

FINAL YEAR PROJECT RESEARCH METHODOLOGY BRIEFING (PART 2)

Date: 17 November 2020 (Tuesday)

Time: 2.15pm – 4.15pm

Venue: Online



SPEAKER

**PROF DR. OMAR BIN YAAKOB
School of Mechanical Engineering
Faculty of Engineering**

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- Go to **www.menti.com** and use the code **93 78 01 5**
- Which of the following words is not a good verb to be used for Research Objectives?



Chapter 1 Introduction

The Introduction Chapter is a a chapter that should include the following sections which **define the PROBLEM**:

1. Background
2. Brief Literature Review explaining previous research and the knowledge gap
3. Problem Statement
4. Purpose statement
5. Research questions
6. Objectives
7. Scope
8. Significance

Chapter 2 Literature Review

Literature review looking at past literature , what other people has studied on your topic.

Chapter 3 Methodology

Methodology, showing your flow chart and explanation of each block of the activity. What you want to do and how are you going to do it?

Chapter 4 Preliminary Results

Give a brief report of what you have done and obtained so far.

OUTLINE

1. GENERAL ADVICE ON THE CONDUCT OF FINAL YEAR PROJECT
2. RESEARCH PROBLEM FORMULATION
3. LITERATURE REVIEW

PART III

LITERATURE REVIEW

Literature Review

- Why literature review?
 - to provide the background and the context for the research problem
 - to know what other researchers have done and discovered
 - may find a similar study, in turn point to relevant literature and give you head-start
 - help ensure all relevant theoretical underpinning is included
 - help in selecting appropriate research methods and instruments
 - help anticipate common problems – avoid common traps and pitfalls

Go to www.menti.com and use
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**What are sources of literature
you can use in your UGP?**



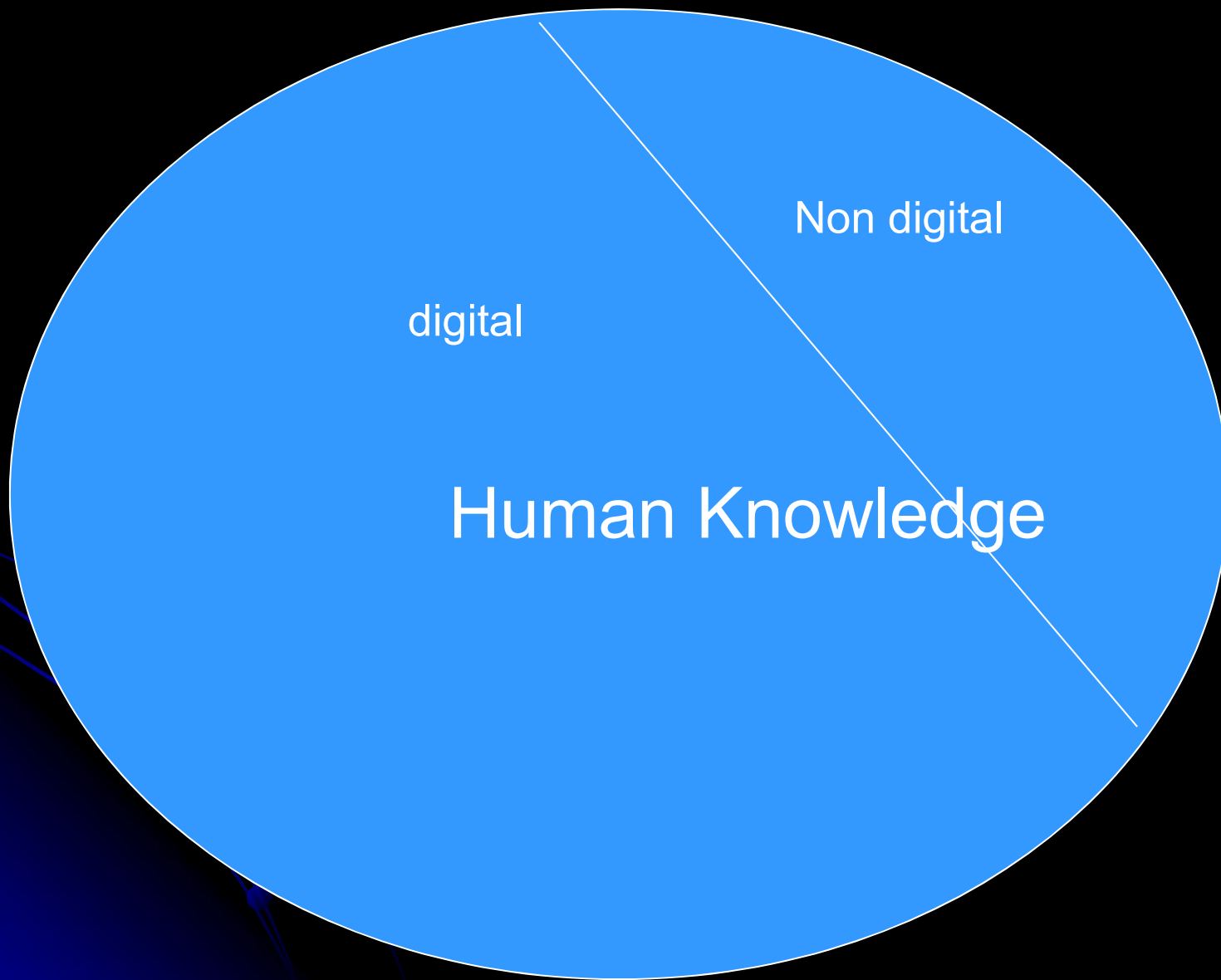
Literature Review.

Sources

- Use only scientific scholarly literature (Journal articles/Conference papers)
- Google Scholar (*scholar.google.com*)
- Science Direct (*www.sciencedirect.com*)
- Scopus (<http://www.scopus.com/>)
- Thesis
- Books
 - If necessary, only few of your references can be from credible websites.

Wikipedia, blogs etc should not be listed as references.

God's Knowledge

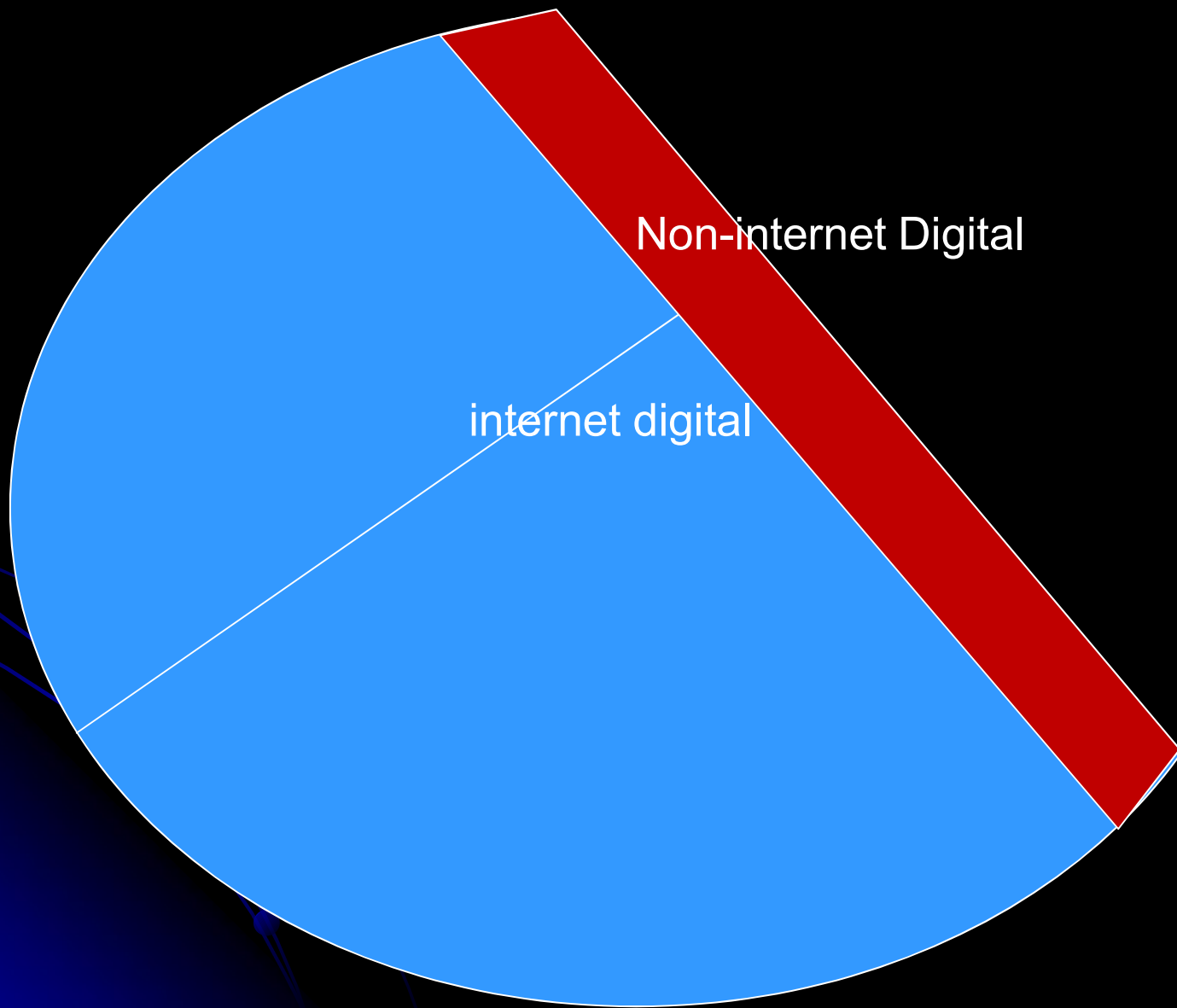


digital

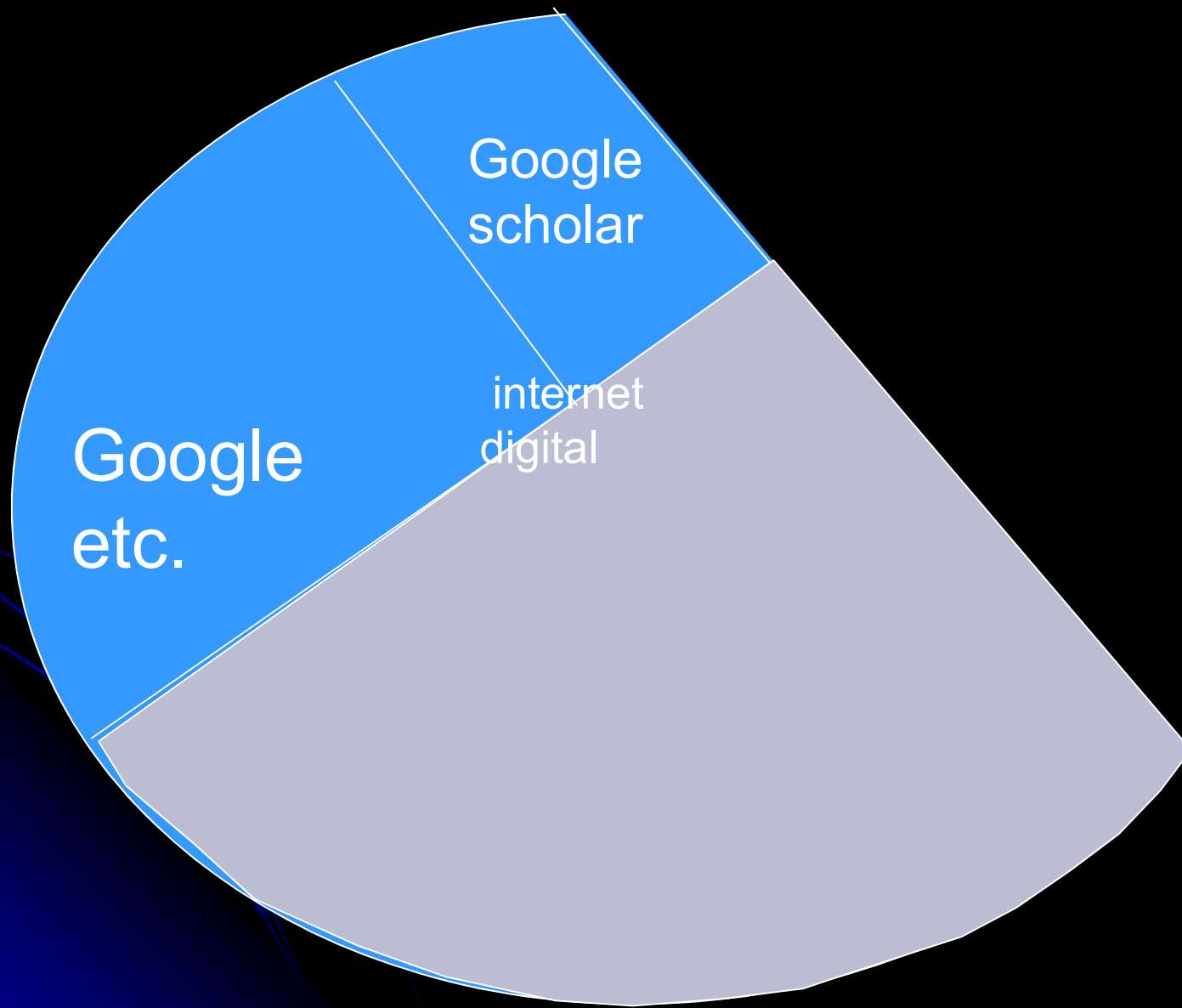
Non digital

Human Knowledge

God's Knowledge



God's Knowledge



patents

Books

Google Scholar

Theses

Journal
Articles

standards

Conference
Articles

digital

digital

digital

digital

digital

Google Scholar Journal & Conference Articles

Indexed Journals	Indexed and flagship Conferences	Non indexed Journals	Low quality Journals	Low quality Conferences	Predatory Journals & Conferences	
Higher quality			Lower quality			
Web of Science (ISI)	Scopus/ ERA					

Searching for Articles

1. scholar.google.com
2. www.sciencedirect.com
3. www.scopus.com

Searching for Articles

The screenshot shows a Google search for "ship hull fouling". The search bar contains the text "ship hull fouling" and the search button is visible. Below the search bar, there are navigation options: "All", "Images", "News", "Shopping", "Videos", "More", "Settings", and "Tools". The search results show "About 1,640,000 results (0.48 seconds)". The first result is from "mfame.guru" with the title "All you need to Know About Hull Fouling - Intertanko's Guide ..." and a date of "Feb 22, 2016". The snippet describes "Fouling" as the settlement and growth of marine plants and animals on submerged structures of a ship. Below the first result is a "People also ask" section with four questions: "What is hull fouling?", "What is fouling on ships?", "What does biofouling mean?", and "How can biofouling be prevented?". The second result is from "safety4sea.com" with the title "Understanding marine biofouling: How anti-fouling systems ..." and a date of "Dec 13, 2018". The snippet explains that anti-fouling paints are applied on the hull of a ship to reduce the accumulation of invasive aquatic species. The third result is from "www.researchgate.net" with the title "The Ship Hull Fouling Penalty - ResearchGate" and a date of "Oct 6, 2020". The snippet discusses the roughness of a ship's hull arising from various causes like corrosion and biofouling.

https://www.google.com/search?client=firefox-b-d&sxsrf=ALeKk029SxPKcQ4qhw1VezHabKl 80%

Google

ship hull fouling

All Images News Shopping Videos More Settings Tools

About 1,640,000 results (0.48 seconds)

mfame.guru > need-know-hull-fouling-intertankos-guide

All you need to Know About Hull Fouling - Intertanko's Guide ...

Feb 22, 2016 — **Fouling** is the term generally used to describe the settlement and growth of marine plants and animals on submerged structures of a **ship** or any ...

People also ask

- What is hull fouling?
- What is fouling on ships?
- What does biofouling mean?
- How can biofouling be prevented?

Feedback

safety4sea.com > cm-understanding-marine-biofouling-...

Understanding marine biofouling: How anti-fouling systems ...

Dec 13, 2018 — Namely, anti-**fouling** paints are applied on the **hull** of a **ship**, reducing the accumulation of invasive aquatic species, maintaining a smooth **hull**.

www.researchgate.net > publication > 9007423_The_Ship...

The Ship Hull Fouling Penalty - ResearchGate

Oct 6, 2020 — ... The roughness of a **ship's hull** arises from a variety of causes, such as corrosion, failure of marine coatings, and the colonisation of biofouling [1 ...

Searching for Articles

The screenshot shows a Google Scholar search for 'ship hull fouling'. The search bar at the top contains the text 'ship hull fouling' and a magnifying glass icon. Below the search bar, the results are listed under the heading 'Articles'. On the left side, there are filters for 'Any time' (with sub-options: Since 2020, Since 2019, Since 2016, Custom range...), 'Sort by relevance' (with sub-option: Sort by date), and checkboxes for 'include patents', 'include citations', and 'Create alert'. The main results area displays five articles, each with a green checkmark icon, a title, author information, a brief abstract, and citation statistics. To the right of each article, there are links to PDFs or HTML versions. The articles are: 1. 'The ship hull fouling penalty' by RL Townsin (2003), cited by 443. 2. 'The importance of ship hull fouling as a vector of species introductions into the North Sea' by S Gollasch (2002), cited by 403. 3. 'Economic impact of biofouling on a naval surface ship' by MP Schultz et al. (2011), cited by 962. 4. 'Ship hull fouling in the Port of Recife, Pernambuco' by CMR Farrapeira et al. (2007), cited by 94. 5. 'Hull fouling on commercial ships as a vector of macroalgal introduction' by F Mineur et al. (2007), cited by 101. The fifth article is partially cut off at the bottom of the page.

Google Scholar

ship hull fouling

Articles

About 26,400 results (0.08 sec)

Any time

Since 2020

Since 2019

Since 2016

Custom range...

Sort by relevance

Sort by date

include patents

include citations

Create alert

The ship hull fouling penalty

RL Townsin - Biofouling, 2003 - Taylor & Francis

The **ship** resistance penalties of slime, shell and weed are discussed in turn. Methods to measure the hard paint roughness of antifouling coatings are recapitulated. The determination of a satisfactory roughness parameter from correlations with measured ...

☆ 99 Cited by 443 Related articles All 5 versions Web of Science: 278

The importance of ship hull fouling as a vector of species introductions into the North Sea

S Gollasch - 2002 - Taylor & Francis

Ships have long been recognized as a major vector for the introduction of non-native and harmful organisms. From 1992 to 1996 a **shipping** study was undertaken in Germany, focusing on the fauna transported by **ships**, to assess the importance of species ...

☆ 99 Cited by 403 Related articles All 7 versions Web of Science: 194

[PDF] vliz.be

Economic impact of biofouling on a naval surface ship

MP Schultz, JA Bendick, ER Holm, WM Hertel - Biofouling, 2011 - Taylor & Francis

... The economics of **hull** roughness have also been the focus of previous research. For example, Townsin et al. (1981) conducted an economic analysis of **ship** bottom maintenance based on an extensive study of 47 in-service **ships** ...

☆ 99 Cited by 962 Related articles All 6 versions Web of Science: 601

[PDF] psu.edu

Ship hull fouling in the Port of Recife, Pernambuco

CMR Farrapeira, AVOM Melo, DF Barbosa... - Brazilian Journal of ..., 2007 - SciELO Brasil

Ports of big coastal cities are exposed to exotic species as a consequence of **shipping** traffic. As the Port of Recife receives an annual average of 491 **ships** from other regions of Brazil and from all over the world, this work was aimed at knowing which marine animals were ...

☆ 99 Cited by 94 Related articles All 8 versions Web of Science: 45

[PDF] scielo.br

[HTML] **Hull fouling on commercial ships as a vector of macroalgal introduction**

F Mineur, MP Johnson, CA Maggs, H Stegenga - Marine biology, 2007 - Springer

Hull fouling is thought to have been the vector of introduction for many algal species. We studied **ships** arriving at a Mediterranean harbour to clarify the present role of commercial cargo **shipping** in algal introductions. A total of 31 macroalgal taxa were identified from 22 ...

☆ 99 Cited by 101 Related articles All 12 versions Web of Science: 60

[HTML] springer.com

Full View

[PDF] **Hull fouling is a risk factor for intercontinental species exchange in aquatic**

[PDF] aquaticinvasions.net

Searching for Articles

The screenshot shows a web browser window with the URL [https://www.sciencedirect.com/search?q=ship hull fouling](https://www.sciencedirect.com/search?q=ship+hull+fouling). The ScienceDirect logo is in the top left, and 'Journals & Books' is in the top right. A search bar contains the text 'ship hull fouling' with a magnifying glass icon to its right. Below the search bar, it says 'Find articles with these terms' and 'Advanced search' is expanded. The main content area shows '2,768 results' and a 'Set search alert' button. On the left, there are 'Refine by' filters for 'Subscribed journals', 'Years' (2021: 22, 2020: 162, 2019: 182), 'Article type' (Review articles: 169, Research articles: 1,400, Encyclopedia: 77, Book chapters: 528), and 'Publication title' (Marine Pollution Bulletin: 2011). The main list of results includes: 1) A research article titled 'Penalty of hull and propeller fouling on ship self-propulsion performance' from Applied Ocean Research, January 2020, with authors Soonseok Song, Yigit Kemal Demirel, and Mehmet Atlar. 2) A data article titled 'Data on photo-nanofiller models for self-cleaning foul release coating of ship hulls' from Data in Brief, September 2016, with authors Mohamed S. Selim, Sherif A. El-Safy, and Nesreen A. Fatthallah. 3) A research article titled 'Fouling effect on the resistance of different ship types' from Ocean Engineering, 15 November 2020. Each result has a checkbox, a 'Download PDF' icon, and an 'Export' button. A 'Sign in' button is also visible.

Searching for Articles

The screenshot shows a Scopus search results page. The browser address bar displays the URL: <https://www.scopus.com/results/results.uri?numberOfFields=0&src=s&clickedLink=&edit=t>. The page title is "570 document results" for the search query "TITLE-ABS-KEY(ship AND hull AND fouling)". The search is performed by Universiti Teknologi Malaysia. The page includes a search bar, navigation tabs for "Documents", "Secondary documents", and "Patents", and a "View Mendeley Data (2428)" link. The search results are sorted by "Date (newest)". The results table lists three documents:

	Document title	Authors	Year	Source	Cited by
<input type="checkbox"/>	1 Nanobiocides against marine biofouling	Ferreira-Vançato, Y.C.S., Dantas, F.M.L., Fleury, B.G.	2021	Studies in Natural Products Chemistry 67, pp. 463-514	0
	View abstract View at Publisher Related documents				
<input type="checkbox"/>	2 Assessment of the impact of fouling on vessel energy efficiency by analyzing ship automation data	Erol, E., Cansoy, C.E., Aybar, O.Ö.	2020	Applied Ocean Research 105,102418	0
	View abstract View at Publisher Related documents				
<input type="checkbox"/>	3 Four KPIs for the assessment of biofouling effect on ship performance	Carchen, A., Atlar, M.	2020	Ocean Engineering 217,107971	0

The left sidebar contains filters for "Access type" (Open Access: 76, Other: 494) and "Year" (2021: 1, 2020: 40, 2019: 40, 2018: 31, 2017: 33).

WRITING LITERATURE REVIEWS

1. Literature reviews should occur twice in the thesis; in the background & problem formulation section of Chapter 1 and the whole of Chapter 2.
2. Literature Review is NOT an expanded bibliography or a disjointed summary of paper/articles. It should not consist of only of extracts from abstracts of the papers.
3. Literature Review is a critically interwoven write-up, identifying different approaches, similarities and contradictions between contributions, analysis of strengths and weaknesses.

WRITING LITERATURE REVIEWS

4. In the background & problem formulation section of Chapter 1, literature reviews should be mainly focused on giving the background of the problem and identification of knowledge gaps, and hence Problem Statement. Previous works must be cited.
5. In Chapter 2 Literature Review should critically discuss previous works, their methodologies and results. Some form of taxonomy or structure must be created for the review. Contributions from each literature can be cited and critically analysed within the taxonomy.

Citing And Writing References

Two methods of citing references:

1. Author year, e.g. David (2016), Ahmad and Omar (2013) and Hwa et al. (2010).
 - Only use one Surname e.g. Omar bin Yaakob (2011).
 - List of references arranged according to alphabetical order of surnames, e.g.:

Ariel V R, Owen J, Allison S, Tryfonas T, Winter A, Entwistle R,(2011), Design and preliminary testing of a novel concept low depth hydropower device. (*Hawaii, USA*). *Oceans'* ;11:19–22.

Bachant P, Wosnik M, (2015) Performance measurements of cylindrical- and spherical- helical cross-flow marine hydrokinetic turbines, with estimates of energy

Efficiency, *Renewable Energy* 74, 318-325.

Turan A.S., Batten W.M.J., McCann G.,(2007) Experimental verifications of numerical predictions for the hydrodynamic performance of horizontal axis marine current turbines, *Renewable Energy* 32; 2479–2490.

Valje, O. E. (1981), Turbomachines. *John Wiley & Sons Inc.*, New York.

Citing And Writing References

Two methods of citing references:

2. Numbers in brackets , e.g. [1] , ...[56].

- Only use one Surname
- List of references arranged according to order of appearance , e.g.:

1. Valje, O. E. (1981), Turbomachines. John Wiley & Sons Inc., New York.
2. Turan A.S., Batten W.M.J., McCann G.,(2007) Experimental verifications of numerical predictions for the hydrodynamic performance of horizontal axis marine current turbines, *Renewable Energy* 32; 2479–2490.
3. Ariel V R, Owen J, Allison S, Tryfonas T, Winter A, Entwistle R,(2011), Design and preliminary testing of a novel concept low depth hydropower device. (Hawaii,USA).*Oceans'* ;11:19–22.
4. Bachant P, Wosnik M, (2015) Performance measurements of cylindrical- and spherical- helical cross-flow marine hydrokinetic turbines, with estimate of energy Efficiency, *Renewable Energy* 74, 318-325.

GOOD and POOR LR?

A 'good' literature review.....

..... is a synthesis of available research

..... is a critical evaluation

..... has appropriate breadth and depth

..... has clarity and conciseness

..... uses rigorous and consistent methods

A 'poor' literature review is.....

.....an annotated bibliography

..... confined to description

..... narrow and shallow

..... confusing and longwinded

..... constructed in an arbitrary way

Wind Turbine Design in Malaysia

	Ali(2017)	Davis (2020)	Wong (2015)	Musa (2016)	Lee (2010)
Location of study	Melaka	Sabah (Kudat)	Sabah (Kudat)	Pulau Perhentian	Mersing
Wind speed (m/s)	4 -5	5-7	5-8	4-6	3-5
Turbine type	Horizontal Axis 3 bladed	Horizontal Axis 3 bladed	Horizontal Axis 3 bladed	Vertical Axis (Gorlov)	Vertical Axis (Darieus)
Study Method	Field trial full scale	Laboratory test 1:5 scale	CFD only	CFD and Laboratory test 1:5 scale	Field test half scale
Comments	Results not promising	Good results, 15 kWhr	Results not validated	In the process of building full scale	Turbine broke during final testing

❖ EXAMPLE OF POOR LITERATURE REVIEW

R S Trask et al. (2009) demonstrated the self-healing technologies currently being developed for polymeric composite fiber-reinforced substances and most of which are inspired by nature control. The most recent self-healing work has attempted to imitate natural healing by examining natural processes in greater detail.

Y. Yuan1(2008) objective was to extend the lifetime of composite materials by healing which frequently get shorten thanks to microcracking. Studied fundamental self-healing ones that are ready to heal cracks by the polymers themselves, and extrinsic during which healing agent has got to be pre-embedded and summarized early sensing, diagnosis and repair of microcracks become necessary for clearance the underlying risks in condition of micro-cracking of drugs.

Swapan Kumar (2008) found that a lot of common terms like self-repairing and autonomic-healing are wont to define a property in materials. Thus, they concluded that self-healing is often representing by two processes autonomic (without any intervention); no autonomic (needs human intervention/external triggering).

R S Trask et al. (2009) showed the self-healing technologies currently being developed for fiber reinforced polymeric composite materials and most of which are inspired by observation of nature. The most recent self-healing work has attempted to mimic natural healing using more detailed study of natural processes.

❖ **First Stage:** general statements about the field of research to provide the reader with a setting for the problem to be studied

General descriptions of the relevant literature

Research into X has a long history.

The literature has emphasized the importance of ...

Different theories exist in the literature regarding ...

More recent attention has focused on the provision of ...

There are relatively few historical studies in the area of ...

A great deal of previous research into X has focused on ...

A large and growing body of literature has investigated ...

Much of the current literature on X pays particular attention to ...

For many years, this phenomenon was surprisingly neglected by ...

There is a large volume of published studies describing the role of ...

Over the past decade, most research in X has emphasized the use of ...

In recent years, there has been an increasing amount of literature on ...

The generalisability of much published research on this issue is problematic.

During the past 30 years, much more information has become available on ...

A considerable amount of literature has been published on X. These studies ...

The first serious discussions and analyses of X emerged during the 1970s with ...

Historically, research investigating the factors associated with X has focused on ...

What we know about X is largely based upon empirical studies that investigate how ...

- ◇ **Second Stage:** More specific statements about the aspects of the problem already studies by other researchers.

review

Jones *et al.* (2001)

1. Author as a subject

compared the rate of ...
labelled these subsets as ...
measured both components of the ...
used a survey to assess the various ...
identified parents of disabled children as ...
set up a series of virtual experiments using ...
examined the flow of international students ...
carried out a number of investigations into the ...
studied the effects of X on unprotected nerve cells.
analysed the data from 72 countries and concluded that ...
interviewed 250 undergraduate students using semi-structured ...
performed a similar series of experiments in the 1960s to show that ...
reviewed the literature from the period and found little evidence for this ...
conducted a series of trials in which he mixed X with different quantities of ...
investigated the differential impact of formal and non-formal education on ...

◇ **Second Stage:** More specific statements about the aspects of the problem already studies by other researchers.

In 1959, a seminal article was published entitled ...

In 1889, Brown performed a bilateral ablation of the ...

In 1859, the publication of X had a major impact on ...

In 1965, Jones published his major historic survey of ...

In 1975, Smith *et al.* published a paper in which they described ...

In 1984, Jones *et al.* made several amino acid esters of X and evaluated them as ...

In 1981, Smith and co-workers demonstrated that X induced in vitro resistance to ...

In 1990, Patel *et al.* demonstrated that replacement of H₂O with heavy water led to ...

In 1990, Al-Masry *et al.* reported a new and convenient synthetic procedure to obtain ...

Thirty years later, Smith (1974) reported three cases of X which ...

In the 1950s, Gunnar Myrdal pointed to some of the ways in which ...

Following World War 1, Fleming actively searched for anti-bacterial agents.

Almost 20 years ago, Jones (1985) formulated his X theory, centred around ...

2. Time frame
reference

◇ **Second Stage:** More specific statements about the aspects of the problem already studies by other researchers.

A seminal study in this area is the work of ...

One study by Smith (2014) examined the trend in ...

A recent study by Smith and Jones (2012) involved ...

A recent systematic literature review concluded that ...

A longitudinal study of X by Smith (2012) reports that ...

Preliminary work on X was undertaken by Abdul Karim (1992).

A key study comparing X and Y is that of Smith (2010), in which ...

The first systematic study of X was reported by Patel *et al.* in 1986.

Detailed examination of X by Smith and Patel (1961) showed that ...

Analysis of the genes involved in X was first carried out by Smith *et al.* (1983).

A significant analysis and discussion on the subject was presented by Smith (1988).

The study of the structural behaviour of X was first carried out by Rao *et al.* (1986).

A small scale study by Smith (2012) reached different conclusions, finding no increase in ...

The study by Jones (1990) offers probably the most comprehensive empirical analysis of ...

3. Research topics
as subject

◇ **Second Stage:** More specific statements about the aspects of the problem already studies by other researchers.

In an analysis of X, Smith *et al.* (2012) found ...

In a follow-up study, Smith *et al.* (2009) found that ...

In an investigation into X, Smith *et al.* (2012) found ...

In a comprehensive study of X, Jones (2001) found that ...

In a study conducted by Smith (1978), it was shown that ...

In studies of rats given X, Smith and colleagues found that ...

In another major study, Zhao (1974) found that just over half of the ...

In a study which set out to determine X, Smith (2012) found that ...

In a randomised controlled study of X, Smith (2012) reported that ...

In a large longitudinal study, Smith *et al.* (2012) investigated the incidence of X in Y.

In one well-known recent experiment, limits on X were found to be (Al-Masry, 2013)

4. Research objectives as subject

- ◇ **Second Stage:** More specific statements about the aspects of the problem already studied by other researchers.

Relate one study to the next study using verbs/words as follows:

Agreements

Similarly, author B points to...

Likewise, author C makes the case that...

Author D *also* makes this point...

Again, it is possible to see how author E agrees with author D...

Disagreements

However, author B points to...

On the other hand, author C makes the case that...

Conversely, Author D argues...

Nevertheless, what author E suggests

Expressions that can be used to show 'weaving' between various literature.

...On the other hand...	...disagreed...
...similarly...	...in contrast...
...rejected...	... alternatively..
...confirmed...	...agreed...
...in line...	...elaborated...
...expanded...	...improve...
...narrowed...	...concurred...
...explored...	...proposed...

Literature Review: Example #1

.....Some studies also support the conclusion that traditional teaching methods hinder learning calculus. Selden et al. (2004) conclude that isolated, trivial problems, the norm in many classrooms, inhibit students from acquiring the ability to generalize calculus problem-solving skills. Similar results are reported by Norman and Prichard (2007). They demonstrate that many learners can not interpret the structure of a problem beyond surface-level symbols. They show that novices have inaccurate intuitions about problems which lead them to attempt incorrect solution strategies. Because they cannot see beyond high-level features, they can not develop correct intuitions. On the other hand, successful problem solvers categorize math problems based upon underlying structural similarities and fundamental principles (Silver ,2012), (Shoenfeld and Herrman 2012). According to (Owen and Sweller (1989) these categories are often grouped based upon solution modes, which the experts use to generate a forward working strategy....

Literature Review: Example #2

.... An initial experimental study described by Everly et al. (2013) concluded that overlap ratio is one important factor to determine the performance of the turbine. This concurred with an earlier study by Menet (2012) who reported that previous experiments of Savonius-type wind turbine by a number of researchers have shown significant relationships between maximum power coefficient of turbine and the overlap ratio (Hunt&Chong, 2006; Vivarelli et al. , 2009, Tang et al., 2011). These relationships were explored by Gupta et al. (2013) who reported a series of experiments which show that the maximum power coefficients were obtained at overlap ratio of between 0.20 and 0.25. The studies described above were all related to wind-turbines applications. Seyyed (2012) pioneered the introduction of Savonius turbine for ocean current energy extraction. CFD numerical studies were carried out and reported in by Reza (2013) and Han & Leong (2014). Both works have shown that the optimum performance was obtained for a two stack, four-bladed savonius rotor. The optimum overlap ratio obtained by Reza (2013) was 0.21, well within the range described by Gupta

Literature Review: Example #3

.....In recent years a number different authors have addressed the issue of the definition of wake wash criteria, and have come up with a number of different proposals. Ref.[16] suggested that wake wash criteria should be representative of wake wash problems, easy to understand, easy to measure, and independent of the exact distance of the measurement point from the vessel sailing line. Their work was extended by [17] who proposed three wake wash criteria. The criteria are the maximum wave height as suggested by a wide variety of authors, the energy-based approach suggested by [18] and [19], and the decay-based method proposed by [20]. The authors of [21] disagreed with the use of energy-based approach. According to them, energy-based approach failed to take into account body interactions. Their conclusions were confirmed by recent experimental work carried by [22]...

Literature Review: Example #4

9. LITERATURE REVIEW

An initial experimental study described by Jawade et al. (2020) concluded that Specimens manufactured with horizontal orientation, show better results as compared to vertical orientation specimens. In horizontal orientation, layers are manufactured along the direction of loading during tensile testing. They have better interlayer bonding which results in better tensile strength. This concurred with an early study by Aversa et al. (2019) who reported the reduction of the solidification cracking mechanism of commercial high strength aluminium alloys (e.g., 7075, 2024, and 6061). Which was as a result of the introduction of Si which increases the fluidity of the molten phase. Zr was mainly employed to obtain fine coherent Al_3Zr particles which act as nucleant during the solidification process, this method demonstrated to be promising for the processability of 7075, 2024, and 6061 alloys. The introduction of Sc and Zr to Al-Mg alloy has very high mechanical properties due to the precipitation of coherent $Al_3(Sc, Zr)$ particles. On the other hand, Chen et al. (2018) comparative study shows that the pore population, size, and porosity within powders gradually increase with the increase of particle size due to different gas pressures inside of powders. Similarly, Mostafaei et al. (2018) carried out a comparative study and found that water atomized powder particles have irregular morphology in contrast to spherical Gas atomized particles. Koutny et al. (2018) proposed the processing of AL alloy using SLM and confirmed that high Sc content leads to high Yield Strength and loss in ductility.

OUTLINE

1. GENERAL ADVICE ON THE CONDUCT OF FINAL YEAR PROJECT
2. RESEARCH PROBLEM FORMULATION
3. LITERATURE REVIEW

www.menti.com

- Go to www.menti.com and use the code **75 76 87 5**
- **How do you rate this lecture?**



omaryaakob@utm.my

012-7086482

<https://www.facebook.com/Droypostgraduateguide/>