

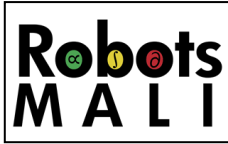
Robots MALI

ACTIVITIES REPORT 2020



CENTRE NATIONAL DE L'ÉDUCATION EN ROBOTIQUE ET
EN INTELLIGENCE ARTIFICIELLE
NATIONAL CENTER FOR EDUCATION IN ROBOTICS AND
ARTIFICIAL INTELLIGENCE

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CONTENTS

INTRODUCTION	2
ACTIVITIES IN 2020	3
Training	3
The Certification Program for STEM and Robotics trainers	3
The Niamakoro Robotics Initiation Program	4
Python Online	4
The Special Robotics Program in the Year of COVID	5
Projects and the RobotsMali Incubator	5
Engineering and Technical Improvisation in a Period of Crisis	5
BAYËLEMABAGA	6
YELENKOURA	7
STEM and Robotics Teaching Curriculum Development	7
Sadly, our first year without a competition	8
Events	9
The RobotsMali Quiz Series	9
Online Events	9
Physical events	10
Visits	10
OUR “ALUMNI”	10
OUR PARTNERS	13
Yelenkoura Technologie SARL	14
The African Institute of Management (IAM)	14
SOME DIFFICULTIES ENCOUNTERED	14
CONCLUSION	15

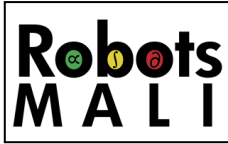
1. INTRODUCTION



Officially inaugurated in **2018**, the National Center for Education in Robotics and Artificial Intelligence (**RobotsMali**) has established itself as the benchmark for innovation and teaching excellence in robotics and artificial intelligence in Mali.

RobotsMali's core mission is to develop scientific culture, to promote the teaching of STEM (Sciences, Technologies, Engineering and Mathematics) at all educational levels, to showcase the talents of Malian youth on the international scene and to build connections between Mali and an international community in STEM and technological innovation. RobotsMali's pedagogical practice is based on hands-on training related to the social and economic needs of Mali and has been adapted to the Malian cultural and educational context in order to best reach all young people in the country.

RobotsMali, since **2016**, has brought many teams of middle school, high school and university students to international competitions where they have won numerous awards. **2020** was different, the year being marked by many crises (coronavirus, school closures due to national strikes, military coup, etc.) which forced **RobotsMali** to curtail some activities such as participation in competitions, to adapt to the circumstances, pivoting toward online education and to launch new initiatives.



Despite the challenges, 2020 proved to be a very productive year with the execution of many online trainings and some face-to-face training leading to many certifications, development of curriculum, launch of a start-up, an increase in our communication activities and evangelism for STEM, robotics and AI in Mali, research activities leading to the participation and publication in 5 international scientific conferences, and the award of two research grants.

2. ACTIVITIES IN 2020

RobotsMali had four main areas of activity in 2020.

1. Training

The teaching of STEM, robotics and artificial intelligence is at the heart of our activity. We continued these activities in 2020 adapting to the restriction in classroom instruction due to COVID. RobotsMali successfully moved parts of its program to online education, while also holding some in-person training that respected all health-related restrictions.



The Certification Program for STEM and Robotics trainers

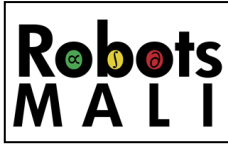
This program was supported by the Malian government through the Ministry of National Education, Higher Education and Scientific Research.

The flagship activity of the year, we aimed to train a body of dynamic, committed, and patriotic young people in the teaching of STEM and robotics with a view to extending our reach and sending these trainers everywhere in schools, spreading STEM education at the lowest possible cost.

Taking into account the budgetary situation, we were limited to accepting only 20 extraordinary Robotics Teachers-in-training selected from more than **500 applicants**.

This training began in February and took place in 2 phases: A theoretical training which ended online due to the arrival of the Coronavirus in Mali, followed by a practical training session in person.

At the end of this program, there is now a group of young graduates in Mali whose competence in teaching STEM and robotics will be certified by the Malian government in the coming weeks.



This is reflected in terms of the objectives achieved by training, empowering and improving the employability of young Malians on the labor market, but above all by setting up a base of trainers in the field of teaching STEM and robotics in Mali.

The Niamakoro Robotics Initiation Program

Consistent with the theme of expanding our reach, RobotsMali partnered with the Association for Development, Sanitation and Solidarity (APDAS) of Niamakoro to hold a robotics camp in the Bamako community of Niamakoro for local youth.

We provided robotics kits and teachers and worked with APDAS to organise the camp.

This training brought together an amazing group of young roboticists from primary and secondary schools in Niamakoro and its surroundings. It made it possible to:

- o Provide field experience needed for certification for the trainers from the **STEM and Robotics Trainers Certification Program**, under the supervision of Senior Educators from the RobotsMali Center.
- o Provide the children of Niamakoro with first-time experiences in building and programming robots and developing related skills relevant to their schooling and the development of their community.

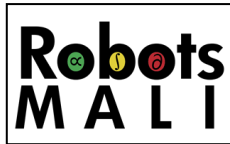
The objective, which was to develop practical critical and scientific reasoning skills and to foster the desire to study in fields critical to the development of their communities and their country, was, by all accounts, fully achieved. It is with pride and a lot of passion that the parents of the students, the school directors and the inhabitants of the district expressed appreciation and love for RobotsMali.

Python Online

Python is the most widely used programming language in the world today. Teaching children Python means preparing them for the jobs in a modern workforce.

Through this training, RobotsMali trained an initial group of 25 high school students in the use of this language.

In view of the problems of internet access by young people due to the cost and instability of connections available to students, RobotsMali has developed distance education techniques that have eliminated the need for constant connection and high bandwidth. In particular, instruction and code practice was combined using Jupyter Notebooks, giving an engaging, interactive learning experience requiring only the download of one text file per lesson unit. Exchanges between students and between students and RobotsMali mentors was accomplished through WhatsApp, the most



accessible platform to all participants. We also developed all curriculum from scratch, combining materials drawn from an African context, the use of French language as it is written and spoken in West Africa, and rigorous pedagogy reaching into the intellectual core of Python programming and computing science. This particular take on distance learning has proven to be extremely effective with our students and is, to our knowledge, unique in the world.

The Python program has helped our young people to establish a new culture of virtual work organization.

RobotsMali launched the course with a small number of carefully selected students with the express purpose of testing the materials and our approach to distance learning. The experiment was extremely successful, with many of our high-school students outperforming graduate university students on a standardised test on Python programming. In 2021 we will be rolling out this program at scale, and introducing new courses using the same distance learning philosophy.

The Special Robotics Program in the Year of COVID



One of our major challenges during this year was to offer children a quality program, while allowing them to flourish despite the constraints linked to the various crises that have crossed the country.

COVID forced the cancellation of our annual 5-week STEM and Robotics Camp (organized during the summer vacation for 200+ primary and secondary school students (including delegations from neighboring countries last year), RobotsMali held a two-week mini-camp during the Christmas break, respecting COVID

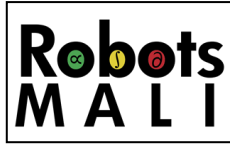
protocols including masking and distancing.

Twenty children, including some that came to Bamako from other regions, took part in this mini-camp which allowed them to discover the world of robotics and STEM through games, interactive activities and scientific modules.

2. Projects and the RobotsMali Incubator

Engineering and Technical Improvisation in a Period of Crisis

In response to the arrival of the Coronavirus in Mali, RobotsMali, in partnership with community organisations, fablabs and universities, embarked on a project to manufacture PPE (personal protective equipment) to meet the needs of our frontline



health and public service workers. Mali has virtually no manufacturing capacity for PPE, so our expertise in 3D-printing and other improvised manufacturing technologies provided a path to respond to an emerging crisis.

Initially staffed on an all-volunteer basis, without financial resources, this project was selected by Mali's National Center for Scientific and Technical Research (CNRST) in a competitive call for projects responding to the COVID crisis for accelerated funding of 17,700,000 FCFA (approx. 27,000 EUR). This has actually not been paid by the Malian government due to funding restrictions due to the COVID crisis.

Despite this disappointing reality, we hope that this project will eventually receive the funding awarded to it, since the project was designed to address not only the immediate needs related to COVID, but also to Mali's low industrial capacity and utter dependence on imported manufactured goods and parts.

Short and long term technological objective: design and manufacture of materials and equipment locally ("Made in MALI"), development of digital applications that can be useful for health services.

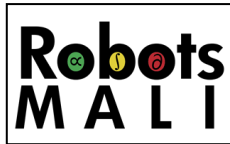
Economic objective: local supply of security, health and public service agents in Mali in large quantities of materials and devices at a lower cost (this is less expensive in the country and enhances the value of local actors knowing that the materials are manufactured here and not imported).

Social objective: Practical training (in hands-on, production-oriented industrial and electronic engineering, computer science, industrial design, and other technical disciplines, and integration of students into different work groups).

BAYËLËMABAGA

Bayëlëmabaga is a Bambara word meaning translator or transformer. This project aims to use artificial intelligence technologies to automatically translate the national languages of Mali, beginning with Bambara. While French is the official language of Mali, Bambara, a native African language, is the most widely understood language in the country. Only 35% of the Malian population is fluent in French as a second language.

This project produced, in 2020, the world's first machine translator between Bambara and French. An international collaboration around this project has been established with the participation of three universities in the United States (University of Rochester, Rochester Institute of Technology, Boston College), INALCO (National Institute of Oriental Languages and Civilizations) in Paris with its collaborators in



Ukraine and Russia, Orange Silicon Valley, Google, Masakhane Group based in South Africa, and, in Mali, RobotsMali, the Académie Malienne des Langues (AMALAN) and the Université des Sciences, des Techniques et des Technologies de Bamako (USTTB). RobotsMali, with its collaborators, published 5 scientific papers in international artificial intelligence conferences. The project has been presented in conferences in Mali at the University of Ségou, Student and Entrepreneur Week, and online in Bambara. In January of 2021, the Lacuna Fund, consisting of Google, The Rockefeller Foundation, IDRC (Canada) and the German Federal Ministry for Economic Cooperation and Development (BMZ) announced that they will provide 46 million FCFA (approximately 70,000 EUR) in funding for the preparation of data needed to improve the performance of the translator.

Bayɛɛmabaga is striving to become a national project of Mali adopted by the Malian government as part of its initiative to use science and technology to advance its education and economic development.

YELENKOURA

After two years of Research and Development, the YELENKOURA project, first place winner in Mali's first national start-up competition "MALI START-UP" in 2019, is currently in the product launch phase.

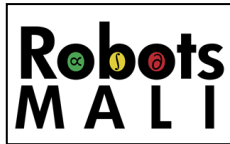
Initiated at RobotsMali and incubated at our Center, YELENKOURA ("New light" in English) uses sensor and artificial intelligence technologies to provide visually impaired people with autonomous and secure mobility at a low cost. YELENKOURA aims to become a leading company in the field of assistance technologies for all types of disabilities.



The project is currently raising capital to begin mass production of the first version of the product, including electronic components sourcing in China and local manufacturing in Mali.

STEM and Robotics Teaching Curriculum Development

This project, in collaboration with Clermont Auvergne University in France, aims to create a coherent and systematic architecture of the teaching materials and curriculum support developed by RobotsMali over the years and used by our STEM and Robotics teachers. The project also aims to provide a managed classroom



support environment to teachers in order to simplify the task of structuring and managing coursework and delivery in the classroom.

This project, which started in September, has enabled the development of a number of materials:

- A cutting-edge curriculum adapted to all levels for the teaching of STEM and Robotics in schools in the Malian and francophone region;
- A guide for teaching each module;
- The content of each module is organized according to a template.

3. Sadly, our first year without a competition

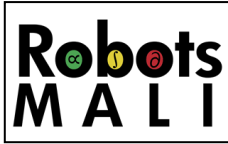
RobotsMali's training of robotics teams and the many medals they have won in competitions have established Mali as a force to be reckoned with on the international scene. While not as widely revered domestically as the famed Malian national football (soccer) team, the Aigles (Eagles), Mali's successes in robotics competition has been featured countless times on national television and has been a source of inspiration to many thousands of students.



(PARC Competition, FIRST GLOBAL, International Robotex competition...).

All of our prospective competitions in 2020 were cancelled in 2020 due to COVID-19. Prior to the crisis, the announcement and opening of applications for this annual training program reached more than **6,000 young people**, of whom more than **200 primary and secondary school students** had been called for individual interviews.

RobotsMali reaches a large segment of Malian youth through our outreach on social networks. Our long term goal is to be able to reach all Malian youth through direct outreach to schools and a presence in the different regions of the country. Up until this point, our national robotics teams have consisted of students residing in Bamako and the immediate region. In the future, we will extend our reach across the country and our national teams will represent the talent found in all parts of the country.



4. Events

The RobotsMali Quiz Series

Only a handful of schools in Mali were able to offer distance learning during the school closures in 2020 due to COVID and teacher strikes. While RobotsMali was able to put some programs online, we sought a rapid solution to engaging kids in all age categories and to keeping them motivated and excited about learning. The RobotsMali Quiz Series was the result, weekly quizzes at elementary, middle school and high school levels designed to challenge and educate while being fun and accessible through a smartphone. The quizzes, of course, covered typical RobotsMali themes like robotics, computers, computer science, artificial intelligence, and mathematics, but also covered other topics in science, technology, and entrepreneurship.

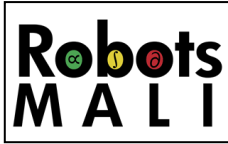
Going far beyond simple multiple choice questions, the content of each quiz was designed to instruct and encourage children to deepen their knowledge in the subjects covered. An explanatory text accompanies each right and wrong answer. Students are encouraged to retake the quizzes to the point that they have mastered the subject. The quizzes are addressed to Malian youth, written in the French spoken in Mali, and replete with cultural references to situate the material in our context.

In order to ramp up the excitement and to introduce something fun in an otherwise somber year, RobotsMali launched a competition for quiz participants, with robots and scholarships to RobotsMali programs as prizes. Each quiz in the students age category passed with 80% correct answers earned them a ticket in a random drawing. One student in each age category was chosen at the end of the year and will receive their prize with public recognition during RobotsMali annual ceremony in February.

Online Events

During the year, RobotsMali participated in a multitude of online activities and conferences for the general public:

- The 3rd Workshop on Low Resource Language Machine Translation Technologies (LoResMT) ACL-IJCNLP;
- Association for the Advancement of Artificial Intelligence (AAAI) Fall Conference 2020;
- The 8th AAIA Human Computing and Crowdsourcing (HCOMP 2020)
- Conference on International Conference on Educational Representations (ICLER 2020);
- A webinar on the occasion of the International Youth Day on the theme “stimulating digital entrepreneurship among young people”;



- Panel at Capitol Hill Maker Faire, an organized by the Makers Nation to celebrate the Makers Movement;
- Workshop on Data Science led by Allahsera Auguste Tapo, Research Manager of RobotsMali;
- Online Conference on the development of Robotics in Mali moderated by Michael Leventhal, Director of RobotsMali;
- Panel on Malian initiatives against Covid-19 with Muso Dev;
- Online conference with the students of the African Institute of Management (IAM);
- Online conference on the economic and social impact of technological change in Africa on KINGUI VISIO;
- Panel at the Malian Academy of Leadership and Innovation moderated by Michael Leventhal.

Physical events

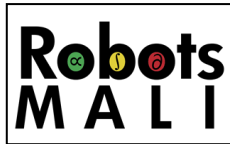
- Conference on Robotics and Artificial Intelligence in Ségou;
- The National Week of Malian Students and Entrepreneurs (SENEE);
- Open House Day at ITMA (African Institute of Technology and Management);
- Course in Building Intelligent Systems, Master’s Program, Normal School of Technical and Professional Teaching (ENETP), Fall semester.

Visits

- Robotics initiation day at the Modern Kati school complex;
- Visit of the Minister of Higher Education and Scientific Research in Mali to the Center;
- Visit of the former Minister of Education Adama Ouane;
- Visit of the ENETP Master’s students.

5. OUR “ALUMNI”

From its creation to today, RobotsMali has drawn many of Mali’s most brilliant young people to our programs. Every participant has become part of our family and we are a community that supports, encourages, and develops a lifelong commitment to personal excellence and service to our nation. RobotsMali staff all devoted a substantial amount of time on a continual basis to foster this community, keeping in touch with our alumni, and providing guidance and coaching whenever we have the opportunity to help them toward their goals. Here are updates on a small selection of a remarkable group of young people who have participated in RobotsMali programs over the last few years.



Maïmouna N'Diaye: Maïmouna has been a participant in RobotsMali activities since the age of 9 and has led national teams to many medal-winning performances. She has been active in education advocacy, inspiring Malians and youth around the world with her love for STEM learning. The Washington Post named her as one of 12 children who is changing their society. While Maïmouna speaks Bambara, French and English fluently, she says her favorite language is “robotics and programming.”

Diadji Diawara: Former member of the robotics teams for PARC (Pan-African Robotics Competition), Diadji is passionate about science and Robotics. After her stint at RobotsMali where she won numerous medals with her team, she was selected for the YES exchange program, allowing her to spend a year in the United States where she qualified to skip a grade and returned to Mali with an American high school diploma. She also showed her American comrades a thing or two about Malian excellence in robotics as captain of the robotics team at her high school.

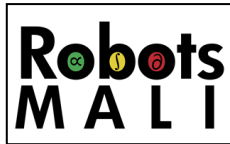
Souleymane Diabaté: Souleymane has been a regular at the Center since he first caught the robotics bug at RobotsMali’s STEM and Robotics Camp in 2016. RobotsMali. Souleymane has participated in four international robotics competitions where he became known for his ice-water-in-his-veins demeanor during the most intense moments of the competition. Currently in high school, he has embraced the notion learned at RobotsMali that knowledge and achievement is pursued as much outside of school as within it. His current activities are focused on technological entrepreneurship.

Sidy Mohamed Diallo: Student in Computer Science at the University of Avignon in France, Sidy Mohamed is one of the former members of the first robotics team in Mali, winner of a silver medal at the FIRST Global international robotics competition held in the United States.

Djoko Keïta: Also a former member of Mali's first national team, Djoko Keïta is studying at the University of Kastamonu in Turkey, where he continues to do robotics.

Aïcha Dicko: When Aïcha joined RobotsMali in the 10th grade, she knew almost nothing about engineering and was mainly interested in biology. Today she is a university student majoring in Electrical Engineering and she is quite keen on the intersection of sciences with technology.

Mamadou K. Keïta: Student and Full Stack Developer, Mamadou Keïta was a member of the robotics teams of the center for 3 years after which he was admitted to the African Leadership Academy, the most prestigious university prep program on



the continent which only accepts 120 students each year out of more than 30,000 applicants.

Aboubacar Dicko: Another beneficiary of the African Leadership Academy program in Johannesburg. Aboubacar Dicko is a former member of the medal-winning robotics team that represented Mali at FIRST Global. He is now a graduate of ALA, as a result of which he has been offered many opportunities to continue his studies in the United States, Europe or Asia.

Bintou Thierme Traoré: Trained by RobotsMali during her 11th year of high school, Bintou had the chance to participate in FIRST Global 2017 as a member of the 1st robotics team in Mali. She came out with a silver medal and continued her studies in France where is studying Geotechnics and Geo-reources and Geohazards.

Seydou Diallo: Former strategist and English-speaking spokesperson for the Malian national team for FIRST Global 2017, and assistant programmer at PARC 2018, Seydou is currently studying computer science in the United States.

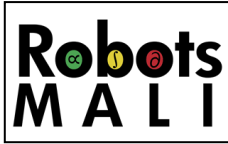
Malick Kassé: Malick Kassé, member of the medal-winning team at PARC 2019, passed the BAC this year despite the challenges of COVID and is planning to continue his education in computer science. He was a participant in RobotsMali online Python programming course and has been working in parallel on his own Arduino projects.

Mamadou Traoré: University student in electronics, electrical engineering and automation in France, he was the captain of the FIRST Global 2017 robotics team.

Fatoumata Ouane: Trained by the center during her first two years of high school, Fatoumata was a member of teams competing in two PARC competitions in Senegal. She got turned on to engineering at RobotsMali and is now pursuing engineering studies at the Polytechnic University of Agadir in Morocco.

Mohamed Sakine Fily: A university student at the Faculty of Science and Technology in Bamako (FST), Fily was a member of Mali's silver medal-winning team at FIRST Global 2017 in the United States.

Fatoumata Diallo: high school student, Fatoumata has participated in many activities of the Center such as the STEM and Robotics Camp and the training of the national robotics team and continues in 2020 with the Center's online Python program. Having had the opportunity to fuel her passion for STEM, she would like to study industrial automation and programming when she gets to the university to help bring more industrialization to Mali.



Moulaye Zanga Diabaté: High school student, he began his scientific career within RobotsMali with the “Tech Team” for the Pan-African Robotics competition. Passionate about programming since then, he continues his adventure with the Python program of RobotsMali and other training courses in programming and Artificial Intelligence.

Adama Coulibaly: His first involvement with RobotsMali was as a participant in the STEM and Robotics Camp where his ambitions were fueled by his contact with members of the team that won a silver medal at FIRST Global 2017. His passion led him to be selected for the PARC 2019 “Team Makers” where he won his own silver medal. Adama’s passion for all things digital has only increased. He was a superstar in RobotsMali’s online Python course, keeping himself busy until he starts his studies in Computer Science as a scholarship winner to a university in Morocco.

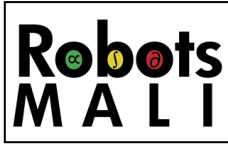
Abdoul Karim Coulibaly: University student in Mechanical Engineering and Energy, he was launched on his academic path at RobotsMali through his participation in the STEM and Robotics Camp. Serving as Chief Engineer of his team, Abdoul Karim participated in PARC as a member of the “Team Makers” winning a silver medal. Today, in parallel with his studies, he continues to develop his own entrepreneurial technical projects.

Harouna Touré: A medical student, Harouna had the opportunity to participate for two consecutive years in the Pan-African robotics competitions (PARC) in Dakar with the teams formed by the Center. An activist passionate about science and Robotics, he dedicates his free time to working to promote STEM education among young people. He was the primary catalyst for the creation of the local robotics program in the district of Niamakoro this year.

These varied and brilliant life trajectories testify to the results obtained through years dedicated to the training of young people and the many perspectives offered by RobotsMali through the teaching of STEM, robotics and artificial intelligence in Mali.

6. OUR PARTNERS

As a collaborative center, RobotsMali works to develop partnerships on a daily basis as part of its mission to help reinforce the capacity of other organisations as well as to achieve its own objectives of contributing to the social and economic development of Mali.



Beyond existing partners such as:

- University of Sciences, Techniques and Technologies de Bamako (USTTB)
- The Malian Academy of Languages (AMALAN)
- The (University) School of Technical and Professional Education (ENETP)
- UNESCO
- The African Institute of Technology and Management (ITMA)
- Impact Hub
- The (University) School of Engineering, of Architecture and Urbanism (ESIAU)
- The Association of Women Engineers of Mali (AFIMA)
- Diakité Robotics.

Joining in 2020 were :

TechWriters without Borders:

Yelenkoura Technologie SARL

Through this partnership, we are focusing on innovation at the service of humanity.

RobotsMali is committed alongside the company Yelenkoura Technologie to develop this project.

Objective: improve the mobility of people with visual disabilities through IoT and artificial intelligence.

The African Institute of Management (IAM)

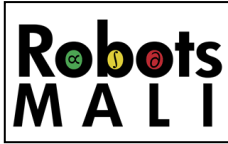
Through this agreement, IAM Bamako and RobotsMali commit to working together for the training of young people and the development of the country.

More partnerships are in the works. As a collaborative center, we remain dedicated to our current partners and open to new collaborations.

7. SOME DIFFICULTIES ENCOUNTERED

The political and health environment during this year disrupted RobotsMali's activities as for most educational institutions. The difficulties encountered were mainly rooted in pandemic-related cancellations and restrictions on in-person activities and an already modest budget allocation for 2020 that was subsequently further reduced without prior warning in the last quarter of the year. We responded to these conditions and, to some extent, thrived in spite of them. We :

- Revised the action plan for the year 2020



- Adapted to the conditions of work due to the country's state of emergency
- Changed at the last minute our various programs, which forced us to act on an ad hoc basis to meet the needs of our community as best possible under the circumstances.
- Focused on doing the groundwork for new programs with longer term impact extended to the post-COVID world.

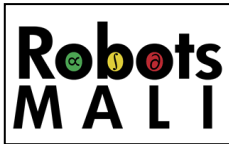
While we believe that the number of projects undertaken by RobotsMali, their depth, and the results obtained make for an impressive portfolio, it should also be noted that, even without COVID, the reach of our programs is severely curtailed by our weak financial capacity. At the launch of each new program, there are hundreds of highly motivated applicants, but we are forced to accept only one or two dozen.

We have not been able to significantly reach the regions of Mali despite requests from all over the country. Our research and development initiatives aimed at using technology for economic growth are proceeding very slowly due to lack of resources.

Recognizing that our country faces many current challenges, we focused on fundraising abroad, thus favoring international collaborations. The Lacuna Fund grant is a concrete realisation of this effort. One of the challenges in winning these grants is that we cannot justify the claim that our projects are endorsed by the government of Mali and the major established actors in Malian development. We have proven ourselves over the course of many years; with policy and communications engagement from the government of Mali and influential partners we will be able to take our activities to the next level in 2021 and have a broader and more long-term effect on the education and economic development of the country.

CONCLUSION

In terms of activities for the year 2020, we can say that despite the many ups and downs that prevented the execution of the activities initially planned, the RobotsMali center achieved feats in terms of innovation and made it possible to open the door to many future prospects.



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