Types of empirical research

The type of research method to be used in a research is defined by the main objective of the research

Types of research

- Non mutually exclusive non-exhaustive categories:
  - **Exploratory**
  - **Descriptive**
  - **Explanatory**
  - **Predictive**
  - **Prescriptive**
  - **Constructive**

Exploratory research

- The exploration of **new phenomena**
  - To better understand,
  - To test the feasibility of a more extensive study, or
  - To determine the best methods to be used in a subsequent study

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Exploratory research

- **Characteristics**:
  - Broad focus
  - It rarely provides definite answers to specific research issues

- **Goal**:
  - To identify key issues and key variables

- **Useful** to conclude that a perceived problem **does not actually exist**

Example

- Study a **new tool** to support SCRUM meetings

- This would be a vital first step before deciding whether to embrace SCRUM

- What are the key functionalities? What are the limitations?

- Can the tool be used with SCRUM?

Exploratory

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Descriptive research

- Provide an **accurate description of observations** of a phenomena
- Produce useful insights and lead to **hypothesis-formation**

Example

- **Customer profiling.** By understanding better the customers, sales and marketing management will be able **to take better decisions on new product development**

- Analyse statistically which software producer customers select when they buy software

- Customers buy apple software more than microsoft software if they buy it online

Descriptive

- Provide an **accurate description of observations** of a phenomena
- Produce useful insights and lead to **hypothesis-formation**

Explanatory research

- Explanatory studies look for **explanations of the nature** of certain **relationships**

- **Hypothesis testing** provides an understanding of the relationships that exist between variables

- **Controlled experiments** are used to show causality between variables

Example

- Investigate whether code ownership increases software quality

- What is the cause-effect relation?

- What are the dependent/ independent variables?

- How would you design an experiment to proof or disproof it?

Explanatory

- Explanatory studies look for **explanations of the nature** of certain **relationships**

- **Hypothesis testing** provides an understanding of the relationships that exist between variables

- **Controlled experiments** are used to show causality between variables

	Exploratory	*Descriptive*	*Explanatory*
Degree of problem definition	Key variables not defined	Key variables are defined	Key variables and key relationships are defined
Possible situations	"Quality of service is declining and we don't know why."	"What have been the trends in organisational downsizing over the past ten years?"	"Which of two training programs is more effective for reducing labour turnover?"
	"Would people be interested in our new product idea?"	"Did last year's product recall have an impact on our company's share price?"	"Can I predict the value of energy stocks if I know the current dividends and growth rates of dividends?"
	"How important is business process reengineering as a strategy?"	"Has the average merger rate for financial institutions increased in the past decade?"	"Do buyers prefer our product in a new package?"

	Exploratory	Descriptive	Explanatory
Degree of problem definition			
Possible situations			

Prescriptive research

- Prescriptive research (also known as Normative research), comes up with an assertion, a **solution**, a proposal for **how to address a known problem**

- After **identifying success or performance or outcomes**, it **recommends** solutions or new ideas

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Example

- Knowledge loss due to developers' turn over

- Prescriptive research
- Known problem

- Pair programming
- Pair programming allows to share knowledge of individuals
- There might be problems of communication and roles
- …

- Solution
- After **identifying success or performance or outcomes**, it **recommends** solutions or new ideas

Predictive research

- It extrapolates from the analysis of existing phenomena, policies, or other entities in order to **predict something that has not been tried, tested, or proposed before**

Example

Predictive

- Pb: predict time of next failure

- Solution: use models of historical failure time occurrence to predict future time of failure

- It extrapolates from the analysis of existing phenomena, policies, or other entities in order to **predict something that has not been tried**, **tested, or proposed before**

Constructive research

- It finds a **new solution** to a specific persisting problem

- **Validation** needs to ensure that conclusions have to be objectively argued and defined, e.g.:

  - Evaluating the construct analytically against some predefined criteria or

  - Performing some benchmark tests with prototypes

  - Performing empirical evaluation

Example

- Small tour operators do not have enough personnel to support all their customers during heaps of requests

- Solution: Build a tour planning system as mobile app

- Validation: Validate for user's expectations with clicks, rates etc

Constructive

- It finds a **new solution** to a specific persisting problem

- **Validation** needs to ensure that conclusions have to be objectively argued and defined,

Time dimension

Cross-sectional research

- Data is gathered **once**, during a period of days, weeks or months

- Many cross-sectional studies are **exploratory** or **descriptive**

- They are designed to look at **how things are now**, without any sense of whether there is a history or trend at work

Longitudinal Research

- Data collection at **multiple points** in time

    - **Trend study:** looks at population **characteristics** over time, e.g. class complexity over releases

    - **Cohort study:** traces a **sub-population** over time, e.g. complexity of abstract classes over releases

    - **Panel study:** traces the **same sample** over time, e.g. complexity of the same set of classes of a given system over releases

Research settings

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Contrived setting

- Artificial environment in which the events are strictly controlled.

- *The researcher is looking at establishing a **cause → effect relationship** beyond any reasonable doubt*

- For this reason, the study participants will be carefully chosen and the stimuli manipulated

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Non-contrived setting

- **Natural environment** in which events normally occur

- Examples: **Field studies / experiments** with minimal interference from the researcher

- A field experiment is *research into a causal relationship set in the natural environment with some manipulation of the variables*

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Qualitative and Quantitative Research

- Qualitative methods provide data in the form of **words** (or maybe visually)

- Quantitative methods generate **numerical data**

- Quantitative and qualitative methods of data collection are often **employed in support of each other** on the one research project.

Quantitative	Qualitative
Objective is to test hypotheses that the researcher generates	**Objective** is to discover and encapsulate meanings once the researcher becomes immersed in the data
Concepts are in the form of distinct variables	**Concepts** tend to be in the form of themes, motifs, generalizations, and taxonomies.
Measures are systematically created before data collection and are standardized as far as possible; e.g. measures of job satisfaction.	**Measures** are more specific and may be specific to the individual setting or researcher; e.g. a specific scheme of values

Quantitative	Qualitative
Data are in the form of **numbers** from precise measurement	**Data** are in the form of **words** from documents, observations, and transcripts. However, quantification is still used in qualitative research.
Theory is largely causal and is deductive	**Theory** can be causal or non-causal and is often inductive
Procedures are standard, and replication is assumed	**Procedures** are particular and replication is difficult
Analysis proceeds by using statistics, tables, or charts and discussing how they relate to hypotheses.	**Analysis** proceeds by extracting themes or generalisations from evidence and organizing data to present a coherent, consistent picture. These generalisations can then be used to generate hypotheses.

Example of Research Technique: Interview

- The researcher asks a series of questions to a set of subjects about the areas of interest in the case study
- The interview can be with a single subject or with a set of subjects

Interviews

- The dialogue between the researcher and the subject(s) is guided by a set of interview questions.

- Questions can be open, i.e. allowing and inviting a broad range of answers and issues from the interviewed subject, or closed offering a limited set of alternative answers.

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Interviews

- Interviews can be divided into:
    - unstructured: questions are formulated as general concerns and interests from the researcher;
    - semi-structured: questions are planned but are not necessarily asked in the same order as planned;
    - fully structured: questions are planned in advance and asked in the same order as planned.

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