



## SCIENTIFIC AREAS AND RESEARCH METHODS OF RESEARCHERS AT THE NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY OF EAST TIMOR – A DISCUSSION ON TYPES OF RESEARCH, NEEDS AND CHALLENGES

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**Abstract:** This article aims to present the thematic areas of study, the types of research methods and their practical applications used by researchers at the National Institute of Science and Technology of Timor-Leste between 2019 and 2023. During this period, 25 studies were carried out that focused on the qualitative research method, 18 studies embarked on quantitative research and 3 studies followed a mixed method, totalling 46 studies. In addition to presenting the types of research methods used by the researchers, the thematic areas of study and practical applications, it will focus on the needs and challenges that the researchers faced throughout the process, as well as some research results that were published based on the scientific areas.

**Keywords:** Research Methods; INCT; Needs and Challenges; Timor-Leste.

### **Áreas Científicas e Métodos de Investigação dos Investigadores do Instituto Nacional de Ciência e Tecnologia de Timor-Leste – Uma Discussão Sobre Tipos de Investigação, Necessidades e Desafios**

**Resumo:** Este artigo tem como objetivo apresentar as áreas temáticas de estudo, os tipos de métodos de investigação e as suas aplicações práticas que foram utilizadas pelos investigadores do Instituto Nacional de Ciência e Tecnologia de Timor-Leste entre os anos de 2019 e 2023. Durante este período, foram realizados 25 estudos que se centraram no método de investigação qualitativa, 18 estudos enveredaram pela investigação quantitativa e 3 estudos seguiram um método misto, totalizando 46 estudos. Para além de serem apresentados os tipos de métodos de investigação utilizados pelos investigadores, as áreas temáticas de estudo e aplicações práticas, focar-se-á sobre as necessidades e desafios que os investigadores enfrentaram ao longo do processo, bem como alguns resultados de investigação que foram publicados com base nas áreas científicas.

**Palavras-chave:** Métodos de Investigação; INCT; Necessidades e Desafios; Timor-Leste.

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## Introduction

In 2019, the National Institute of Science and Technology (INCT) began awarding fully funded research grants to Timorese researchers in different research areas, such as social sciences, natural sciences, technology and innovation in Timor-Leste. The implementation of study areas, research methods and some challenges faced by INCT researchers are highlighted.

## Method

The scientific reports of 2019, 2021, 2022, and 2023, and relevant documents were read and analysed to obtain detailed information. INCT researchers were also interviewed.

## Results

We identified four (4) qualitative research methods and three (3) quantitative research methods that were implemented in 2019; in 2021, twelve studies with twelve (12) qualitative research methods and four studies with four (4) quantitative research methods were implemented; in 2022, five (5) studies with qualitative research methods, four (4) studies with quantitative research methods and three (3) studies with mixed methods were identified; in 2023, four (4) studies with qualitative research methods and seven (7) studies with quantitative research methods were identified.

In the case of research methods and their applications, the result showed that in 2019 around 57 per cent of the research was qualitative and 43 per cent quantitative. In 2021, around 75 per cent of the work was carried out using the qualitative research method and 25 per cent quantitative. In 2022, around 42 per cent of studies implemented qualitative methods, 33 per cent of studies adopted quantitative methods and 25 per cent mixed methods; in 2023, around 36 per cent of studies implemented qualitative research methods and 64 per cent quantitative research methods.

In terms of thematic areas, in 2019, five (5) studies were funded in the social sciences (71%) and two studies in the natural sciences (29%). However, in 2021, nine (9) scientific investigations focused on the social sciences (56%), five (5) types of research concentrated on the natural sciences (31%) and two (2) scientific explorations emphasised innovation and technology (13%).



In 2022, the INCT funded five (5) investigations in the social sciences (47%), two (2) investigations (6%) in innovation and technology and five (5) investigations (47%) in the natural sciences. In 2023, two (2) studies (equivalent to 18%) in social sciences were funded.

## Background

Timor-Leste is one of the latest independent countries in Southeast Asian nations with 1,342,926 populations. The country introduced its education system being used to teach students in the country itself. The education system itself had been taught science and technology in secondary school. The scientific report and publication at higher education institutions and some research institutes were started a few years ago in Timor-Leste (Rangel, G., et al, 2023).

The research method is a tool used by researchers to do scientific investigations. These can be qualitative, quantitative or mixed methods (Pandey & Pandey, 2021). Quantitative methods are used to examine numerical data and often require the use of statistical tools to analyse the data collected (Ahmad, et al, 2019). This allows for the measurement of variables and relationships between them can then be established. This type of data can be represented using graphs and tables. Qualitative data is non-numerical and focuses on establishing patterns (Tenenbaum, et al, 2011). Mixed methods are composed of both qualitative and quantitative research methods (McKim, 2017). Mixed methods allow for the explanation of unexpected results (Baškarada & Koronios, 2018). The transversal research promotor in Timor-Leste is the National Institute of Science and Technology (Decree of law INCT, 2023).

The National Institute of Science and Technology (Acronym in Portuguese, INCT) has a principal mission such as promoting science, cataloguing and disseminating the scientific investigations results to the public (Decree of law INCT, 2023). Therefore, the INCT has started proposal calling and offering fully funded research since 2019 with various research methods applications. In this case, four years of implementing research in the areas of social sciences, exact and natural sciences and technology and innovation had been realized by qualified researchers from different higher education institutions and some government institutions, annually (Rangel, 2023).

There were forty-six (46) scientific investigations had been conducted from 2019 to 2023. Twenty-five (25) studies were concentrated on qualitative methods; eighteen (18) investigations were focused on quantitative methods and three (3) investigations were in both qualitative and quantitative or mixed methods. This article will present the number of research methods that have been used by INCT's researchers in different years of implementation in scientific areas such as social sciences, exacts and natural sciences, innovation and technology, and INCT researcher's opinion. On the other hand, the needs and challenges faced by researchers are also highlighted.

## Method

The data from INCT were collected. The policy documents such as decrees of laws, rules, guidelines, manuals and other relevant reports were identified, read and analysed. The INCT researchers were interviewed. The key informants interviewed in different areas of study such as social sciences, natural sciences and innovation and technology were interviewed to get the point. The diverse sample of individuals was taken into consideration, as can be seen in Table 1.

List of KIIs (Key information interviews)	Number of KIIs	List of FGDs	Number of FGDs
Social Sciences	2	Social Sciences	1
Natural Sciences	2	Natural Sciences	1
Innovation and Technology	1	Innovation and Technology	0
Total	5	Total	2
Grand Total		7	

Table 1 - List of key informant interviews and group discussions (KIIs and FGDs)



## Criteria for Selection of Key Informants

The key informant selection criteria were: (1) INCT researchers from 2019-2023; (2) researchers that have conducted research in social sciences, natural sciences, innovation and technology; (3) researchers that have realized the research on applied, basic and experimental.

The questionnaires were used to collect the data. The respondents took 5-10 minutes to answer the questions which was carried out in the municipalities of Dili and Ermera. Both the Tetum and English languages were used to interview the key informants.

The quantitative methods through descriptive study (Vaismoradi, 2013), the results of scientific research in 2019, 2021, 2022 and 2023 (n = 46) and the results of scientific investigation based on subject areas (n = 7). It was possible to collect 46 research results reports available at the INCT secretariat and 7 research publications accessible online through the research portal and Google Scholar (see Table 2).

Scientific investigations based on subject areas	Year of implementation					Several types of research have been published based on subject areas
	2019	2020	2021	2022	2023	
Social sciences	5	0	9	5	2	1
Natural Sciences	2	0	5	5	6	6
Innovation and Technology	0	0	2	2	3	1
Total	7	0	16	12	11	8
Grand Total	46					8

*Table 2 - List of scientific investigations based on subject areas in different years of implementation*

All scientific reports from 2019-2023 have been collected and analysed. Data collection and analysis were accomplished. The framework method was employed in the types of research methods, and subject areas of studies and key informants were created to code, categorise, analyse and interpret the data using Office tools, Excel and Word.

## Results

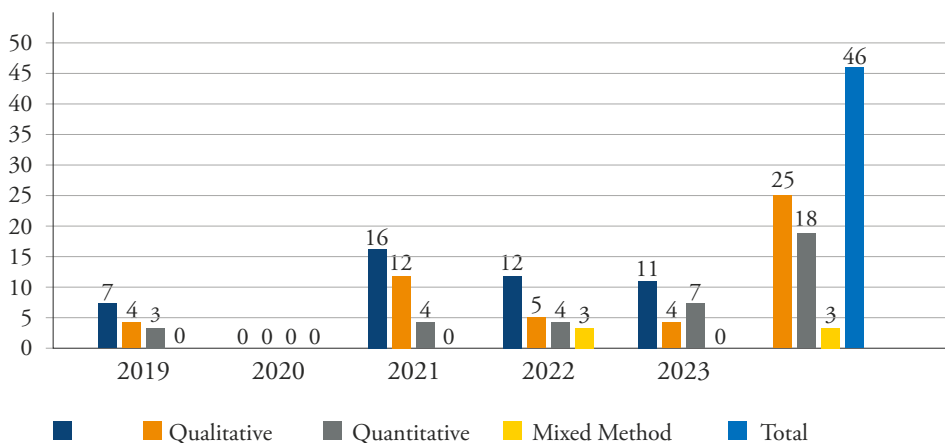
The seven scientific research in 2019, sixteen in 2021, twelve in 2022 and eleven in 2023 were conducted and reported by INCT's researchers. The scientific research results also were disseminated and distributed by INCT to the institutions researched, line ministries and the national parliament of Timor-Leste. The total scientific investigations were 46 studies.

In 2019, seven (7) scientific investigations were conducted with four (4) qualitative studies and three (3) quantitative studies. In 2021, there were sixteen (16) investigations were implemented, twelve (12) in qualitative and four (4) in quantitative methods. In 2022, the twelve (12) studies were realized five (5) were concentrated in qualitative, four (4) were focused on quantitative and three (3) were included both (mixed) methods such as qualitative and quantitative. However, in 2023 there were only eleven scientific investigations such as four (4) studies were in qualitative and seven (7) were in quantitative methods. Thus, the total number of studies is forty-six (46) as indicated in Table 3.

Types of Research Methods	Year of implementation and number of investigations					Total
	2019	2020	2021	2022	2023	
	7	0	16	12	11	
Qualitative	4	0	12	5	4	25
Quantitative	3	0	4	4	7	18
Mixed Method	0	0	0	3	0	3
<b>Total</b>						<b>46</b>

*Table 3 – The research methods based on year implementations*

From 46 scientific investigations, twenty-five (25) investigations were focused on qualitative methods, eighteen (18) were concentrated on quantitative methods and three (3) studies were on mixed methods as shown in graphic 1.



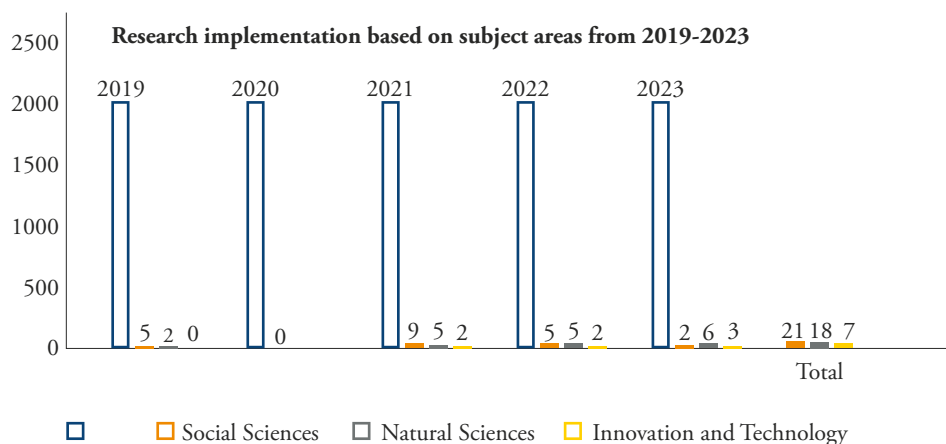
Graphic 1. Scientific investigations implementation based on research methods applications

In terms of subject areas, social sciences were five (5) studies, natural sciences were two (2) studies in 2019. In 2020, there was no research activity due to the COVID-19 pandemic affecting Timor-Leste. Nevertheless, in 2021, nine (9) scientific investigations were focused on social sciences, five (5) investigations were concentrated on natural sciences and two (2) scientific explorations were emphasized in innovation and technology. Nonetheless, in 2022, five (5) investigations were in social sciences, two (2) investigations were in innovation and technology and five (5) investigations were in natural sciences. In 2023, two (2) studies were in social sciences, six (6) investigations were in natural sciences and three (3) scientific investigations were concentrated on innovation and technology, as displayed in table 4.

Subject areas	Year of implementation					Total
	2019	2020	2021	2022	20203	
Social Sciences	5	No activity due to COVID-19 Pandemic	9	5	2	21
Natural Sciences	2		5	5	6	18
Innovation and Technology	0		2	2	3	7

Table 4 – The yearly research methods implementations based on subject areas

From forty-six (46) scientific investigations, twenty-one (21) studies were focused on social sciences, eighteen (18) investigations were concentrated on natural sciences and seven (7) investigations were related to innovation and technology as designated in Graphic 2.



Graphic 2. Scientific investigations implementation based on subjects' areas

## Results of the Interview with Key Informants

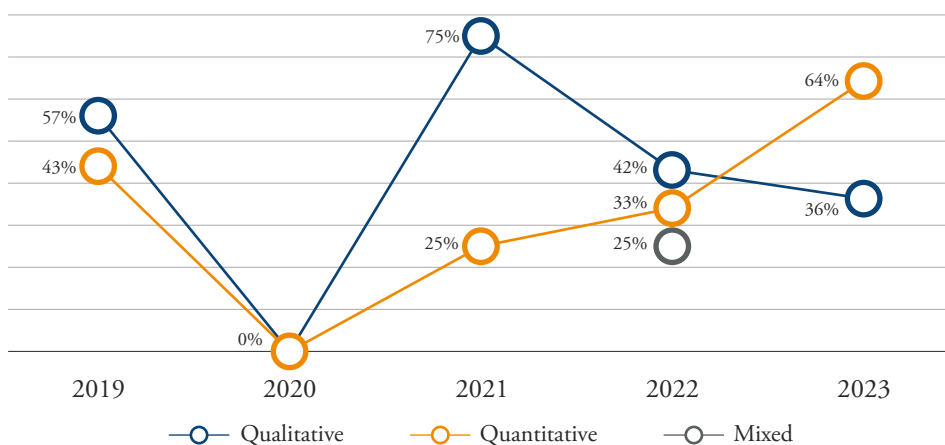
Some INCT researchers argued that as a top research institute in the country to promote science, technology and innovation Timor-Leste, needs to establish a proper criterion to support national researchers to conduct a qualified scientific investigation in the country to contribute to the government for better decision-makers. The existence criteria which focused on the distance and number of samples are not sufficient to differentiate the applied, basic and experimental scientific investigations. Therefore, INCT requires a strong and fundamental criterion for funding scientific research in Timor-Leste in the future.





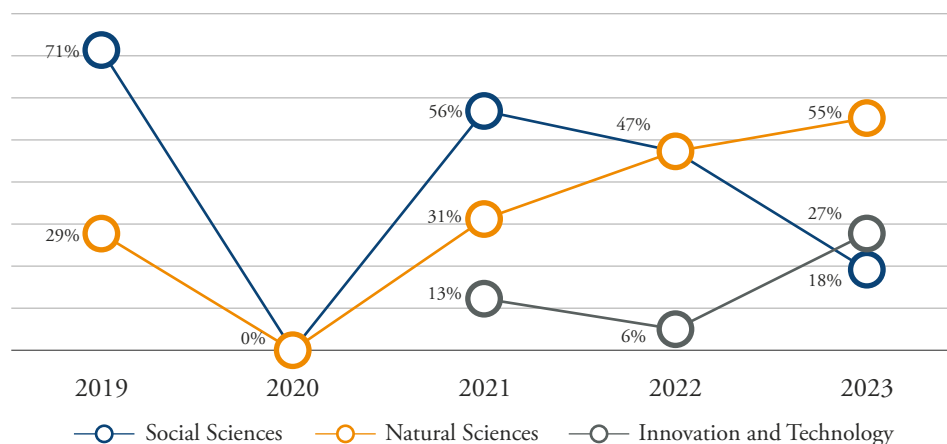
## Discussion

In the case of research methods and their applications, the result showed that in 2019 research about 57% were qualitative and 43% in quantitative research methods. In 2021 about 75% in qualitative and 25% in quantitative research methods. In 2022 around 42% in qualitative, 33% in quantitative and 25% in mixed methods and in 2023 about 36% in qualitative and 64% in quantitative research methods as indicated in graphic 3.



*Graphic 3. Research methods percentages based on year implementations*

In 2019, the seven (7) scientific investigations carried out in different thematic areas resulted in the following: social sciences with 71% and natural sciences with 29%. However, in 2021, there were sixteen (16) scientific investigations, 56% of them focused on social sciences, 31% on natural sciences and 13% on innovation and technology. Nonetheless, in 2022, twelve (12) studies were conducted, 47% of them on social sciences, 6% on innovation and technology and 47% in natural sciences. In 2023, eleven (11) investigations were implemented, the social sciences with 18%, the natural sciences with 55%, and innovation and technology with 27%, as shown in graphic 4.



Graphic 4. Subject areas implementation based on year implementation

## Opportunity And Challenges Encountered by INCT's Researchers

### *Current Opportunities*

The INCT has various research guidelines and reports to guide INCT's researchers to adapt and follow the ethical rules and scientific research implementation instructions. INCT has an annual plan to allocate a research budget to recruit and fund scientific investigations annually since 2019. INCT has established an online journal named "Revista de Ciências e Tecnologia Timor-Leste" since 2022, the volumes 1 and 2 are available online. On one hand, INCT also had realized and signed various cooperation programs with different higher education in the country and overseas, and research institutes inside and outside the country as well as to expand cooperation program-related research and publication.

From these opportunities created by INCT, researchers benefit from research funds to conduct research in various areas of study such as social sciences, natural sciences, technology and innovation. Studies in the humanities open in 2024. Even with limited funds, INCT funded 57 studies from 2019 to 2024, with different research methods such as qualitative, quantitative and mixed methods.



### *Challenges Encountered*

The INCT is one of the newest government institutions in the country after its establishment and functioning in 2019. Varieties of scientific research have been conducted since its establishment and fully funded from 2019, 2021, 2022, 2023 and 2024.

Unavailable transversal laboratory to accommodate laboratory experiments in various experimental research in health and agriculture sciences, geosciences and other relevant pure research has been funded by INCT so far. On one hand, limited budget to cover publication fees in online international journals that are indexed in various world databases such as Scopus, Esmeralda, Taylor and Francis, PubMed and other relevant world-recognised and trustful databases. On the other hand, external funds are needed to upgrade research and publication quality in the country in the future.

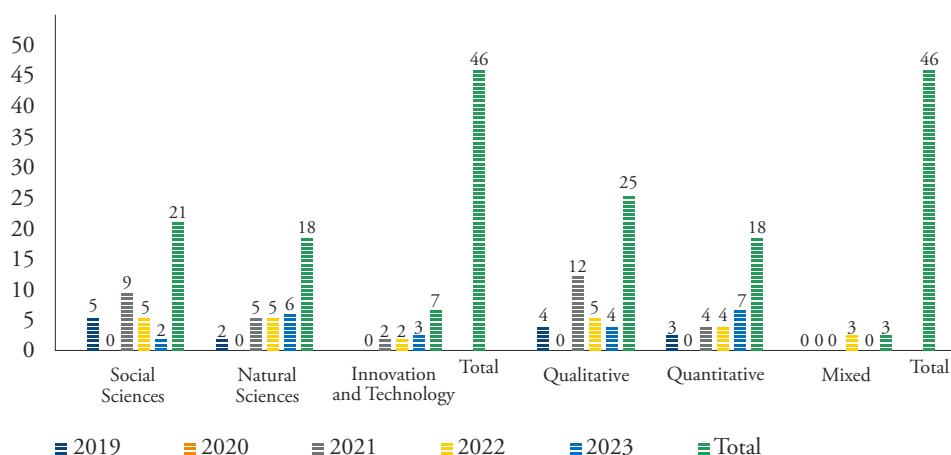
### **Conclusion**

From three (3) study areas at INCT, forty-six (46) scientific investigations had been realized and reported. The subject areas studied were social sciences, natural sciences, innovation and technology. The research methods were used qualitative, quantitative and mixed methods as indicated in Table 5.

Research/subject areas	2019	2020	2021	2022	2023	Total
Social Science	5	0	9	5	2	21
Natural Sciences	2	0	5	5	6	18
Innovation and Technology	0	0	2	2	3	7
Total						46
Qualitative	4	0	12	5	4	25
Quantitative	3	0	4	4	7	18
Mixed	0	0	0	3	0	3
Total						46

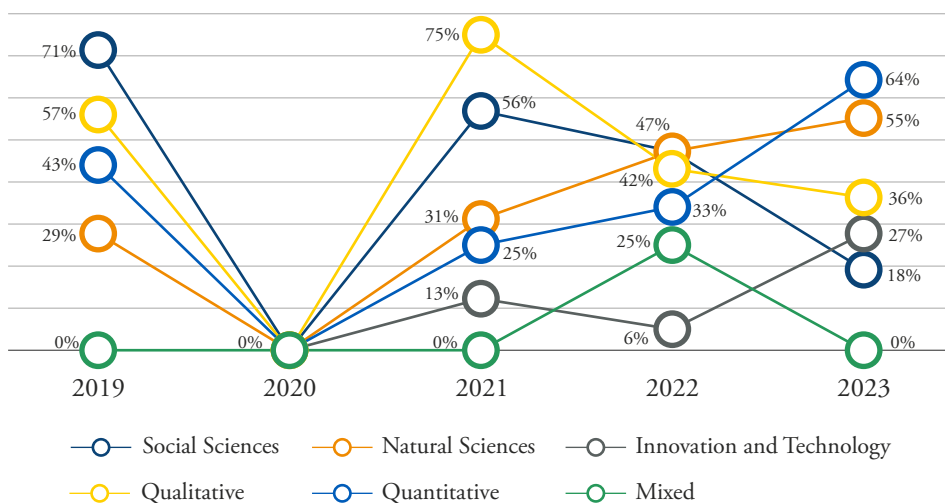
*Table 5 – The summary tables based on subject areas and research methods*

There were twenty-one (21) studies focused on social sciences, eighteen (18) investigations were concentrated on natural sciences and seven (7) investigations were on innovation and technology. From forty-six (46) studies in various subject areas, twenty-five (25) researchers used qualitative methods, eighteen (18) scientific investigations used quantitative methods, and three (3) studies used both qualitative and quantitative methods or mixed methods as indicated in graphic 5.



Graphic 5. Number of study areas and research methods had been used from 2019-2023

The highest percentages of study areas were social sciences, with 71% in 2019, 56% in 2021, 47% in 2022 and 18% in 2023. The percentage of natural sciences was 55% in 2023, 47% in 2022, 31% in 2021 and 29% in 2019. The percentage for innovation and technology was 27 per cent in 2023, 13 per cent in 2021 and 6 per cent in 2022. However, the percentages relating to research methods were higher in qualitative studies, with 75 per cent in 2021, 57 per cent in 2019, 42 per cent in 2022 and 36 per cent in 2023. However, quantitative studies were the highest in 2023 with 43 per cent in 2019, 33 per cent in 2022 and 25 per cent in 2021, as shown in graph 6.



Graphic 6. The study areas and research methods percentages from 2019 - 2023

Based on the tables and graphs presented, it can be concluded that need for more investment in science, technology and innovation through research and development or research and innovation in Timor-Leste that is funded by research institutes including INCT and other relevant research institutes in the country in the future.

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