LEADERSHIP CAPABILITIES FOR A MARITIME UNIVERSITY IN THE 21ST CENTURY

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Abstract

Faced with a rapid evolution in technology, maritime universities are under increasing pressure to recognize, anticipate and respond to the complex needs of the maritime industry. This depends on organizational leadership and the capabilities of its leaders. Our study proposes a set of 16 capabilities for the leadership in maritime universities, allocated to four groups: Self-Mastery; Interpersonal Mastery; Process Mastery; Systems Mastery. We present results from an online survey to explore these leadership capabilities, seeking to test the relevance of the proposed leadership capabilities using Bootstrap statistical analysis. It also defines and confirms the gap between the required level, at which a capability should operate, and the actual level experienced and practiced within the organization. Our study also examines the findings for both academic and professional staff to discern any statistically significant variances in the responses of the two groups, which could be seen as being culturally distinct. These results are compared to a control sample from a non-maritime university to identify if there were capabilities unique to a maritime university. As future research, we can validate these leadership capabilities across all maritime universities and then, on a more critical basis, compare these capabilities to those considered most important by the maritime industry.

Keywords: leadership mastery, demographical features, Bootstrapping, skills and attributes, online survey, statistical analysis

1. Background and developments in higher education leadership capabilities

After researching universities in Australia and New Zealand, Langford (2013) positions leadership among senior managers as a key factor of success. Given the link between the quality of higher education and national GDP, it might be expected that leadership would be an area of vital interest to universities. However, recent research shows that university leadership is very sparsely researched [Scott et al., 2008] and often criticized [Hall, 2017]. The situation is similar regardless of the profile of the higher education institution (HEI) and includes maritime education and training (MET) institutions as well. Different models to restructure the university sector have been proposed [Dempster, 2009; Townsend, MacBeath, 2011]. There is also the

expectation to properly identify the leadership capabilities in universities [Ghasemy, Hussin, Daud, 2016], although the studies mostly concentrate on the skills amongst senior university roles, i.e. vice-chancellors, deans and heads of school and their academic credentials [Bolden et al., 2012]. There is an evident need to construct an overarching approach to leadership based on proper understanding of leadership capabilities in universities using a well-structured model.

The changes faced by leaders of universities might be driven by external or internal factors. Analyses show that universities are rather partial to adapting their understanding of a successful educational model to changing external realities [Boxall, 2015] even though there are developments of forward-looking operating models [Bokor et al., 2012; Cawood, 2018]. These are driven by the knowledge economy concept inspired by the concept of providing education for all students aiming for social justice [Taylor et al., 1997], and the strong connection between educational levels and a country's GDP [Valero, 2016]. A key driver of internal change is the popular concept of adaptive leadership and its adequacy to turbulent environments [Heifetz, 1994; Dweck, 2008]. Another factor of internal change stems from the need to challenge the traditional teaching and learning concepts. For example, [Bowles, 2016] focused on educational changes following the future needs of the workforce through the identification and development of capabilities.

University leadership is identified as understudied [Scott et al., 2008], with the suggestion that leadership skills are not explored beyond individual performance measures [Burgoyne, 2009]. The increased significance of institutional leaders in a university leading change and maintaining organizational identity [Bolden, 2012] and the translation of purpose into staff engagement and strategic response to disruptive change remain nascent in the university sector [Mukerjee, 2014]. Dempster's model of Leadership for Learning (L4L) [Dempster, 2012] is one of the highly ranked leadership models with specific application to education institutions. A proper model of leadership requires a better understanding of leadership capabilities, i.e. the set of behaviours, attributes and traits that are essential to the recruitment and development of staff in an organisation. Leadership requires a suite of capabilities to recognise turbulence, its impact on individuals, the organisation, and strategic direction and identify the actions required to change the organisation to anticipate and respond in ways which allow the organisation to adapt, survive and achieve its strategic goals [McCann, Selsky, 2012]. The early work [Bowles, 2007] and later [Scott et al., 2008] worked on identifying leadership capabilities, which were later confirmed in [Bowles, 2015; Bowles, 2016]. We shall adopt and explore those capabilities in this paper as a foundation of our analysis.

In this paper, we explore a set of capabilities of university leadership and their impact, focusing more specifically on MET institutions. We shall explore the assumption that the leadership framework of L4L may be a basis for a potential model for university leadership. We shall adopt a modified version of the L4L framework with sixteen leadership capabilities from a previous study and explore the extent to which those factors are acknowledged and measured. To test the suitability of this framework, we shall utilize the results of an online study across academic and professional staff at two universities in Australia and South Africa. Participants rated the capabilities both in terms of theoretical importance and practical demonstration using a Likert scale. We shall use both quantitative and simulation-based approaches to analyze the survey data, utilizing techniques developed in earlier study around simulation based statistical tests (which helps us improve the quality of statistical findings). We shall show that the analysis fo survey data demonstrated (with minor exceptions) that in the view of respondents the selected

capabilities are important for university leadership. We shall also aim to explore the respondents' views of how well developed the capabilities are in practice to explore a gap between importance and development of those capabilities, and whether these findings can be validated in terms of importance. Our research may lay the foundations for the development of university leadership model (with more focus on MET institutions) which can be further refined through larger survey, more participating universities and through comparison against the leadership models being developed in industry.

2. Setup of the survey

Our focus of study is to explore leadership skills and how those apply to the reality of two universities, one of which a leading MET institution. We selected capabilities that stem from the modified L4L framework in [Bowles, 2015]. Initially those were presented in [Bowles, 2007] as a framework of 4 domains of leadership with 3 capabilities each (12 in total). Later on, reflecting on works of [Swaffield, McBeath, 2009; Kotter, 2012], those were developed into the Institute for Working Futures' Leadership and Management for the Digital Age (LaMDA) capability framework [Bowles, 2015] to specifically deal with the core capabilities required in the future workforce. The final framework has 4 domains of leadership with 4 capabilities each (16 in total), given in **Table 1**.

Table 1. Framework of leadership capabilities adopted in the analysis

Self Mastery	Interpersonal Mastery
1. Develops self.	5. Connects with stakeholders & builds collaborative relationships.
2. Communicates with clarity.	
3. Acts in a professional and ethical manner.	6. Leads and empowers others.
4. Displays personal resilience.	7. Displays emotional judgment.
	8. Embraces individual and cultural differences.
Process Mastery	**Systems Mastery**
9. Builds positive conditions for learning.	13. Develops a shared moral purpose and vision.
10. Plans/coordinates quality curriculum, learning & teaching.	14. Fosters a learning culture.
11. Instils focus on priority actions & educational outcomes.	15. Thinks and acts strategically.
	16. Fosters innovation and creativity.
12. Leads change.	

We constructed a survey in two universities in South Africa (SA) and Australia (AU), where the data sought was comprised of two parts:

a) demographic features of respondents (gender, country of residence, and type of position in the organization) each with two sublevels (male/female; SA/AU; academic/professional);

b) Likert responses [Bishop, Herron, 2015] on five-level scale of each of the 16 capabilities (using the scheme: "Completely Disagree", "Disagree", "Mildly Agree", "Agree", "Strongly Agree" coded as 0, 1, 2, 3, and 4) in terms of their *importance* and their *level of development* (making a total of 32 assessments from respondents).

This would test all capabilities for relevance to higher education and assess the relative levels of development and therefore the developmental variance for each capability. The results are expected to shed light on whether there are leadership capabilities needed for the effective leadership of universities. The results would also provide further evidence as to how well the capabilities are demonstrated in practice.

The survey was distributed to academic and to professional staff of the University of KwaZulu Natal, South Africa (UKZN) and the University of Tasmania's Australian Maritime College (AMC). The international nature of the survey population was to test that the capabilities were valid between countries. The survey was conducted using the *QuestionPro* platform and was conducted over three weeks in February of 2016. The survey and the collection methodology were conducted under ethics approval H15432 from the University of Tasmania Ethics Committee. A total of 66 respondents took part in the survey from both organizations.

3. Data analysis on leadership capabilities

3.1. Methodology of analysis

In the survey, we sought information on importance/development of capabilities based on a five-level Likert scale. Hence, the answers of each respondent can be presented as a random variate of the discrete random variable X with $T=5$ discretes $d_1=0<d_2=1<d_3=2<d_4=3<d_5=4$. In our previous work [Nikolova et al., 2020], we have presented approaches to compare two samples of a discrete parameter using Bootstrap simulations [Efron, Tibshirani, 1993]. We formalized a generic statistical test that determines whether the evidence in the two samples is enough to claim that the distributions of X in the two populations are different. We developed a Bootstrap procedure based on the Pearson test statistic pn_{re} [Ghasemi, Zahediasl, 2012] calculated from a contingency table. The test p-value was estimated using the simulated conditional distribution of the test statistics under null hypothesis for equality of population distributions. We aim to demonstrate the higher precision of our procedure compared to analytical approaches and also to show how our methods decrease uncertainty in small and large samples.

For the sake of experimentation, we applied our techniques over the results about the level of development of *capability 11: Instils focus on priority actions & educational outcomes* (see Table 1) from the leadership survey. In this paper, we shall adopt the statistical Bootstrap based techniques from [Nikolova et al., 2020] to conduct a full-scale analysis of the survey results. All our statistical results are obtained from simulations with $N=10000$ pseudo-realities. Let us adopt the 5 populations denoted as in [Nikolova et al., 2020]:

Q_1– all male university staff members from SA and AU;
Q_2– all female university staff members from SA and AU;
Q_3– all university academic staff members from SA and AU;
Q_4– all university professional staff members from SA and AU;

Q_5– all university staff members from SA;
Q_6– all university staff members from AU.

Those form six samples $\chi^{(i)}$ of response results, with their variates sampled from Q_i for i=1,2,…,6. Initially, we shall explore the significance of demographic categories over the assessment of mastery groups. Then we shall explore if there are significant differences on each of the leadership capabilities caused by the different demographic categories. In other words, we explore a series of claims regarding an existent statistical difference of responses across the mastery categories or across individual leadership capabilities that might be caused by the different gender, different country of residence, and different type of position in the organization.

3.2. Comparison by groups of leadership capabilities

Based on the setup in section 3.1, the statistical results for importance and level of development of each of the four mastery categories (given in Table 1) are given in **Table 2**. In that table, we presented the sample size, Pearson test statistic and p-value across the four mastery groups based on the three demographic features (gender, country of residence, and type of position in the organization). There are only two p-values (bolded) that indicate statistical significance of responses, as follows (all other results showing no statistically significant differences):

1) the claim that "the position in the organization affects the distribution of answers regarding the importance of systems mastery among all university staff members from SA and AU" is considered statistically significant based on the data in $\chi^{(3)}$ and $\chi^{(4)}$ with estimated p-value=0.0246;

2) the claim that "the country of residence affects the distribution of answers on the level of development of the interpersonal mastery among all university staff members from SA and AU" is considered with borderline statistical significance based on the data in $\chi^{(5)}$ and $\chi^{(6)}$ with estimated p-value=0.0476.

Table 2. Statistical results by group of leadership mastery across gender, position and country (significant p-values are bolded)

Mastery	Gender				Position				Country			
	$\chi^{(1)} n_1$	$\chi^{(2)} n_2$	pn_{re}	p-value	$\chi^{(3)} n_1$	$\chi^{(4)} n_2$	pn_{re}	p-value	$\chi^{(5)} n_1$	$\chi^{(6)} n_2$	pn_{re}	p-value
Importance												
Self	187	75	2.255	0.2908	181	79	3.778	0.1808	35	225	6.609	0.0859
Interpersonal	184	76	5.891	0.0648	180	80	5.266	0.0852	36	224	2.094	0.3214
Process	186	74	5.055	0.1546	182	78	4.295	0.2238	36	224	1.819	0.5941
Systems	184	76	6.493	0.0990	181	79	9.579	**0.0246**	35	225	4.911	0.1816
Development												
Self	184	75	3.452	0.4898	180	79	4.171	0.3815	36	223	7.678	0.1004
Interpersonal	183	76	2.917	0.5820	180	79	7.664	0.1053	36	223	9.740	**0.0476**
Process	182	74	8.229	0.0745	178	78	6.864	0.1366	36	220	4.246	0.3586
Systems	181	71	6.763	0.1275	178	74	5.908	0.1783	35	217	4.041	0.3403

3.3. Analysis by individual leadership capabilities

The statistical results for importance of each of the 16 leadership capabilities is given in **Table 3**, where we present the sample size, Pearson test statistic and p-value based on the three demographic features. There is only one p-value (bolded) that indicates statistically significant responses. It shows statistical significance for the claim that "position affects the distribution of answers regarding the importance of capability 16 among all university staff members from SA and AU" based on the data in $\chi^{(3)}$ and $\chi^{(4)}$ with estimated p-value=0.0354. All other answers do not give substantial grounds to claim statistically significant differences of opinion.

Table 3. Statistical results for importance of leadership capabilities (numbering based on Table 1) across gender, position and country (significant p-values are bolded)

Capability	Gender				Position				Country			
	$\chi^{(1)} n_1$	$\chi^{(2)} n_2$	pn_{re}	p-value	$\chi^{(3)} n_1$	$\chi^{(4)} n_2$	pn_{re}	p-value	$\chi^{(5)} n_1$	$\chi^{(6)} n_2$	pn_{re}	p-value
1	47	19	1.721	0.2167	46	20	0.0567	0.8319	9	57	0.6723	0.4668
2	47	19	0.4105	0.5962	46	20	0.4415	0.5162	9	57	0.1603	0.6361
3	45	19	0.8717	0.3775	44	20	0.9384	0.3810	8	56	2.654	0.1173
4	46	18	0.04224	0.8728	45	19	1.329	0.2840	9	55	0.9672	0.2419
5	46	19	0.8523	0.3998	45	20	0.3582	0.7163	9	56	0.3316	0.6101
6	46	19	0.4195	0.5977	45	20	0.4514	0.5188	9	56	0.1632	0.6266
7	46	19	0.02559	0.9482	45	20	1.398	0.2847	9	56	0.5055	0.5254
8	46	19	0.6656	0.5135	45	20	4.529	0.0556	9	56	1.062	0.3381
9	46	18	0.4887	0.5174	44	20	0.9384	0.3839	9	55	0.3378	0.6213
10	47	18	1.205	0.2976	46	19	1.299	0.2915	9	56	0.5055	0.5250
11	46	19	0.2231	0.7259	46	19	0.2231	0.7330	9	56	0.8705	0.4145
12	47	19	1.732	0.4230	46	20	0.06748	0.9167	9	57	1.584	0.3327
13	44	19	4.072	0.1085	44	19	2.173	0.3448	9	54	1.527	0.4130
14	47	19	0.4477	0.5838	46	20	4.06	0.0733	9	57	0.8542	0.3937
15	46	19	1.768	0.4166	45	20	3.595	0.1353	8	57	1.101	0.5081
16	47	19	0.4527	0.5285	46	20	4.744	**0.0354**	9	57	0.3257	0.6091

The statistical results for the level of development of each of the 16 leadership capabilities is given in **Table 4**, where we present the sample size, Pearson test statistic and p-value based on the three demographic features. There are four p-values (bolded) that indicate statistically significant responses:

1) the claim that "position affects the distribution of answers regarding level of development of capability 8 among all university staff members from SA and AU" is considered statistically significant based on the data in $\chi^{(3)}$ and $\chi^{(4)}$ with estimated p-value=0.0367;

2) the claim that "country affects the distribution of answers regarding level of development of capability 9 among all university staff members from SA and AU" is considered statistically significant based on the data in $\chi^{(5)}$ and $\chi^{(6)}$ with estimated p-value=0.0249;

3) the claim that "position affects the distribution of answers regarding level of development of capability 11 among all university staff members from SA and AU" is considered with borderline statistical significance based on the data in $\chi^{(3)}$ and $\chi^{(4)}$ with estimated p-value=0.0452;

4) the claim that "gender affects the distribution of answers regarding level of development of capability 12 among all university staff members from SA and AU" is considered statistically significant based on the data in $\chi^{(1)}$ and $\chi^{(2)}$ with estimated p-value=0.0311. All other answers do not give substantial grounds to claim statistically significant differences of opinion.

Table 4. Statistical results for level of development of leadership capabilities (numbering based on Table 1) across gender, position and country (significant p-values are bolded)

Capability	Gender				Position				Country			
	$\chi^{(1)} n_1$	$\chi^{(2)} n_2$	pn_{re}	p-value	$\chi^{(3)} n_1$	$\chi^{(4)} n_2$	pn_{re}	p-value	$\chi^{(5)} n_1$	$\chi^{(6)} n_2$	pn_{re}	p-value
1	47	19	1.759	0.6831	46	20	1.356	0.7338	9	57	5.146	0.2184
2	45	19	4.703	0.1847	45	19	2.786	0.4189	9	55	0.8723	0.8177
3	47	18	6.437	0.1384	45	20	3.611	0.4133	9	56	5.066	0.2300
4	46	19	2.436	0.4272	44	20	5.116	0.1644	9	55	7.499	0.0838
5	45	19	3.18	0.3873	45	19	0.5418	0.9159	9	55	4.106	0.2442
6	47	19	3.125	0.3954	46	20	0.7863	0.8693	9	57	1.913	0.6098
7	44	19	1.558	0.6877	43	20	1.415	0.7165	9	54	7.101	0.0681
8	47	19	3.622	0.4087	46	20	9.369	**0.0367**	9	57	2.965	0.4542
9	46	18	1.57	0.4699	44	20	2.931	0.3394	9	55	10.51	**0.0249**
10	46	19	2.23	0.5455	45	20	3.067	0.3899	9	56	5.049	0.1601
11	44	19	6.736	0.0876	44	19	8.051	**0.0452**	9	54	4.476	0.2156
12	46	18	9.869	**0.0311**	45	19	6.226	0.1550	9	55	2.499	0.5568
13	42	17	4.536	0.2156	42	17	3.795	0.2900	9	50	0.8789	0.8665
14	47	19	3.088	0.4783	46	20	2.735	0.5383	9	57	2.566	0.5151
15	45	16	3.705	0.3049	44	17	0.4003	0.9473	8	53	4.834	0.1771
16	47	19	1.152	0.7822	46	20	3.069	0.3988	9	57	2.83	0.4264

4. Discussion

We can generalize based on the information from **Table 3** and **Table 4** that:

a) responses from males were very dominant in number compared to responses from females (which might be attributed to gender balances in participating universities);

b) more academic and professional staff members responded to the survey (which might be due to the difference between academic and professional roles and the level of understanding and interest in institutional leadership);

c) the responses from AU were substantially more than those from SA, which might distort some of the conclusions based on country of origin.

5. Conclusion

In this paper, we outlined the importance and level of development of a framework of 16 identifiable leadership capabilities needed for the effective leadership of universities. Those were based on the LaMDA capability framework. The capabilities were structured into four groups, with four capabilities in each group. We explored both their importance and their level of development. To explore those capabilities, we utilized the results of an online survey on university leadership capabilities conducted in 2016. The survey data included 66 respondents from AU and SA. Using the survey results, we performed analysis firstly on the four groups of leadership masteries and then on each individual capability. For each of the groups and for each of the capabilities, we analysed the significance of difference in the responses depending on country, gender, and capacity of the respondents. In the analysis over groups of mastery, we identified statistically significant responses based on the Pearson test on the importance of systems mastery depending on position and a borderline significance of country on the level of development of the interpersonal mastery. In the analysis of the individual capabilities, we identified statistical significance depending on position for capability 8 (and borderline for capability 11), depending on country for capability 9, and depending on gender for capability 12.

The lack of prior research into university leadership capabilities is some form of a limitation of our study. This is a field which is rapidly evolving outside academia which makes reliable data difficult to source. The impact of this on the findings cannot entirely mitigated. The survey structure accounted for the potential impact of social desirability bias (SDB) which arises when respondents answer test questions in such a way as to present themselves in a socially acceptable way. Amongst the most critical factor in minimising SDB is ensuring a high level of respondent anonymity, which we have factored into the design of the survey and data collection. The capacity for the responses to be impacted by SDB was assumed to be limited mostly to those respondents who saw themselves as being the leadership being evaluated. This can only be evaluated retrospectively as part of the input into future surveys and the continuing research. Overall ensuring the complete anonymity of respondents was seen as the most effective method of minimising any SDB by removing social exposure.

We can outline several directions for future research of our research:

a) Conducting further data collection to refine the survey for a global population. This would require testing one or more of the concepts that the capabilities would need a central guiding purpose and may also reflect the different types of university.

b) Analyse the results from the current survey to refine and test the capabilities with cross comparisons.

c) Extend the research into the variances between the importance and the level of development of each capability to develop evidence-based leadership training programs for universities

d) Expand the survey with input from other universities (incl. MET institutions) from other countries to explore the development of leadership across various education systems and cultural settings.

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