Chapter 10 A Critical Analysis of Research Paradigms in a Subset of Marine and Maritime Scholarly Thought

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1. Introduction

The application and applicability of the humanities and social sciences are not always visible in the practical world. This is especially the case in technology-dependent areas like the marine and maritime sectors. In these sectors, control, prediction and recommendations that rely on technologies and their advancement are of the utmost importance. These sectors are, after all, those on which we rely for international trade, defence and security, sources of food and other energy requirements, like oil and gas. At first glance, it would appear that the sectors are devoid of the humanities and social sciences and that these have a minimal, if not marginal role to play. The humanities and social sciences consist of a number of subject fields like anthropology, economics, history, international relations, law, philosophy and sociology. These fields of enquiry are at times service providers to sectors when their services are needed. This relegates the fields to the cupboard of scientific investigation when long-term strategies are developed, which should not be the case. The humanities and social sciences should play a constant role in a human-dominated world. The maritime sector is, after all, human constructed. Trade routes, ports, harbours, warehouses, cranes, rail links and truck routes are not natural occurrences; neither are the technologies that constitute and sustain them. Because of the dominance of the human element, even in the marine environment, the humanities and social sciences can play a more fruitful role in creating opportunities and solving problems. What is more, it is not only the humanities and social sciences that are of importance, but also how humans view the world and react to it either through theoretical or concrete means. Here, paradigms and theories of various kinds from the humanities and social sciences also have their place.

This chapter explores these dimensions in more detail. It starts by presenting a framework, called PULSE^3, for analysing the role of the humanities and social sciences in the two sectors. The paradigms of the presentations delivered at the Integrated Marine and Maritime Technologies Workshop in October 2013 are assessed. This chapter reviews the abstracts of the presentations made at the workshop. The review of the abstracts is not representative of the state of research and development in the entire sector. It is only a snapshot of it. However, it provides useful insights into current thinking and practice in the marine and maritime sectors. The purpose of this assessment is to determine the type of paradigm that was dominant. Two paradigms, rationalism and interpretivism, are identified through the assessment. Rationalism views the researcher and reality as separate, with only one reality present. Research is able to control and predict this reality. This means that an objective reality exists beyond the human mind. Interpretivism, however, notes that the researcher and reality are inseparable in that realities are mentally constructed. Multiple realities exist and, as such, knowledge of the world is intentionally constituted through researchers' lived experiences. There is no objective meaning (Wendt, 1999; Weber, 2004; Guba and Lincoln, 2005; Lincoln et al., 2011). An overview of the ethos of analytic eclecticism is provided and how it can aid the marine and maritime sectors. After this, the role of the humanities and social sciences in the public and government policy domain is presented. This is followed by the setting of a number of beacons that the marine and maritime

sectors could follow to expand the role of the humanities and social sciences. The repertoire of theories plays a central role in this, the penultimate section of the chapter.

2. Framework for analysis

The PULSE^3 framework is used to analyse water governance and politics. This forms the foundation of the chapter. PULSE is an acronym for 'people understanding and living in a sustained environment'. The cube denotes three forces: thinking, shaping and causing change. Individuals think, shape and cause changes in the environments in which they live, be it the natural environment or the working environment (Meissner, 2013). The natural environment shapes and affects changes that impact on human society and the way we live in the environment (Berger and Luckmann, 1966; Giddens, 1984; Meissner, 2003; Kooiman and Bavinck, 2005; Gillings, 2010). Although the framework is geared towards an analysis of water governance and politics (Meissner, 2013), it is equally at home in a review of the marine and maritime technology research landscape. This is because of the framework's ability to analyse issues at a paradigmatic and theoretical level, and not at a macro level. The rationale behind PULSE^3 is that paradigms and/or theories have an impact on how humans act in the world and subsequently the policies, programmes and projects they put in place to resolve problems or create opportunities. A paradigm is a research tradition, which, in turn, is a set of assumptions about how knowledge is produced (Schultz and Hatch, 1996; Sil and Katzenstein, 2010). Stated more formally, a paradigm is a world view that describes – for the person holding that paradigm – the nature of the 'world', his or her place in this world, as well as the range of potential relationships to that world and its parts (Pearse, 1983; Guba and Lincoln, 1994). Considering this definition, it becomes clear that the 'world' of marine and maritime technology has a particular nature with a range of relationships that span individuals, corporates, scientists, government officials, operators and education specialists. If this is the case, it would hold that a certain paradigm is present in the marine and maritime technology landscape that influences how problems are confronted and opportunities created.

PULSE^3 consists of three components or elements. The first is a paradigm assessment index (see Table 1), the second is the ethos of analytic eclecticism, and the third is a repertoire of theories. The paradigm assessment index calculates the nature of the paradigm found in the marine and maritime technology landscape and makes it visible.

2.1 Paradigm assessment of the presentations

The difference between rationalism and interpretivism is the foundation of the paradigm assessment. This differentiation can assist with profiling the paradigm of the workshop and the state of research in the two sectors. The paradigm assessment index investigates how knowledge contained in each presentation was generated by the author. In other words, did the author follow a rationalist or interpretivist route to generate his or her knowledge?

Table 1: *Paradigm assessment index*

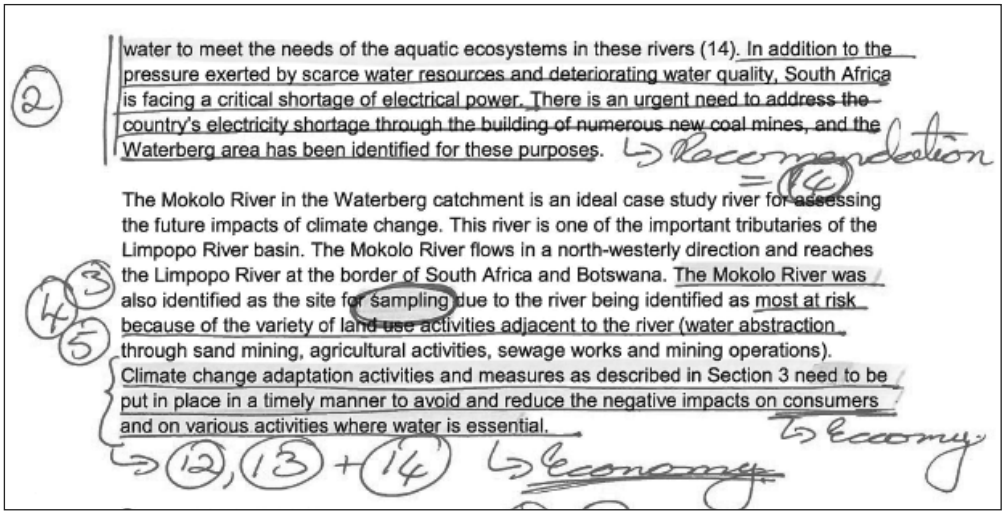
	Metatheoretical assumptions about	Rationalism	Score	Score	Interpretivism
KNOWLEDGE GENERATION	Ontology **(1)**	The researcher and reality are separate.			The researcher and reality are inseparable (life-world). **(15)**
	Epistemology **(2)**	Objective reality exists beyond the human mind.			Knowledge of the world is intentionally constituted through a person's lived experience. **(16)**
	Research object **(3)**	The research object has inherent qualities that exist independently of the researcher.			The research object is interpreted in light of meaning structured of the researcher's lived experience. **(17)**
	Method **(4)**	Statistics, content analysis, laboratory experiments, field experiments and surveys (empirical data gathered and analysed through statistical analyses).			Hermeneutics, phenomenographic studies, case studies, ethnographic studies and ethnomethodological studies. **(18)**
	Theory of truth **(5)**	Correspondence theory of truth: one-to-one mapping between research statements and reality.			Truth as intentional fulfilment: interpretations of the research object match the lived experience of the object. **(19)**
	Validity **(6)**	Certainty: data truly measures reality.			Defensible knowledge claims. **(20)**
	Reliability **(7)**	Replicability: research results can be reproduced.			Interpretive awareness: researchers recognise and address implications of their subjectivity. **(21)**
	Total				

	Theoretical assumptions about	Rationalism	Score	Score	Interpretivism
AGENCY	Organising question **(8)**	Who governs and who benefits?			Who acts and what are the consequences of their actions (how are their actions enabling change)? **(22)**
	Unit of analysis **(9)**	Hegemons/great powers, international regimes, ideational entrepreneurs, capitalist world economy, structures of rule.			Everyday actors interacting with elites and structures. **(23)**
	Prime empirical focus **(10)**	The supply of order and welfare maximisation by elites, as well as the maintenance of the powerful and the unequal distribution of benefits.			The social transformative and regulatory processes enacted, or informed, by everyday actions of individuals. **(24)**
	Locus of agency **(11)**	Top-down.			Bottom-up. **(25)**
	Level of analysis **(12)**	Systemic.			Complex/holistic. **(26)**
	Ontology **(13)**	Structuralist.			Agential or structurationist. **(27)**
	Recommendations based on specific theoretical assumptions **(14)**	Rationalist, positivist or interpretivist.			Interpretivist, post-positivist and rationalist. **(28)**
	Total				
	Grand total				

(Weber, 2004; Hobson and Seabrooke, 2007)

The index also indicates to what extent 'agency' is regarded by the author. Agency is defined as any action discussed in a programme, project or policy that involves some form of human action to set in motion general or specific ideas, operations or recommendations. The separation along knowledge generation and agency lines will determine the extent of the landscape's rationalism or interpretivism. There is a simple sorting system to determine the extent of the paradigm backing the policy, programme or project. The paradigm underpinning the action is scored against the presence or absence of rationalist or interpretivist metatheoretical and theoretical elements. A value of 0 = absent, while 1 = present. In a case where both elements are present, a score of 1 is awarded to both the rationalist and

interpretivist assumptions. It is possible for both rationalism and interpretivism to exist in one research endeavour. Alexander Wendt (1999), considered to be an interpretivist, says that he is ontologically an interpretivist, while he is epistemologically a rationalist. It is not entirely impossible to come across rationalist elements in his interpretivist work. A combination of the two paradigms in one assumption is also possible, although both will then receive equal weight. The bold number in brackets is there to aid in the analysis of policies, programmes or projects. For instance, should the assumption (whether rationalist or interpretivist) be present in the text, the analyser will mark it with the appropriate bold number to indicate its presence (see Figure 1 for an example of a piece of text marked in this manner) (Meissner, 2013).


water to meet the needs of the aquatic ecosystems in these rivers (14). In addition to the pressure exerted by scarce water resources and deteriorating water quality, South Africa is facing a critical shortage of electrical power. There is an urgent need to address the country's electricity shortage through the building of numerous new coal mines, and the Waterberg area has been identified for these purposes.

The Mokolo River in the Waterberg catchment is an ideal case study river for assessing the future impacts of climate change. This river is one of the important tributaries of the Limpopo River basin. The Mokolo River flows in a north-westerly direction and reaches the Limpopo River at the border of South Africa and Botswana. The Mokolo River was also identified as the site for sampling due to the river being identified as most at risk because of the variety of land use activities adjacent to the river (water abstraction through sand mining, agricultural activities, sewage works and mining operations). Climate change adaptation activities and measures as described in Section 3 need to be put in place in a timely manner to avoid and reduce the negative impacts on consumers and on various activities where water is essential.

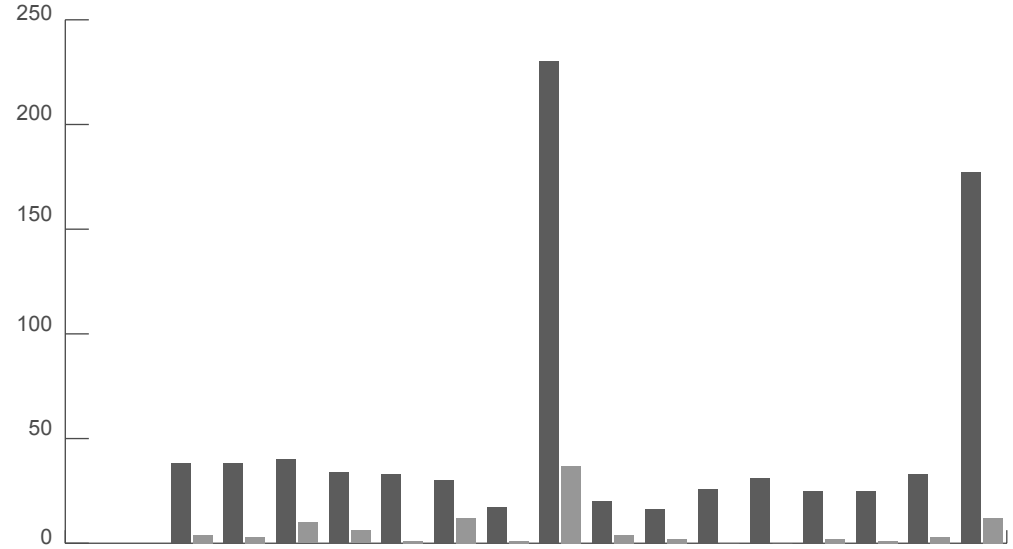
Figure 1: *An example of the 'marking' of a text using the numbering system in the paradigm assessment index. The numbers in the circles correspond with those in the paradigm assessment index to indicate the presence of the assumption.*

The methodology used for this chapter was to start with the paradigm assessment of all the abstracts of the presentations delivered at the Integrated Marine and Maritime Technologies Workshop, hosted by the Department of Science and Technology (DST) and the South African Maritime Safety Authority (SAMSA), which was held on 30 October 2013. Each abstract was assessed according to the metatheoretical assumptions present or absent in the text of the abstract. For example, if an author used a rationalist ontology (the study of the general properties of things) (Viotti and Kauppi, 1999) instead of an interpretivist ontology, a score of 1 (present) is accorded to the rationalist ontological assumption and 0 (absent) for the interpretivist ontological assumption. Going through the list of metatheoretical assumptions, and scoring each abstract in that way reveals a paradigm profile for each abstract. This profile indicates to what extent each profile is rationalist or interpretivist. Adding the total rationalist and interpretivist scores for all 43 abstracts reveals an overall paradigm profile for the entire workshop.

The individual and overall assessments can aid in conducting a literature review of the abstracts and the workshop. Such a review reveals the topics and themes under discussion, suggested recommendations, the challenges and constraints facing the marine and maritime technologies landscape and the role-players involved. The paradigm assessment also exposes how people converse over the issue and specifically which world view or paradigm is dominant.

3. The marine and maritime research landscape

Having done the paradigm assessment of all 43 abstracts of the workshop's presentations, an overall paradigm assessment was produced (see Figure 2). The dominant paradigm is rationalist.



	Knowledge generation								Agency							
Rationalism	38	38	40	34	33	30	17	230	20	26	31	16	25	26	33	177
Interpretivism	4	3	10	6	1	12	1	37	4	0	0	2	2	1	3	12

Figure 2: *Overall paradigm assessment of all presentation abstracts delivered at the SAMSA workshop, 30 October 2013.*

This is not surprising, especially considering the topics and themes under discussion, as well as the 'type' of scientist or practitioner making the presentation and the challenges addressed. The purpose of the workshop was to bring together and strengthen relationships between various representatives for various parts of the maritime sector. The workshop also aimed to provide a platform for the participants to share relevant information about the current state of knowledge and technologies in the sector with colleagues. The workshop supported the National Maritime Research and Innovation Agenda. The aim of this Agenda is to enhance and integrate maritime policy, contribute to establishing networks and cross-relations, accelerate knowledge diffusion and innovation, build a long-term sustainable future, identify knowledge to be acquired for the future, and contribute to changing the image of the maritime sector (Nlumayo, 2011).

The main themes under consideration were shipping and transport, marine resources and marine tourism. Under each of the main themes, a number of workshop themes were outlined. Shipping transport was divided into maritime logistics infrastructure, shipping transport and ports, marine services, and coastal. Marine resources was divided into oceanography and environmental, fisheries, pharmaceutical and aquaculture, and offshore energy and mining. Marine tourism was divided into boating and cruising, sports and recreation, and leisure. These subthemes fell under a number of workshop topic areas (see Table 2).

Table 2: *Workshop themes and workshop topic areas*

Workshop themes	Workshop topic areas
Maritime logistics infrastructure	Ports, pipelines, roads, rail, maritime logistics hub
Shipping transport	Shore-based management, long-haul and short-haul shipping, vessel operations, shipping-generated pollution, cargo
Ports, marine services and coastal	Shoreside operations, aids to navigation, offshore operations, ship-to-shore transfer, diving, infrastructure development and maintenance, port and coastal administration
Oceanography and environmental	Marine ecosystems, global change, estuaries, inland waters, coastal development, dredging, protected areas, maritime archaeology
Fisheries, pharmaceutical and aquaculture	Ocean, tidal and inland water resource management, pharmaceuticals, catching and processing, aquaculture
Offshore energy and mining	Minerals mining, oil and gas exploration and production, renewable energy (wind, tides and nuclear)
Boating and cruising	Hospitality and entertainment, cruising and ferrying, yachting, inland
Sports and recreation	Sailing, swimming, diving, marine activities
Leisure	Adventure and views, real estate, ecomarine tourism

The main topics are predominantly those at home in the natural sciences, except for management, administration, hospitality and entertainment, and tourism. The latter are all social science topics. Even so, it would appear that the marine and maritime technologies landscape is predominantly situated in the natural sciences, with the natural sciences representing and informing the functioning of the marine and maritime environments. Because of the highly technical nature of the landscape, it is natural to have a predominantly rationalist paradigm as the discourse in the marine and maritime industry. The industries look towards the natural sciences to explain, predict and recommend solutions to the problems they face.

Safety in the maritime sector was put forward as one of the most important aspects. Topics under discussion included the surveillance of maritime vessels and the marine environment using satellite technology (Sibiya, 2013; Skoryk, 2013; Van Zyl, 2013), unmanned aircraft (Moore, 2013) and radar technology (Kleynhans, 2013). Management and administration are therefore also viewed in terms of natural-scientific problem-solving technologies. In 40 of the 43 topics, the research object, be it marine, maritime, satellite, navigational, data management or boat-building, was viewed through a rationalist ontological and epistemological lens. This means that the topic under discussion is seen by the researcher or presenter as a reality that is separate from himself or herself and that there is an objective reality to the research object. This means that the research object has inherent qualities that exist independently of the researcher. Because of this, it is possible to control the research object to a certain extent. For example, in a benchmarking study of the shipping, and oil and gas construction industry, Gowans (2013)

notes that: "The future requirements of the shipping, and oil and gas industries are specialised ships for Africa, including coastal cargo an[d] gas vessels, and production modules for offshore gas fields." The governance and management of shared resources like the Agulhas and Somali ecosystems are also informed by a rationalist perspective (Stapley, 2013).

There are exceptions to a predominantly rationalist treatment of the research object and its ontology and epistemology. Swanepoel (2013) treats climate change and its impact on search and rescue activities as an uncertainty. For her, the uncertain impact of climate instils scepticism among stakeholders to implement concrete plans and actions. The presentations by Davidson (2013a; 2013b) are good examples of the use of both rationalism and interpretivism. The topics she discusses in her presentations are training and education, subjects at home in the social sciences. Even so, with the technical nature of the boat-building industry, where artisans, architecture and engineering play important roles in the correct functioning of the industry, Davidson (2013a; 2013b) employs a predominantly rationalist perspective in her studies. These studies can be used as good examples of how the rationalist and interpretivist perspectives can work in synergy to explain the intricacies of training, education and innovation in the boat-building industries. She states that: "South Africa is not the only country chasing global opportunities in the boating sector. To remain truly competitive, we need to not only provide innovative market-leading products, but ensure that we continue to develop the skills and technology needed for the long term." Davidson is the chief executive officer of the Marine Industry Association South Africa (MIASA) and therefore has first-hand experience of the challenges facing the industry (MIASA, 2014). Her ontology and epistemology are informed by the boating industry that influences her lived experience. This results in her interpretation of the research object – the boat-building industry – in light of the meaning she structured of it in terms of her lived experience.

Other examples where interpretivism were also used include the presentations by Argawal (2013), Byrnes (2013), Dixon (2013), Ngcobo (2013), Maitland (2013), Vrancken (2013a) and Werz (2013). These presentations do not represent such a strong usage of interpretivism as exhibited in the presentations by Davidson (2013a; 2013b). What is interesting about these presentations, except for the presentation by Ngcobo (2013), is that they all deal with education, training or skills development to some extent.

It is also interesting to note that defensible knowledge claims, as an interpretivist assumption regarding the validity of data, scored the highest (see Figure 2). This is mainly due to aspects such as forecasts (Byrnes, 2013), opportunities (Ngcobo, 2013), climate change uncertainty (Swanepoel, 2013), scenarios (Gowans, 2013) and where the service of one agency has not been fully realised in assisting the marine and maritime industries. An example of the latter is the South African National Space Agency (SANSA) as a potential partner in supporting maritime safety (Avenant, 2013). This means that only where uncertainty is linked to the rationalist project, interpretivism has a tendency to creep in. It does not mean that interpretivism is deliberately used in the utilisation or construction of the data. This is done by default. Under knowledge generation, rationalism had by far the highest score compared to interpretivism (see Figure 2). This is mainly due to the technical nature of the subject matter and the technical background of the presenters. Many were either engineers or artisans or had been involved in the maritime industry either as shiphands or in control of ocean-going vessels. What is more, the majority of researchers from the Council for Scientific and Industrial Research (CSIR) who presented their work are employed in the organisation's Defence, Peace, Stability and Security Unit. They had been trained in science, technology, engineering or mathematics disciplines.

The agency profile of the abstracts paints a different picture. The total score for the rationalist paradigm was 177 and for the interpretivist paradigm it was 12 (see Figure 2). This is much lower than the knowledge-generation component, where rationalism scored 230 and interpretivism scored 37 (see Figure 2). The main reason for this could be the nature of the presentations. Many of the presentations were descriptive analyses of what the scientists or practitioners are researching or practising and how it can aid the marine and maritime sectors (for example, the presentations by Bornman (2013), Chen (2013), Kleynhans (2013), Le Roux (2013), Ngcobo (2013), Sibiya (2013), Skoryk (2013) and Van Zyl (2013)). A number of presentations also considered how research and practices can aid the sectors (for example, the presentations by Awad (2013), Barwell (2013), Bernard (2013), Chilalika (2013), Goschen (2013), Goslett (2013), Grobler (2013), Kramer (2013), Kroese (2013), Otto (2013), Vrancken (2013b) and Wainman (2013)). There were also presenters who are looking at agency from an interpretivist paradigm (for example, Davidson (2013a), Jacobs (2013), Maitland (2013), Stapley (2013) and Swanepoel (2013)). Even so, interpretivism did not score very high in their presentations, except in Maitland's presentation.

Maitland (2013) took a rationalist and interpretivist stance to formulate her organising question and to discuss the locus of agency, level of analysis, ontology and recommendations. Her presentation considers the possibility of making archaeology an attractive career opportunity for school-leavers. According to Bastow et al. (2014), archaeology is situated at the intersection between the humanities and the science, technology, engineering and mathematics disciplines. Archaeology's location in the arrangement of scientific disciplines is the potential reason why Maitland utilises a mixture of rationalism and interpretivism in her presentation. She notes that "archaeology is seen by the youth as an exciting career filled with discovery and adventure." She does not provide concrete proof of this, but as an archaeologist, she is aware of the 'excitement' that goes with making a new 'discovery' or starting a new 'adventure'. Since her research object is painted in such a subjective manner, her agency-organising questions go wide to include a host of stakeholders in archaeological research. She speaks of the involvement of communities as part of South Africa's multicultural heritage. This defines her locus of agency as interpretivist. She also talks of multiple and forgotten histories. Her agenda is not top-down, but rather bottom-up; by involving schoolchildren in archaeology at an early age, the discipline could become a "gateway to the maritime sector" (Maitland, 2013). By talking about 'public archaeology', it would appear that she is taking a complex/holistic view in her level of analysis. Because of this, her ontology around agency is agential and structurationist. For her, archaeology could facilitate the involvement of individuals in the maritime sector. Since archaeology is multidisciplinary for Maitland (2013), she is convinced (in a very rationalist way) that attracting the youth to archaeology will open a myriad of career opportunities for them. This implicit recommendation is also interpretivist, since it is made from a subjective position. It would appear that Maitland is projecting her enthusiasm onto the youth. Her statement also contains empathetic notions of being involved in archaeology.

If the presentations presented at the workshop are overly rationalist in the way they generate knowledge and describe agency, it could possibly be an indication that interpretivism does not play a significant role in the sectors. If this is the case, how can one proceed to indicate how the newer social science thinking, like interpretivism, can play a role in the sectors? The answer lies in analytic eclecticism, which is the second component of PULSE[3].

3.1 The ethos of analytic eclecticism

So far, this chapter indicates that the marine and maritime sectors are steeped in the rationalist tradition where natural scientific theories and paradigms play an important role in describing, analysing and recommending how the natural sciences can aid the sectors. This is due to the two sectors' technical functionality in a variety of spheres, ranging from marine pollution to maritime security. This does not mean that the marine and maritime sectors are devoid of issues pertinent to the social sciences. A social scientific subject that is close to the maritime sector is economics. The sessions where presentations with an economics flavour were discussed were supply, manufacturing and construction, shipping and maritime logistics, offshore energy and mining, and water safety, fisheries, pharmaceuticals and aquaculture. Management and business studies were presented in the workshop by Argawal (2013), Dixon (2013), Elfick (2013) Mugumo (2013) and Vrancken (2013b). Their presentations were discussed in the human capital development session. Human capital development also touches on economics. It is therefore not surprising that the workshop presentations were predominantly rationalist because of economics' 'scientific aspirations' (Bastow et al., 2014). The presentation by Vrancken (2013b) was on law, which is a humanities discipline. The representation by Maitland (2013) of the HerBe Programme focuses on a crossover discipline between the humanities and the science, technology, engineering and mathematics disciplines. These are, however, not the only disciplines or subjects that can inform or highlight issues, problems and opportunities in the marine and maritime sectors.

The paradigmatic character of the workshop is the first step in highlighting the role of the social sciences. The social sciences are increasingly taking the improvement of practical problems to heart. This indicates that these sciences have begun to take a pragmatic stance. Should this be the case, the social scientist and the practitioner are now part of the same team and should seamlessly interact to address problems and create opportunities. Paradigmatic limitation can lead to a disjunction between the scientist and what he or she can offer the practitioner. The purpose of analytic eclecticism is to avoid paradigmatic limitations. Arguing from a particular paradigm could become an obstacle, even if it gives powerful insights, especially since clear explanations of complex problems become the victim in an arena where prior assumptions are at the top of the research agenda. The scientist focuses his or her attention on refuting or validating prior assumptions, with pragmatism potentially falling by the wayside (Sil and Katzenstein, 2010). However, analytic eclecticism does not discard established paradigms or research traditions, but tries to discover applicable relationships between seemingly incompatible paradigms like rationalism and interpretivism. After this, invisible connections of perceived mismatched paradigm-bound theoretical elements come to the fore. The objective is to produce novel insights that influence policy debates and practical problems. Achieving this requires alternative thinking about the relationships between assumptions, concepts, theories, research, science and problems (Sil and Katzenstein, 2010).

At this stage, it is important to note that analytic eclecticism is not the same as complexity thinking, transdisciplinarity and theoretical synthesis. Analytic eclecticism is not one theoretical approach to tackle problems, but a diverse convergence of theoretical elements for diverse problems (Sil and Katzenstein, 2010). Problem formulation from a particular paradigm rests on cognitive structures. These constructions are concepts, assumptions and analytical principles. With these, observations are made of complex social and biophysical phenomena. Simplification is unavoidable and a part of reality. Simplification can serve as a sample of

the wider scheme of things that are under investigation. How and to what extent we simplify problem formulations have an impact on our understanding of matters and issues. Problems that are stated as different objects of already existing theoretical assumptions may seem inappropriate and misleading to everyone except those adhering to the researcher's assumptions (Shapiro, 2005, cited in Sil and Katzenstein, 2010). Problems formulated in this way can create blind spots for practitioners. Decision-makers are unlikely to consider alternatives on different plains and across paradigmatic borders. It is problematic to coach societal and biophysical phenomena in a specific paradigm or theory. Analytic eclecticism goes beyond such boundaries. Straddling boundaries entails smoothing the progress for open-ended analysis that is able to join the insights from different theories and communicate them to decision-makers in an effective manner (Sil and Katzenstein, 2010).

Analytic eclecticism promises not to slice up complex social phenomena just to make them simple and easy to analyse. This means that reductionism is not an underlying premise. Important substantive questions with relevant real-world application are in the offing by integrating empirical observations and causal stories, which means that rationalism is incorporated into interpretivism and vice versa. This brings about the 'promise of richer explanations' and deeper understandings (Sil and Katzenstein, 2010). It facilitates the quantum leap from singular explanations of real-world problems to fuller clarification, alternatives and solutions to such problems. Paradigms may have blind spots, but at the same time, they also provide useful insight into issues, challenges and opportunities. This inherent paradox of paradigms indicates that there are connections and complementarities between paradigms that can be exploited. Taking advantage of the inherent paradox could lead to a situation where more useful theoretical and empirical insights are generated to service practitioners in a meaningful manner (Sil and Katzenstein, 2010).

A useful distinction in this regard is Robert Cox's dichotomy between problem-solving and critical theory. Problem-solving theories arise from the direct response to problems. This type of theory makes the relationships and institutions that form reality work more smoothly by dealing effectively with particular problems. Critical or opportunity-creation theories are situated apart from the order of the world and investigate how that order came about. These types of theories do not take institutions and social power relations for granted, but question them by looking at their origin and then asking if they are changing. Opportunity-creation theories provide normative choices in favour of the existing social and political order (Cox and Sinclair, 1996). The paradigm assessment indicates that the majority, if not all, of the presentations were written from a problem-solving theory perspective. The presentations deal with a myriad of problems that face the marine and maritime sectors, and suggest ways to improve those problems. Even the presentations of Davidson (2013a; 2013b) and Maitland (2013) are written in the rubric of a problem-solving theory. This is despite the higher incidence of interpretivism found in their presentations.

Thus, the presentations at the workshop fit neatly into the rationalist paradigm and have the characteristics of a problem-solving theory. There is therefore an opportunity for the interpretivist paradigm and opportunity-creation theories to make a contribution in the two sectors. It is in this regard that the social sciences and, more importantly, interpretivism should be brought into view to determine how it can aid the marine and maritime sectors. The next section looks at the role of the humanities and social sciences in society in general. It also highlights the practicalities of these disciplines for society.

4. The humanities and social sciences in the policy process

Outside the workshop, the marine and maritime sectors are not devoid of humanities and social science research. Bonnin et al. (2004) investigated training and development in the maritime industry, and identified racial division of labour, a shortage of employment opportunities, and a fragmented training and certification system. However, they also found that training in the sector is of a high quality. To address the shortcomings, they suggested an "overall policy linking initial training with employment opportunities, ongoing skills development and the promotion of greater equality" (Bonnin et al., 2004). Ruggunan (2005) also conducted research on the composition of the maritime labour market in South Africa. He found an occupational differentiation of seafarers that contributes to labour inequality in the sector. In another article, Ruggunan (2011) found that globalisation is not always bad for organised labour's bargaining power in the South African and Filipino maritime sectors, and that globalisation has not led to less seafarers coming from these nations.

Humanities and social science research projects, like those described above, are increasingly focusing on the improvement of critical public problems (Calhoun, 2008; Bastow et al., 2014). This section of the chapter focuses on the relationship between the social sciences and the public policy domain. Because of the increasing emphasis of the humanities and social sciences on the solution of public problems, it is also important to emphasise the other side of the paradigmatic coin: interpretivism. This is not to say that there is a clear categorisation with the natural sciences being rationalist and the social sciences being interpretivist. The social sciences can be just as rationalist as the natural sciences. The reason why interpretivism should also be emphasised is because of the existence or creation of opportunities for better livelihoods. This does not mean that the natural sciences are failing in this regard. Yet, also focusing on the social sciences and their interpretivist contribution can generate a larger pool of opportunities and solutions for the betterment of livelihoods. Thus, the opportunity-creation domain of social sciences also has a critical role to play.

Humanities and social science research have a close relationship with public policy-making. This link comes from academics' strong impulse to help improve policy. Academics in public administration help shape the attitudes of officials through the provision of best practices and trends, and through social science research (Bastow et al., 2014). The recommendations contained in the presentations indicate this shaping of attitudes.

Politicians acknowledge the need for humanities and social science research for the following reasons:

- Policies that work well have a welfare-maximising effect. To accomplish this, policies need to be properly evaluated. At each stage of the policy process, social science knowledge and evidence is indispensable. This means that evidence-based policy formulation and implementation has a tendency to improve policy efficiency (Bastow et al., 2014). The research conducted by Elfick (2013), and presented at the workshop, is a good example of research that could have a positive impact on policy effectiveness. His research indicates that a national maritime institute is required, and that the establishment of such an institute will promote and develop the provision of education for the maritime sector. This will have to happen with the cooperation of partner institutions and the establishment of shared maritime research and education centres. Elfick (2013) made these recommendations instead of promoting the establishment of a separate maritime university that would replace any of the established universities where marine and maritime subjects are taught.

It would be a waste of resources to establish a separate university, since there are already schools, departments and research centres at various South African universities that conduct research on marine and maritime affairs.

- Another reason for politicians to acknowledge the need for humanities and social science research is that political success for government is an outflow of the maximisation of policy effectiveness. Highly effective policies will be chosen by politicians to create an optimal policy mix (Bastow et al., 2014). Here, social sciences can play a pivotal role in gathering qualitative and quantitative evidence to give politicians optimal choices. The paradigm assessment index is a typical example of analysing this mix through both qualitative and quantitative methodologies. As mentioned, the presentations focus predominantly on rationalist problem-solving theories to improve problems. Established institutions should also be looked at to determine how they could be transformed for optimal policy implementation.
- It is not always politicians that make policy decisions. The service can devolve down through the bureaucratic hierarchy or be rendered by service providers (consultants) like Elfick or university-based professionals like Vrancken. Politicians will delegate such tasks for various reasons, because decisions can be complex and costly in terms of time. Politicians also have to abide by the rule of law. Impartial policy delivery systems are needed for this compliance. There are therefore theoretical, empirical, moral and public-interest reasons for politicians to adopt the findings of the humanities and social sciences for policy improvement (Bastow et al., 2014).

Social scientists are also involved in the maintenance of large-scale databases, established through government funding. In addition to this, social scientists are part of a cadre of professionals that construct, improve, interpret and analyse the information in these databases. The databases are important social science resources and have an influence on policy formulation and implementation (Bastow et al., 2014). Examples include economic research on transport costs and logistics, the numerous censuses that are used as baseline information and utilised to indicate the socio-economic transformations of society, qualitative studies in defining long-term strategies for DST and SAMSA's *Research, Innovation and Knowledge Management Road Map for the South African Martime Sector*, and the distribution of research funding by the National Research Foundation (NRF). What is significant about research of this nature is that there is a long-distance link between researchers and public officials, departments and ministries (Bastow et al., 2014). This means that humanities and social science research does not always have an immediate impact on the views and attitudes of public officials; it takes time for such research to filter through and make an impact on decision-makers and, ultimately, policy.

That said, there is also a short-term dimension between the social sciences and government policy. The humanities and social sciences can play an integral part in immediate policy evaluation, how implementation is progressing, how problems are tackled and the handling of crisis events. When politicians need to review options, they might be in direct contact with humanities and social science researchers. Through this direct contact, public officials can also get new ideas from novel research. This is usually the case when humanities and social science research outpaces regulatory structures (Bastow et al., 2014). Public problems can be described as 'wicked problems'. Problems are defined as 'wicked' when they are difficult to distinguish from other problems. Wicked problems do not have permanent solutions, but tend to reappear (Jentoft and Chuenpagdee, 2009). Because of this, wicked problems extend beyond systems (Johnson, 2014) like ports, harbours, logistics hubs and marine environments.

For instance, there is an argument that the maritime sector extends to cargo owners like mining companies extracting coal and iron ore in inland environments (Jones, 2014). This would mean that these companies are at the behest of wicked problems. Here, the humanities and social sciences play a central role regarding government policy, which is to clarify life's complex realities (Caplan et al., 1975; Bastow et al., 2014).

With regard to complexity, the marine and maritime sectors could benefit from the humanities and social sciences. Although presented as fairly straightforward by the presenters at the Integrated Marine and Maritime Technologies Workshop, the marine and maritime sectors are anything but straightforward and simple. Technology plays an important part in both sectors, but as Davidson (2013a; 2013b), Elfick (2013), Maitland (2013) and others indicated, we are not only dealing with a technology-'rich' reality, but also with a healthy dose of human involvement, where human behaviour is not only central to, but constitutive of how the sectors are structured and researched, and how technology is utilised. Where human behaviour is involved, either as a platform for action or in the construction of governance structures, things are bound to become complicated, if not complex.

5. Quo Vadis?

Where to from here? To take forward the agenda of successfully integrating the humanities and social sciences into highly technical domains like the marine and maritime sectors, it is necessary to have alternative theories to those that are rational and problem-solving. With alternative theories in hand, one gets an idea of the type of theories that could aid the marine and maritime sectors to fully integrate the humanities and social sciences. This could help enlarge the small percentage of decision-relevant information at policy-makers' disposal (Bastow et al., 2014). There are three examples of these theories and how they could be applicable in the marine and maritime sectors. These theories are the ambiguity theory of leadership, the everyday international political economy theory and the theory of social learning and policy paradigms.

The ambiguity theory of leadership is relevant to business management. The theory emphasises the role that followers in organisations play in leaders' success and/or failure. The theory notes that leadership varies from person to person, and context to context. Leadership is not easy to define, and is complex and sometimes incoherent. Because people attach different meanings to the concept of 'leadership', it brings forth the potential for ambiguous interpretations, understanding and experiences of leadership. This means that leaders need to cope with ambiguity. The effect of this is that leaders are not always aware of their roles and that followers interpret different acts as leadership. The theory problematises leadership and acknowledges its limitations. Leadership is not a panacea to the problems organisations are facing, which means that everything does not succeed or fail because of good or bad leadership (Alvesson and Spicer, 2011).

The presentations in the human development session placed a lot of emphasis on skills development. Leadership is a skill that is seen as important in any section of society. The ambiguity theory of leadership implies that there are different sets of leadership and that followers also play an important role in leadership. These are aspects that a skills development programme in the marine and maritime sectors should keep in mind. This means that where a lot of faith is placed in leadership to solve problems, the ambiguity theory of leadership represents another side of the leadership coin to remind us that success is not always a straightforward outflow of good leadership.

An international political economy theory that places a lot of emphasis on the individual is the theory of the everyday international political economy. It starts off by asking 'who acts and how do their actions produce and change the world economy in various spatial dimensions?' The theory moves away from the normal 'who governs and who benefits' dichotomy of the international political domain. This question is an outflow of the hierarchical nature of the international political economy, with government entities and large corporations at the top, and everybody else – private citizens included – at the bottom. The question posed by everyday international political economy turns this dichotomy upside down and puts individuals at the top as power-givers instead of power-takers. The bottom-up process is therefore just as important as government processes and regulatory mechanisms. Yet, not all actions that emanate from the bottom-up process affect the world economy. Dominant political elites also play a role, but no longer play an exclusive role. The authority of dominant elites is sometimes rejected through protests and subtle forms of rejection. This does not mean that the rejecters of dominant elite actions can do as they please. Structures are restrictive. Sometimes rejecters are victims, and at other times they could become agents of change. Everyday actions are the acts of agents that play a subordinate role in a power relationship. These acts can take the form of negotiation, resistance or non-resistance, which can occur suddenly or over a period of time. The acts shape, constitute and transform the political and economic environment around and beyond everyday actors (Hobson and Seabrooke, 2007).

In contrast to the ambiguity theory of leadership, everyday international political economy places a lot of attention on ordinary individuals and their interaction with the global economy. The link between this and the marine and maritime sectors is that the two sectors rely on technological advancement for different reasons, which means that the ordinary individual and his or her actions are at times side-lined. By applying everyday international political economy theory, the subtleties of individual actions in the two sectors could become more pronounced. The plea by Maitland (2013) for a 'public archaeology' is a good example of a case where ordinary individuals become the catalysts of a maritime sector stimulated by bottom-up activities like the creation of an interest in marine archaeology among schoolchildren.

For the theory of social learning and policy paradigms, the most important factors that influence policy are past policy and associated practices. In this regard, previous policies are the most important influence in the learning process around policies. The central agents that push for policy change are the experts in a given policy or issue field. They are either advisors in government departments or external consultants. Politicians do not play a central role in social learning. Learning takes place when individuals accumulate new information, which includes past experience. The information is utilised by individuals in their succeeding actions. Social learning is a deliberate process to adjust the goals or techniques of policy in response to past experience and new information. Ideas are therefore central to the policy process. Policies are the products of systems of ideas and standards that are comprehensible to the actors involved in the issue. A framework of ideas and standards specifies the policy's goals. This framework is a policy paradigm. Once ideas associated with some actor or set of actors are adapted to the organisation of a policy issue, the ideas get institutionalised into the procedures of an entity and formalised as a synthesis of some sort in standard texts around the issue. The ideas then specify the nature of the issue's domain, how it needs to be observed, which goals are attainable through policy, and what instruments should be used to attain them. The ideas are the prism through which practitioners see the domain and their role in it (Hall, 1993).

The workshop is a good example of bringing together experts around issues related to marine and maritime technology and the ideas they have about such issues. The presentation of new information, such as that presented by Gowans (2013), is a manifestation of the learning process in the maritime sector. How the various new ideas will be incorporated into practice is up to SAMSA. Even so, the theory of social learning and policy paradigms could become a guide on how to optimally define such a framework.

Conclusion

Although the integration of marine and maritime technologies is a field where functional technology and natural science expertise play a central role, the two sectors are not devoid of the role and involvement of the humanities and social sciences. The paradigm assessment of the workshop presentations indicates this. Yet, rationalism and problem-solving theories or perspectives are dominant in the presentations. Even where interpretivism is present, it is only applicable to how certain elements of knowledge generation and agency are approached. The paradigm assessment is an indication that the humanities and social sciences can play a more active role in the two sectors. The ethos of analytic eclecticism indicates why the social sciences and, more importantly, interpretivism should play a more active role. The presentation of the three theories and their applicability to the marine and maritime sectors gives an idea of where and how interpretivist perspectives can aid the sectors. Having said that, it is not up to the authorities in the sectors alone to increasingly include the humanities and social sciences and make them applicable. Social scientists have a bigger role to play in this regard. If the theory of social learning and policy paradigms is anything to go by, the more social scientists become involved in the sectors and produce robust research to create opportunities and solve problems, the better the chances for the humanities and social sciences to make a practical impact in the sectors.

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