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A RESEARCH ON THE TECHNOLOGICAL INNOVATION TENDENCIES OF THE STUDENTS OF FIRAT UNIVERSITY

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Yusuf Cemalettin Copuroglu¹, Ozge Ozturk²

¹Firat University, Elazig, Turkey. ccopuroglu@firat.edu.tr

²Firat Technocity, Elazig, Turkey. ozgeozgenozturk@yahoo.com

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ABSTRACT

Purpose- This study is Firat University undergraduate students oriented and it has been studied to determine the innovation inclinations of these students. Innovations serves as a driving force for both society and economy. Today universities are quite effective adopting and spreading innovations. Creating environment and conditions for enhancing students' innovation inclinations in our country, will make us feeling this effect more. In this way, a society that can temporize to social and technological innovations quickly and provides accretion value to the country by achieving these innovations, can be built.

Methodology- This study was carried out to measure the tendencies on innovation and points of view of university students on technological innovation. The survey consists of short answered, scaled, ordinal by priority and multiple-choice 47 questions.

Findings- In the analyzes, the respondents' demographics and trends towards technological innovation were evaluated respectively. In the paper, primarily, innovation and technological innovation notions will be explained and after these descriptions some assessments will be made about which specialities of students and their environment affect innovation inclinations.

Conclusion- Finally, some suggestions were made to support the technological innovation trends of university students.

Keywords: Innovation, technological innovation, innovative tendencies, creative thoughts, technological creativy

JEL Codes: M10, O30, O32

1. INTRODUCTION

Novelty is the state of adaptation and becoming widespread in society by developing an organization and application, product and idea containing a comment and point of view different from the previous one about any issue or finding a solution to any problem different and not known already or to make any situation different from its previous state. This is because, novelty is a social fact. Any thing actualized as innovation but not accepted by society and cannot become widespread and not pose a social result will not be a novelty and will remain as an individual situation no matter what it is. The reason for that is continuity must take place for the existence of novelty so that it becomes old and traditional in time as a result of continuity. Therefore, it comes to the state of a social value and continues its existence until the necessities causing it to reveal changes and the novelty become insufficient to meet the needs. Hence, people respond to new problems they face with the solutions they have learnt previously and actually become a part of the culture at first. In fact, this is the fundamental mechanism of social structure's continuing its existence. However, this structure has structured as a product of the conditions that constitute it and it has become insufficient to meet the needs in new situations and falls

behind the social systems finding solutions and becomes addicted to those or it improves and develops itself by producing new solutions. In this regard, novelty is a society-based phenomenon and creating or producing a novelty depends on cultures of the societies, values and attitudes concerning novelty and organizations and mechanisms they have formed in social structure. According to 'Das Online-Forum' (2001), innovation is not a technical but a complex *social process* where economical interests, relationship between public and production forces, cultural norms and values and other "soft" factors play a major role (Janiūnaitė,18). In this sense, novelty directly itself has become a fundamental value in majority of the societies in our day. Therefore, several types of organization and institutional structures gather around the value of novelty. In terms of freedom of thought and expression, criticism and tolerance to criticism, modes of work such as flexible working, being open to change, societies use the system of education as the most important tool both to form a structure that can find a solution for the problem encountered and to continue their traditional structures. Innovativeness is a characteristic that visible in behaviors as an activating factor in individual conscious to provide revealing of novelty formed as a social value. As a result of this, it is tried to develop creative and free thought ability which is being a must for novelty as well as teaching basic elements that create socio-cultural identity for the society from primary school to university. The most important phase of this education process in terms of novelty is the process of higher education. The reason for that is while the previous processes are improving skills and teaching fundamental information, higher education aims at application of the abilities acquired with learning more refined knowledge and providing production of novelty by improving those information. With this purpose, panels, conferences, seminars and innovative certificate programs are organized in universities. However, all these are general applications and those do not take characteristics of students concerning innovation and creativity into consideration. In this respect, it is important to know the extent of the potentials of university students about innovativeness and developing strategies and policies compliant with this. The reason for that is the features' that we deal with on the sample being evaluated as an indicator of individuals' being ready of innovation. In this regard, the relationship between both environmental and individual variables and Firat University students' technological innovativeness tendencies is tried to be determined.

In the study, firstly the basic problem of the research was discussed. Then, in some studies at the literature have focused on how to deal with this subject. In the other steps, the methodology and hypotheses of the research, the interpretations of the findings and the conclusion part are presented.

2. LITERATURE REVIEW

In literature, innovativeness is generally handled as an element of entrepreneurship as creativeness. In the study carried out by Koh (1996) on post graduate students in Hong Kong; innovativeness is assessed among the entrepreneur personal characteristic of students and in the conclusion of the research, it was specified that innovativeness is higher in the students with entrepreneur tendency together with tendency of taking risk and tolerance towards uncertainty than the students not having those features (Börü,3;Koh,19-22). Three key elements are stated as the basis of entrepreneurship in Börü conducting a research on students of Marmara University, Department of Business Administration, and these are specified as innovation, taking risk and being proactive (Börü, 19).

This approach is a correct but deficient one. However, these three are interlocked and in a mutual interaction prioritizing one another. It is probable to be an entrepreneur without being innovative to some extent; however, it is not possible to be innovative without being entrepreneur. The reason for that is innovativeness at the same time foresees thinking beyond-outside the box determined in cultural sense that is to say that being creative, while requiring taking action to breaking these taboos by necessity; and foresees entrepreneurship.

While innovativeness comes into prominence in the individual attitudes to generate creative solutions for the problems, indeed it means the ability of producing ideas and thinking independent from the decisiveness of this structure in which they are born and exist within the frame of culture they acquire with socialization processes. In this respect, innovativeness shall be able to design a problem. It is to see a situation as a problem to be solved and to solve it and making it a mental habit. We can state this as problem solving process within Popper's perspective; P1 – TS – EL – P2. Here, P1 is the problem in the beginning, TS is the trial solution offered, is EL process of eliminating errors (Debugging) applied to trial solution, P2 is the situation arrived in the end and when new problems arise. This is a self-feeding process in itself; not cyclic; because P2 is always different from P1: even completely failing to solve a problem teach us much about where the difficulties of that problem are and which conditions that the solution for the problem have to meet (Çopuroğlu, 15 ; Magee 1982: 59). Therefore, all kinds of problem-solving results in innovation by nature. This process constitutes the dynamics of technological evolution stated by George Basalla by creating range of products beyond the needs of humankind with continuity, innovation and selection processes underlying technological development. (Basalla, 46-47)

According to Drucker, innovativeness is the most substantial part of entrepreneurship. Entrepreneur realizes the changes and turns these into opportunity for different works. For a successful innovation, entrepreneur shall thoroughly assess the source, reasons and results of the change and the opportunities it has (Gümüšoğlu and Karaöz,64; Aksoy,318). In this respect, innovativeness lies both behind the competitiveness and orientation to new conditions, being the two basic

features of organizational achievement in our day; that is to say change by innovation. The concepts of innovativeness and innovation are accepted as complementary characteristics of entrepreneur. In fact, in the meaning of presenting new things, innovativeness is one of the most difficult duties of an entrepreneur because it requires not only the ability of creating but also considering all forces existing and efficient in the environment. The concept of innovation with this definition covers everything from creating a new product or service and offering a new distribution channel or way to generate a new organization (Atasoy,6-7). In this content, innovativeness is also one of the fundamental features of entrepreneurship. The analysis of innovative culture conception, the discernment of its segments in the individual level, innovation, innovative process and culture analysis lead to the definition of individual innovative culture: individual's innovative culture might be considered the expression of individual values, attitudes, expectations, behaviour and norms, rules, even way of thinking that manifest during the innovative process through the characteristics of creativity and entrepreneurship. (Janiünaitè, 20)

3. DATA AND METHODOLOGY

This study was carried out by applying a questionnaire prepared by adding questions about some environmental and individual variables along with Technological Innovation Scale of "University Student Innovation Evaluation Questionnaire" developed by Dr.Hakan Eren (2010). A scale was developed by Eren to analyze the effects of environmental factors on university students' innovative, creative and entrepreneur characteristics together and on social ad technological innovativeness tendencies on a model experimentally. Eren conducted this study to improve scales to measure the individual social and technological innovativeness tendency and testing validity. With this purpose, the study was conducted on 767 students in different faculties of departments of 10 universities foreseen to represent different socio-economic and socio-cultural segments of society from different geographies considering the fact that the future social structure will be formed by and rapidly increasing need for individuals who received university education in our day when technological knowledge and global competition increase as university students have pioneering role in innovative thinking and innovation implementations compared to other sections of the society. As a result of correlation, structural equation modeling and regression analysis performed with 767 individual data acquired, the conclusions on the influences of each individual characteristic on social and technological innovativeness were found out. The fact that each variable have positive and meaningful relations with one another and social and technological innovativeness variables is the most fundamental finding obtained from correlation analysis in the research (Eren, 2010; Halaç, 2014).

This survey was carried out to measure the tendencies on innovation and points of view of university students on technological innovation. The survey consists of short answered, scaled, ordinal by priority and multiple-choice 47 questions. "Technological Innovation Assessment" titled survey form comprises of 3 sections in total; there are questions about demographical features in the first section, the questions to measure the capabilities of finding solution, creativity and technological background of the participants are presented in the second section and finally in third section, the questions on ambient for putting capabilities of finding solution, creativity and technological background into practice are given. The questions in the survey prepared in Likert type requests participants to choose one of the options "totally agree", "agree", "neutral", "disagree", "totally disagree" to state to what extent they agree with the opinion given in the survey. Answers of the participants are received online through internet.

Targeted survey group are the lisans students of Firat University Departments of Education, Science, Engineering, Technology, Medicine, Health Sciences, Economics and Administrative sciences, Human and Social Sciences, Water Products and Veterinary. The reason for performing this study particularly on Firat University students is the success of Firat University students in various techno-entrepreneurism in the recent years. This case has great influence on performance of the study especially in Firat University

Hypothesis of the Research

The following hypotheses are determined within the direction of the objectives of the research:

H₁: Gender of participants has a meaningful influence on tendency of technological innovation.

H₂: The faculty of the participant has a meaningful influence on tendency of technological innovation.

H₃: The department of the participant has a meaningful influence on tendency of technological innovation.

H₄: Level of education of mother's of participant has a meaningful influence on tendency of technological innovation.

H₅: Level of education of father's of participant has a meaningful influence on tendency of technological innovation.

H₆: Family Income Level of participant has a meaningful influence on tendency of technological innovation.

H₇: Participation in any project competition of participant, has a meaningful influence on tendency of technological innovation.

H₈: Participant’s membership to a technological creativity club, has a meaningful influence on tendency of technological innovation.

H₉: Participant’s any scientific work published about a topic that includes technology, has a meaningful influence on tendency of technological innovation.

H₁₀: Having enough knowledge about the organizations that provide technology support and develop technology has a meaningful influence on tendency of technological innovation.

H₁₁: Producing ideas and creating new solutions with friends by participants, has a meaningful influence on tendency of technological innovation.

H₁₂: To have a plan to set up a company, has a meaningful influence on tendency of technological innovation.

H₁₃: Undergraduate class of participants, has a meaningful influence on tendency of technological innovation.

Model

The questionnaire form that 161 people in total responded was applied in May of 2016. In the analysis of the data acquired as a result of the application, IBM SPSS Statistic 22 program was used. Demographical features and tendencies to technological innovations of the respondents are tried to be evaluated in the analysis respectively. First of all, the means, standard error and standard deviations of the variables are calculated and whether there is any meaningful difference that can reveal the one-to-one relationship among variables for items with homogenous distribution is investigated and test results of the research hypothesis are included. The findings of these analysis carried out are respectively given in the following sections.

When Technological Innovation tendency is accepted as dependent variable, “ANOVA Test (Analysis of Variance)” is used in this study to measure accuracy against other aforementioned independent variables. Allowing comparison of group average vectors for a data set based on categorically, in this test is accepted as data of the variable, being subject of the research are normally distributed and variance is homogenous.

The hypotheses being subject to the analysis are as follows;

$$H_0 : \text{There is no difference among group average. } (\mu_1 = \mu_2 = \dots = \mu_k)$$

$$H_1 : \text{At least one group average is different from others. (at least one } \mu_j \text{ is different)}$$

ANOVA test statistic is as follows:

$$F_{test} = \frac{GAKT / (k - 1)}{GIKT / (N - k)}$$

GAKT: Inter groups sum of squares

GIKT: In-group sum of squares

N: number of observations, **k:** number of groups

In variance analysis, dependent variable series is obtained by acquiring average Likert value of each answer given to each question related to Technological Innovation tendency. After dependent variable is obtained in this way, the findings acquired from one-way variance analysis (One way ANOVA) carried out as per independent categorical variables are presented in the related tables. The analyzes are based on the assumption that the variances are homogeneous.

4. FINDINGS AND DISCUSSIONS

Demographic features of university students participating in the survey are given in the following table.

Table 1: Demographical Features of the Sampling

	Frequency	Percent		Frequency	Percent
Age			Faculty		
22-23	107	66.5	Technology, Engineering	98	60.9
23 and Upper	54	33.5	Aquaculture,	25	15.5

			Science, Veterinary, Medicine, Health		
Income (Annually)			Economy, Social Science, Education	38	23.6
7000\$ and lower	63	39.1	Gender		
7001\$ and 14.000\$	35	21.7	Female	47	29.2
14.000\$ and upper	57	35.4	Male	114	70.8

When demographic features of the students who participated in the questionnaire are analyzed, age, income, faculty and gender distributions of the participants can be observed in table 1. According to the data in Table 1, it is seen that there are 107 people between 22-23 age range and 54 people over 24 years old, and when distribution by gender is dealt, it is observed that there are 47 female and 114 male attendants. Furthermore, classification by the faculties the fields of which are close to one another is performed. According to this, there are 98 students in one group comprising of technology and engineering faculties, 25 students in one group comprising of Water Products, Science, Veterinary and Health Faculties and finally 38 students in one group comprising of Economics and Administrative Sciences, Human and Social Sciences and education. 161 university students participating the survey in total receive education in the senior classes of the departments of the related faculties.

As for the distribution by incomes of the families of university students; there are 63 people having 7000\$ and lower income, 35 people between 7001 and 14000\$ annually income and 57 people with 14000\$ and upper annually income.

Table 2: Technological Innovation Tendencies

Technological Innovation Tendencies	Frekans	Percent
Low	7	4,3
Middle	59	36,6
High	72	44,7
Too High	23	14,3
Total	161	100,0

When Table 2 is analyzed, it is observed that there is not any student having too low Technological Innovation tendency. Furthermore, average Technological Innovation of 161 students who participated in the survey is found as 3.69. When proximity of this value to 4 is taken into account, it can be deduced that university students have high Technological Innovation tendencies.

Table 3: Relationship Between Gender of Participants and Tendency of Technological Innovation

Gender	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,864	1	1,864	4,269	,040
Within Groups	69,424	159	,437		
Total	71,288	160			

P<0.05

The result of the anova analysis according to gender and innovativeness tendency shows a significant difference in tendency of innovativeness among the groups. When we look at the Likert's average of the groups, we see that the average of female students is 4,1011 and the average of male students is 4,3377. In this case, despite the tendency to technological innovativeness of both groups is high; as a result of the ANOVA analysis, the difference between the groups in tendency to technological innovativeness depending on gender leads to the higher level tendency to technological innovativeness of the male students. In this case, H1 has been confirmed at the significance level of P = 0,04 <0,05.

Table 4: Relationship between Faculty of Participants and Tendency of Technological Innovation

Faculty	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,928	8	,616	1,411	,196
Within Groups	66,359	152	,437		
Total	71,288	160			

Table 5: Relationship between Department of Participants and Tendency of Technological Innovation

Department	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10,719	19	,564	1,313	,184
Within Groups	60,569	141	,430		
Total	71,288	160			

There is no significant relationship between tendency to technological innovativeness and Faculties and Departments of Students, with the $P < 0.05$ significance level. It is expected that the tendency to technological innovativeness of university students in specific faculties and departments; especially in the medical, engineering and technology faculties and the students in the departments in these areas would be higher than the students of the other Faculty and department, because of the necessity to follow innovations and technology. However, the H_2 and H_3 hypotheses for this expectant have not been confirmed by the Anova analysis.

Table 6: Relationship between Mothers Education Level of Participants and Tendency of Technological Innovation

Mother's Education Level	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13,371	5	2,674	7,157	,000
Within Groups	57,917	155	,374		
Total	71,288	160			

$P < 0.05$

Table 7: Relationship between Fathers Education Level of Participants and Tendency of Technological Innovation

Father's Education Level	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,676	6	,446	1,001	,427
Within Groups	68,612	154	,446		
Total	71,288	160			

$P < 0.05$

Family is the environment in which the most basic personality traits are shaped and the individual attitudes are developed. The parents' educational levels influence the children through their knowledge and awareness. In this respect, it is thought that the educational level of the parents, as an important environmental factor, would positively influence students' tendency to technological innovativeness. However, as a result of the ANOVA analysis, it has been found that there is no significant relationship between the father education and students' tendency to technological innovativeness, whereas the mothers' education have a very significant relation. Thus, while H_4 is being verified, H_5 is false. On the other hand, as to the relationship between maternal education levels and tendency to technological innovation, it has been observed that there is a significant difference between the education levels of the mothers and the tendencies to technological innovativeness, where as there is no significant relationship between the groups, this difference increases as the education level decreases. Namely, it has been determined that the children of mothers with the lowest education level, primary and lower education, with a mean of 4,4354 likert, have the highest average tendency to technological innovativeness. In this case, we can also indicate that mothers are particularly interested in the education of their children and that low-educated mothers motivate them to not live in their current situation in our society. It would be more meaningful to evaluate this together with the income levels of the families.

Table 8: Relationship between Family Income Level of Participants and Tendency of Technological Innovation

Family Income Level	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20,598	30	,687	1,842	,011
Within Groups	46,220	124	,373		
Total	66,818	154			

$P < 0.05$

As it can be seen, there is a highly significant relationship between the income levels of the families and the students' tendency to technological innovativeness. Thus, the H_6 hypothesis $P = 0,011 <$ has been verified; There is a significant difference between the annual average income groups of the families. However, just like the difference has been observed

in the education levels of the mothers, it has been emerged that the lower the level of income, the higher students' tendency to technological innovativeness. The group with a yearly average of below \$ 7,000 has the highest likert average of 4,3373. We can say that looking for new solutions to their problems as a way out of negative conditions increases the students', who are the children of low-income families, tendency to technological innovativeness of.

Table 9: Relationship between Participation in Any Project Competition of Participants and Tendency of Technological Innovation

Participation in any project competition	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,496	1	2,496	5,768	,017
Within Groups	68,792	159	,433		
Total	71,288	160			

P<0.05

It was found out that a significant relationship between the being participant to any project and students' tendency to technological innovativeness, with P <0,05 significance level. Participation to a project is important in terms of implementing what they learn and acquiring new knowledge and experience, and is a concrete indication of a person with innovative tendencies. The hypothesis H₇ has been confirmed at a significance level of P = 0,017 <0,05.

Table 10: Relationship between Membership of a Technological Creativity Club of Participants and Tendency of Technological Innovation

Membership of a technological creativty club	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,040	1	4,040	9,552	,002
Within Groups	67,248	159	,423		
Total	71,288	160			

P<0.05

Being a member of any organization is a sign of interest and inclination. Organizations engaged in activities to produce creative technological ideas on technological innovation offer a variety of opportunities to realize individual talents. Taking action to see and capture these opportunities is a sign of technological innovativeness. H₈ Hypothesis in this value frame has been confirmed with P = 0,002 <0,05 significance level.

Table 11: Relationship between Any Scientific Work Published by Participants About a Topic that Includes Technology and Tendency of Technological Innovation

Any scientific Work Published about a Topic that Includes Technology	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,721	1	1,721	3,933	,049
Within Groups	69,567	159	,438		
Total	71,288	160			

P<0.05

The result of the analysis shows that H₉ Hypothesis has been confirmed with P = 0,049 <0,05 significance level. Working in any subject aims a production related to the topic of work. While a production itself is naturally new, it is also closely related to the tendency to innovate to make a study of technological innovativeness and to share the result.

Table 12: Relationship between Having Enough Knowledge by Participants about the Organizations that Provide Supporting and Developing Technology and Tendency of Technological Innovation

Having Enough Knowledge by Participants about the Organizations that Provide Supporting and Developing Technology	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,830	1	1,830	4,190	,042
Within Groups	69,457	159	,437		
Total	71,288	160			

P<0.05

It is not an idea but an awareness of what you have to realize you thoughts and being aware of your capability is an important influence that transforms technological innovativeness into innovative entrepreneurship. We have seen that the students of Firat University have this awareness. That Firat University was the first with 170 applications in Techno Entrepreneurship in 2015 and was 4th after Istanbul, Izmir and Ankara according to the number of projects that received the Teknogiris support during the same application period and was the second in TUSIAD's "This Youth Can Do!" organization among the universities applying for the contest with 152 applications shows the awarness of the studens of the Firat University. According to the table value, H10 Hypothesis has been at P = 0,042 <0,05 significance level.

Table 13: Relationship between Producing Ideas and Creating New Solutions by Participants with Friends and Tendency of Technological Innovation

Produce Ideas and Create New Solutions with Friends	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7,975	1	7,975	20,027	,000
Within Groups	63,313	159	,398		
Total	71,288	160			

P<0.05

Discussions and conversations provide a suitable base for the emergence of creative and new ideas. Especially, getting together of young people to create a lot of ideas about future designs and discussing and sharing them with their friends creates a synergy for the emergence of new ideas. Participating to such interaction with friends encourages university students to produce analytical new thinking for similar problems. H₁₁ Hypothesis questioning the relations of friends to the tendency of technological innovativeness has been confirmed with P = 0,000 <0,05.

Table 14: Relationship between to Having a Plan by Participants to Set Up a Company with Friends and Tendency of Technological Innovation

To Have a Plan to Set Up a Company	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,013	1	1,013	2,292	,132
Within Groups	70,275	159	,442		
Total	71,288	160			

Planning to start a business is to become ready to act in order to realize ideas in a sense. At the same time, it has been assumed that she/he relies her/his ideas and talents, and thus it means that self-reliance is high. However, the H₁₂ Hypothesis we formulated for this approach has been unconfirmed with Anova analysis, meaning that there is no significant relationship between business start-up planning and tendency to technological innovativeness.

Table 15: Relationship between Undergraduate Class of Participants and Tendency of Technological Innovation

Undergraduate Class	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,290	3	,097	,214	,887
Within Groups	70,997	157	,452		
Total	71,288	160			

It has already been stated that communities use education for their members as a means to socialize the solution of problems. It has been envisaged that tendency to technological innovativeness increases due to the increase in the duration of education, with the idea that university education, the most important stage of this process in this frame, teaches innovativeness by both information and application methods. However, the research data have not confirmed the H₁₃ Hypothesis expressing this relationship.

5. CONCLUSION

Innovativeness means taking an attitude. These attitudes are primarily determined by the characteristics of the socio-cultural environment and then shaped by the subjective consciousness of the individuals. In this study, tendency to technological innovativeness as the appearance of individual consciousness has been related to the some variables. It has been found out that there is a significant relationship between tendency to technological innovativeness and variables such as gender, mother education, family income, friend interaction and awareness; whereas there is not a significant relationship between tendency to technological innovativeness and variables such as faculty, department, class, institutional characteristics and establishment of a business. The socio-economic levels of individuals will influence their perceptions, goals and motivations regarding their attitudes, thoughts and beliefs, along with many other factors. The most important way for children of low socioeconomic level families to recover their situation is to be able to utilize education and opportunities. For this reason, it is a rational attitude for individuals who struggle with difficulties since the day they were born and who develop solutions to the problems that they constantly face to go for innovative solutions to improve the conditions they are in.

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