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## Writing Methodology & Results

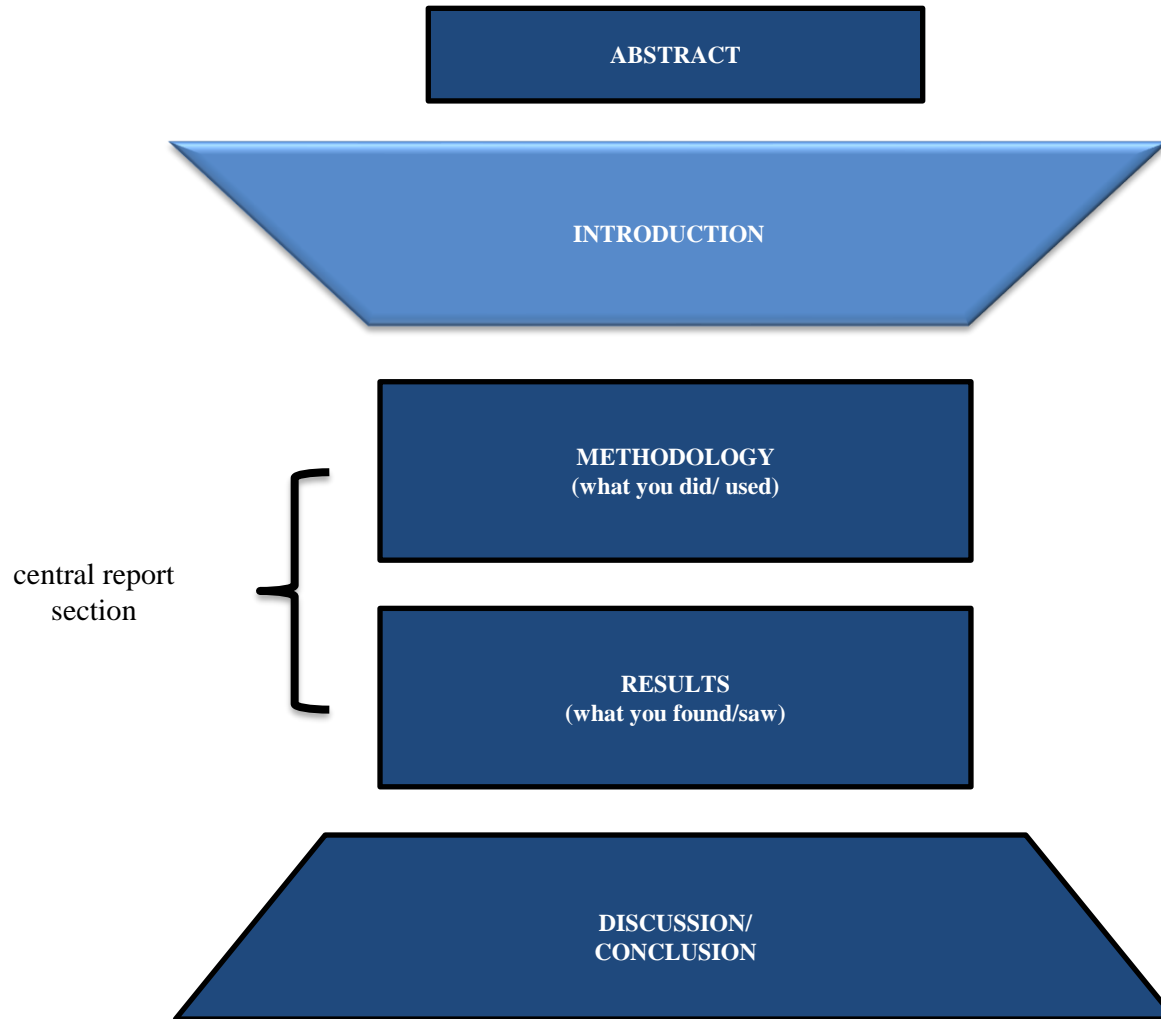
S. M. Ahsan Kazmi

Research Methods

# Recap: Skim Efficiently and Quickly

1. READ THE TITLE  
and try to predict the type of information you expect to see
2. LOOK AT THE NAME OF THE AUTHOR  
What you know about the writer will help you predict and evaluate the content.
3. CHECK THE DATE  
and use it to help you assess the content.
4. READ THE ABSTRACT  
to find out what the researchers did and/or what they found
5. LOOK QUICKLY AT THE FIRST PARAGRAPH  
without trying to understand all the words.
6. LOOK QUICKLY AT THE FIRST SENTENCE OF EACH PARAGRAPH  
without trying to understand all the words
7. LOOK QUICKLY AT EACH FIGURE/TABLE AND READ ITS TITLE  
to try and find out what type of visual data is included
8. READ THE LAST PARAGRAPH  
especially if it has a subtitle like 'Summary' or 'Conclusion'

# The Shape of a Research Article



# Introduction of your own research

To write the Introduction of your own research, the model you build must answer the following three questions:

1. How do writers normally start the Introduction?
2. What type of information should be in my Introduction, and in what order?
3. How do writers normally end the Introduction?

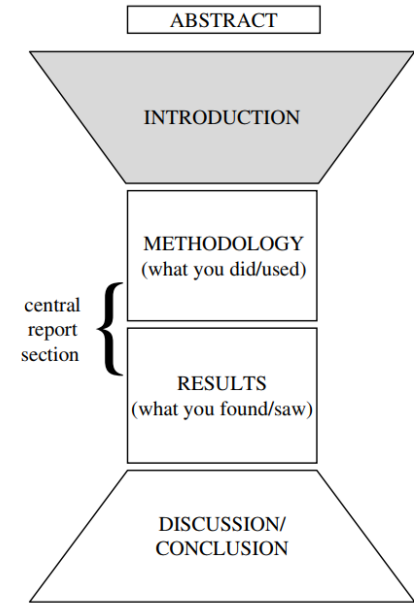


Fig. 1. The shape of a research article or thesis.

# Building a model

1	ESTABLISH THE IMPORTANCE OF YOUR FIELD
	PROVIDE BACKGROUND FACTS/INFORMATION (possibly from research)
	DEFINE THE TERMINOLOGY IN THE TITLE/KEY WORDS
	PRESENT THE PROBLEM AREA/CURRENT RESEARCH FOCUS
2	PREVIOUS AND/OR CURRENT RESEARCH AND CONTRIBUTIONS
3	LOCATE A GAP IN THE RESEARCH
	DESCRIBE THE PROBLEM YOU WILL ADDRESS
	PRESENT A PREDICTION TO BE TESTED
4	DESCRIBE THE PRESENT PAPER

# Building a model

- The introductory article generally follows the following order.
  - ✓ most Introductions begin with item 1, that the order of the model components is usually reliable
  - ✓ items 2 and 3 can occur more than once
  - ✓ almost all Introductions finish with number 4

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# A Novel Contract Theory-Based Incentive Mechanism for Cooperative Task-offloading in Vehicular Networks

S. M. Ahsan Kazmi, Tri Nguyen Dang, Ibrar Yaqoob, Aunus Manzoor, Rasheed Hussain, Adil Khan, Choong Seon Hong

**Index Terms**—Next-generation vehicular network, task offloading, contract theory, vehicle to vehicle resource sharing.

## I. INTRODUCTION

Intelligent Transportation System (ITS) realized through connected car technology is poised to transmute the traditional driving experience to a new digital experience. Over the last few decades, the automotive industry in cooperation with tech-giants has been successful in equipping their products with communication, computation, and storage capabilities. As a result, such cars have become a part of the communication eco-system. However, these cars are still resource-constrained for applications that require enormous communication, computation, and storage resources such as autonomous driving. On the other hand, the inception of electrically charged battery-propelled vehicles (Electric Vehicles – EV) instead of fossil fuel-propelled vehicles has considerably contributed to the decrease in carbon emission, footprints and other greenhouse gases that are endangering the environment [1], [2]. Apart from EV, the integration of connected car technology, EV, and autonomous car will be another step towards realizing a futuristic service- and application-rich paradigm [3]. Moving forward, connected car technology (with the addition of EV and autonomous car) alone cannot complete the smart city eco-system without enabling technologies such as cloud computing and Internet of Things (IoT). In this regard, connected car technology is further extended (from services and applications perspective) to vehicular cloud computing [4], [5] and vehicular social networks [6]. Despite the exciting advancements in these technologies, there are still challenges such as security, privacy, trust, and operational issues that need to be addressed [7], [8]. However, the scope of this work is limited to task offloading and resource utilization. In the following, we discuss the challenges of ITS realized through integrated connected, electric, and autonomous cars.

Kazmi, SM Ahsan, et al. "A novel contract theory-based incentive mechanism for cooperative task-offloading in electrical vehicular networks." *IEEE Transactions on Intelligent Transportation Systems* 23.7 (2021): 8380-8395.

# Building a model

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# Literature review

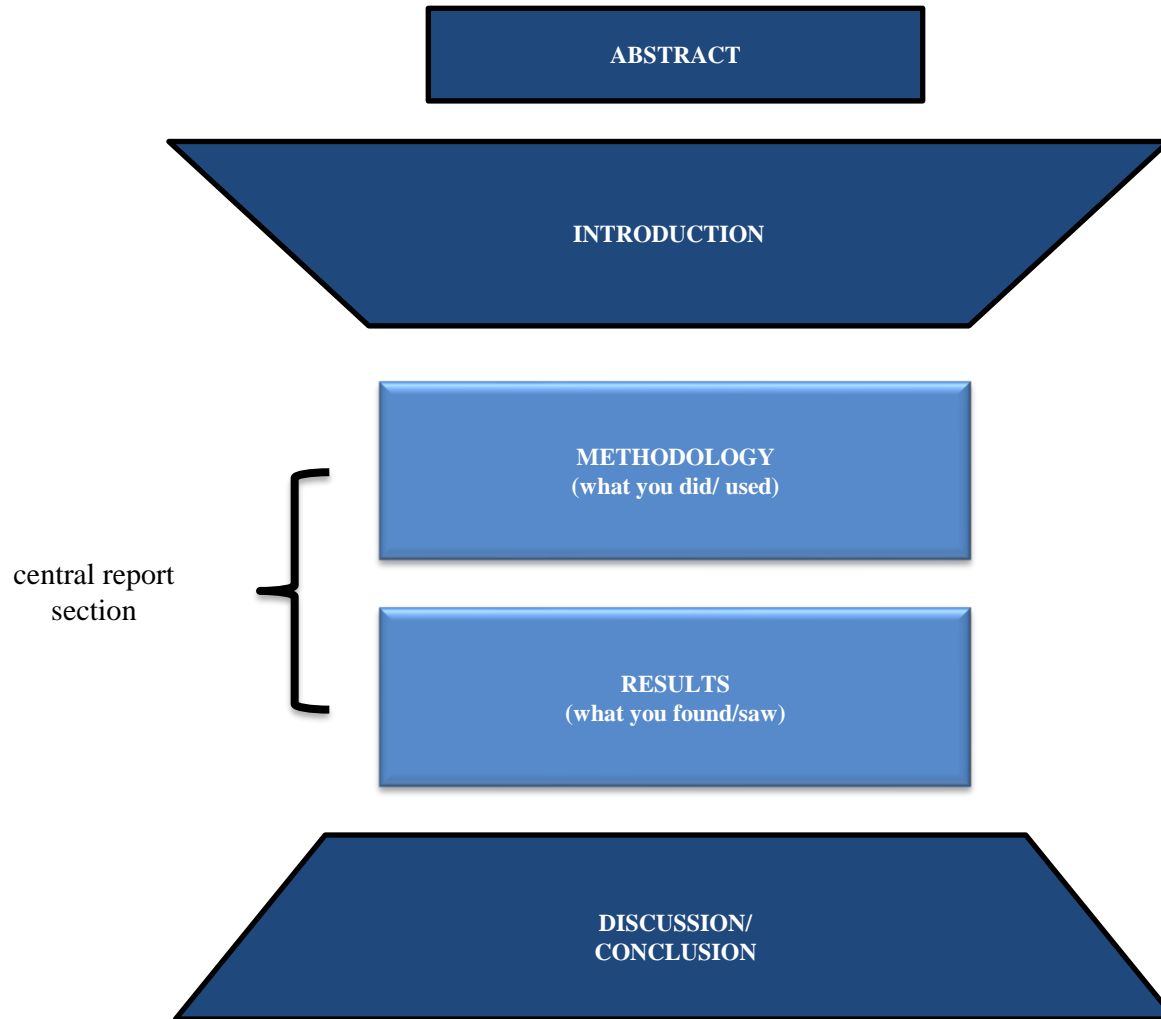
- The section should begin with an introductory paragraph summarizing the goals and the contents.
- The section should contain a classification (grouping) of the existing works.
  - ✓ You can identify the factors on the basis of which you will create this grouping.
  - ✓ The section could contain both a diagram (a tree structure) presenting the grouping and a brief description of the diagram explaining why you grouped the existing work the way you did.
- A section for each group of methods, explaining in detail each method:
  - The problem that was solved
  - How it solved the problem
  - How did it perform the validation
  - What are the main results
  - What are its strengths and weaknesses

Task offloading has captivated significant attention in futuristic networks such as smart cities, smart homes, and 1 We want to clarify that we use the terms ‘cars’, ‘vehicular nodes’, and ‘vehicles’ interchangeably and they represent vehicles including EVs, autonomous cars, and normal vehicles, unless specified, otherwise. vehicular networks due to the emergence of novel applications and high computational demands. Several works have been carried out to enhance the task offloading performance in edge computing considering key factors such as fairness among tasks [15], energy optimization [16], etc. In particular, there have been several recent works [17]–[19] that have utilized edge computing paradigm in vehicular networks to achieve fruitful performance gains. For instance, in [17], the authors solved a mixed-integer linear programming problem to optimize the cost of edge computing deployment in a vehicular network coverage area. In [18], the authors proposed a heuristic energy-efficient task scheduling approach for edge computing in vehicular networks. Edge computing has also been proposed to enable infotainment services in vehicular networks. In this context, an optimization-based solution to minimize the task latency in vehicular networks for joint communication, caching, and computational problems, has been proposed in [19]. Indeed, edge computing for vehicular networks has enhanced the network performance as evident from the aforementioned works; however, the exponential growth of smart vehicles with increasing task offloading requirements will strain the edge computing capacities and increase the network cost due to massive installation of edge computing servers to meet the next-generation vehicular network requirements. To alleviate this problem, one possible solution is to employ the strong onboard computing resources of the vehicles via V2V communication for task offloading. This phenomenon is also referred to as vehicular Fog to meet the next-generation vehicular network requirements.

# Problems / prediction to be tested

In summary, none of the aforementioned solutions consider the incentive-based task offloading approach for practical mobile environments with information asymmetric scenarios. Setting out incentivizing measures in terms of task offloading will motivate private-owned cars to participate and result in a huge resource capacity for vehicular networks. This will result in unlocking the full potential of novel resource-hungry services in next-generation vehicular networks

# The Shape of a Research Article



# Research Methodology (1/2)

- **Research**

- The Advanced Learner's Dictionary of Current English lays down the meaning of research as “a careful investigation or inquiry especially through search for new facts in any branch of knowledge.”
- Redman and Mory define research as a “systematized effort to gain new knowledge.”

- **Research Methodology**

- systematic way to solve a problem
- the procedures by which researchers go about their work of describing, explaining, and predicting phenomena

# Research Methodology (2/2)

## Methodology

- The specific procedures or techniques used to identify, select, process, and analyze information about a topic.
- Allows the reader to critically evaluate a study's overall validity and reliability.
- Answers questions:
  - How was the data collected or generated?
  - What method has been used?
  - Why was a particular technique of analysis of data used?
  - How was it analyzed?
  - what you did and/or what you used
- Contain sufficient detail for readers to replicate the work done and obtain similar results

**Called** Materials and Methods, Procedure, Experiments, Experimental, Simulation, Methodology or Model



# Structure

- **Ask three questions:**

(a) How do I start the Methodology/Experiments section? What type of sentence should I begin with?

(b) What type of information should be in this section, and what order?

(c) How do I end this section?

# Writing Task: Build a Model

- **Why do I need to introduce the Methodology?**

make the entry to that section smooth for the reader

- **Three of the most common ways**

- Offer a general overview by **outlining** the parameters of the work
- Provide background information about the materials or the source of the materials/equipment
- The aim of the project or the problem you are hoping to address

# Writing Task: Build a Model

- **Why do I need to justify or give reasons for what I did? Isn't it obvious?**
  - Your reasons may be obvious to you, but they are not always obvious to your readers
  - Wonder why you did things in a particular way, or why you used a particular procedure
  - Readers cannot be expected to accept your methodology affect the way they evaluate your whole paper
  - Justification enables the reader to trust the choices you made

# Writing Task: Build a Model

- **How much detail do I need to provide?**
  - Better to give slightly too much information than too little
  - If you want another researcher to be able to reproduce your work and obtain similar results, you should include every specification and detail
  - The work was carried out with care
  - Reader accepts the conclusions at the end of your paper for this he must first accept your methodology

# Writing Task: Build a Model

- Why should I refer to other research; why not just describe the method I used?
  - Part of your research may be taken from a method used or discovered by someone else and their method may be very well known
  - Providing research references will provide you with a shortcut

-

# Writing Task: Build a Model

- But if the reference is available in the literature, why does the writer need to give any details? Why can't readers just go to the library, find the reference and read it themselves?
  - Readers may not be familiar
  - Not always appropriate to send readers to the library or Internet to look up a reference
  - Matter of professional courtesy

# Writing Task: Build a Model

- **Why should I mention problems in the methodology? Won't it make me look bad?**
  - You look far more professional if you do mention them
  - If you ignore or try to hide imperfections and your readers notice them, they will begin to doubt your legitimacy as a researcher
- **But how can I talk about problems in my work without looking like a failure?**
  - Use vocabulary **that minimizes the problem, minimizes your responsibility, maximizes the good aspects, and suggests a solution**

# The Model

1	<ul style="list-style-type: none"><li>• Provide a general Introduction &amp; Overview of the Materials/Methods</li><li>• Restate the purpose of the work</li><li>• Give the source of Materials/Equipment Used</li><li>• Supply essential background information</li></ul>
2	<ul style="list-style-type: none"><li>• Provide specific and precise details about materials and methods (i.e. quantities, temperatures, duration, sequence, conditions, locations, and sizes)</li><li>• Justify choices made</li><li>• Indicate that appropriate care was taken</li></ul>
3	<ul style="list-style-type: none"><li>• Relate materials/methods to other studies</li></ul>
4	<ul style="list-style-type: none"><li>• Indicate where problems occurred</li></ul>



# The Result section

- The steps involved in building a model for the results section are,
  - ✓ Outline a model.
  - ✓ Develop a key that serves as the basis for writing this section.
  - ✓ Produce the model based on the key developed.
  - ✓ Testing the model.
- The section deals with connecting the dots, rather than collecting the dots

# Results model

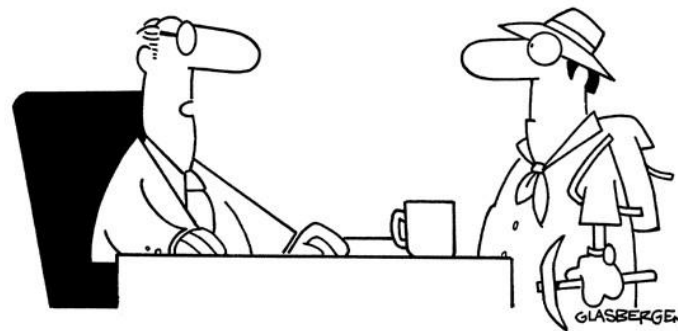
The following are the basic components (but not limited to) of a model

1	REVISITING THE RESEARCH AIM/EXISTING RESEARCH  REVISITING/EXPANDING METHODOLOGY  GENERAL OVERVIEW OF RESULTS
2	INVITATION TO VIEW RESULTS  SPECIFIC/KEY RESULTS IN DETAIL, WITH OR WITHOUT EXPLANATIONS  COMPARISONS WITH RESULTS IN OTHER RESEARCH  COMPARISON/S WITH MODEL PREDICTIONS
3	PROBLEMS WITH RESULTS
4	POSSIBLE IMPLICATIONS OF RESULTS

# Write well

- 90% of research papers get less than 10 citations
- Sell your work and ideas

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**"If people aren't buying our product, they must have rocks in their heads. So we thought it might be helpful to have a geologist on staff."**

- Give the reader a "map" of what you are writing about
- Structure your document

# Proposal Presentations

- For your proposal presentation, you and your team will present the chosen research area and provide a list of selected papers (5 papers) that support your topic. The goal is to explain why you chose this area and how the papers you selected reinforce your choice.
- As part of the exercise, you will evaluate the quality of the selected papers by considering the following:
  - Where is the paper published?
  - Is it in a reputable journal or conference? Impact factor vs accept. Rate?
  - Who are the authors, and how many papers have they published in this area?
  - What are the citation counts for the paper or the authors?
- Each group will have 10 minutes to present.

Thanks