao Paulo with the same operating capacity of TC2. So far, 18 editions were successfully completed and two more are now occurring as shown in figure 2.

This report introduces all the infrastructure, ranging from physical space to software, needed to run the training, as well as the required human resource. A survey answered by former students shows the impact of the program in

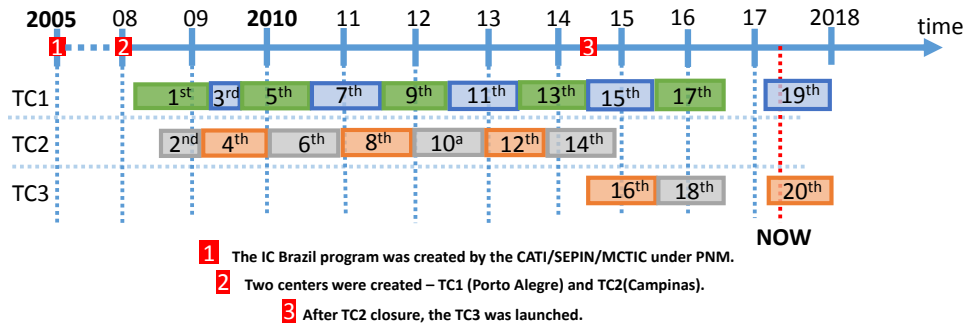


Fig. 2. 18 editions were successfully completed and 2 more are now occurring.

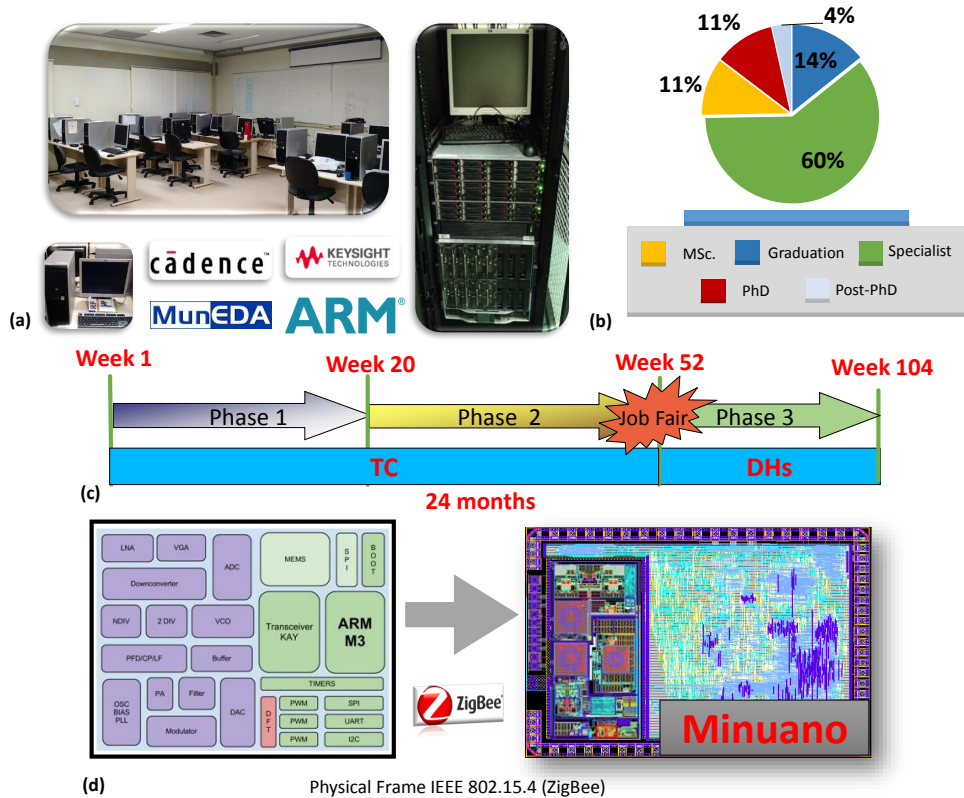


Fig. 3. (a) (b) (c)

the current Brazilian semiconductor scenario. The answers to the questionnaire help to track the career path taken by them, specifying what type of activity they are doing. This paper is organized as follows: Section II shows the program infrastructure, organization and some results achieved by the trainees during the training. In Section III, the results of 8 years of program and the Brazilian semiconductor scenario after the creation of the IC Brazil Program are shown. Section IV presents the concluding remarks.

## II. IC BRAZIL TRAINING

### A. Infrastructure and HR

An infrastructure compatible to a design company and an outstanding group of instructors are needed to maintain the

high quality of the course. In both TC's, the infrastructure is comprised of servers (used to manage software licenses and course databases), 2 clusters for simulations distributable to round 200 cores, more than 150 workstations, and six rooms. There are licenses for most important vendors of IC design tools and available Intellectual Properties (IP's) such as ARM, which enhances even more the student's experience (we use or have used, for example, ARM M0, M3 and R4 as one of core element within a specific part of training [3]). Fig. 3 (a) illustrates all infrastructure installed into each TC. Fig. 3 (b) shows the educational background of our cadre of instructors. Each instructor is a specialist in a particular area of IC design flow. Our knowledgeable staff is undoubtedly the key element

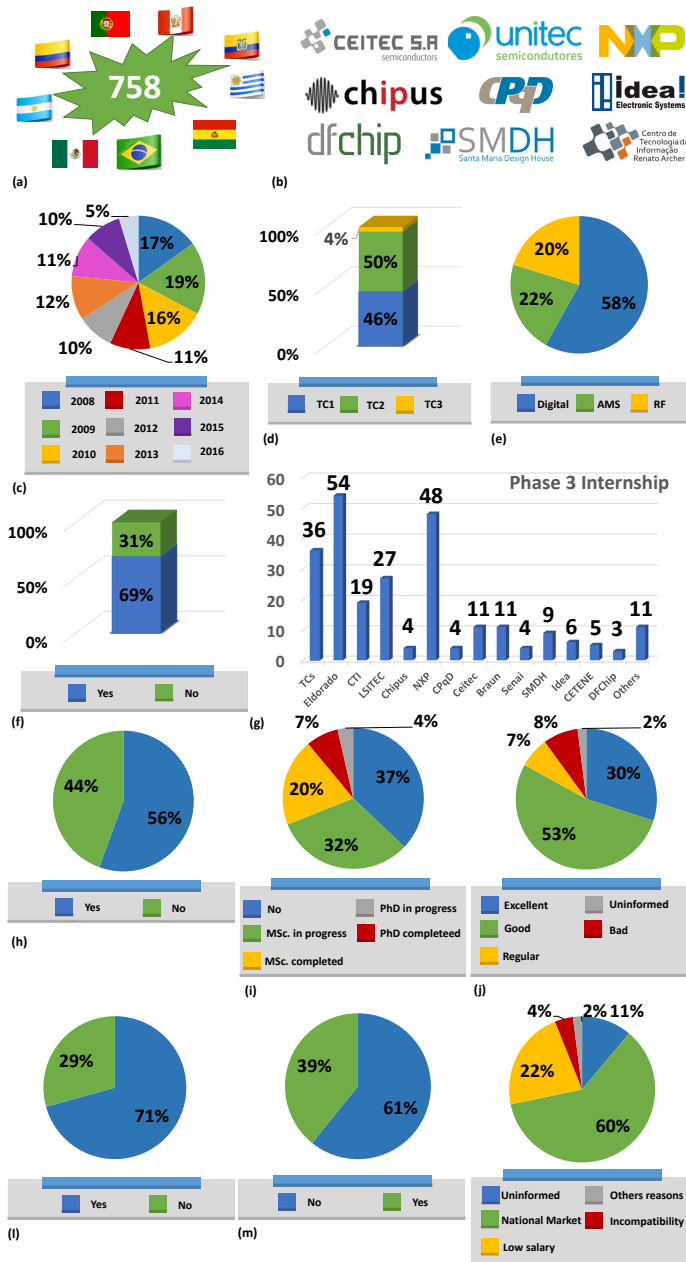


Fig. 4. (a) 758 IC Designers formed over the last 8 years (b) Brazilian IC Design Ecosystem post IC Brazil Program (c) Year of start of training (d) Training center: (TC1, TC2 and TC3) (e) Profile: (Digital, AMS and RF) (f) Did you go through phase 3? (g) What is or was the company in phase 3? (h) Have you been hired by the company after Phase 3? (i) Did you graduate in the area of microelectronics before / after the Training Program? Which graduation? (j) Briefly, what was the impact of the Training Program on your professional career? (l) Do you remain active in the area (Microelectronics, electronics and/or related) professionally and/or academically? (m) If you left the microelectronics area, what was the reason?

for maintaining the excellence of the program.

### B. Training organization

Our training program is divided in three parts as shown Fig. 3 (c) : Phases 1, 2 and 3. In phase 1, a set of concepts needed to form a IC designers is introduced. A rich description of phase 1 for each profile can be found in [4], [5]. In phase 2, A market-compatible design challenge is put to trainees as practical task. A complex System on Chip (SoC) is divided

in several building blocks in which each one is designed by a student. With instructors support, the trainees have also to integrate the blocks and verify the whole system functionality. Fig. 3 (c) shows the final layout of one of the SoC made by the students in the last years of the course. As result, the IC Brazil team always attempts to disseminate what have been made by students over the years through publications in workshops and events [6]–[8].

### III. IC BRAZIL PROGRAM RESULTS

The IC Brazil Program has already trained 758 IC Designers, in which 440 are Digital IC designer, 164 AMS IC designer and 164 RF IC designer. Fig. 4 (a) shows that over the years the IC Brazil program has been pushing the national territory boundaries forming Latin American engineers as IC designers. One good effect caused by this specialized HR generation is the visualization of whole ecosystem formed after the program implementation as shown Fig. 4 (b). Nowadays there are many Design Houses (DH) or companies internal divisions that are working with design or its verification, employing several IC Brazil program former students.

To track the former students professional career after the training, a survey was realized in august of 2016. Fourteen questions were included:

- 1) Year of start in the training program: (2008 to 2016)
- 2) Training Center: (TC1, TC2, and TC3)
- 3) Profile: (Digital, AMS, and RF)
- 4) Have you done the phase 3?
- 5) What is or was the company in phase 3?
- 6) Have you been hired by the company after Phase 3?
- 7) Did you graduate in the area of microelectronics before/after the Training Program?
- 8) Which graduation?
- 9) In which company are you currently working on?
- 10) Do you remain active in the area (Microelectronics, Electronics and / or related) professionally and / or academically?
- 11) Briefly, what was the impact of the Training Program on your professional career?
- 12) If you left the microelectronics area, what was the reason? What area are you currently working on?
- 13) If you are not working in the area of microelectronics, would you like to come back if you had the opportunity?
- 14) Would you recommend the Training Program to anyone? Why?

Among 758 graduates, 365 responded to the survey, which can be considered as a good sample compared with the whole population. Fig 4 summarizes the answers. Around 70% had the opportunity of the internship in a semiconductor company after the first two phases of the training in which 56% were hired afterward. It gives an employability rate of 39% (70% \* 56%), numbering around 295 IC designers over 758 total graduates have been hired after internship period.

Fig. 5 (a) shows that many IC designers have momentarily left the microelectronics area and are working in several electronics fields. Looking optimistically, it can generate in near future good business prospects for IC design. Furthermore, there was a question if they would recommend the training program. 73% recommend the training mainly due to program quality and the great opportunity to learn microelectronics, which is crucial to the development of the nation.

### IV. CONCLUSIONS

The Training Centers of IC Brazil Program have been performing along the last eight years their main key roles: to

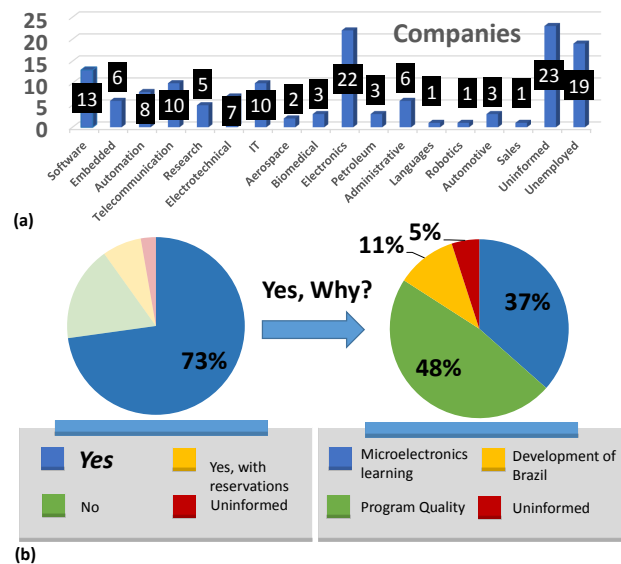


Fig. 5. (a) What area are you currently working on? (b) Would you recommend the Training Program to anyone? Why?

stimulate the IC design activity and to include the country in the worldwide semiconductor market. Having HR as the main pursuit, the TC's have already trained 758 IC Designers in which around 36% have been hired after the complete training process. It demonstrates how an investment in education and training managed with seriousness and dedication, can present very positive results for the development of the national industry.

### V. ACKNOWLEDGMENTS

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